

**JOINT LEGISLATIVE
AUDIT AND REVIEW
COMMISSION**

**THE
VIRGINIA
GENERAL
ASSEMBLY**

**ORGANIZATION AND
ADMINISTRATION OF THE
DEPARTMENT OF
HIGHWAYS AND
TRANSPORTATION**

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



INTERIM REPORT OF THE
JOINT LEGISLATIVE AUDIT AND REVIEW COMMISSION AND
THE SJR 50 SUBCOMMITTEE ON
THE ORGANIZATION AND ADMINISTRATION OF THE
DEPARTMENT OF HIGHWAYS AND TRANSPORTATION
TO
THE GOVERNOR
AND
THE GENERAL ASSEMBLY OF VIRGINIA



SENATE DOCUMENT NO. 14

COMMONWEALTH OF VIRGINIA
Richmond, Virginia
1981

**MEMBERS OF THE
JOINT LEGISLATIVE AUDIT AND REVIEW COMMISSION**

Chairman
Delegate Richard M. Bagley

Vice Chairman
Senator Hunter B. Andrews

Delegate Robert B. Ball, Sr.
Senator Herbert H. Bateman
Senator John C. Buchanan
Delegate Vincent F. Callahan, Jr.
Delegate L. Cleaves Manning
Delegate Theodore V. Morrison, Jr.
Delegate Lacey E. Putney
Delegate Ford C. Quillen
Senator Edward E. Willey
Mr. Charles K. Tribble, Auditor of Public Accounts

Director
Ray D. Pethtel

**MEMBERS OF THE
SJR 50 SUBCOMMITTEE**

From the Joint Legislative
Audit and Review Commission

Delegate Theodore V. Morrison, Jr. (Chairman)
Delegate Vincent F. Callahan, Jr.
Senator Edward E. Willey

From the Senate
Committee on Finance

Senator Peter K. Babalas
Senator J. Harry Michael, Jr.
Senator William A. Truban

From the Senate
Committee on Transportation

Senator Daniel W. Bird, Jr.
Senator Richard L. Saslaw
Senator Lawrence Douglas Wilder

From the House
Committee on Finance

Delegate Archibald A. Campbell
Delegate C. Richard Cranwell
Delegate Norman Sisisky

From the House Committee on
Roads and Internal Navigation

Delegate Orby L. Cantrell
Delegate Earl E. Bell
Delegate V. Earl Dickinson

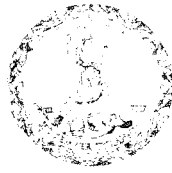
**JLARC STAFF
FOR THIS REPORT**

Construction Needs

Mark S. Fleming, Project Director
F. Daniel Ahern, Jr.
William E. Wilson

Organization and Management

Walter L. Smiley, Project Director
L. Douglas Bush, Jr.
Ronald L. Tillett
Glen S. Tittermary



COMMONWEALTH of VIRGINIA
Joint Legislative Audit and Review Commission

*Suite 1100, 910 Capitol Street
Richmond, Virginia 23219
(804) 786-1258*

January 12, 1980

RICHARD M. BAGLEY
Chairman

HUNTER B. ANDREWS
Vice Chairman

COMMISSION MEMBERS

HUNTER B. ANDREWS
Senator

RICHARD M. BAGLEY
Delegate

ROBERT B. BALL, SR.
Delegate

HERBERT H. BATEMAN
Senator

JOHN C. BUCHANAN
Senator

VINCENT F. CALLAHAN, JR.
Delegate

L. CLEAVES MANNING
Delegate

THEODORE V. MORRISON, JR.
Delegate

LACEY E. PUTNEY
Delegate

FORD C. QUILLEN
Delegate

EDWARD E. WILLEY
Senator

CHARLES K. TRIBLE
Auditor of Public Accounts
ex Officio

RAY D. PEITHEL
Director

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 transmit to you this interim report dealing with selected issues in the organization and administration of the Department of Highways and Transportation. 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 Subcommittee Chairman

Richard M. Bagley
JLARC Chairman

RMB:TVM:ji

Table of Contents

	Page
I. INTRODUCTION	1
II. CONSTRUCTION NEEDS ASSESSMENT	9
Highway System Planning	9
Project Programming.....	14
Strengthening Construction Needs Assessment	24
III. EQUIPMENT UTILIZATION AND MANAGEMENT	27
Fleet Equipment Utilization and Management	29
Hired Equipment.....	38
Strengthening Equipment Management	41
IV. CONTRACT ADMINISTRATION	43
DHT Contracting Procedures	47
Strengthening Contract Administration.....	57
V. ORGANIZATION AND STAFFING	59
APPENDIX	71

I. Introduction

Senate Joint Resolution No. 50, enacted by the 1980 Session of the General Assembly, mandated that the Joint Legislative Audit and Review Commission (JLARC) review the programs and activities of the Department of Highways and Transportation (DHT). The resolution called for the study to focus on transportation expenditures including highway needs, transit assistance programs, revenues and methods of financing construction, maintenance, and transit needs, and the allocation of construction and maintenance costs according to vehicle size and weight. The Commission was directed to make an interim report prior to the 1981 Session of the General Assembly.

This interim report presents findings and recommendations concerning construction planning and fund allocation procedures, equipment management, contract administration, and staffing. An interim report on the methodology developed for the cost responsibility study has also been prepared. A final report will be presented to the 1982 Session.

A joint subcommittee, consisting of appointees from JLARC, House Roads and Internal Navigation Committee, Senate Transportation Committee, House Finance Committee, and Senate Finance Committee, has cooperated in the preparation of this report. The members of the subcommittee are:

Joint Legislative Audit and Review Commission

Theodore V. Morrison, Jr., Chairman
Vincent F. Callahan, Jr.
Edward E. Willey

House Roads and Internal Navigation Committee

Orby L. Cantrell
Earl E. Bell
V. Earl Dickinson

House Finance Committee

Archibald A. Campbell
C. Richard Cranwell
Norman Sisisky

Senate Transportation Committee

Daniel W. Bird, Jr.
Richard L. Saslaw
Lawrence Douglas Wilder

Senate Finance Committee

Peter K. Babalas
J. Harry Michael, Jr.
William A. Truban

An overview of the transportation function was presented to the subcommittee in May 1980. The overview provided subcommittee members with information on the history, organization, and staffing of DHT;

highway construction and maintenance needs; transit needs; highway and transit revenues; methods of financing; and cost allocation principles. Members were also consulted on the proposed plan of study.

During the course of this review, two seminars were held--one on cost allocation and another on critical transportation issues of the 1980s. The cost allocation workshop was held in June 1980 to introduce the concept of a highway cost responsibility study and to promote a general understanding of the important political, economic, and technical issues related to the apportionment of highway costs. The other seminar was held in October 1980 and focused on transportation-energy relationships, technological trends, and financing needs.

Two public hearings were also held. The first one in September 1980 concerned transportation issues facing the Commonwealth. A second public hearing was held in December on the proposed methodology for the cost responsibility study.

The Transportation Function

Transportation is the third largest function in the Commonwealth's budget. At \$2.1 billion for the 1980-82 biennium, transportation ranks behind only the Individual and Family Services and the Education functions (Figure 1). Transportation programs encompass activities in ground, air, and water transport. Components of this function are broadly related to the movement of people, goods, and services.

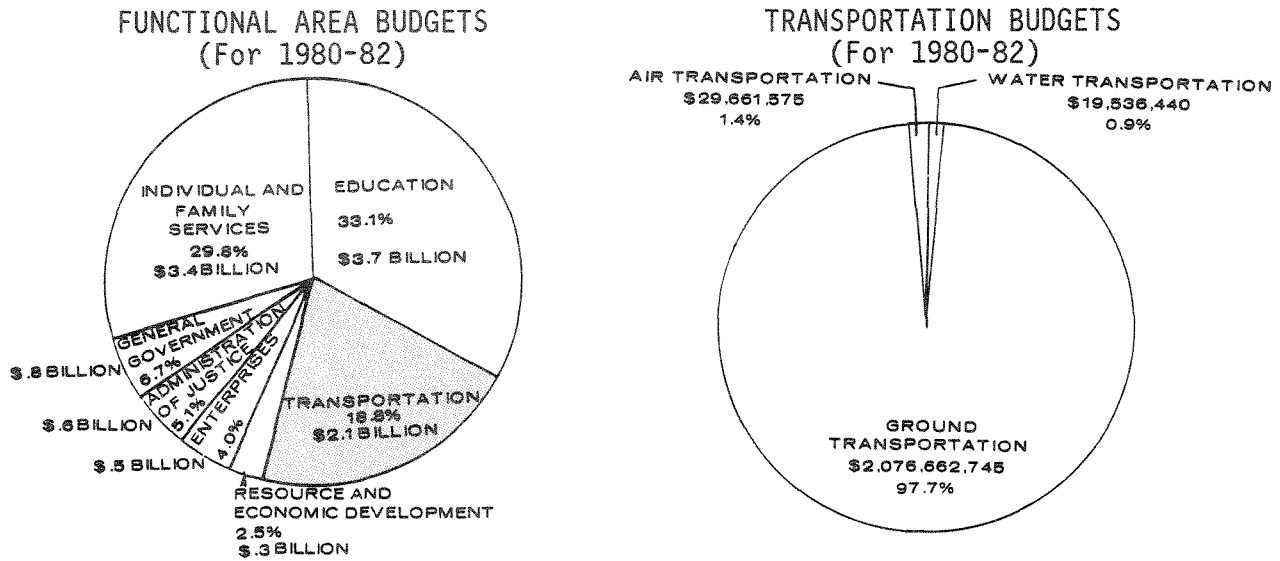
As illustrated in Figure 1, most transportation funds--more than \$2 billion--are appropriated for ground transportation programs. DHT receives the bulk of these funds, which are derived largely from the Highway Maintenance and Construction Trust Fund. The trust fund is financed through a variety of taxes and fees dedicated to improving Virginia's highway network (Appendix 1). Appropriations from the trust fund are shown at the bottom of Figure 1. Although most appropriations go to DHT, ground transportation funds are also used to support the activities of nine other State agencies. The justification for this support is the highway-related nature of some agency programs.

The Department of Highways and Transportation

This report focuses on selected activities of the Department of Highways and Transportation. DHT is one of the largest State agencies, with approximately 12,000 authorized staff positions. DHT appropriations totalled approximately \$1.9 billion in the 1980-82 biennium. During fiscal year 1980, approximately 500 construction projects valued over \$650 million were under way. DHT also spends almost \$200 million annually to maintain the existing highway system.

Figure 1

TRANSPORTATION BUDGETS AND APPROPRIATIONS



FY 1981 APPROPRIATIONS FROM HIGHWAY TRUST FUND (DOLLARS IN MILLIONS)		
OVERALL DISTRIBUTION	APPROPRIATIONS DETAIL	
DHT CONSTRUCTION AND ACQUISITION \$590	INTERSTATE	\$245
	PRIMARY	\$130
	SECONDARY	\$108
	URBAN	\$ 99
	MISCELLANEOUS	\$ 8
DHT MAINTENANCE \$222	SECONDARY	\$ 118
	PRIMARY	\$ 73
	INTERSTATE	\$ 31
	ADMINISTRATION AND RESEARCH	\$ 42
DHT OTHER \$ 85	TOLL FACILITIES	\$ 41
	REGULATION	\$ 2
DHT ASSISTANCE TO LOCALITIES \$ 73	URBAN MAINTENANCE	\$ 47
	TRANSIT	\$ 16
OTHER AGENCY PROGRAMS \$ 52	COUNTY	\$ 10
	DEPARTMENT OF MOTOR VEHICLES	\$ 45
	STATE CORPORATION COMMISSION	\$ 3
	DEPARTMENT OF EDUCATION	\$ 2
	DEPARTMENT OF TRANSPORTATION	\$ 1
	SAFETY	
	DEPARTMENT OF STATE POLICE	*
	MARINE RESOURCE COMMISSION	*
	DEPARTMENT OF HEALTH	*
	SECRETARY OF TRANSPORTATION	*
	DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT	*

*Less than \$1 million

Source: 1980-82 Executive Budget; 1980-82 Appropriations Act.

DHT is governed by the Highway and Transportation Commission, whose 11 members are appointed by the Governor and confirmed by the General Assembly. The Highway and Transportation Commissioner is chairman of the commission and chief executive officer of the department. Departmental operations are directed from the central office in Richmond and eight district offices (Figure 2). The central office consists of five directorates under the supervision of the commissioner and deputy commissioner: planning, engineering, program management, operations, and administration. The DHT field organization reports to the central office through the director of operations. Field operations are carried out by 45 residencies which report to the various district offices. There are geographic subunits called maintenance areas.

Development of Virginia's Highway and Transportation System

The State highway system was created in 1918 and was a continuation of efforts that began in the colonial era (Appendix 2). The system was greatly expanded in 1932 when the Byrd Road Act gave counties in Virginia the option of unifying their secondary road systems with the State system. The modern era of highway system expansion began in 1956 when the interstate system was created by Congress, which authorized 1,053 miles of interstate highway in Virginia. In 1964 the General Assembly created an arterial network to supplement the interstate system and connect major cities and towns with modern divided highways.

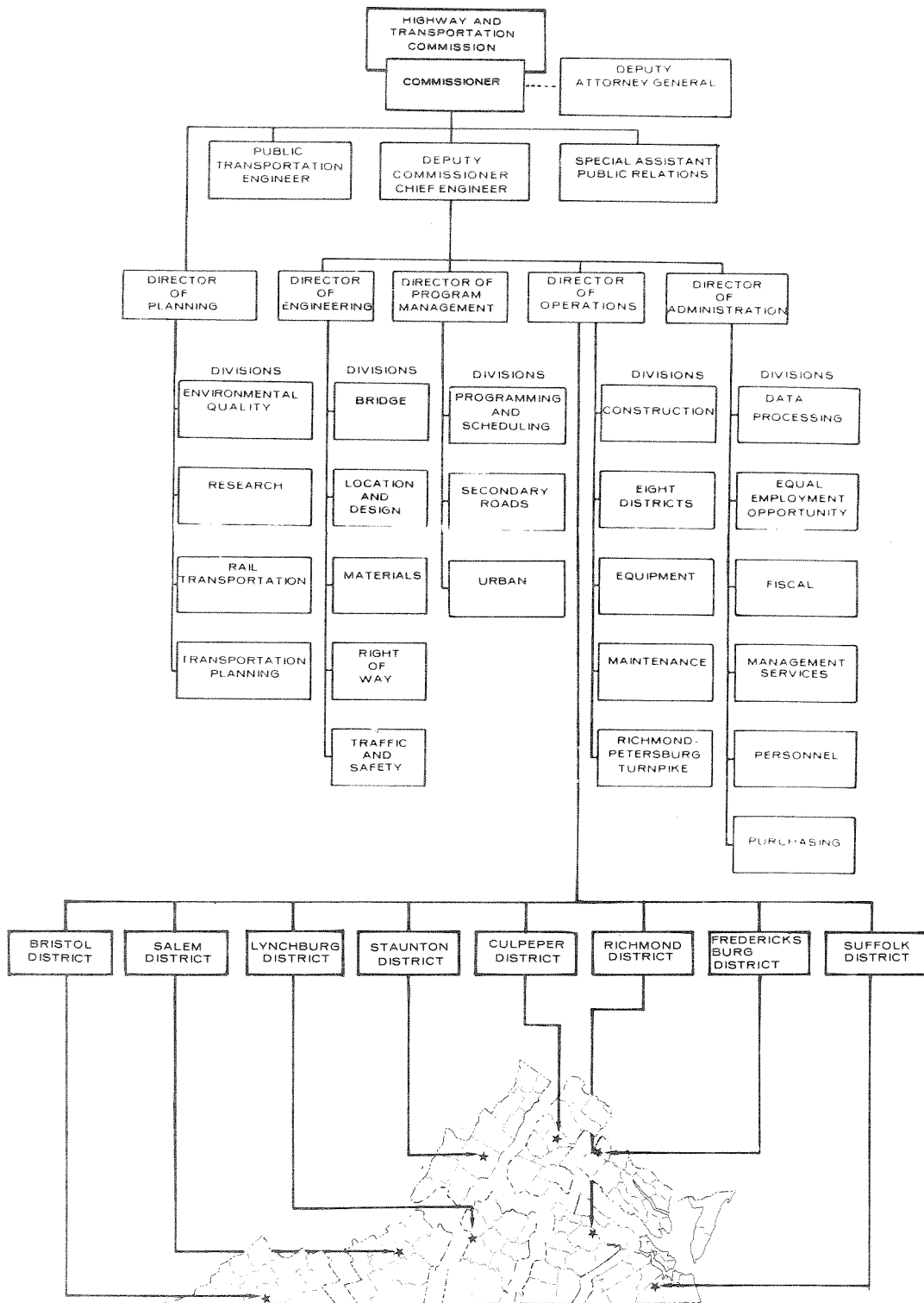
During the 1950s and 1960s the need for an improved transportation system was widely perceived. Sales of automobiles and gasoline grew steadily and the need for adequate highways grew at a corresponding pace. The Virginia Highway Study Commission in 1963 recommended increasing highway revenues and embarking on an ambitious construction program in order "to provide the roads needed and keep them up-to-date." Improving and expanding the Commonwealth's highway system was seen to be a means of encouraging economic growth and development.

During these years, plentiful revenues and stable construction costs encouraged highway construction. In this environment of well-defined and widely accepted transportation needs, Virginia's State Highway Commission, with the strong encouragement of the General Assembly, directed the Department of Highways to optimize the use of available resources to develop a modern system of highways that would facilitate commerce and travel.

As the highway system became better defined through the 1960s and early 1970s, the need for more comprehensive planning became apparent. Planning for the orderly growth of the transportation system was recognized as an important facet of the State's transportation program. General Assembly endorsement of the 1966 and 1972 highway improvement programs, and the 1974 requirement for the preparation of a statewide transportation plan, were sought to broaden the statewide process and include all forms of transportation while at the same time continuing the highway construction program.

Figure 2

DEPARTMENT OF HIGHWAYS AND TRANSPORTATION ORGANIZATION



Federal initiatives and financial aid also encouraged the development of more refined planning for highway construction and maintenance and greater coordination of highway transportation with other transportation modes, particularly in urban areas. Beginning in the late 1960s, transportation plans were developed for urban areas throughout the Commonwealth.

The most visible shift in emphasis in Virginia's transportation program was the department's 1974 change in name to the Department of Highways and Transportation. Although the department's primary function continued to be highway maintenance and construction, the change recognized the growing interrelationships among all forms of transportation. Since 1974 DHT has added divisions concerned with mass transportation and railroads, and has provided staff for the development of the statewide transportation plan.

Virginia's Highway System Today

The State highway system comprises approximately 129,243 lane miles of roads. DHT is responsible for construction and maintenance of approximately 111,000 lane miles, the third largest state maintained highway system in the United States. In addition, 17,400 lane miles of city and town streets are included in the State system although they are maintained by local jurisdictions. The State highway system has five road classifications: interstate, primary, arterial, urban, and secondary (Table 1).

Table 1

STATE HIGHWAY SYSTEM MILEAGE (1979)

<u>System</u>	<u>Centerline</u>	<u>Lane</u>
Interstate	908	4,059
Primary/Arterial	7,882	20,046
Secondary	43,628	87,426
Urban	<u>8,138</u>	<u>17,712</u>
Total	60,595	129,243

Source: Department of Highways and Transportation.

Interstate System. Authorized by the Federal-Aid Highway Act of 1956 and by §33.1-48 of the Code of Virginia, interstate highways are designated by the Highway and Transportation Commission. Typically, these are four-lane divided highways on controlled access right-of-way.

Primary System. The primary system, authorized by §33.1-25 of the Code of Virginia, comprises roads in the State highway system not otherwise designated in statute. The commission has discretion to transfer roads into the primary system from the secondary system under §33.1-34.

Arterial Network. The arterial network of highways is composed of specially designated primary routes which complement the interstate system and connect major cities and towns in the State. Generally, arterial highways are divided four-lanes on non-controlled access right-of-way. Section 33.1-26 sets out criteria to be used in designating highways to be part of the arterial network.

Urban System. Primary highways which pass through cities and towns over 3,500 in population constitute urban highways. According to §33.1-41 of the Code of Virginia, these roads are selected by the State Highway Commissioner, subject to the approval of the Highway and Transportation Commission.

Secondary System. All public roads in the counties, and all public roads and community roads leading to and from public schools, streets, bridges, and wharves in incorporated towns with 3,500 or fewer residents, comprise the secondary system of highways. Certain other roads (for example, those connecting public schools to either primary or secondary highways) are also classified as part of the secondary system, as provided by §§33.1-67 and 33.1-68 of the Code of Virginia.

Study Scope

The findings in this interim report are based on data collected through field interviews, file searches, and interviews with DHT central office staff. JLARC staff visited all eight DHT districts and nine of the 45 residencies. Data on project development, contracting, and equipment management were systematically reviewed. In addition, an on-site visit was made to the North Carolina Department of Transportation and telephone contacts were made with transportation departments in several other states.

JLARC staff also reviewed the findings of the management study of DHT operations conducted by R. J. Hansen Associates, Inc. The consultant study was initiated in January 1980 and a final report was presented to the department in September. Recommendations were made concerning preconstruction and construction management, maintenance, personnel, and organizational management.

The focus of JLARC research for this interim report has been on activities in construction needs assessment, equipment management, contracting, and organization and staffing. The findings presented here are subject to further research prior to completion of the final report in 1981. Nevertheless, the recommendations are considered to be in final

form. In addition, findings and recommendations in the areas of maintenance needs assessment and management, public transportation, materials management cost allocation, and such other matters as may be requested by the joint subcommittee will also be presented in 1981.

Report Organization

The interim report is organized into five chapters. Chapter I has introduced the department and the State highway system. Chapter II examines planning for new highway construction, with particular emphasis on how the construction program is presented to the public and General Assembly. Chapter III reviews equipment management and Chapter IV looks at contract administration for maintenance and construction. Finally, Chapter V presents interim findings on DHT organization and staffing. A separate document contains the cost responsibility methodology.

II. Construction Needs Assessment

Since the General Assembly established the Commonwealth's highway system in 1918, the State has been responsible for building and improving an ever-growing network of roads and highways. Assessing the need for new and upgraded highways and determining what maintenance is required to keep these roads serviceable are important to the management of this major public investment. During fiscal year 1980, approximately \$500 million was spent for construction projects on the State highway system.

The process for assessing construction needs has changed significantly as the highway system has developed. From the simple goal of "getting out of the mud," needs assessment has evolved into highway system planning. More recently, assessing the need for highway construction has become part of a broad-based transportation planning process which seeks to assess highway needs in relation to all transportation needs.

Needs assessment encompasses two interrelated functions: planning and programming. Planning includes those activities which establish broad policies for constructing highway systems as well as activities which define the various systems. Programming involves matching construction projects to funding sources.

JLARC's preliminary conclusion is that the needs assessment is based on a wide range of information. However, the results of the needs assessment process are not presented to the General Assembly, local officials or the interested public in a manner which clearly indicates the priorities for highway construction. More emphasis needs to be placed on communicating priorities and integrating highway and transportation planning.

HIGHWAY SYSTEM PLANNING

Effective planning is essential to the development of Virginia's highway system. The long lead time inherent in many construction projects and complexity of the design process require careful assessment of needs well in advance of the anticipated start of a project. Planning is also needed for flexibility, so that the Commonwealth can fully use additional federal aid that may become available. In recent years, the Department of Highways and Transportation in Virginia has been a leader among the states in programming federal-aid construction funds.

Planning is a staged process which begins with an assessment of needed improvements, establishes priorities among projects, designates funding, and schedules projects for construction. The process is a dynamic one, which requires constant revision and adjustment. Thus, reporting is also an essential component.

A variety of planning tools are used. At the broad policy level are legislative statements of intent. Specific objectives may be found in long-range goals and plans prepared by DHT and local and regional plans. In recent years, the General Assembly has also sought to include highway planning as part of a broad statewide transportation plan, an effort which is now under way under the direction of the Secretary of Transportation.

Legislative Intent

The development of Virginia's highway network is governed by policies established by the U. S. Congress and the General Assembly. The most significant congressional statement of intent is the Interstate and Defense Highway Act passed in 1956. This act established the interstate system, of which Virginia was authorized 1,053 miles. The designation of these interstate corridors and authorization of the interstate system by the General Assembly in 1958 are the basis for much of the highway development policy followed by the Commonwealth in the past two decades.

The General Assembly further developed the Commonwealth's highway policy in 1964 when the arterial network within the primary system was created. Based on the recommendations of the Highway Study Commission made in 1963, the General Assembly designated specific corridors that would supplement the interstate system to provide four-lane, divided highway access between all cities. The development of the arterial network and interstate systems was seen as essential to promote economic development in the Commonwealth.

The General Assembly has also provided guidance through statutory distribution of highway funds (Figure 3). Funds are allocated first for highway maintenance, DHT general administration, and transfer to several agencies with transportation-related programs. Remaining State and federal funds are used for new construction. Construction funds (exclusive of interstate federal aid) are further divided by law: 50 percent to the primary system (including arterial construction and State matching funds for interstate construction), and 25 percent each to the urban and secondary systems. By establishing system allocations, the General Assembly has set the basic policy for highway development in Virginia.

DHT Long-Range Highway Plans

Long-range highway planning within DHT includes the ten-year construction plans for all systems first developed in 1966 and revised in 1972, urban transportation improvement plans, and six-year improvement plans for secondary roads in each county. The Programming and Scheduling Division, in cooperation with other DHT divisions, is responsible for preparing the plans while the Transportation Planning Division works with urban areas to prepare improvement plans. Secondary road improvement plans are developed by the governing boards in each county working with their respective resident engineers.

Figure 3

ALLOCATION OF HIGHWAY MAINTENANCE AND
CONSTRUCTION REVENUES
FY 1981
(Dollars in Millions)

STATUTORY ALLOCATIONS

TO OTHER AGENCIES	50.1
AID TO TRANSIT AND RAIL	18.7
PERCENT OF FUEL TAX FOR 2 COUNTIES NOT IN SECONDARY SYSTEMS	10.2
SUBTOTAL	\$79.0

MAINTENANCE

SECONDARY	117.9
PRIMARY	73.3
INTERSTATE	31.0
URBAN ASSISTANCE	46.9
SUBTOTAL	\$269.2

GENERAL EXPENSE

47.2

REVENUE SHARING

25.0

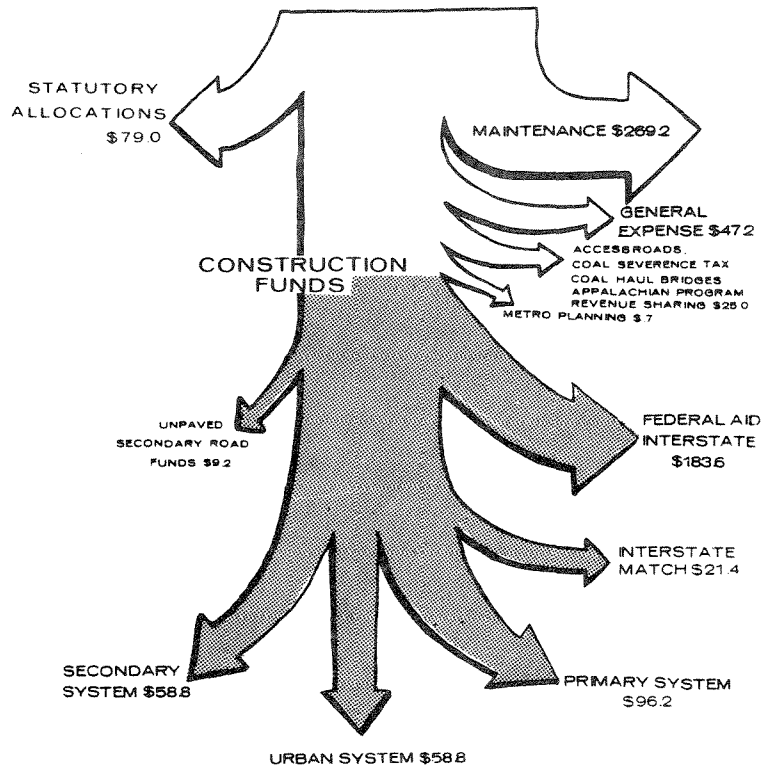
METRO PLANNING

.7

CONSTRUCTION

428.0

TOTAL ESTIMATED
ALLOCATIONS = \$849.1



Source: Department of Highways and Transportation.

Ten-Year Plans. The ten-year construction plans are the basic guide for development of Virginia's highways, particularly the primary and arterial systems. The current plan was developed in 1972 and received the endorsement of the General Assembly, which raised gasoline taxes to provide additional revenue to accomplish the plan's objectives. These objectives, to be accomplished by 1983, were:

- Complete or have under construction the interstate system.
- Complete or have under construction critical segments of arterial network.
- Complete or have under way highest priority primary and urban projects.
- Limit acceleration of secondary improvement program.
- Give highway-related aid to mass transit in urban districts (where warranted in relation to other critical needs).

The total cost for implementing this plan was originally estimated at \$4.2 billion. However, inflation reduced the amount of work accomplished and raised the cost of the remaining projects to the point that DHT officials now acknowledge the program goals cannot be achieved as planned.

The most recent restatement of long-range objectives was the 1980 assessment of highway construction needs which was done as a part of the ten-year planning process. The report for 1980 showed the need for some \$6.6 billion in new construction and reconstruction of existing facilities. However, the report concludes that it would take 17 years to complete the program even assuming no inflation, stable revenue, and no additional needs identified. These assumptions are unrealistic--an acknowledgement that all current needs cannot be met. Despite this fact, the DHT report did not attempt to set priorities for construction.

In short, the DHT ten-year plan no longer provides the General Assembly or others a usable guide to highway development. DHT staff, however, update the plan biannually and establish construction priorities for use in project programming and long-range planning. This fiscal plan of priorities is not published and is not readily available to interested officials or citizens.

Urban System Plans. Urban transportation plans are long-range plans (usually to the year 2000 or beyond) used to assess need for improvements in cities and towns over 3,500 population. Urban planning was originally required for a variety of federal aid funds and is the basis on which city and town councils establish their construction priorities. DHT policy requires that an urban project be included in an urban plan before it will be funded. This approach to planning provides a systematic means for assessing need and establishing priorities, but its value is limited to a specific segment of Virginia's highway--urban streets--which comprise only 13 percent of State highway mileage.

In addition to these urban plans, each of Virginia's seven metropolitan planning organizations prepares a transportation plan for its area. These plans include goals and objectives, a long-range plan for highways and transit, and a program of transportation improvement priorities. Plans have been prepared in each metropolitan area, thus providing a means for assessing need in the State's most populous areas.

Six-Year Secondary System Plans. Little systemwide planning is carried out for secondary road construction. Rather, each county develops its own plans. In 1977 the General Assembly transferred responsibility in setting priorities for the secondary system from DHT resident engineers to county boards of supervisors. Each county board prepares a six-year improvement plan every two years. DHT provides guidelines and technical assistance to county boards through resident engineers. The plans show which construction projects will be undertaken each year of the plan and how projects will be funded.

Although this process appears to offer a systematic means for assessing and meeting secondary road needs in each county, the process is relatively new and unproven. Of particular concern is the potential for ever-changing priorities resulting from changes in board membership.

Statewide Transportation Plan

The most recent development in planning and needs assessment for highway development is the statewide transportation plan now being developed by the Secretary of Transportation. To promote more integrated transportation system development, the 1974 General Assembly directed DHT to:

Develop and coordinate balanced and unified transportation system plans. This shall include coordinating the development of highways with public urban transit (including interurban rail), air and water transportation facilities.

DHT did not develop these plans. In 1978, responsibility for general statewide transportation planning was transferred to the Secretary of Transportation.

Despite the fact that statewide transportation planning was mandated in 1974, no plan has yet been completed. Preparation of the plan began in earnest in 1980 and a final plan is not anticipated until 1982. The Secretary of Transportation intends to give a status report to the 1981 Session of the General Assembly which presents information for each of the 22 planning districts. The information in the report will encompass all transportation modes and is supposed to provide demographic data, inventory existing systems and capabilities, and broadly identify transportation needs, problems, and issues.

As presently envisioned, the 1981 status report on the statewide transportation plan will be a compilation of information received from the planning districts, existing urban area plans, and plans developed for public transit, air, rail, and water transportation. The status report will not establish priorities for development or estimate costs for transportation alternatives. Integrated planning for all transportation modes will not be attempted. Rather, the current effort is described as simply an attempt to present transportation issues for all modes together in one document. An operational plan is not anticipated before 1982.

Beyond the interim status report, the impact of the statewide transportation plan is uncertain. Personnel in the Secretary's office and the DHT Transportation Planning Division were unsure as to the final format of the plan, what information and analyses would be presented, or how the plans will be used. The plan will assess need for significant highway facilities (major arterial routes and major collectors); local road and street needs will not be addressed. The plan is intended to be a general guide for the development of transportation improvements which have statewide significance; however, it is not yet clear whether the plan as presently envisioned will be adequate as a basis for making major transportation decisions in the 1980s.

PROJECT PROGRAMMING

Programming is the process of translating legislative policies and long-range plans into work programs which link available funds with specific projects. In Virginia the foundation of construction programming is the annual allocation process which is carried out by the Highway and Transportation Commission and DHT staff (Figure 4). The process begins with the statutory allocation of funds by the General Assembly. System allocations reflect the legislature's expectations for the distribution of construction funds. Each year the commission members work with Programming and Scheduling staff to apportion the construction funds available for each highway system to individual construction projects.

The first step in programming for the interstate, primary, and urban systems is the development of staff recommendations for tentative allocations. DHT staff work with the commission members from each district to make allocations for projects in each district. Top priority for allocations is accorded to projects under way. Second priority is given to projects which extend or complement work already completed. Finally, allocations are made to new projects if funds are available. Generally, few new projects are added each year because most available funds are needed to continue already active projects.

Tentative allocations are presented to the commission after a series of preallocation hearings held by DHT staff in each district. Following commission approval, the tentative allocations are published with wide distribution to the media, legislators, public officials, and interested citizens. Additional allocation input is received by the commission at formal final allocation hearings. During the hearings, commission members and DHT staff receive comments and requests for proposed allocations. After commission review of all hearing data, the Highway and Transportation Commission finalizes allocations to projects.

Highway project programming for the secondary system is a parallel function to the process for the other systems. Tentative allocations are developed cooperatively by the local boards of supervisors and the DHT resident engineer. Public hearings are then held and, following these hearings, the board of supervisors determines final allocation to projects.

Once a project has received an initial allocation it is considered "active" and may begin to move through the varying stages of development, ranging from preliminary engineering activities and right-of-way acquisition to actual construction. Project development takes place over a number of years, during which additional allocations are made. DHT policy is to require that 70 percent of the total project cost be allocated before the project can be advertised for construction. This does not mean all projects reaching the 70 percent "trigger" are advertised since the advertising decision must be based on the availability of funds at the time of advertisement.

The allocation process illustrated in Figure 4 represents the formal, public representation of project programming in Virginia. The

HIGHWAY PROJECT PLANNING AND PROGRAMMING



General Assembly established the allocation process as the means for stating legislative intent. The importance of the allocation process as a means of public communication was noted by the R.J. Hansen consultants who found that allocations are ". . . a communication of priority to the public and, of course, result in expectations by the public." This view was confirmed by local officials interviewed by JLARC staff who indicated that they considered an allocation a commitment to construct a project.

In fact, the formal allocation process does not provide an accurate representation of the programming decisions made by DHT. Rather, an allocation simply establishes a project as active and means that expenditures from current or future revenues may be made for the project at some point in time. In practice, projects have been or can be moved toward construction at a faster or slower pace than indicated by allocations, and in at least one instance a project was built without any allocation. Projects with large allocations may show little or no expenditures because the funds were actually used elsewhere. In this case the allocation represents a debt to the project to be funded in future years providing funds are available.

The nature of the allocation process can lead to confusion and misunderstanding. Development and construction of projects at a rate different from that indicated by allocations raises a question of compliance with legislative intent. While it is important for the department to have flexibility in programming, the differences between construction allocations and expenditures means that the General Assembly is not provided with accurate information on construction priorities. In addition, it means that public input through allocation hearings has limited value. The potentially misleading nature of the allocation process can be illustrated in two ways: (1) a comparison of allocations and expenditures by system, and (2) a comparison of allocations and expenditures on an individual project basis.

System Comparison

Table 2 shows a 14-year comparison of allocations and actual expenditures (including current contractual obligations) for construction by each of the four highway systems. Actual expenditures and current obligations for the interstate system have exceeded allocations by \$72 million over the period, while the other three systems show combined allocation balances of \$248 million. An allocation balance means that a commitment to spend these funds on a particular system has not yet been fulfilled. In the case of the urban system this commitment is \$160 million.

It is important to emphasize that an allocation is not a cash reserve for a project. DHT has been successful in keeping available funds obligated by moving cash among projects. Full obligation of funds is an important objective for departmental management, particularly during periods of high inflation. However, the fact that the \$248 million combined allocation balance is not an actual cash reserve means that, if the department is to eventually reduce the current balances, a similar amount will have to be obtained from future revenues. This will

Table 2

ALLOCATIONS AND EXPENDITURES BY SYSTEM
(Amounts in Millions)

<u>Interstate</u>				<u>Primary</u>			
<u>Year Ended</u>	<u>Alloca- tions^a</u>	<u>Expendi- tures^a</u>	<u>Allocation Balance</u>	<u>Year Ended</u>	<u>Alloca- tions</u>	<u>Expendi- tures</u>	<u>Allocation Balance</u>
Previous Balance			\$ 84	Previous Balance			\$ 21
1967	\$101	\$107	78	1967	\$ 64	\$ 64	56
1968	115	94	99	1968	79	72	63
1969	129	98	128	1969	68	70	63
1970	103	96	135	1970	80	75	70
1971	104	124	115	1971	89	87	71
1972	115	106	125	1972	92	90	72
1973	116	133	118	1973	121	83	103
1974	116	114	118	1974	120	153	82
1975	158	133	142	1975	112	155	47
1976	147	142	146	1976	110	111	61
1977	161	155	150	1977	106	81	89
1978	166	154	159	1978	141	113	118
1979	178	214	128	1979	135	112	112
1980	180	223	76	1980	120	138	107

<u>Secondary</u>				<u>Urban</u>			
<u>Year Ended</u>	<u>Alloca- tions</u>	<u>Expendi- tures</u>	<u>Allocation Balance</u>	<u>Year Ended</u>	<u>Alloca- tions^b</u>	<u>Expendi- tures^c</u>	<u>Allocation Balance</u>
Previous Balance			\$ 11	Previous Balance			\$ 17
1967	\$ 33	\$ 35	7	1967	\$ 15	\$ 14	20
1968	35	34	7	1968	17	16	26
1969	33	29	9	1969	15	24	21
1970	34	33	12	1970	19	26	21
1971	42	51	3	1971	23	35	16
1972	45	44	3	1972	27	28	21
1973	58	48	14	1973	50	32	46
1974	71	64	19	1974	62	49	67
1975	70	62	24	1975	58	55	70
1976	60	41	40	1976	51	38	92
1977	49	44	48	1977	58	38	120
1978	83	55	76	1978	76	45	156
1979	71	78	70	1979	71	45	193
1980	64	81	60	1980	61	59	197

SUMMARY OF
ALLOCATIONS AND EXPENDITURES BY SYSTEM
1967-1980

<u>System</u>	<u>Interstate</u>	<u>Primary</u>	<u>Secondary</u>	<u>Urban</u>
Projects under contract as of June, 1980	\$148	\$ 67	\$12	\$ 37
Allocation Balance as of June 30, 1980	\$ 76	\$107	\$60	\$197
Amount by which expenditures and obligations exceed (+) or fall short of (-) allocations by system	+\$ 72	-\$ 40	-\$48	-\$160

Source: Department of Highways and Transportation Fiscal Division. ^aIncludes State matching funds from Primary System. ^bDoes not include local share of urban projects. ^cIncludes local share of urban projects.

Table 3

LEGISLATIVE MANDATE, ALLOCATIONS AND
EXPENDITURES BY SYSTEM
(State Funds, FY 1978 - FY 1980)

Fiscal Year	SYSTEM					
	Primary*		Secondary		Urban	
	All.	Exp.	All.	Exp.	All.	Exp.
1978	50%	56%	26%	24%	24%	20%
1979	52%	52%	24%	30%	24%	18%
1980	52%	53%	24%	27%	23%	20%
Legislative Mandate for Annual Allocation	50%	--	25%	--	25%	--
1978-80: Percent of Cumulative Funds Allocated and Expended	51%	54%	25%	27%	24%	19%

*Includes interstate matching.

Source: Department of Highways and Transportation Fiscal Division.

have the effect of reducing the funds available for future allocations to new projects being considered for construction.

In 1977 the General Assembly mandated that available construction funds drawn from all sources exclusive of federal interstate aid be allocated 50 percent to the primary system (including interstate matching requirements) and 25 percent each to the secondary and urban systems. Table 3 compares the 1977 legislative mandate with allocations and expenditures for each of the three intervening fiscal years.

Project Comparison

Although the system comparison illustrates broad trends, a comparison of individual project allocations with expenditures can better illustrate the potentially misleading nature of the allocation process. To make the comparison, a random sample of 115 primary and urban construction projects was drawn from all projects receiving allocations in fiscal years 1974, 1977, and 1980. Data on allocations and expenditures for each project were then collected from DHT records. The resulting sample is statistically representative of all construction projects receiving allocations in those three years and is designed to be representative of project histories over the last seven years.

The analysis found that construction expenditures cannot be predicted or characterized by reviewing allocations. In other words, an interested individual outside of DHT, looking only at the allocation history of a particular project, would have no basis for making a judgment on the project priority or progress. The basic reason for this is that actual expenditures can exceed or trail allocations without being noted in any published record.

Three patterns of allocation and expenditures were grouped in the data: (1) construction projects with expenditures in excess of allocations; (2) projects for which substantial allocations had been made with little corresponding expenditure; and (3) projects for which allocations and expenditures were generally consistent. Overall, allocations and expenditures differed by more than ten percent in most cases for each of the three samples reviewed (Table 4). In fiscal year 1974 only 14 percent of projects sampled had expenditures that fell within ten percent of allocations. In fiscal year 1977, only one in seven projects sampled had expenditures within ten percent of allocations. In fiscal year 1980, only eight percent of projects had expenditures within ten percent of allocations. Thus, only in a relatively small proportion of projects could allocations be used as a measure of expenditures made for the project.

Expenditures in Excess of Allocations. In about one-quarter of all projects DHT has accelerated project completion by spending at a faster rate than funds were allocated. The cash for this accelerated spending was drawn from current revenues allocated to other projects.

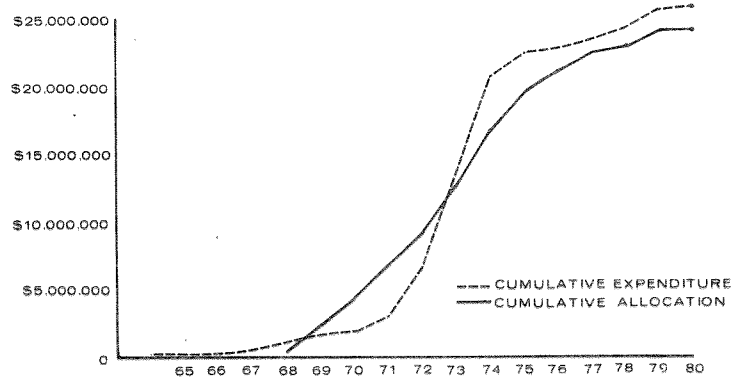
Figure 5 illustrates accelerated spending. In the first three examples, initial expenditures were made before any allocation and the projects experienced a pattern of spending in excess of allocations for most of the project duration. In the fourth case, a small safety project was completed before the initial allocation was made.

Table 4			
ALLOCATION/EXPENDITURE PATTERNS FOR SELECTED PROJECTS			
	<u>FY 74</u>	<u>FY 77</u>	<u>FY 80</u>
Expenditures within ± 10% of Allocation	14%	15%	8%
Expenditures exceed Allocation by 10%	25	25	26
Expenditures less Allocations by 10%	63	60	66
N =	(36)	(40)	(39)
Source: JLARC allocation/expenditure analysis.			

Figure 5

PROJECTS WITH EXPENDITURES IN EXCESS OF ALLOCATIONS

From 1964 through 1980, the dual-laning of a 30-mile segment of Route 29 (an arterial highway) has been under construction south of Lynchburg in Campbell and Pittsylvania counties. By the time the first allocation to this project was made by the commission in 1968, more than \$1.3 million had already been spent for preliminary engineering, right-of-way acquisition, and construction. Between 1969 and 1972, total allocations kept pace with total expenditures, but for each year since 1973 expenditures have exceeded allocations. In 1974, the difference was over \$4.0 million. As of June 30, 1980, \$26.1 million had been spent on this project, of which \$24.1 million had been allocated.



Route 17 in Fauquier County south of Marshall received its first construction allocation in 1969, three years after preliminary engineering work began. From 1969 to 1980, \$985,000 was allocated to this project. In every year except 1969, total expenditures exceeded total allocations. The final comparison between allocations and expenditures shows expenditures exceeding allocations by \$52,181.

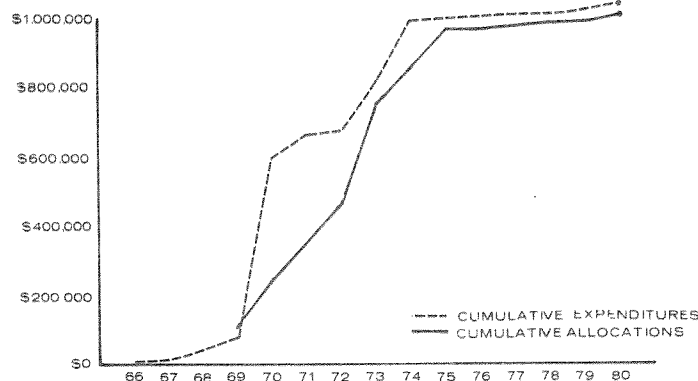
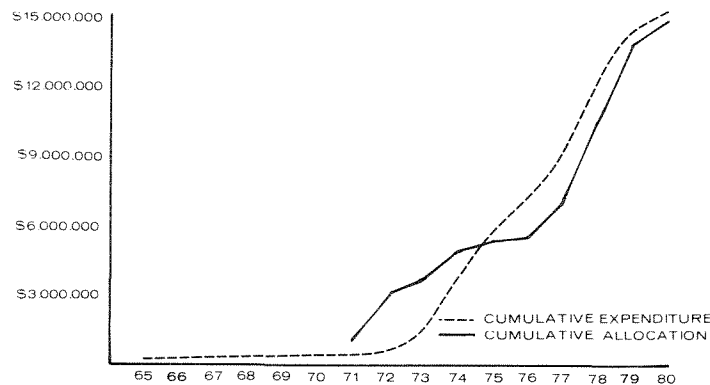


Figure 5
(Continued)

The first allocation for the dual-laning of Route 19 east of Hansonville in Russell and Tazewell counties was \$1.1 million and was made in 1971. Prior to that time, however, more than \$250,000 had been expended for preliminary engineering and right-of-way acquisition. Even after the initial allocation was made, total allocations still did not consistently keep pace with total expenditures. In six out of ten years more was spent on this project than was allocated, and for two years this overexpenditure was greater than \$2 million. At the end of fiscal year 1980, the gap had been narrowed to just under \$400,000.



Funds were allocated to improve an intersection on primary routes 1 and 301 in Chesterfield County in 1979 a year after the project was completed. The allocation was for \$90,000. However, the contract for this project was awarded in October 1977 and construction was completed by June 1978. At the time of the initial allocation, \$142,000 had been spent. Subsequent allocations of \$20,000 and \$23,000 were made to cover the total cost of the project.

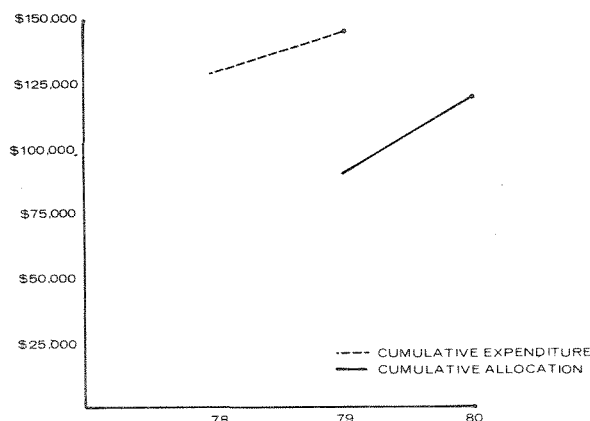
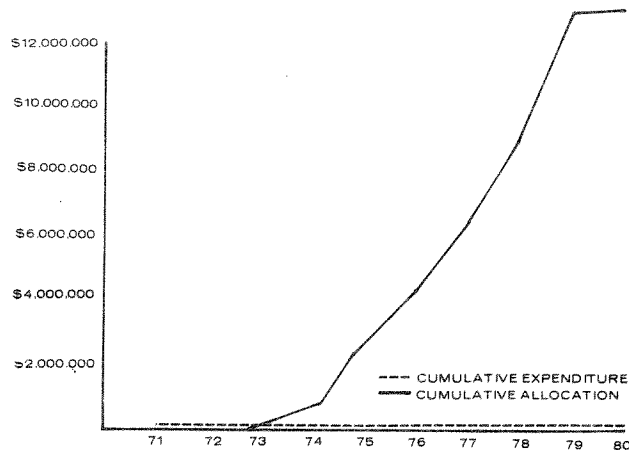


Figure 6

PROJECTS WITH ALLOCATIONS IN EXCESS OF EXPENDITURES

The East-West Expressway project in Hampton has received substantial allocations since 1973. By 1980 the project had accumulated \$13,265,000 in allocations. The expenditure pattern for this project is very different, however. The first expenditures were made in 1971 and continued through 1980, but cumulative expenditures equaled \$163,953, only one percent of total allocations, as of June 30, 1980. All expenditures have been for preliminary engineering work.



Routes 60 and 143 in Hampton have been scheduled for improvement since preliminary engineering began on the project in 1972. Each year some preliminary engineering work has been performed on the project and its allocation has continued to increase. By July 1, 1980, over \$3.8 million has been allocated to this project, of which only \$204,000 (five percent) had been spent after eight years of project development.

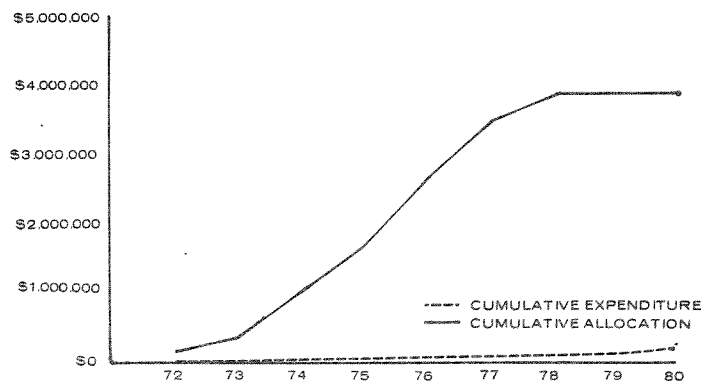
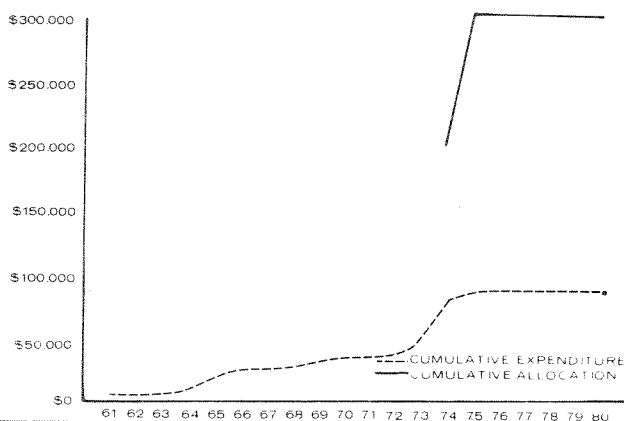
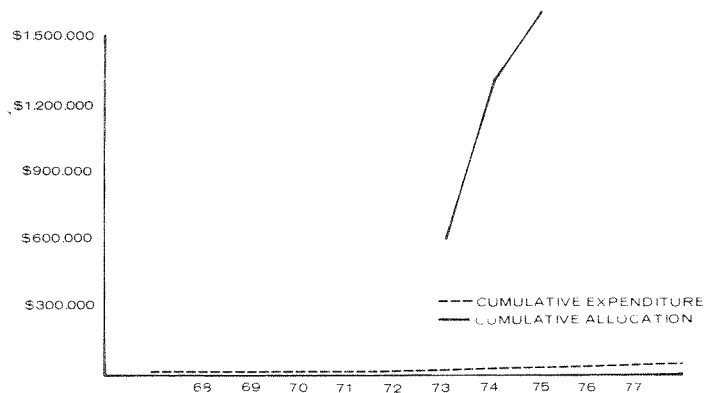


Figure 6
(Continued)

Reconstruction of primary Route 6 in Fluvanna County between Scottsville and Cohasset began as a project in 1961. Over the next 13 years a few thousand dollars a year were spent on the preliminary engineering of the project. By the time the project received its first allocation of \$200,000 in 1974, over \$43,000 has been spent. In 1975 an additional \$100,000 was allocated and total expenditures increased to \$84,000, including \$33,000 for right-of-way acquisition. The project has been deferred since 1975 because of substantial local opposition voiced at a public hearing. Since that time, no additional allocations have been made nor have there been significant additional expenditures.



Allocations for improvements to Warwick Boulevard (Route 60) between Rivermont Drive and Harrison Road in Newport News began in 1973 and reached \$1.6 million by 1975. Preliminary engineering for this project began in 1967 and continued through 1978, at which time over \$49,000 had been spent. In addition, almost \$479,000 was formally transferred for use on other segments of the same road during 1974 and 1975. In 1978 the city cancelled the project and was billed for \$49,000. The project was closed by DHT in June 1978 but the allocation balance of \$1.1 million remained on the books for the project.



Expenditures Less Than Allocations. Figure 6 shows four examples of projects which have large allocation balances but limited expenditures, a common pattern observed in the project samples. In the two Hampton projects, a total of \$17 million has been allocated but only \$368,000 spent over the seven to eight years of project activity. The third example shows a large allocation in 1974 and 1975 with only minor expenditures and virtually no activity since 1975, although the balance remains allocated to the project. The final example is similar to the first two except that the project was canceled by the city in 1977. DHT continues to show large unexpended allocations for the project.

STRENGTHENING CONSTRUCTION NEEDS ASSESSMENT

Assessing the need for highway construction and planning to implement construction projects is a dynamic process. As a result, priorities are constantly changing to meet new circumstances. The various plans and financial documents prepared by DHT are an attempt to adjust the construction program to meet these changes.

In making adjustments in the construction program, however, DHT does not seem to be following the underlying intent of the General Assembly. Although construction allocations for the various highway systems are set by statute and the Highway and Transportation Commission appears to have complied with the law in making allocations, expenditures differ substantially from allocations. To some extent the intent of the General Assembly on this matter may not be clearly stated. Although there is a common perception that expenditures should equal allocations (at least over a period of several years), the statutory relationship between the two has not been documented by legislation or legislative reports.

Recommendation (1). The General Assembly may wish to clarify its intent regarding construction allocations and expenditures. A more explicit statement of legislative intent would provide the basis for greater legislative direction and establish a clear basis of accountability for the distribution of construction funds among the various highway systems.

In addition to clarifying legislative intent, there is also a need to provide the public and General Assembly with up-to-date, accurate information on the status and priorities of the construction program. The present system of multiple plans, allocation lists, programs, and construction schedules provides only a limited amount of information to interested observers outside of the department. The allocation process may be a useful means of in-house planning, but the process does not provide an accurate representation of actual construction priorities or activities.

Annual allocation lists published by DHT are only a small part of construction planning. Other, equally significant information concerning construction and pre-construction activities is not routinely

presented to the public. Thus, it appears that while DHT has information on which to assess need and program construction projects, the General Assembly, local officials, and the public will find it difficult to keep track of the construction program with the information now available publicly.

The need for a more realistic and informative means of communicating highway construction priorities has also been noted by R. J. Hansen Associates, Inc., in its review of DHT operations. The consultant recommended limiting the length of the construction program to four or six years and periodically updating the program to account for inflation and other factors which affect program accomplishment. DHT should implement these recommendations by taking two specific actions.

Recommendation (2). DHT should prepare, on a one-time basis, an inventory of all projects to which funds have been allocated. The inventory should provide complete information on each project, including:

- project parameters (for example, system, length, location, type of improvement);
- estimated total cost;
- allocations to date;
- expenditures to date;
- current status of major activities (design, right-of-way, construction of individual segments); and
- projected completion dates for major activities (if known; if completion dates are not known, the date should be listed as indefinite).

This inventory would provide for the first time a complete status report on all active projects.

Recommendation (3). The Highway and Transportation Commission should prepare and annually update a multi-year construction program. The commission should allocate anticipated revenues to individual projects for activities that will be undertaken during each year. The program should be published annually, widely distributed, and provided to the General Assembly and its appropriate committees. The program should incorporate the following elements:

- A time period that is consistent with planning and forecasting capabilities--not less than four or more than six years.
- A project-specific list of actions to be taken and anticipated expenditures during each year of the program.

- An annual update of the program which would add an additional year, delete completed projects, note and reprogram projects which have not progressed as originally scheduled.
- A report of progress made against plans for each project as part of the annual update.
- Appropriate linkages to the statewide transportation plan and other long-range plans.

Use of such a process would provide a sound basis for determining revenue needs and tracking expenditures. Presentation of this information would also serve to make annual allocation hearings more meaningful forums for developing construction priority. DHT officials have indicated that the department is currently preparing a four-year construction program along these lines.

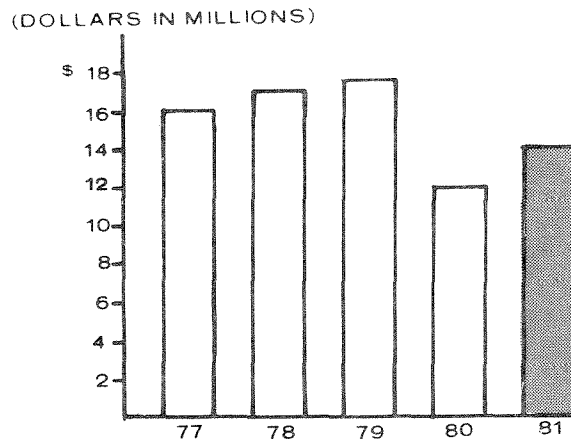
The principal elements and information needed to improve priority programming already exist within DHT. What is needed is a commitment to a more systematic and informative presentation of anticipated work, priorities assigned to various projects, and project accomplishment.

III. Equipment Management and Utilization

As of June 1980, the Department of Highways and Transportation owned and operated 18,808 pieces of equipment valued at over \$91 million. The department spends about \$15 million each year to buy and replace equipment. DHT expenditures for equipment over the last four fiscal years and projected expenditures for fiscal year 1981 are shown in Figure 7.

Figure 7

EQUIPMENT PURCHASES (FY 1977-FY 1981)



Source: DHT Purchase Records, 1977-1980; Approved Expenditure Estimates, 1981.

DHT classifies its equipment inventory into two broad categories and several hundred classes. The two broad categories are fleet equipment and expendable equipment. Units of equipment in both categories are located at district and residency facilities throughout the State (Table 5).

Fleet equipment includes 6,750 large motorized pieces of machinery (Table 6). Acquiring, managing, and disposing of fleet equipment is the responsibility of DHT's equipment division.

Expendable equipment includes 12,058 pieces which usually have a lesser value and shorter life than fleet equipment. Such items as chain saws, water pumps, chemical spreaders, snow plow attachments, and generators are examples of expendable equipment. The equipment division is responsible for acquiring and disposing of expendable equipment, while district and residency personnel manage day-to-day use of the items.

Table 5

LOCATION OF FLEET AND EXPENDABLE EQUIPMENT
(June 30, 1980)

<u>District</u>	<u>Units of Fleet Equipment</u>	<u>Units of Expendable Equipment</u>
Bristol	922	1,455
Salem	828	1,509
Lynchburg	663	1,201
Richmond	904	1,568
Suffolk	730	1,308
Fredericksburg	512	1,021
Culpeper	1,167	2,327
Staunton	787	1,623
Equipment Depot	<u>137</u>	<u>46</u>
Total	6,750	12,058

Source: DHT Equipment Inventory, 1980.

Table 6

CLASSES OF FLEET EQUIPMENT
(In operation a full fiscal year)
(Fiscal Year 1980)

<u>Class</u>	<u>Number of Units</u>	<u>Class</u>	<u>Number of Units</u>
Large Trucks	2,245	Line Markers	25
Pickup Trucks	1,311	Rotary Snow Plows	19
Tractor Mowers	737	Cranes	17
Loaders	455	Gradalls	16
Motor Graders	394	Pulverizers	11
Rollers	231	Buses	11
Survey Wagons	185	Tunnel Trucks	11
Compressors	124	Car Washers	10
Dozers	111	Fork Lifts	9
Distributors	110	Vans	7
Welders	77	Trenchers	6
Trailers	58	Alignment Machines	6
Trailer-Mounted Drills	51	Pay Haulers	5
Tractors	49	Crack Fillers	4
Sprayers	40	Ferry Boats	4
Brush Chippers	38	Mud Jacks	3
Spreaders	36	Line Removers	3
Sweepers	32	Paver	1
Mixers	29	Asphalt Heater	1
Scrapers	25	Bituminous Plant	1

Note: Each general class may contain from one to 10 more specific classes of equipment. There are 135 classes of fleet equipment. This table excludes equipment housed at Fulton Depot.

Source: Equipment Utilization Standards Report, July 1980.

In addition to DHT equipment, district and residency personnel may use equipment and operators hired from private sources. In fiscal year 1980, expenditures for hired equipment totalled \$6.2 million. Equipment and operators are hired for emergency snow removal and storm damage purposes as well as for routine use in highway maintenance and construction activities.

FLEET EQUIPMENT UTILIZATION AND MANAGEMENT

DHT has developed utilization standards for its fleet equipment. Actual utilization of DHT fleet equipment was 86 percent of the desired utilization standards in fiscal year 1980 (Table 7). Underutilization by 14 percent represents 1.1 million hours of time which was potentially productive but during which the equipment stood idle.

Table 7
UTILIZATION OF FLEET EQUIPMENT BY DISTRICT
(FY 1980)

<u>District</u>	<u>Utilization</u>
Staunton	81%
Fredericksburg	82
Culpeper	84
Suffolk	85
Richmond	86
Bristol	88
Lynchburg	92
Salem	93
Statewide	86%

Source: DHT Equipment Operating Statement, FY 1980.

Utilization Standards

The equipment division has developed standards for 104 of the 135 classes of fleet equipment. The equipment division's manual states:

These standards serve as a guide in governing the amount of equipment required in each district, thereby, creating greater utilization and economy in equipment operations.

The standards currently in use are based on average utilization of each class of equipment for fiscal years 1971 through 1975. The equipment division chose this period as representative of the desired level of utilization. The equipment division expects the utilization standards to be achieved, as noted in the division's manual:

The average usage of all equipment in a particular class within the district should equal or exceed the prescribed standard. In cases where individual units are below the recommended standard, evaluation should be made to determine the feasibility of retention.

Except for a few classes, utilization standards have not changed since fiscal year 1975.

Equipment utilization standards are expressed in terms of hours of use per year (Table 8). Because they are based on actual utilization, the standards include allowances for breakdowns and seasonal variations. In addition, the standards reflect the geographical distribution of equipment during the base period, thereby incorporating the special needs of some districts and residencies due to topography. Actual utilization should, therefore, equal 100 percent of the standard.

Table 8

EXAMPLES OF DHT UTILIZATION STANDARDS
FOR SELECTED CLASSES OF EQUIPMENT
(One employee year = 2,080 hours)

<u>Class</u>	<u>Hours Per Year</u>
Pick-up trucks	1,915
Dump trucks	1,600
Motor graders	1,100
Crawler loader	800
Tractor mower	490
Athey loader	400
Concrete mixer	85

Source: DHT Equipment Rental Rates and Utilization Standards Report, July 1980.

Classes of equipment intended for special or emergency use are not assigned a standard. There are 31 such classes, including ferry boats, fork lifts, mobile cranes, and wrecker trucks.

Utilization of Fleet Equipment

Although the average utilization of fleet equipment in fiscal year 1980 was 86 percent of the standards, utilization of individual classes of fleet equipment ranged from six to 263 percent. Sixty classes of fleet equipment, comprising 1,229 items, were utilized less than 80 percent of the standard in fiscal year 1980, as shown in Table 9. Sixteen classes of equipment containing 197 items were utilized less than 50 percent of the respective standard. These classes included pulverizers, diamond-core drills, concrete mixers, and patch mixers. Classes with the

Table 9
UTILIZATION OF FLEET EQUIPMENT CLASSES
(FY 1980)

<u>Utilization</u>	<u>Number of Classes</u>	<u>Number of Items</u>
1 - 10%	3	7
11 - 20%	1	1
21 - 30%	4	22
31 - 40%	3	30
41 - 50%	5	137
51 - 60%	13	207
61 - 70%	17	534
71 - 80%	14	291
81 - 90%	20	2,620
91 -100%	15	2,409
Over 100%	<u>9</u>	<u>164</u>
Total	104	6,422

NOTE: Does not include equipment classes which do not have a utilization standard.

Source: JLARC Utilization Analysis.

highest level of utilization included chemical sprayers, large trailers, and Athey loaders. As these figures are average utilization for an entire class of equipment, utilization of individual units may differ from the average, and be either higher or lower.

Underutilization is significant both in terms of higher than necessary costs to purchase equipment which is not used, and in the added cost of maintaining equipment in operating condition. The following example illustrates these costs.

DHT has a "bare pavement" policy for snow removal, and owns 19 rotary snow plows for use in heavy snow falls. The purchase price for these units was \$519,283. In fiscal year 1980, the 19 plows recorded 46 hours of use, or an average of two and one-half hours apiece. Eight units were not used at all in fiscal year 1980, even though the State experienced several heavy snows.

Since 1972, each of the 19 units has averaged two and one-half hours of use a year, although heavy snows fell during this period. The operating costs for these units has been \$405,043 in depreciation and maintenance expenditures over the eight-year period.

The need for effective management of the DHT equipment inventory is clear. However, the JLARC review noted three major weaknesses in

the management of fleet equipment which have contributed to the purchase and retention of potentially unneeded equipment and a corresponding underutilization. The weaknesses include:

- Lack of central office information and authority to review and control utilization of fleet equipment within districts.
- Hourly rates charged by the equipment division for the use of fleet equipment appear to promote underutilization.
- Lack of a thorough needs assessment process for new equipment which has resulted in the approval to purchase some equipment which appears unjustified.

Central Control

Underutilized fleet equipment appears to have remained in districts and residencies when the units could have been transferred to another part of the State and used. In part, this has occurred because the equipment division lacks the information and initiative to provide central control.

The equipment division periodically reviews the utilization of fleet equipment in the districts. However, such reviews are not conducted annually on all classes of equipment. Utilization is reviewed only when a district requests additional or replacement equipment. In addition, current procedures specify that the central office equipment engineer may not initiate a request to transfer equipment out of a district. It is left up to the district personnel to determine when a piece of equipment is sufficiently underutilized to be transferred.

The mechanism for districts to use in informing the equipment division of underutilized items available for transfer is a monthly report. This report is intended to list all equipment available for transfer. However, the monthly reports are of little value because they list only a few items available for transfer. In fact, two districts did not submit any monthly reports for all of fiscal year 1980. This lack of systematic information on the availability of underutilized equipment, coupled with the fact that the central office equipment division does not mandate a transfer even if it knows of equipment availability, indicates that DHT has not been effectively overseeing the distribution and use of fleet equipment.

Hourly Rates

The equipment division is operated by DHT as an intra-departmental auxiliary enterprise and is intended to be self-sustaining through revenues generated by the use of fleet equipment. Districts and residencies which use fleet equipment are charged an hourly fee paid from their budget based on the class of equipment. Hourly rates are calculated to cover operating costs, depreciation, and any prior year shortfalls incurred by the district in operating equipment.

Current hourly rates charged for the use of DHT fleet equipment appear to promote underutilization. Personnel in three residencies indicated that needed maintenance on highways is being reduced or deferred, and that DHT equipment is standing idle, because their budget cannot support the rates charged by the equipment division for some classes of equipment. Specifically, the residency personnel stated that the rate of increase in the hourly rates charged against their budgets is a key factor in management decisions not to use available equipment, as illustrated in the following example:

Machine ditching uses a crew and several vehicles to clean ditches along a road for as much as several miles. An assistant resident engineer indicated that his residency could not afford to do as much ditching as in prior years, and that some of the equipment was not being used.

Instead, the residency was doing critical "spot" maintenance of ditches by hand but not completing the large-scale routine work required under maintenance standards.

Maintenance division staff said that this residency has adequate funding for machine ditching. Nevertheless, residency personnel chose not to do machine ditching as they felt it was too expensive.

DHT increased hourly rates by an average of 26 percent in fiscal year 1980. Much of the increase was unavoidable due to rising fuel costs. However, two DHT policies artificially inflate hourly rates and result in unnecessary pressure on residency and district budgets.

Treatment of Fixed Costs. DHT sets hourly rates based on both variable operating costs such as fuel, oil and repair parts, and on fixed costs including depreciation and overhead charges such as the cost of storage facilities and clerical support. As noted earlier, hourly charges are only applied if the equipment is used; there is no cost to the residency or district for equipment which is idle. This is done despite the fact that the fixed portion of the hourly rate is a cost to DHT regardless of whether the equipment is used.

By attempting to offset all fixed costs through hourly charges for use, DHT is increasing the cost to field units of operating their equipment. This serves as a disincentive to using equipment because a field manager can reduce a field unit's cost of operation by allowing equipment to stand idle even though the real cost of underutilization in terms of depreciation and overhead exists and must be passed on to all field units.

The current DHT policy does not adequately treat the fixed costs of the fleet equipment inventory and may contribute directly to underutilization. DHT should develop separate fixed and variable charges and apply fixed charges to equipment in the possession of a district or residency based on the utilization standard and not on actual use.

The recommended treatment of fixed cost charges would have the additional benefit of promoting more careful inventory management. Kentucky, which has such a charge, noted in a recent report that the rate structure had been:

. . . established after departmental officials noted that some districts possessed an inordinate amount of equipment . . . Since much of the equipment (had been) only charged only as used, the districts were able to possess excess equipment at little liability . . . The result (of the flat monthly rate) has been a reduction in the overall size of the equipment fleet, since many users do not have sufficient operating budgets to carry extra equipment charges.

Carryover of Shortfalls. For a variety of reasons, including increasing fuel costs and underutilization of some equipment, DHT experienced a \$5.6 million shortfall in FY 1980 between total fixed and variable costs and the "revenues" received from district and residency users of the equipment. This shortfall does not represent a cash deficit; rather it is an accounting imbalance that results primarily from failing to recover the total depreciation charge made against the FY 1980 time period.

By DHT policy the \$5.6 million was added to the costs to be recovered through hourly charges during FY 1981. Although the general approach adopted by DHT for accounting for equipment costs is sound, the inclusion of a prior year shortfall, if not an actual cash deficit, has the effect of artificially increasing the hourly rates charged to field staff. If this increased charge results in deliberate underutilization of equipment, as is suggested by field personnel, the treatment of the shortfall for accounting purposes results in an unintended and undesirable impact on current operations.

DHT should reconsider its treatment of prior year shortfalls which do not involve actual cash deficits and are, therefore, simply accounting transactions.

Needs Assessment

The DHT needs assessment process is inadequate to ensure that only needed pieces of equipment not available within the department are purchased. Resident engineers initially identify a need to add or replace a piece of fleet equipment. These requests are then reviewed at the districts. In some cases, the district equipment superintendents indicated that they are not consulted about equipment that may be available for transfer within the district. Since equipment superintendents are responsible for day-to-day oversight of the district-wide inventory, a needs review which does not include their participation is incomplete.

The equipment division then compiles all district requests for equipment and calculates expenditure estimates for approval by the director of operations. The equipment division expenditure estimate is used by DHT for budget planning and as a guide in purchasing equipment.

A final review of requests for new or replacement purchases is conducted by the equipment division when districts actually requisition equipment. The district requests for equipment may differ from requisitions due to reviews and communication with the equipment division. As noted earlier, the equipment division conducts no systematic review of utilization for all classes of fleet equipment. Not surprisingly, the equipment division staff indicated they approved virtually all requisitions to purchase equipment. The division estimated they approved 99 percent of all replacements and 90 percent of all requisitions for new equipment.

Improved needs assessment could result in substantial savings. To illustrate the potential for cost savings, JLARC staff analyzed the pending requests for new or replacement purchases for equipment. The procedure for analyzing the requests is shown in Figure 8.

Table 10 shows that for all equipment requested in the equipment division's fiscal year 1980 expenditure estimate, as much as \$9.4 million could be saved both through transferring available underutilized items to fill pending requests, and by not purchasing items where a surplus exists. While extenuating circumstances may justify the retention or replacement of individual underutilized units of equipment, the extent of underutilization confirms that significant savings are available through better equipment management. The following examples illustrate how these savings could be realized.

DHT operated 56 compressors in fiscal year 1980. Statewide utilization was only 65 percent. If all compressors were operated at the utilization standard, as many as 21 compressors located across the State could be surplus.

Five districts requested replacement of ten units, and one district requested an additional unit for fiscal year 1981. The total cost for the 11 requested units is \$154,660.

If underutilized items were transferred, none of the requested replacements would be needed. A one-time savings of \$154,600 could result.

* * *

DHT operated 63 tractor mowers at a 57 percent level of utilization in fiscal year 1980. Six districts requested ten units for fiscal year 1981, at a cost of \$177,000. However, it appears that better utilization of existing equipment could eliminate the need for those requests.

One district requested two additional tractor mowers, although its four existing units were only operated at 35 percent utilization. Another district

Figure 8

UTILIZATION OF FLEET EQUIPMENT

Utilization of all classes of equipment during FY 1980 was reviewed. JLARC staff calculated the surplus equipment for each class which was then compared with district purchase requests.

Surplus equipment in each district and class was calculated by using the equation:

$$\frac{(\text{Units} \times \text{Standard}) - \text{Actual Hours Used}}{\text{Standard}} = \frac{\text{Hours Idle}}{\text{Standard}} = \text{SURPLUS}$$

where

Units = Total number of units operating a full 12 months

Standard = Required number of hours for each unit

Actual Hours = Actual number of hours for all units

The equation results in a class surplus of equipment within the district, as in the following example.

One district operated 192 pickup trucks for 12 months in FY 1980. The 192 trucks recorded 307,683 hours of use. The standard for pickup trucks is 1915 hours per year. Application of the utilization standard would result in determination of surplus trucks as shown below.

$$\frac{(192 \times 1915) - 307,683}{1915} = \frac{59,997}{1915} = 31.3 \text{ Surplus Trucks}$$

The district requested to replace 33 pickup trucks in FY 1981 at an approximate cost of \$172,260.

If the equipment division does not replace the surplus trucks, the actual need is for only two of the 33 requested. A potential savings of \$161,820 could be achieved by not replacing surplus trucks.

Table 10

ESTIMATED SAVINGS OF DEFERRED
PURCHASES FOR EQUIPMENT

<u>Class of Equipment</u>	<u># Requested but Not Needed Based on Standards</u>	<u>Estimated Unit Cost</u>	<u>Estimated Savings</u>
Dump Trucks	149	\$ 20,000	\$2,980,000
Motor Graders (25,000 lb)	20	43,820	876,400
Pickup Trucks	146	5,220	762,120
Tractor Mowers	65	9,740	633,100
Crawler-Dozers	8	69,800	558,400
Tractor Loaders	11	36,260	398,860
Trucks w/Aerial Bucket	6	36,690	220,140
Loader Crawlers	4	53,000	212,000
Loader w/Backhoes	4	49,170	196,680
Distributors (1000 Gal.)	8	24,580	196,640
Trucks (3/4 To 1 Ton)	27	7,260	196,020
Gas Operated Rollers	12	14,850	178,200
Rotary Guardrail Mowers	10	17,700	177,000
Athey Loaders	3	57,000	171,000
Trucks 6-8 Tons	3	52,300	156,900
Compressors (250 Cu. Ft.)	11	14,060	154,660
Mobile Cranes	1	152,400	152,400
Survey Wagons	19	7,500	142,500
Trucks (3 Ton)	7	15,730	110,110
Mowers w/Cutter Bars	8	13,030	104,240
Gradalls	1	95,150	95,150
Trucks (5 Ton)	5	15,990	79,950
Rollers w/Tires	4	18,670	74,680
Pulverisers - Diesel	2	36,000	72,000
Distributors (600 Gal)	10	6,930	69,300
Small Loaders	3	21,950	65,850
Small Angledozer	2	30,000	60,000
Buses	3	16,140	48,420
Brush Chippers	5	7,690	38,450
Tractors (110 HP)	2	18,970	37,940
Trucks (1½ Ton)	3	10,230	30,690
Compressors (150 Cu. Ft.)	4	7,200	28,800
Sweepers	3	8,700	26,100
Sheepfoot Rollers	4	6,240	24,960
Spreaders	6	4,090	24,540
Vibrating Rollers	1	24,000	24,000
Diamond Core Drills	1	20,660	20,660
Trailer Mounted Drills	1	19,030	19,030
Welders (400 AMP)	7	3,770	18,850
Compressors (365 Cu. Ft.)	1	15,480	15,480
Trailers (16 Ton)	2	7,440	14,880
Total	592		\$9,467,100

Source: Compiled by JLARC staff using DHT utilization data and field requests for equipment purchases shown in FY 1980 expenditure estimates.

requested replacement of two of their five units plus one additional unit, although the five existing units were only used 20 percent of the utilization standard.

And finally, a district requested replacement of three of its 14 mowers although the 14 existing units operated at 36 percent of the standard. In all there may be as many as 27 surplus tractor mowers in the present inventory.

* * *

DHT operated 69 angledozers in FY 1980 at a 71 percent level of utilization. Four districts requested replacement of eight units at a cost of \$558,400.

However, one district operated three dozers at a 29 percent level of utilization and another district operated nine units at a 44 percent level. Rather than replace eight units, the department should transfer dozers from districts where utilization is low. A savings of \$558,400 could result.

* * *

DHT operated ten tandem drive rollers used in construction work for a full 12 months in FY 1980. The rollers averaged 51 percent utilization in all districts.

One district operated one roller only 10 hours for the year which amounts to a two percent utilization. Another district requested to replace one unit at a cost of \$24,000. DHT could transfer a roller rather than purchase a new one.

These examples illustrate the potential savings that could result if DHT (1) thoroughly assessed utilization of all existing equipment on an annual basis, and (2) transferred underutilized items to districts and residencies requesting to add or replace a unit.

HIRED EQUIPMENT

Equipment is hired from outside sources by district and residency staff for several reasons:

- To fulfill maintenance and construction obligations when State equipment is not available.
- To get a specialized piece of equipment.

- To use equipment for a short period of time without incurring the added potential costs of repair.
- To supplement equipment already being utilized during peak workloads.
- To fill an emergency need.

An additional reason frequently cited by DHT staff for hiring equipment was to acquire the services of an equipment operator.

The use of hired equipment has increased dramatically over the last five years. Expenditures increased from \$920,000 in fiscal year 1976 to more than \$6 million in fiscal year 1980 (Table 11). Cumulative expenditures have exceeded \$26 million since fiscal year 1976.

Table 11
HIRED EQUIPMENT COSTS

<u>Fiscal Year</u>	<u>Costs</u>
1976	\$ 920,000
1977	3,156,000
1978	6,715,000
1979	9,846,000
1980	<u>6,221,000</u>
Total	\$26,858,000

Source: Management Services Division Report 8/2/79 and Maintenance Division Hired Equipment Summary Report, 1980.

According to DHT policy, the determination to rent private equipment for routine purposes is made by resident engineers or district section heads after reviewing the availability of fleet equipment. When it is determined that fleet equipment is not available, a request for hired equipment is submitted to the district engineer for approval. The maintenance engineer in the central office approves contracts for equipment hired for emergency reasons such as snow removal and flood and storm damage.

It appears that the district review process does not always review all available information about utilization. Six of the eight district equipment superintendents said they were not contacted in many instances when equipment was hired from private sources during fiscal year 1980. As a result, information about DHT equipment available for transfer, which is the responsibility of the superintendents, was not considered prior to final approval to hire equipment.

A review of hired equipment utilization during FY 1980 found that the lack of effective district or central office review resulted in the hiring of private equipment when DHT equipment was available. The following examples illustrate the problem.

A residency paid \$1,508 to private contractors for the use of dozers in September 1979. In the same month, the residency utilized its own two dozers only four hours. The utilization standard for each dozer is approximately 45 hours monthly.

* * *

A residency hired 503 hours of angledozers from private contractors at a cost of \$18,121 in September 1979. In the same month, the residency operated two of their own dozers for only 64 hours.

* * *

A residency operated its loaders at a 49 percent level of utilization and paid \$12,712 to private contractors for loaders in the same month.

* * *

A residency rented dozers from private sources at a cost of \$5,810 for the month, while not utilizing their own three dozers at all. The resident engineer stated that the dozers were hired to get operators instead of equipment.

* * *

A residency rented a dozer from private sources at a cost of \$2,152 for the month. The residency utilized its own two dozers for only 16 hours during the month.

In each of these cases, the fact that the equipment was available was verified with DHT field staff. A reason often given for hiring equipment when DHT equipment is available is the need for operators to supplement DHT personnel. In effect, the residencies are using their flexibility in hiring equipment to hire part-time personnel. Regardless of the circumstances in each case, the use of hired equipment to obtain operators appears to be a costly and generally questionable practice and suggests the need for additional district and central office review.

A second problem in review procedures for hired equipment is the lack of a clear policy on temporary transfer of items. Temporary transfer between residencies to fill short term needs can be a cost effective way of meeting the demand of workload fluctuation. One district equipment superintendent said that transfer of many items of equipment between residencies within a district, or even between contiguous

districts, could pay for itself in one day's operation compared to hiring equipment.

The large number of equipment classes with significant underutilization indicates the potential for temporary as well as permanent transfer as a cost-saving alternative. This potential is further illustrated in the following examples.

In March 1980 three residencies in one district hired dozers at a cost of \$2,720. Another residency in the same district had three dozers that were not used at all during the month. The residencies renting dozers were within 80 miles of the residency with idle dozers.

* * *

Four residencies in one district paid \$35,950 for rental of angledozers in September 1979. During the same month, one residency had two dozers that were not used at all, and another residency had two dozers that recorded a total of four hours utilization. In each instance equipment was available in adjacent residencies.

These examples clearly illustrate the need to identify underutilized DHT equipment and to ensure its use before hiring equipment from private sources.

STRENGTHENING EQUIPMENT MANAGEMENT

During FY 1980, underutilization of DHT fleet equipment occurred in each district and across many classes of equipment. Weaknesses in the equipment division's oversight procedures for fleet equipment have resulted in districts and residencies retaining idle and underutilized units. In addition, residencies hired equipment from outside sources to obtain operators when State equipment was available for use. A careful review of pending requests for the purchase of new equipment could result in substantial savings.

DHT needs to improve utilization of fleet equipment. The following recommendations appear to be necessary first steps.

Recommendation 4. The equipment division should periodically review and update the utilization standards. The standards should be achievable and should also reflect a desirable level of utilization. Guidelines should be developed for designating a class of equipment to be emergency equipment requiring no standard.

Recommendation 5. The equipment division should annually review utilization of all items of fleet equipment. The equipment engineer should use the results of this review to initiate transfers of

underutilized items, to declare items surplus, and to assess the need for purchasing new equipment.

Recommendation 6. The equipment division should change its reporting system to provide information on utilization rates for each item of fleet equipment by location in the DHT inventory. This will require only minor changes in the existing recordkeeping system which shows data by equipment class. Using this information, the equipment division should provide active oversight of equipment utilization.

Recommendation 7. DHT should defer purchase of all new fleet equipment except for emergency cases authorized by the commissioner until an improved process for determining the need for fleet equipment has been implemented. In addition, DHT should conduct more thorough and systematic assessments of equipment need prior to replacing or adding items to the inventory.

Recommendation 8. A thorough review of the availability of fleet equipment should be conducted at the district level prior to hiring equipment from private sources. Available equipment and associated operators should be transferred to meet the need wherever the transfer can be shown to be cost-effective.

Recommendation 9. DHT should reassess the basis for charging costs to users of fleet equipment. Cost categories should be established for both fixed and variable costs and applied separately with the fixed cost charge applied whether or not the equipment is actually used. DHT should also reconsider including prior year accounting losses in the calculation of current rate structures unless an actual cash deficit in fleet operation was incurred.

IV. Contract Administration

Private firms under contract to the Department of Highways and Transportation do most of Virginia's highway construction and much of the maintenance replacement work. In fiscal year 1980, the department received bids for 336 projects. Of these, 306 projects valued at over \$241 million were awarded. Various characteristics of the projects bid in fiscal year 1980 are shown in Table 12. Half of the projects involved maintenance work. The nine largest projects accounted for 43 percent of the total value of contracts bid. Forty projects valued at \$21.3 million received only a single bid.

Virginia, along with several other states, has experienced a major bid-rigging investigation in recent months in which 19 firms have been implicated for collusion and antitrust violations. As of January 6, 1981, 15 firms were disqualified by DHT for involvement in bid-rigging. Effective contract administration is needed not only to prevent illegal activity but also to ensure adequate and timely completion of the contracts which are awarded. Recommendations have been made by the Attorney General for improving DHT's contracting procedures.

It appears that several weaknesses in the prequalification process may limit DHT policies which apply to disqualification of certain companies. Procedures used to estimate the price of contracts are not fully effective. Cost and time overruns were substantial in fiscal year 1980.

The Contracting Process

The administration of contracts for the construction of highways involves three related phases:

- prequalification of bidders;
- bidding and contract award; and
- construction administration.

Prequalification. Prior to submitting any bid for a highway construction project, a contractor must prequalify. Prequalification means that the contractor has been judged by DHT to be financially and organizationally qualified to complete construction projects up to a specified dollar value. As of September 1980, there were 657 contractors prequalified with the department. Contractors may qualify as individuals, partnerships, or corporations.

To prequalify, a prospective bidder must submit a financial statement prepared by an independent certified public accountant and an application listing previous experience and qualifications. The application shows the education and experience of key staff and the amount and type of equipment owned by the contractor. The application also requires

Table 12

PROJECT CHARACTERISTICS FY 1980

TYPE OF WORK			PROJECT LOCATIONS		
Type	Projects	%	District	Projects	%
Construction	131	39	Bristol	50	15
Maintenance	173	51	Culpeper	60	18
Other	32	10	Fredericksburg	24	8
			Lynchburg	24	8
TOTAL	336	100%	Richmond	45	13
			Salem	46	13
			Staunton	40	12
			Suffolk	46	13
			Statewide	1	*
			TOTAL	336	100%

*Less than 1%

PROJECT VALUE

Project Value	Projects	%	Total Value	%
\$0 to \$100,000	68	20	\$ 4,694,991	2
\$100,000 to \$500,000	164	49	41,608,056	17
\$500,000 to \$1,000,000	25	8	17,956,543	8
\$1,000,000 to \$5,000,000	40	12	72,584,230	30
\$5,000,000 or more	9	2	104,764,848	43
No Award Made	30	9	--	--
TOTAL	336	100%	\$241,608,668	100%

Range: \$13,755 to \$26.7 million

Average Value of Each Project: \$790,000

BIDDERS FOR ALL PROJECTS

No. of Bidders	No. of Projects	Average Project Size	Total Value of Project
1	40	\$ 532,000	\$ 21.3 million
2	63	565,000	35.6 million
3 to 5	155	734,000	113.8 million
6 or more	78	1,173,000	91.5 million

BIDDERS BY PROJECT TYPE

No. of Bidders	Construction		Maintenance		Other	
	No. of Projects	Percent	No. of Projects	Percent	No. of Projects	Percent
1	10	8%	27	15%	3	10%
2	15	11	37	21	11	34
3 to 5	57	43	89	51	9	28
6 or more	49	38	20	13	9	28
	131	100%	173	100%	32	100%

BIDDERS BY PROJECT VALUE

No. of Bidders	\$0 to \$100,000	\$100,000 to \$500,000	\$500,000 to \$1,000,000	\$1,000,000 to \$5,000,000	\$5,000,000 or more	No Award Made
1	2	16	4	7	0	11
2	18	30	2	3	1	9
3 to 5	31	84	10	16	5	9
6 or more	17	34	9	14	3	1
	68	164	25	40	9	30

Source: Compiled by JLARC from VDHT bid tabulations.

disclosure of other states in which the contractor is prequalified, other firms with which the contractor is affiliated, and any previous disqualifications. Applications must be resubmitted annually.

Applications and financial statements are reviewed by DHT along with reports on the contractor's performance in the completion of projects in Virginia. Performance reports are used to develop a maximum amount of work which the firm may have under way and still bid on DHT contracts. This information is used, along with the financial statements, to make the prequalification decision and assign a limit on the value of projects for which a contractor may compete. The prequalification process used in Virginia is shown in Figure 9.

Bidding. The second phase of contract administration is the letting of contracts in a competitive bid process. Sections 33.1-185 through 33.1-187 of the Code of Virginia require that all highway construction and maintenance contracts, except those for emergencies, be awarded by competitive bid. The major steps in the bidding process are (1) preparation of the pre-bid estimate; (2) advertisement of the contract; (3) receipt and tabulation of bids; and (4) recommendation and award of the contract.

The pre-bid estimate is prepared by the construction division from completed plans. The estimate is designed to provide an independent measure of the reasonableness of the bids. For the low bid to be accepted, it generally must not be more than seven percent higher than the estimate. In the past, the department used historical price data from bids to establish the estimate, but in the future will use current prices.

After the bid proposal forms have been assembled, the project is advertised. Normally, the advertisement is made at least four or five weeks prior to the closing date for submission of bids. The advertisement is run in newspapers and trade publications, and bid proposal forms are mailed to each prequalified bidder. The department also conducts a "showing," which is a field review of the project with the prospective bidders.

On the closing date for receipt of the bids, the bids are publically opened and read. The construction division then makes a detailed review of the lowest bid to ensure compliance with the specifications. The lowest bidder which complies is recommended for award by DHT's chief engineer. The final award is made by a vote of the Highway and Transportation Commission.

Contract Administration. Once a contract has been awarded, the day-to-day responsibility for contract administration shifts to the field organization. Project engineers and inspectors in the residencies are responsible for administration of the contract in the field. Among the most important duties of the field inspector are inspection and documentation of construction to ensure compliance with specifications and the terms of the contract. Because cost and time are important constraints in each contract, expenditures and progress are closely monitored.

Figure 9

PREQUALIFICATION PROCESS

1. Potential contractor submits a certified financial statement and an application using experience, previous work, ownership, and affiliations.
2. The financial statement is audited by the DHT fiscal division. Total net assets are calculated.
3. If the potential contractor has done work for DHT, the department uses the five most recent performance reports, which are completed by the resident and district engineers at the end of each project, to calculate an ability factor. The factor is the average of the five ratings.
4. The total net assets and ability factor are used to calculate the contractor's maximum capacity rating. The rating is the maximum dollar amount of work which a contractor may have on hand not yet completed.
5. The contractor's experience is used to determine which type of construction he is qualified to do. The contractor is given a classification, which is usually general highway construction.
6. Once a contractor has been classified and has had a maximum capacity rating calculated, he is placed on the prequalified bidders list.

Example

A contractor with total net assets of \$500,000 requests renewal of his prequalification. His performance ratings on the last five jobs were 7.4, 8.2, 8.0, 7.8, and 7.5.

The department averages the five ratings to give the contractor an ability factor of 7.8. The factor is multiplied by the net assets to give the contractor a maximum capacity rating of \$3.9 million.

As the result of increasing requirements for the inspector's time on the job, the department has begun to use phase inspection. This simply means that inspectors now inspect the contractor's work at certain "critical points," rather than throughout the work. Prior to phase inspection, continuous on-site inspection was required.

DHT CONTRACTING PROCEDURES

A review of procedures used by DHT in preparing and awarding contracts disclosed several weaknesses. The current prequalification process does not ensure complete and accurate disclosure of corporate affiliations. The pre-bid estimate, which is intended to serve as a check on the reasonableness of bids, may add to the costs of some projects because of the way it is used by the department. In addition, management tools used by DHT to enforce time limits on contracts may not be fully effective.

To perform the review, information was collected on DHT's contract administration process in several ways. Interviews were conducted with key personnel in the construction division who prepare and award contracts, and with project engineers, construction inspectors, and additional district and residency staff involved with the field administration of contracts. Data was collected on 336 projects on which bids were submitted in fiscal year 1980, and on 200 projects completed during that year. In addition, a special analysis was conducted of all 657 contractors prequalified to bid on contracts. Findings of the recent study by R. J. Hansen Associates, Inc., were also reviewed.

Prequalification

A review of the DHT prequalification process noted two areas which should be addressed by DHT: disclosure of affiliations and the treatment of field performance ratings.

Disclosure of Affiliations. The policy of the department is that all affiliated companies be disqualified and removed from the bidders list if any one is implicated in collusion or other illegal activity. For example, if an officer or owner of one firm is implicated in illegal activities, other firms in which he is an officer or owner may also be disqualified. This policy has been applied in several instances as a result of the U.S. Justice Department's investigation of bid-rigging in several southern states. To enforce its policy, the department must have accurate information on the extent and nature of affiliations of prequalified contractors. For this purpose the prequalification application requires disclosure of affiliations and ownership.

Review of Current Disclosure. The current prequalification process does not ensure complete and accurate disclosure of affiliations. JLARC staff examined the addresses and telephone numbers of all 657

contractors on the August 1980 bidders list as a starting point in testing the accuracy of affiliations shown on applications. The examination found 14 instances involving a total of 37 firms where contractors appeared to be affiliated based on address and telephone numbers but the applications on file with DHT failed to disclose the full nature of the affiliation. Three case examples illustrate the finding:

Three Tidewater firms--E.V. Williams Co., Inc., Williams Paving Co., and Portsmouth Paving Corp.--were identified as being associated. The first two firms share the same address and telephone number. The president of E.V. Williams is the chairman of the board for the other two.

In their applications, E.V. Williams Co. lists both Williams Paving and Portsmouth Paving as affiliations; Williams Paving lists only E.V. Williams Co.; and Portsmouth Paving lists no affiliations.

* * *

Henry S. Branscome, Inc., and Chickahominy, Inc., share the same address and telephone numbers. Both firms are owned by the same two people, who are also the only officers of the companies.

In its application, Branscome lists an affiliation with a third, non-construction corporation, but not with Chickahominy. On the other hand, Chickahominy lists both Branscome and the non-construction company.

* * *

Echols Bros., Inc., and Fairfield Bridge Co. operate from the same address and share the same officers. Echols owns stock in Fairfield. Both firms list no affiliations.

The fact that the JLARC review was limited to a review of matching telephone and address numbers suggests that there may be additional erroneous or incomplete applications in the DHT files.

The failure of contractors to fully disclose their affiliations appears to be due, in part, to two weaknesses in DHT's disclosure requirement. First, the DHT policy on disclosure is not clearly explained in the application instructions. For example, the instructions do not specifically require disclosure of the fact that an individual is an officer of more than one prequalified firm, even though this kind of a relationship would logically be considered an affiliation for the intent of the DHT policy. The vague nature of the current language makes it difficult to enforce this provision.

Second, DHT does not audit the application information even though the department reserves the right to audit the records of all prequalified firms. Periodic audits of a limited sample of firms would provide an important control to ensure compliance.

Use of the Performance Reports. The practice of averaging the five most recent performance reports in developing a maximum capacity rating is intended to give contractors the benefit of several experiences in establishing a rating. This is a reasonable approach since the rating should include as much of the contractor's experience as possible. However, the current practice may excessively discount recent performance in evaluating a pattern of poor performance by a contractor. An example of a trend of declining performance which would not be reflected in any way in the assignment of a rating follows:

A contractor has total net assets of \$1.2 million. In his past five jobs, the performance ratings have been:

<u>Completion Date</u>	<u>Performance Rating</u>
January 1976	8.7
December 1976	8.6
November 1977	8.4
May 1979	6.0
November 1980	4.9

The ability factor is the average of the five ratings, or 7.3. This ability factor is much higher than either of the two most recent jobs. In fact, it is closer to the job completed three years ago, in November of 1977. With a factor of 7.3, the maximum capacity for the contractor is \$8.76 million (\$1.2 million x 7.3).

Conversely, a contractor might continue to carry a lower overall rating due to a low field evaluation given a number of years ago.

A related and perhaps more significant problem is the practice of disregarding very high or very low performance field ratings in calculating the ability factor. The purpose is to eliminate any possibility of including aberrant performance ratings in the calculation, thus protecting the contractor from poor ratings due to personal differences with the department's field personnel. However, it appears that low ratings are discounted automatically regardless of the evidence or documentation available to field staff to justify their evaluations. The result of this practice is a somewhat arbitrary moderation of the ability factor, reducing the impact of either very good or very poor performance. A different approach would be to treat any unusually high or low performance ratings as a requirement for further investigation by the central office prior to determining the appropriate use of the field evaluation.

A final weakness in the use of field evaluation is the department's limited use of the past performance reports. It appears that the reports are currently used only in the calculation of the ability factor. Although the form contains information on specific problems experienced by the contractor, the department has no systematic way to ensure that problems identified in the past performance report are corrected prior to awarding that contractor any subsequent jobs. The following example shows what can result when problems go uncorrected.

A Northern Virginia firm has performance reports dating from January 1970 which consistently show problems with equipment management and organization, such as inadequate supervision and a poor attitude toward work.

Despite the poor reports, the firm continues to do work for the department. Field personnel on the contractor's current job again report insufficient equipment and personnel on the job, a factor which is causing some delay on the project.

Review of chronic problems with contractors could help to improve performance on subsequent work.

Bidding

The bidding process has been the most controversial area of contract administration in recent months. Several criminal investigations have led to convictions for collusion and antitrust violations in Virginia and other southern states. As a result of this criminal activity, the Virginia attorney general's office made recommendations to the department for various changes in the contract award process.

One of the most important safeguards used by DHT against abuse is the availability of accurate engineering estimates to guide the awards process. The estimating procedures of the department have come under scrutiny in a recent management review of DHT.

Summary of Recent Criminal Investigations. In late 1979 the U.S. Department of Justice began an investigation in Virginia of collusion and antitrust violations by highway construction and paving firms. The investigation in Virginia was an expansion of investigations already under way in several other southern states. As of January 6, 1981, convictions on the federal charges have resulted in fines in Virginia totalling \$1.8 million. The collusive activity in all the states involved as many as 19 firms prequalified in Virginia. No DHT officials have been implicated in the schemes.

As a result of the investigations in Virginia and other states, DHT disqualified 21 firms and removed them from the bidders list for an indefinite period. Two firms were reinstated after showing no involvement in the illegal activity. The remaining 19 firms include four based

in Virginia, five in North Carolina, five in Tennessee, and five in Georgia. Two of the companies and one subsidiary have been reinstated as the result of negotiations by the attorney general, which were approved by the Highway and Transportation Commission. Those arrangements involved the repayment to the State of \$50,000 by one firm, and \$325,000 by the other. Two other firms have recently filed lawsuits in an effort to be reinstated to the list of prequalified companies.

Attorney General's Recommendations. As the result of the criminal investigations, the Virginia attorney general made recommendations in September 1980 for improving the department's bidding and contract award procedures. The recommended changes include:

1. The department's management services division should audit the contract award system annually instead of biennially. The audits should have an expanded scope over those done in the past.
2. The attorney general's office will develop a training program for department personnel to help them recognize possible illegal activity.
3. The attorney general's office will also assist in the development of a contract charting system which would be used to identify patterns of illegal bidding activities.
4. The department should end its practice of allowing bids to be placed in a box at a Richmond hotel. All bids should be submitted at the department's offices in Richmond. Employees should be prohibited from attending the contractor meetings at the hotel.
5. Each contract should include a statement requiring contractors to certify that they have not participated in any conspiracy or collusion in compliance with the new Governmental Frauds Act. This would be in addition to the affidavit now required under Section 33.1-343 of the Code of Virginia.
6. The pre-bid estimate should not be based solely on historical price data from past bids, but on actual current costs. The estimating procedure should be reviewed to see if it has historically helped to hold down costs.

The department has accepted all of the recommended changes. To date, only the fourth and fifth have been fully implemented.

Engineering Estimates. Prior to advertising a project for bids, DHT develops its own estimates of project cost to act as a guide in evaluating the reasonableness of bids received. DHT policy is to review bids very closely if the low bid is not within 107 percent of the engineering estimate, and to check the estimate itself for any possibility of error. If there is no error in the estimate and the low bid is more than

seven percent higher than the estimate, then the bids are usually rejected. Rejected projects are then readvertised. Although engineering estimates cannot prevent bid-rigging, sound estimates can help avoid awarding contracts at inflated costs.

In their recent study of DHT, R. J. Hansen Associates, Inc., conducted an analysis of 540 advertised projects. The analysis found that 121 (22 percent) were rejected. However, when the projects were readvertised the consultant noted that the departmental estimates had been raised an average of 34 percent while the corresponding low bids were reduced less than one percent. As a result there is little evidence that the estimation procedure actually served as a check on the eventual contract price and, in some instances, may have actually led to higher project costs as illustrated in the following example.

A project to build a bridge in Hampton was advertised on three occasions in 1979. There were two bidders on the first and second advertisements.

The original pre-bid estimate was \$603,164. Because the low bid on the first letting was \$802,848, more than 33 percent higher than the estimate, all bids were rejected.

The second estimate was \$647,910, or nine percent more than the original estimate. The low bid was \$828,049 on the second letting, or 26 percent more than the estimate. As a result, all bids were again rejected.

When the project was advertised a third time, the estimate was again increased to \$681,604. The single bid received on this third letting was \$834,289, or 22 percent above the estimate.

Because the bridge to be replaced was in poor condition, however, the department awarded the contract. As a result of rebidding, the final report cost increased \$31,000.

Both the R. J. Hansen consultants and the attorney general recommended that DHT adopt means of acquiring current cost data which would serve as the basis for pre-bid estimates which are as accurate and current as possible. DHT is in the process of implementing this recommendation. Steps taken to date include:

- a review of staffing needs and recommendations for increased estimating staff;
- a review of possible techniques with DHT staff and faculty at the University of Virginia; and
- discussions with officials in North Carolina, West Virginia, and Georgia.

These are important first steps but will require additional efforts to improve the usefulness of engineering estimates. One such effort would be the collection of information on the cost of rebidding, and the effects of rebidding on contract prices. Such information would be useful in deciding whether to reject a bid.

Construction Administration

JLARC's staff review of construction administration included interviews in each of the eight districts, nine residencies, and the central office as well as a statistical analysis of 200 construction projects completed in fiscal year 1980. Data were collected on the cost overruns and time delays experienced by DHT, and on the procedures available to the department to enforce contract provisions.

Cost Overruns. The total contract value of the 200 projects reviewed was \$190 million. The actual final cost for the projects was \$207 million, or about nine percent more than the original contract price. These cost overruns are authorized expenditures made by contractors, and represent additions to or revisions of the contracts. All additions and revisions must be authorized by the department.

Based on the analysis of 200 projects completed in fiscal year 1980, 82 percent of the projects had some cost overrun (Figure 10). For the most part, the overruns were less than ten percent. Cost underruns also tended to be less than ten percent under the contract value. However, several projects experienced large increases in cost.

A highway construction project had a cost overrun of \$49,417, or about 90 percent of the original contract price of \$54,375.

* * *

A second highway construction project had a cost overrun of \$852,559, or about 59 percent of the original contract price of \$1,448,260.

* * *

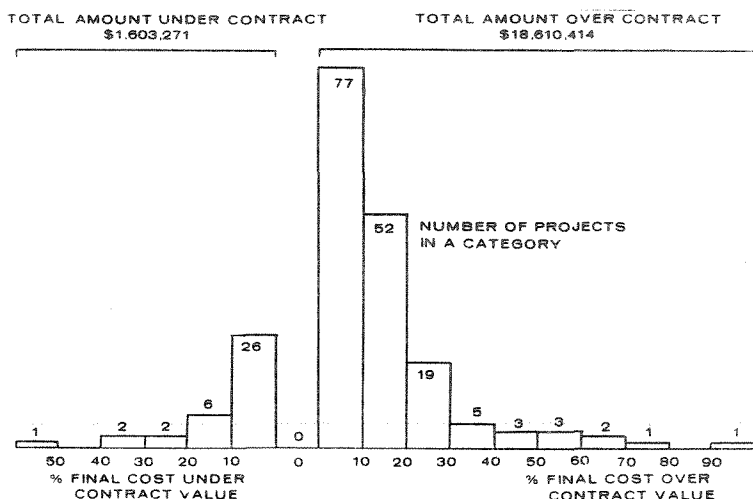
A third construction project had a cost overrun of \$258,919. This was 42 percent more than the original price of \$614,189.

In all, 51 projects had cost overruns in excess of \$100,000.

In interviews with project engineers and inspectors throughout the State, the most commonly cited causes for cost overruns were revisions to construction plans and the inability of designers to accurately estimate the quantities or costs of items such as erosion or traffic control. In addition, extensions of time may add costs to projects. Though it would be preferable if there were no increases in project

Figure 10

PROJECT COST COMPARISON
CONTRACT VALUE TO FINAL COSTS
(200 Projects Completed FY 1980)



Source: Compiled from DHT data.

costs, such overruns may be unavoidable. A more detailed analysis of cost overruns will be prepared for in the final report.

Time Delays. Unlike cost overruns, time delays appear to be primarily due to the actions, or inactions, of contractors. Of 200 projects completed in fiscal year 1980, 56 took longer to complete than allowed either in the contracts or through authorized delays approved by DHT inspectors. Three cases are illustrative of the problem:

One construction firm was 153 days late in completing a project. The original contract was for 375 days.

This substantial time delay was in addition to 849 shutdown days authorized by DHT. Thus, a job which was to have been completed in one year actually took more than three and one-half years.

* * *

A second firm was 84 days late on a 150-day contract. DHT had already granted 438 authorized shutdown days.

* * *

Another firm was 115 days late on a 360-day project. The department had already authorized 337 additional shutdown days.

Causes of Time Delays. A major cause for time delays cited by field staff was the failure of contractors to provide sufficient equipment and personnel to do the work. Other contractors failed to provide competent supervision of the crew. All of the field personnel interviewed expressed some frustration over the fact that there is little the department can do to get contractors to correct such problems.

The department's prequalification and bidding system is intended to prevent time delays by ensuring that contractors are properly staffed and equipped. The maximum capacity rating and the requirement to list current contracts in the bid are designed to help keep contractors from overextending themselves. Despite these precautions, it appears that some companies manage to take on more work than they can handle, which results in project delays.

It appears that the primary problem is in the area of contractor staffing, an area not covered in the prequalification form. One improvement may be requiring contractors to show, in each bid submitted, what portion of their labor force will come from a permanent staff and what portion will require hiring of temporary and part-time employees. The use of past performance reports to help contractors identify problem areas for correction might also be effective.

Current Responses to Poor Performance. One factor compounding the department's difficulties with firms which fail to progress satisfactorily is the limited effectiveness of management tools used by DHT to enforce time limits. The department currently has four primary actions it can take when a contractor's progress is unsatisfactory: (1) withhold ten percent on each monthly payment; (2) temporarily remove the contractor from the bidders list; (3) declare the contractor in default and remove him from the job; or (4) require the contractor to pay liquidated damages to cover the additional administrative costs resulting from the delay. Since 28 percent of the projects completed in fiscal year 1980 had unauthorized time delays, the department's methods for controlling time delays are not fully effective.

Withholding Payment. Ten percent of each monthly payment to a contractor is withheld when progress is ten percent behind. The purpose is to ensure adequate funds to cover anticipated liquidated damages. After liquidated damages have been assessed at the end of the job, the remainder is paid to the contractor. Since contractors know the funds will eventually be paid, this is an effective sanction only against firms for which the withholding may cause cash flow problems. Withholding funds could make it more difficult for the contractor to provide the necessary personnel or equipment to get back on schedule.

Temporary Removal. Temporary removal from the bidders list is designed to prevent contractors which are already having problems from further overextending themselves. As of November 13, 1980, there were three firms temporarily removed from the list due to poor performance.

Removal from the bidders list may not always serve as an incentive to correct problems, because firms are automatically returned to the list when a job is completed. There is no requirement that serious problems be corrected prior to being placed back on the list. As a result, a company can consistently cause delays, be removed, and at the end of the job, bid on more work. A more effective method may be temporary removal for poor performance until a good faith effort to correct problems which caused excessive delays is documented.

Default. In extreme cases, the department may declare a contractor in default and remove him from the project. Once the first contractor is removed, the bonding company would have to arrange for completion of the work, a situation which would lead to further delay. The department reports that it has declared only three contractors in default since 1976. An option so rarely used, and which leads to further delays when it is used, may be of limited effectiveness in the daily management of projects.

Assessing Liquidated Damages. Time delays can increase the department's administrative costs as well as construction costs. One way DHT recovers additional administrative costs is by assessing liquidated damages against the companies responsible for delays. Liquidated damages are the administrative costs to DHT of the delay in a project. They are not intended to be punitive.

For the 200 completed projects reviewed by JLARC staff, 56 had time delays. Of these, 54 were assessed liquidated damages in excess of \$759,000.

Liquidated damages are to be assessed in accordance with a scale of charges set forth in the highway specifications manual. The department may exercise considerable judgment in the amount to be assessed, however, in its determination of what delays were due to the contractor. The department can reduce or eliminate liquidated damages by making a determination that the delay was beyond the control of the contractor. For example, if the scale of charges in the DHT specifications book were strictly applied to the 56 projects cited, the total liquidated damages assessed would have been \$972,100 rather than \$759,000.

The department may further reduce damage charges as a result of claims submitted by the contractor. In the case of the examples cited above, only \$615,000 of the \$759,000 assessed was actually paid with the rest being returned to contractors as the result of various claims.

Some judgment regarding the lowering of damages is appropriate for needed flexibility. However, there was some indication from DHT

field staff that partial recovery of costs which were due to poor performance by the contractor may weaken the ability of field staff to enforce contract specifications. This point is illustrated in the following example.

A contractor was 55 days late in completing a 60 day project. The project engineer, after considering all factors causing the delays, recommended \$8,400 in liquidated damages.

The department decided, however, not to assess any liquidated damages because the contractor claimed he had not been given ample time to complete the project. The project engineer reported that this department action may reduce his ability to keep the contractor on schedule in subsequent jobs.

A more general problem is the fact that the department does not fully document the history of each case of damage assessment. Although there is documentation of the original amount assessed, in some cases where the department waives all or part of the assessment the reasons are not given. In essence, the department is performing an adjudication in each case and should provide a documented record to avoid charges of inconsistency or favoritism in its decisions.

STRENGTHENING CONTRACT ADMINISTRATION

DHT can take several steps to strengthen procedures in the existing contract administration process. These steps are in addition to improvements recommended by the attorney general which the department indicates it intends to implement

Recommendation (10). The department should develop written policies which define specific relationships between corporations or partnerships which must be disclosed at the time of prequalification.

Recommendation (11). The current application form should be revised to require that all officers and owners of any prequalified company disclose any offices held or financial interest in any other prequalified firm. For consistency, the disclosure standards should also be applied to reflect ownership or controlling interest in non-stock corporations.

Recommendation (12). In order to ensure that information supplied by contractors is complete and accurate, the department should periodically review and verify a sample of applications. When information cannot be verified, the department should exercise its option to audit records maintained by the contractor.

Recommendation (13). The department should view all field evaluations which are either very high or very low as a reason to conduct

an inquiry to determine the reason for the rating and the manner in which it should be subsequently used.

Recommendation (14). The department should make fuller use of the performance report. Problems of a serious nature should be reviewed with the contractor, and a good faith effort toward correcting the problem should be required prior to the award of subsequent contracts.

Recommendation (15). DHT should develop a more systematic approach to reviewing bids in excess of the pre-bid estimate. Specific data on the cost of rebidding should be prepared and used in any decision to reject a bid. Other factors such as the likelihood of receiving lower bids if readvertised, and the amount by which the bids exceed the pre-bid standard, should be considered in accepting bids. A review of the efforts of rebidding previous projects may help to show which types of projects may be most successfully rebid.

Recommendation (16). The department should change its methods of ensuring adequate contractor personnel and equipment will be available for each contract. The department should consider revising the bid proposal to require contractors to state the source of personnel and equipment to be used on the project.

Recommendation (17). A contractor whose progress is unsatisfactory should be removed from the bidders list, pending documentation of a good faith effort by the company to correct the problem which caused the delay.

Recommendation (18). The department should develop procedures to adequately document decisions made in the assessment of liquidated damages. These documents should be retained as a permanent record.

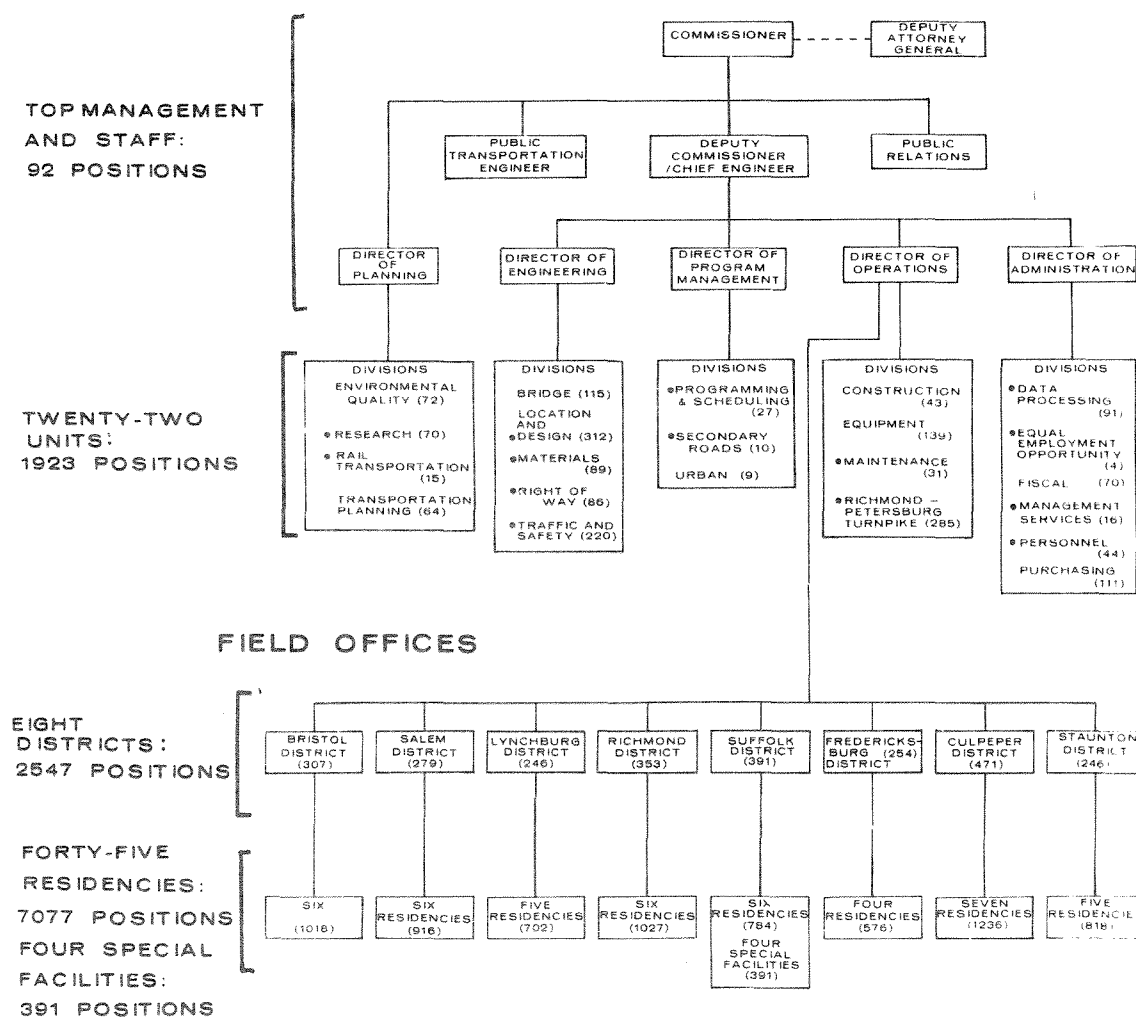
V. Organization and Staffing

The Department of Highways and Transportation is a large bureaucracy with an extensive field organization. To carry out its mission, DHT has established five directorates, 21 divisions, eight districts, 45 residencies, and 239 area headquarters. Total authorized positions as of September 30, 1980, were 12,030.

The multi-layered organization of DHT is illustrated in Figure 11. Of the five directorates, four report to the deputy commissioner and one--the director of planning--reports directly to the commissioner. The operations directorate contains 10,513 positions, or 87 percent of all authorized positions in the department. Most of these positions are district and residency field staff.

Figure 11

ORGANIZATION AND STAFFING OF THE
DEPARTMENT OF HIGHWAYS AND TRANSPORTATION
September 30, 1980



Preconstruction and maintenance-related functions have been decentralized to the districts, as shown in Figure 12. This decentralization has created field units with responsibilities parallel to those of divisions within the central office. For example, each of the eight districts has a section with the same name and basically the same functions on a district level as the following central office divisions: environmental quality, bridge, location and design, materials, right-of-way, traffic and safety, and equipment. Further decentralization is evidenced by 45 residencies, which are the operational level where maintenance activities are conducted and construction projects are inspected. The structure of a typical residency (Figure 13) reflects both construction and maintenance activities.

Figure 12

A TYPICAL DISTRICT

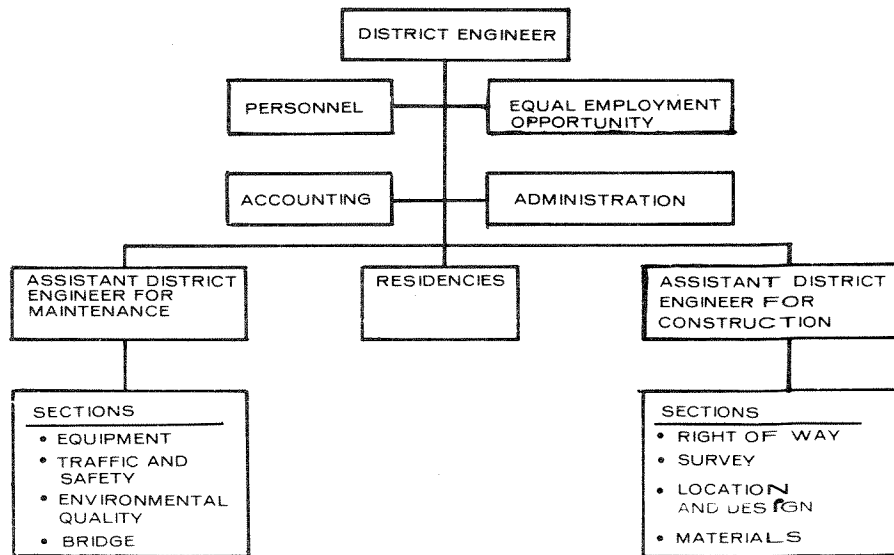
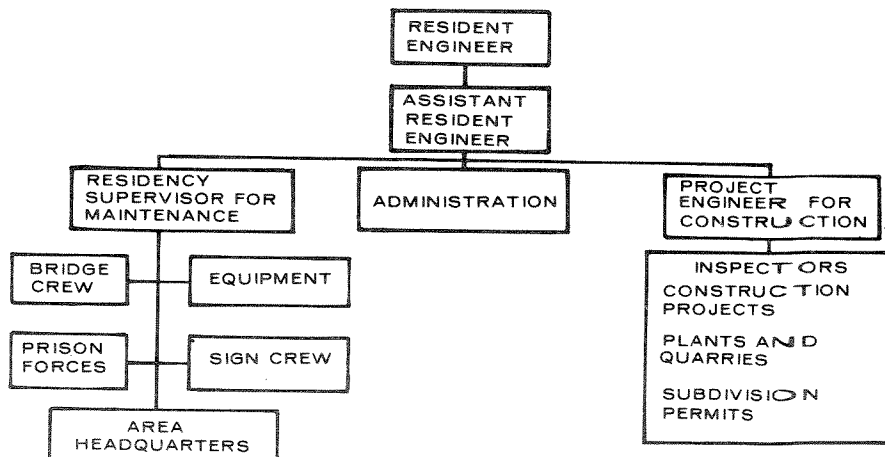


Figure 13

A TYPICAL RESIDENCY

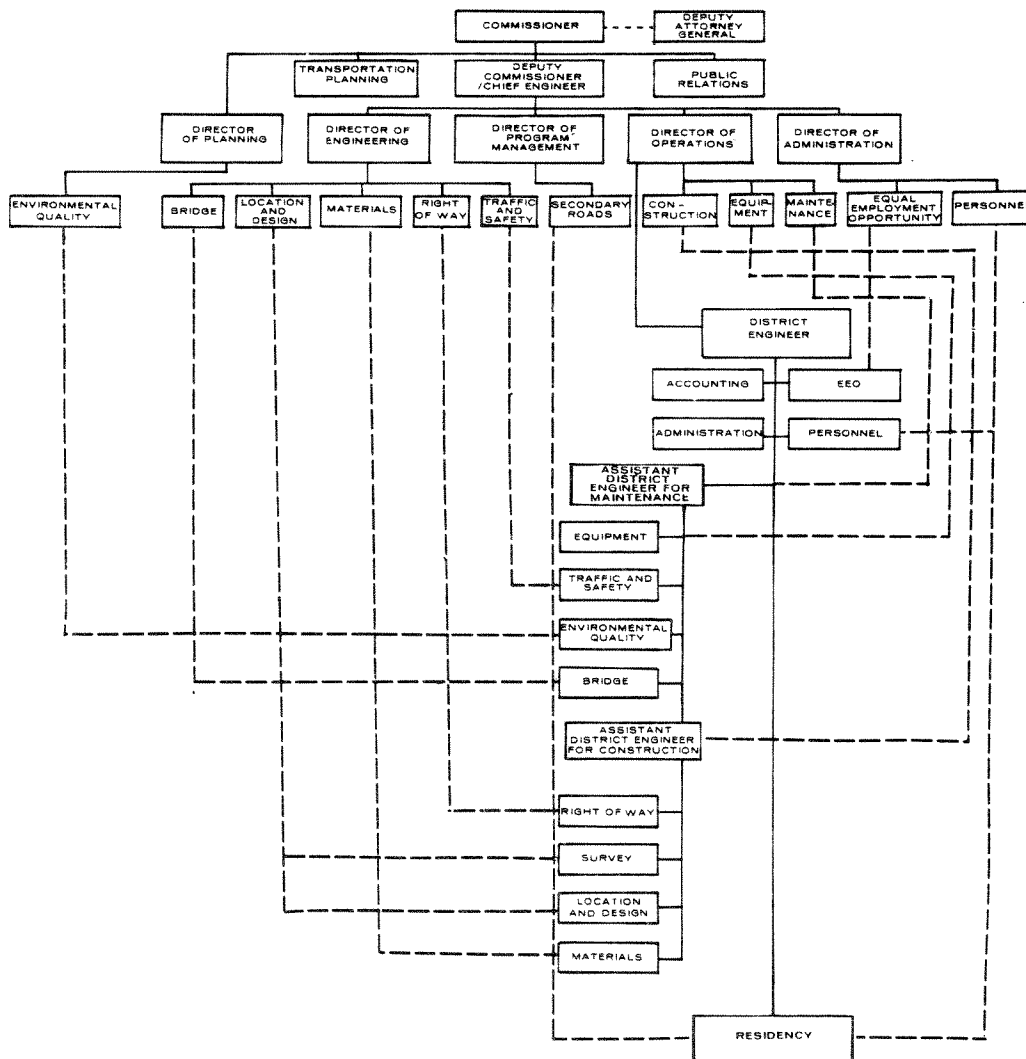


Organizational Communication

DHT staff work in 15 major functional areas in addition to general administration. The functional organization is complex with multiple lines of authority, communication, and control (Figure 14). Extensive coordination and communication are necessary between levels, divisions, and directorates. For example, because of their parallel functions, each division provides technical guidance to its district counterparts. Formal, administrative reporting for these district sections is still maintained through the district engineer and his assistants.

Figure 14

FUNCTIONAL ORGANIZATION OF THE DEPARTMENT OF HIGHWAYS AND TRANSPORTATION



In addition, coordination for some departmental activities is accomplished by direct exchanges between central office division staff and personnel in district offices. In particular, the maintenance division routinely coordinates with the districts regarding maintenance activities without channeling communications through the director of operations. Similar direct exchanges of information occur between the districts and the divisions for construction, personnel, and equal employment opportunity.

A third type of informal organizational link occurs between the secondary roads division and the residency offices. The residencies communicate information to this division on the priorities of their localities for improvements on the secondary road system.

The recent review by R. J. Hansen Associates, Inc., suggested that, in general, the DHT organizational structure is appropriate for the agency mission. However, the consultant review did find that DHT needs to improve organizational communication through adoption of standards and policies in several key areas. The Hansen review also concluded that DHT personnel should avoid bypassing existing control channels which can result in loss of control and lowered morale, particularly among field staff.

The general conclusion of DHT's management consultant with regard to organizational communication was summarized in a review of departmental procedures:

There is a need for developing and implementing processes which will improve communications and coordination among and between managers at the district level, key division managers in the central office and directors.

This conclusion is based on the following:

. . . (problems) with existing information systems which reveal inconsistent perceptions among various managers as to the schedules and priorities;

. . . the perception of a number of field managers that there is too little receptivity and acceptance by central office personnel to inputs, suggestions and recommendations made by district level managers. There is also a perception that too many decisions must go through too many channels, and take too much time for approval.

During fieldwork, JLARC staff noted instances of the kinds of problems described in the Hansen report.

Central office senior staff visit construction sites and discuss problems and schedules with the contractor. The results of these discussions are not always shared with DHT inspectors on the site. As a

result, inspectors receive some information about plan changes from the contractor they are supervising.

Central office maintenance staff routinely travel through residencies observing road quality and evidence of maintenance performance. Four of the nine resident engineers interviewed said that they did not receive sufficient feedback from these supervisory reviews and in some cases were not even informed that a supervisory visit had taken place.

Maintenance division staff are responsible for maintenance budgeting, including the rates charged residencies for use of DHT equipment. The equipment division raised these rates in January 1980 contrary to written policy and without informing maintenance division personnel. The result was an avoidable shortfall in maintenance budgets.

Some misunderstandings are inevitable in an organization as large as DHT. However, the frequency of comments made by field staff regarding communication breakdowns indicates a more extensive and serious problem. Similar concerns to those illustrated above were noted in all 17 field units visited by JLARC staff. Overall, district and residency staff rated communication breakdowns with the central office as the most significant problem they encountered in meeting their responsibilities within the present organization.

In the final JLARC report an assessment of organizational communication and coordination will be presented.

Staffing

Staffing levels and manpower utilization were areas of primary emphasis for the R. J. Hansen consultant review. Overall, the consultants concluded that DHT could experience staff reductions of about 1,500 positions over the next several years due to declining revenues and corresponding reductions in services or workload. A comparison of maintenance staffing levels with North Carolina's highway department (requested by members of the SJR 50 study committee) found that Virginia appears to use more staff per lane-mile to maintain its highways than does North Carolina. Staffing and productivity remain, however, areas in which additional review is needed.

Consultant Conclusions. The consultant study used historical trends and estimates of future revenues to make projections regarding DHT staffing requirements over the next several biennia. Their conclusions were that DHT could experience:

- a decrease in construction inspectors from 965 in FY 1979 to fewer than 800 for the 1980-82, 1982-84, and 1984-86 biennia;

- a decrease in preconstruction staff from 1,860 positions in FY 1981 to 1,270 positions in FY 1984; and
- a decrease in maintenance service levels and staffing of as much as 756 positions by FY 1984 if revenues continue to decline.

It must be emphasized that the consultant did not conduct an evaluation of current DHT staffing or productivity. The projections were made based on past staffing trends without evaluative judgment on the part of the consultant as to the appropriateness of past staffing patterns. In other words, the R. J. Hansen conclusions do not address the issues of productivity or efficiency but reflect an expectation of declining revenue and corresponding reductions in staff.

Maintenance Staffing. An interim review of DHT staffing levels for road maintenance crews was conducted to develop descriptive information on the nature of staffing patterns in Virginia. Maintenance activities routinely performed by these crews include patching, ditching, mowing, grading, hauling, snow removal, and clearing brush and other obstructions. Some non-maintenance activities, primarily small safety or drainage projects, are occasionally conducted by these crews.

To compare staffing levels, the following road crew positions within residencies were reviewed: highway superintendents, foremen, equipment operators, maintenance helpers, and timekeepers. Generally, persons holding these positions work out of an area headquarters facility rather than the residency offices. Other residency-based staff functioning in administrative or specialized maintenance roles, such as bridge repair and rest area or tunnel operation and maintenance, were not included. Maintenance positions assigned to special facilities, such as toll roads, were also excluded.

The average residency has a total of 109 roadway maintenance personnel. Table 13 shows the breakdown of personnel by position.

Table 13

HIGHWAY MAINTENANCE POSITIONS FOR RESIDENCIES

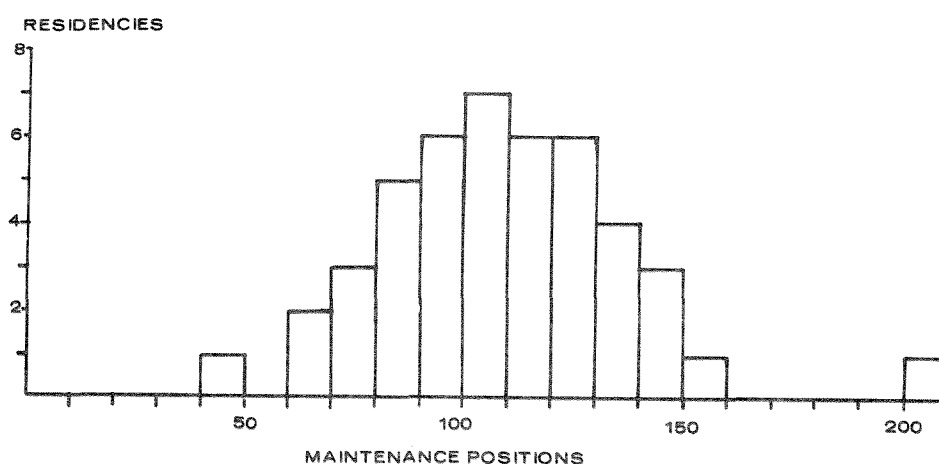
<u>Position</u>	<u>All Residencies</u>	<u>Average</u>
Highway Superintendent	334	7.4
Foreman	573	12.7
Equipment Operator	3,605	80.1
Maintenance Helper	201	4.5
Timekeeper	212	4.7
Totals	4,925	109.4

Source: DHT Personnel Strength Report, September 30, 1980.

There is substantial variation in the number of maintenance positions at each of the 45 residencies across the State (Figure 15). Norfolk residency, with only 48 positions, has the smallest staff. At the high end of the range is Fairfax residency, with 203 maintenance positions.

Figure 15

RESIDENCY-LEVEL DISTRIBUTION OF HIGHWAY MAINTENANCE POSITIONS



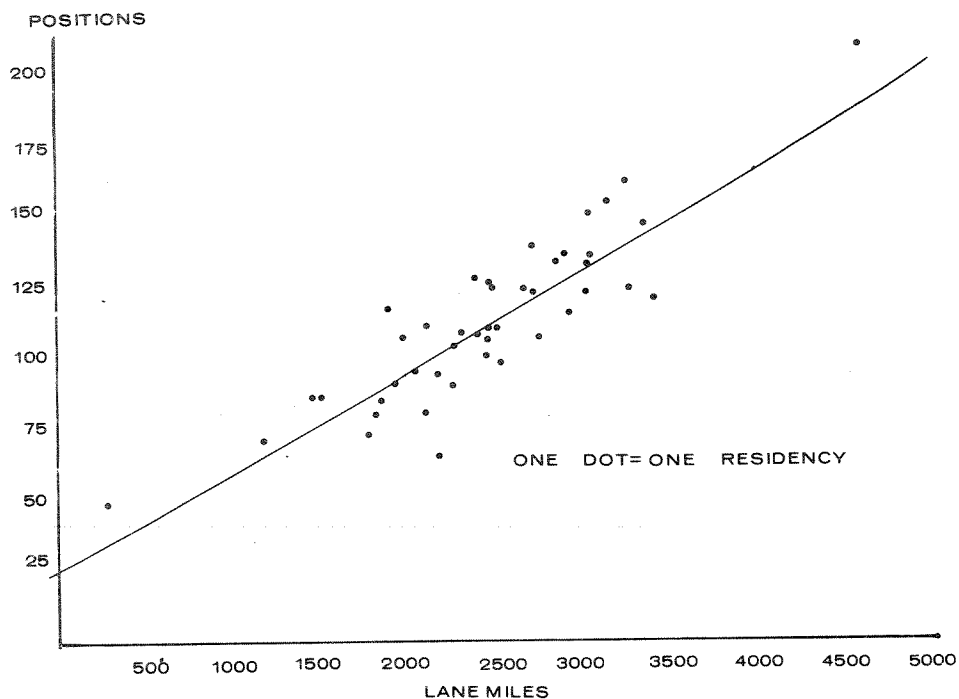
Source: DHT Personnel Strength Report, September 30, 1980.

The primary factor influencing staffing needs is the amount of lane mileage which a residency maintains (Figure 16). Lane mileage accounts for 87 percent of the residency-by-residency variations in staffing levels. Consequently, the amount of lane miles within a residency is consistent with the number of highway maintenance positions authorized. This is true even though other differences, such as population or topography, may exist between residencies.

Additional information about Virginia's maintenance staffing was obtained by comparing staffing in Virginia and North Carolina for road crew positions. Such a comparison is useful because the highway departments of Virginia and North Carolina are similar. Both maintain essentially all public roads in their states, with the exception of city-owned roads. North Carolina, with 156,000 lane miles, and Virginia,

Figure 16

CORRELATION BETWEEN LANE MILES
AND RESIDENCY MAINTENANCE STAFFING
(45 Residencies)



Source: JLARC Analysis of DHT positions and mileage.

with 111,000 lane miles, rank second and third, respectively, among the largest state-maintained road systems in the country. One reason for the difference in the size of the two systems is that North Carolina has a land area 29 percent larger than Virginia. Also, North Carolina maintains primary roads which pass through its cities, while Virginia provides a payment to cities to perform this maintenance.

A review of North Carolina's field structure shows that it is similar to Virginia's. North Carolina has 14 divisions, subdivided into 35 districts and encompassing 100 counties. This structure parallels Virginia's organization into eight districts, 45 residencies, and 239 area headquarters. The most significant difference is that an area headquarters in Virginia is typically responsible for a geographic area smaller than a county.

Table 14 compares equivalent maintenance position classes found in the field offices of both states. The figures for Virginia represent positions assigned to the residency and area headquarters. The figures for North Carolina represent positions assigned the same maintenance tasks as their Virginia counterparts. The position total for Virginia is adjusted to delete sign maintenance positions because this responsibility is assigned to a higher organizational level in North Carolina.

Table 14

HIGHWAY MAINTENANCE POSITIONS BY CLASS
VIRGINIA AND NORTH CAROLINA

Virginia		North Carolina	
Position Class	Number	Position Class	Number
Maintenance Superintendent	334	Crew Leader III & IV	265
Foreman	573	Crew Leader I & II	609
Equipment Operator	3,605	Machine Operator & Drivers	3,134
Maintenance Helper	201	General Utility Worker	1,017
Timekeeper	<u>212</u>	Clerk III	<u>98</u>
Total	4,925		5,123
Less FTE Sign Crews	<u>150</u>		<u>0</u>
Adjusted Total	4,775		5,123

As Table 14 indicates, North Carolina apparently uses only slightly more positions than Virginia to maintain a significantly larger highway system.

Some staffing level variation between the two states can be attributed to Virginia's greater mileage of high traffic volume roadways, i.e., interstate and divided primary highways. It is generally acknowledged that these high traffic volume systems require higher levels of maintenance staffing. Table 15 shows a comparison of lane mileages by level of system for North Carolina and Virginia, based on the most recent Federal Highway Administration statistics.

Table 15

LANE MILES BY LEVEL OF SYSTEM

	Virginia	North Carolina
Interstate and Divided Primary	10,424	6,984
Other Primary	13,576	26,006
Secondary	<u>86,982</u>	<u>124,772</u>
Total	110,982	156,762

Source: Federal Highway Administration.

The impact of the difference in high traffic volume interstate and divided primary mileage on maintenance staffing was assessed using a statistical model of Virginia's staffing patterns. To construct the model, an analysis of residency staffing patterns focused on the variation in staffing as a function of the amount of high traffic volume mileage in each residency.

The analysis found that high traffic volume mileage receives a commitment of about two and one-half times the staff committed to other types of mileage. In other words, Virginia tends to assign two and one-half times the number of maintenance positions to a given high traffic volume stretch of road compared to an equal length of lower volume road.

Using this ratio, the existing staffing patterns based on adjusted lane mileage in the two states were compared. Table 16 shows the results of this comparison.

Table 16

HIGHWAY MAINTENANCE POSITIONS PER LANE MILE
VIRGINIA AND NORTH CAROLINA

	<u>Virginia</u>	<u>North Carolina</u>
Staff Positions	4,775	5,123
Adjusted Lane Mileage to Account for High Traffic Volume Mileage	127,417	168,773
Adjusted Lane Miles Per Employee	26.7	32.9

Source: JLARC analysis.

The result of the Table 16 comparison is a 23 percent difference in the lane miles per employee statistic which cannot be explained by the fact that Virginia has more high traffic volume roadway than North Carolina.

Adjustment for Organizational Differences. Two organizational factors explain most of the differences in maintenance staffing levels between the two states. First, Virginia's organizational structure includes 239 area headquarters as the lowest element in field organization. Each area headquarters is usually staffed with a timekeeper who maintains records for the headquarters. In contrast, North Carolina uses the county as the lowest element in field organization. This difference in organizational structure adds 114 timekeeper positions to Virginia's staffing level.

The second factor is that North Carolina makes extensive use of temporary employees during peak work periods. An analysis performed by the North Carolina highway department found that annually they use 555 full time equivalent employees, compared to about 85 in Virginia.

Table 17 shows a comparison of staffing levels with these factors taken into consideration. Using these adjusted position figures, Virginia's ratio of lane miles per maintenance employee is 27.4 and North Carolina's ratio is 30.3. By accounting for these organizational factors, the difference in the ratios is reduced from 23 percent to 10 percent. Thus, the use of larger field organization units and the use of temporary employees appear to be primary factors allowing North Carolina to maintain more lane miles per permanent employee than Virginia.

Table 17

HIGHWAY MAINTENANCE POSITIONS
(adjusted)

	<u>Virginia</u>	<u>North Carolina</u>
Full time positions	4,775	5,123
Less time keepers and clerks	212	98
<u>Plus</u> FTE temporary employees	<u>85</u>	<u>555</u>
Adjusted Positions	4,648	5,580

Source: JLARC analysis of positions.

The comparison with North Carolina may indicate other differences in management procedures which allow that state to maintain more roadway with relatively fewer staff. Potential areas of variation are the levels of service and the quality of maintenance provided by each state. In addition, there may be different maintenance procedures used in each state which affect employee productivity.

Additional research is necessary to assess relationships between maintenance policies and employee productivity. The final JLARC report will assess these relationships more closely, as well as expanding the analysis to address staffing patterns in other functional areas of DHT.

Conclusion

The department is facing an era of declining revenues which requires that some previously appropriate policies regarding organization and staffing be reconsidered. The R.J. Hansen study projected a possible decrease in maintenance staffing of 756 positions by FY 1984 as a result of declining revenues. To continue providing an acceptable level and

quality of maintenance, the department will need to evaluate alternatives for organizing and staffing maintenance operations. In view of the lower staffing levels used by North Carolina's highway department to maintain a similar road system, two features of that organization's maintenance operations deserve consideration.

Recommendation (19). The department should evaluate the appropriateness of increasing the mileage served by an area headquarters and a corresponding reduction in the number of area headquarters. A reduction in the number of area headquarters could decrease the need for a number of timekeeper positions required and improve the efficiency of maintenance operations.

Recommendation (20). The department should evaluate the possibility of using temporary positions to vary maintenance staffing to meet seasonal needs for low skilled labor. This practice could allow the department to significantly reduce permanently funded positions which may not be needed on a year round basis.

APPENDIX

Senate Joint Resolution No. 50	73
Appendix 1 (Estimated Revenue for Highway and Transit Programs) . . .	74
Appendix 2 (Major Events in Evolution of Virginia's Highway and Transportation System)	75
Response of the Department of Highways and Transportation	76

As part of an extensive data validation process, each State agency involved in JLARC's review and evaluation efforts is given the opportunity to comment on an exposure draft of the report.

Appropriate corrections resulting from the written comments have been made in the printed report. Page references in the agency response relate to the exposure draft and may not correspond to page numbers in the printed report.

SENATE JOINT RESOLUTION NO. 50

Implementing the provisions of the Legislative Program Review and Evaluation Act of 1978, relating to systematic review of State government by the Joint Legislative Audit and Review Commission.

Agreed to by the House of Delegates, February 29, 1980

Agreed to by the Senate, February 18, 1980

WHEREAS, the Legislative Program Review and Evaluation Act of 1978 (§§ 30-64 et seq., of the Code of Virginia) provides for the Joint Legislative Audit and Review Commission to conduct a systematic evaluation of State government according to schedules and areas designated for study by the General Assembly; and

WHEREAS, § 30-66 of the Code of Virginia provides for the nineteen hundred eighty Session of the General Assembly to establish by joint resolution a review schedule, based on the functional areas of State government as defined in the act; and

WHEREAS, § 30-67 of the Code of Virginia provides for each session of the General Assembly to specify to the extent possible by joint resolution the agencies, programs, and activities to be reviewed by the Joint Legislative Audit and Review Commission according to the schedule established; and

WHEREAS, in accordance with Senate Joint Resolution No. 133 passed by the nineteen hundred seventy-nine General Assembly, the Joint Legislative Audit and Review Commission is evaluating during fiscal year 1979-80 agencies and activities in the Standards of Living subfunction including the Homes for Adults, Title XX, and General Relief programs and selected issues in the organization and administration of social services in the Commonwealth; and

WHEREAS, Senate Joint Resolution No. 133 directs the Joint Legislative Audit and Review Commission to schedule the functional area of Resource and Economic Development for review; now, therefore, be it

RESOLVED by the House of Delegates, the Senate concurring, That, pursuant to § 30-64 et seq. of the Code of Virginia, the functional areas of State government shall be reviewed and evaluated by the Joint Legislative Audit and Review Commission according to the following schedule, the order of which may be reviewed and revised by future sessions of the General Assembly:

Functional Area
Transportation
Resources and Economic Development
General Government

The Commission shall make an interim report to the Governor and General Assembly on the functional area of Transportation focusing on programs and activities of the Department of Highways and Transportation including: an overview of the Department and transportation functions and expenditures; highway and transit needs; revenues and methods of financing those needs; [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;] and such other matters as the Commission may direct, prior to the nineteen hundred eighty-one Session of the General Assembly. For purposes of the interim report, the Commission shall coordinate its review effort with a joint committee consisting of three members appointed by the Chairman of the House Roads and Internal Navigation Committee, three members appointed by the Chairman of the Senate Transportation Committee, three members appointed by the Chairman of the House Finance Committee, and three members appointed by the Chairman of the Senate Finance Committee; and, be it

RESOLVED FURTHER, That the review and evaluation in the functional area "Resource and Economic Development" shall be initiated at such time as sufficient Commission resources become available and, such review shall generally include, but not be limited to, programs, activities, and agencies concerned with the regulation of professions and occupations as specified in § 30-77 of the Code of Virginia, and other consumer affairs regulation. The Commission shall coordinate its review effort concerning regulation of professions and occupations with the House Committee on General Laws and the Senate Committee on General Laws, and other appropriate legislative committees as may be deemed necessary; and, be it

RESOLVED FINALLY, That the reports, findings and recommendations prepared by the Joint Legislative Audit and Review Commission for the studies to be performed under this resolution shall be transmitted to the appropriate standing committees of the House of Delegates and the Senate, all members of the General Assembly, and the Governor.

Appendix 1

ESTIMATED REVENUE FOR HIGHWAY AND TRANSIT PROGRAMS FY 1981

<u>Source of Revenue</u>	<u>Estimated Amount</u>
<u>State Taxes and Charges</u>	
Motor Fuel Tax	\$326,700,000
Motor Vehicle License Fees	79,048,000
Motor Vehicle Sales and Use Tax	73,448,000
International Registration Plan	12,798,000
Motor Vehicle Title Registration	9,540,000
Motor Vehicle Operators Permits	7,320,000
Commercial Carrier Permits	1,930,000
Revoked License Fees	1,082,000
Weight Limit Violation Charges	1,045,000
Miscellaneous Permits and Fees	8,689,000
<u>Local Payments</u>	
Local 5% Share of Urban Construction	3,500,000
Revenue Sharing From Counties	1,500,000
<u>Other Taxes</u>	
Coal Severance Tax	9,000,000
<u>Federal Aid</u>	
Interstate System	185,633,000
Bridge Replacement	44,182,000
Primary System	37,649,000
Urban System	14,807,000
Secondary System	13,155,000
Other Categorical Programs	21,574,000
<u>Toll Receipts</u>	
State-Operated Toll Facilities	41,450,000
TOTAL ESTIMATED FY 1981 REVENUE	\$894,050,000

Note: In addition to FY 1981 appropriations based on anticipated revenues, the General Assembly reappropriated an unexpended trust fund balance from June 30, 1980, of an estimated \$270 million.

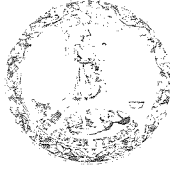
Source: Department of Highways and Transportation.

Appendix 2

MAJOR EVENTS IN EVOLUTION OF VIRGINIA'S HIGHWAY AND TRANSPORTATION SYSTEM

- 1723 - First colony-wide public levy imposed for the support of military defense, including road improvements.
- 1816 - Board of Public Works created and assumed control of the assets of a turnpike company, four canal companies, and two banks. Assets were invested in certain public works, including road building.
- 1906 - Highway Commission created by the General Assembly. Principal functions were to allocate State aid to counties on a matching basis, and to advise counties on road construction methods. License tag fees implemented.
- 1908 - License tag fees earmarked for maintenance and construction of roads.
- 1918 - State highway system initiated, incorporating 4,000 miles of road previously administered by counties.
- 1923 - Motor vehicle fuel tax implemented at a rate of 3¢ per gallon.
- 1932 - The Byrd Road Act, brought all county roads into the State secondary road system at county option. Four counties (Henrico, Arlington, Nottoway, and Warwick) originally chose to remain independent of the State system. Payments authorized to municipalities for maintenance of certain roads within their boundaries.
- 1956 - Interstate system of highways created by Congress. 1,053 miles were authorized in Virginia.
- 1964 - Arterial network of highways created.
- 1966 - Nine-year highway improvement program endorsed by General Assembly.
- 1974 - Name of agency changed by General Assembly to Department of Highways and Transportation. State aid appropriated to local public transit systems in FY 1974-76 biennium totaled \$23.1 million.
- 1977 - Formula for allocating construction funds among highway systems adjusted by General Assembly to 50 percent for interstate and primary, and 25 percent each to secondary and urban.
- 1980 - Motor vehicle fuel tax increased to 11¢ per gallon for autos, 13¢ per gallon for truck fuel.

WILLIAM KING, COMMISSIONER
NORMAN BANE, GRUNDY, BRISTOL DISTRICT
ACE G. FRALIN, ROANOKE, SALEM DISTRICT
AMBER WATKINS, SOUTH BOSTON, LYNCHBURG DISTRICT
AMBER MOHR, RICHMOND, RICHMOND DISTRICT
AMBER PLODS, YORKTOWN, SUFFOLK DISTRICT
AMBER ROBINSON, WEST POINT, FREDERICKSBURG DISTRICT
AMBER WRENCH, SPRINGFIELD, CULPEPER DISTRICT
AMBER ROBINSON, JR., WINCHESTER, STAUNTON DISTRICT
WILLIAM HASSELL, III, CHESAPEAKE, AT LARGE-URBAN
WILLIAM S. HOOPER, JR., CREWE, AT LARGE-RURAL



COMMONWEALTH of VIRGINIA

DEPARTMENT OF HIGHWAYS & TRANSPORTATION

1221 EAST BROAD STREET
RICHMOND, 23219

LEO E. BUSSEY, III
DEPUTY COMMISSIONER & CHIEF ENGINEER
J. T. WARREN
DIRECTOR OF ADMINISTRATION
J. M. WRAY, JR.
DIRECTOR OF OPERATIONS
H. R. PERKINSON, JR.
DIRECTOR OF PROGRAM MANAGEMENT
W. L. BRITTLE, JR.
DIRECTOR OF ENGINEERING
OSCAR K. MABRY
DIRECTOR OF PLANNING

IN REPLY PLEASE REFER TO

January 7, 1981

Honorable Theodore V. Morrison, Jr.
Chairman, SJR 50 Subcommittee
c/o Joint Legislative Audit and Review Commission
Suite 1100, 910 Capitol Street
Richmond, Virginia 23219

Dear Mr. Morrison:

In response to your request, I submit for the Subcommittee's consideration the following comments on the review draft of the Interim Report of JLARC's Operational Review of the Department of Highways and Transportation, which was presented to the Subcommittee on December 18, 1980:

II. Needs Assessment -

The Interim Report dwells at length on the fact that annual construction expenditures do not precisely coincide with annual construction allocations. Further, the Report indicates that although the Department's allocation procedures are in compliance with the requirements of state statute, the Department's actions may be contrary to legislative intent.

Interpretation of legislative intent clearly is a prerogative of the Legislature; however, we believe had the Legislature not agreed with a process which has been followed for more than 40 years, it would have been brought to the Department's attention by the Legislature long before now.

The need for the flexibility provided by the allocation system is even greater today than in the past, and we believe the current system should be retained. There are many external factors which now influence the pace at which a project may be developed--permits, environmental impact analyses, public participation procedures, and local government involvement. The uncertainty associated with these factors makes it

II. Needs Assessment (Continued) -

mandatory that the Department have a high degree of flexibility to proceed with the development of projects as conditions permit if maximum effectiveness is to be achieved. Under the present allocation system, greater effectiveness is achieved because, if some unavoidable delay is encountered for a specific project, available funding is shifted temporarily to another project which is ready to move forward. Yet, in the long term, the current system does assure that the expenditures for a specific project do conform to the amounts allocated for that project.

The Interim Report describes the unobligated Urban System balance as an example of inconsistency between allocations and expenditures. A closer examination of the variables affecting Urban projects will explain why this has occurred.

In comparison to normal Primary or Secondary projects, the typical Urban project is a complex, high cost project, and involves a higher degree of local government and public participation. Urban projects frequently require the relocation of substantial numbers of both businesses and people; involve complex utility relocations; are more likely to affect historical sites; are subject to changing priorities and desires of city councils, and are, therefore, more difficult to develop.

The funding for the proposed replacement of the Lee Bridge in Richmond illustrates why it is necessary to accumulate larger Urban allocation balances. The estimated cost of the new bridge is about \$50 million. Since 1977, the Commission has been allocating substantial sums to this project annually. The accumulated unexpended allocation balance is \$25 million and additional annual allocations will have to be made to the project as it is being developed to provide sufficient funding for construction. However, if expenditures on this project had to conform precisely to allocations, the bulk of the required allocation would have to be made in two years. In each year, this would require an allocation of nearly one-fourth of the entire statewide annual Urban System allocation for this project alone.

By following the current procedure as has been done with the Lee Bridge, a record is established showing the amounts allocated each year to each city to fund its priority projects, instead of having one or two cities receiving all of the

II. Needs Assessment (Continued) -

allocation in any single year. We believe most cities prefer this procedure instead of one which would require them to wait until some future year before a significant commitment is made to a project, and we think it contributes to more orderly planning.

Although we do not agree that the allocation procedure should be revised, we do concur with the apparent intent to the recommendations made in the draft Interim Report regarding the development and distribution of a four- to six-year construction work program (a similar recommendation was made as a result of the Hansen study).

The Department is developing a report which will show the total estimated cost of each proposed project, the estimated cost of each major phase (i.e., preliminary engineering, right of way acquisition and construction), the funds previously allocated, future allocations required, and the time period each activity will be under way.

The major difference between the document being prepared by the Department and the type of report recommended by the JLARC staff is that we have not included expenditure data. We have some reservations regarding the practicality of preparing such a report in the detail suggested by the JLARC staff. The basic data is available; however, to print and distribute this data would be an overwhelming task. At the present time, the Department has approximately 8,000 projects in various stages of development--preliminary engineering, right of way acquisition, construction, and post construction. Our initial assessment of the recommendation is that the sheer volume of paper involved makes it impractical to print and make public distribution of this data.

In summary, we believe the present allocation procedures should be retained because they not only provide a proper record of compliance with statutes but also provide the flexibility needed to achieve the most effective use of funds available. We agree with the recommendations that a more specific construction work program should be developed and distributed, and are now in the process of preparing such a schedule.

III. Equipment Utilization and Management -

The draft Interim Report indicates there is a significant under-utilization of equipment. This conclusion is based upon an analysis which assumes under-utilization exists if a piece of equipment is not used to 100% of the established "standards". We take exception to both the assumption and the resulting conclusions.

Equipment utilization standards were developed by this Department on the basis of utilization actually achieved during the period 1971-76. The standards have been set at higher levels than the average rates actually achieved during that period, to encourage increased efficiency. Therefore, failing to meet the standards, or exceeding the standards, is not a precise indication of effective utilization, but rather is a measure of utilization for a class of equipment as compared to a higher-than-average level achieved in the period of 1971-76.

The Interim Report cites certain examples of equipment being used up to 263% of standard. Obviously, this indicates the standards cannot be specific indicators of the need or lack of need for additional equipment. The standards are helpful guides in assessing equipment utilization, but cannot be simply cranked into a formula to automatically determine to what extent equipment is being effectively utilized.

The geographical location and the seasonal fluctuation of work are two important factors which must be considered in determining to what extent equipment is being utilized and the need for additional equipment. For example, front-end loaders used in snow removal operations may show a less-than-standard utilization during any one year at a specific location. Increased utilization could be achieved by transferring this equipment from one location to another and the level of snow removal service would remain the same, provided it didn't snow in both locations at the same time. Obviously, heavy and frequent widespread snowfalls produce high utilization rates for such equipment. This is especially true for such specialized equipment as the rotary snow plows cited in the Report. The rotary snow plow is the only type of equipment which is capable of opening heavy drifts on narrow Secondary roads. Although this equipment is infrequently used, it must be available when needed if the snow removal capability of the Department is to include opening roads blocked with high drifts. It is not unlike a city that buys fire trucks, hoping not to use them frequently but finding them essential when fires occur.

III. Equipment Utilization and Management (Continued) -

Numerous other types of work such as patching bituminous surfaces, ditching, and mowing all require the same type of equipment at the same time of year at different locations. The utilization of mowers, for example, may vary substantially from year to year and from area to area, depending on the amount of rainfall.

In making a decision to replace equipment or buy additional equipment, full consideration must be given to the specific use of the equipment. Such decisions cannot be made solely on the basis of a statistical standard developed using higher-than-average rates of utilization.

The table on Page 49 indicates that a savings of \$9.5 million could be realized by deferring "requested" equipment purchases. This table was developed using the equipment standard without giving consideration to the factors referred to above. Furthermore, the requests were taken from a preliminary estimate of equipment needs for the current fiscal year. Much of this equipment will not be purchased. A further review of need is made before any purchase orders are approved. For example, the Report cites the requested replacement of 33 pickup trucks for the Bristol District; no pickup trucks have been purchased or ordered for the Bristol District this fiscal year, nor is there any intention to do so.

In regard to hiring equipment and operators, factors other than the apparent availability of state equipment must be considered. As indicated in the Report, one of the factors influencing the decision to use hired equipment is the need to also obtain operators. The Department is not staffed to provide a full-time operator for each piece of equipment (e.g., an operator may operate a grader while one type of work is being performed and a front-end loader when another type work is under way). Operators alone are not readily available for hire as temporary workers and the only alternative is to hire equipment with an operator. Hired equipment and operators are normally hired only for specific tasks, such as small construction or repair projects, or for emergency conditions such as snow removal or repair of flood damage. This procedure minimizes the number of full-time equipment operator personnel required by the Department.

III. Equipment Utilization and Management (Continued) -

We take exception to many of the statements in the Report regarding the review of equipment purchases and the authority exercised by the Central Office in transferring equipment. Equipment purchases receive careful review and require Central Office approval. The Equipment Engineer does have full authority to transfer equipment and has exercised that authority when appropriate.

In summary, we take exception to the presumption that there is significant under-utilization of equipment. Equipment need must be judged on a number of factors and cannot be based on average statistical data.

However, we agree with the main thrust of the recommendations made in this section of the Report. To strengthen our equipment management practices, we intend to improve equipment usage reporting information to provide better data for decisions on hiring equipment or purchase of new equipment. An Equipment Review Committee will be established to carefully consider equipment needs. The method of charging fixed costs will also be reviewed to determine if a system can be developed to encourage increased utilization.

IV. Contract Administration -

Prequalification

We concur in the recommendations pertaining to contractors' disclosure of affiliation with other contracting firms. Disclosure information required in the prequalification application will be expanded, clarified and audited as appropriate.

As to the use of "field evaluations" of a contractor's performance, we concur with the intent of this recommendation and will give greater consideration to this information in setting a contractor's bidding capacity.

Cost Overruns

Although no specific recommendation was made regarding cost overruns, the Interim Report indicates that average final costs exceed original contract price by about 9%. This is certainly well within an acceptable range for highway construction, especially when a great number of contracts include a provision for cost escalation for asphalt.

IV. Contract Administration (Continued) -

Bidding & Engineers' Estimates

The Department does not automatically reject and readvertise all projects if the low bid is in excess of 107% of the engineers' estimate.

The Department's policy is to recommend to the Commission award of all contracts to the low bidders which are below the engineers' estimate or do not exceed the engineers' estimate by more than 7%. Whether a recommendation for award is made when the low bid exceeds 107% depends upon a number of factors, such as the number of bidders, the closeness of bids received, omissions in the engineers' estimate, the nature of the work to be performed, and the probability of obtaining a more favorable bid by readvertisement. If, in the judgment of the Department, one or a combination of these factors indicates an award should be made, a recommendation is made to the Commission for award, even if the low bid is in excess of 107% of the engineers' estimate.

With the benefit of hindsight, it is obvious that the re-advertisement of a project does not necessarily produce the lowest cost. However, when projects are readvertised, the decision is made at that time on the basis of a judgment that the bids received did not reflect a fair cost of doing the proposed work and that readvertisement may result in a lower bid price.

Estimates are normally raised after each advertisement and rejection of bids. Time alone dictates raising the estimate. During a period when construction costs are increasing at an annual rate of 18%, it unfortunately is logical that estimated costs be increased at about 1-1/2% for each month's delay. Since automatic rejection of bids in excess of 107% of the estimate does not occur, we take exception to this finding as set forth in the draft Interim Report.

Time Delays

The failure of a limited number of contractors to complete projects within specified time limits is a common problem throughout the roadbuilding industry. However, in our judgment, the several actions now available to the Department (i.e., default, removal from the bidding list, increased retainage, lower pre-qualification rating) are sufficient to assure prompt completion of the great majority of projects.

In response to the concerns expressed in the draft Interim Report, increased emphasis will be placed on applying these penalties to contractors who fail to properly staff and equip their construction projects.

V. Organization and Staffing -

The draft Interim Report refers to the comments and findings of the Hansen Report, regarding need for improved communication within the Department. The recommendations of the Hansen Report in the area of organization are now being reviewed by the Department and the Highway and Transportation Commission, and, no doubt, many will be implemented.

The draft Interim Report provides a comparison of Virginia's manning levels for maintenance employees with those of North Carolina. A number of manipulations were made in an attempt to eliminate the variables which exist because of different types of road systems, traffic volumes and the Departments' responsibilities.

The highway systems maintained by the North Carolina Department of Transportation are probably more similar to those maintained by Virginia than to any other state. However, there are a sufficient number of differences to make any comparison at least suspect, and, at the very best, only a very broad gauge of relative efficiency. Since our initial review of the preliminary draft, JLARC staff has added about 600 more employees to the North Carolina manning level. No doubt, there are other changes which should be made to obtain a more accurate comparison. To what extent does North Carolina use contract forces to perform maintenance, as compared to Virginia? Would not the best measure of relative efficiency be the cost of maintaining the roadways? Even in such a comparison, how would the relative quality of maintenance be measured to provide a fair comparison? Further, North Carolina's state maintained road mileage includes mileage in the cities; Virginia's does not.

The number of variables is so great that any comparison can only be an exercise in numbers, with little meaning.

Although we do not agree with the conclusion that North Carolina provides comparable public service with relatively fewer employees, we will evaluate the feasibility of reducing the number of area headquarters and the possibility of using a greater number of temporary employees to meet seasonal needs for low skilled labor, as recommended in the Report.

Honorable Theodore V. Morrison, Jr.
Page 9
January 7, 1981

In conclusion, I assure the Subcommittee that although we disagree with some of the contents of the Report, the Department will respond positively to the majority of the recommendations, either through implementation or further study.

I believe it to be most helpful to any organization to have the benefit of an outside review of its operations. The Interim Report certainly addresses and emphasizes some of the more important areas which must be given careful attention during the coming months and years as the Department is faced with continuing inflation and limited revenue.

The JLARC staff has conducted its review in a professional manner, and the only criticisms I have regarding the conduct of the audit are the lack of opportunity to review the findings as they were developed during the course of the review, the inadequate time for review after the draft Interim Report was written, and the lack of a revised Interim Report before we were required to formally respond to the Subcommittee.

I hope during the next several months as the review is continued and a final report is prepared that I will be given the opportunity to review the findings and tentative recommendations as they are being developed, rather than after conclusions and recommendations have been set out in writing in a draft report.

Sincerely,

A handwritten signature in dark ink, appearing to read "Harold C. King". The signature is fluid and cursive, with a large, sweeping initial "H".

Harold C. King, Commissioner

Copy - Members of the Highway and Transportation Commission
Mr. George M. Walters

**REPORTS ISSUED BY THE
JOINT LEGISLATIVE AUDIT AND REVIEW COMMISSION**

The Virginia Community College System, March 1975
Virginia Drug Abuse Control Programs, October 1975
Working Capital Funds in Virginia, February 1976
Certain Financial and General Management Concerns, Virginia Institute of Marine Science, July 1976
Water Resource Management in Virginia, September 1976
Vocational Rehabilitation in Virginia, November 1976
Management of State-Owned Land in Virginia, April 1977
Marine Resource Management Programs in Virginia, June 1977
Sunset, Zero-Base Budgeting, Evaluation, September 1977
Use of State-Owned Aircraft, October 1977
The Sunset Phenomenon, December 1977
Zero-Base Budgeting?, December 1977
Long Term Care in Virginia, March 1978
Medical Assistance Programs in Virginia: An Overview, June 1978
Virginia Supplemental Retirement System, October 1978
The Capital Outlay Process in Virginia, October 1978
Camp Pendleton, November 1978
Inpatient Care in Virginia, January 1979
Outpatient Care in Virginia, March 1979
Management and Use of State-Owned Vehicles, July 1979
Certificate-of-Need in Virginia, August 1979
Report to the General Assembly, September 1979
Virginia Polytechnic Institute and State University Extension Division, September 1979
Deinstitutionalization and Community Services, September 1979
Special Study: Federal Funds, December 1979
Homes for Adults in Virginia, December 1979
Management and Use of Consultants by State Agencies, May 1980
The General Relief Program in Virginia, September 1980
Federal Funds in Virginia, October 1980

JOINT LEGISLATIVE AUDIT AND REVIEW COMMISSION

Professional Staff

F. Daniel Ahern, Jr.
John M. Bennett
L. Douglas Bush, Jr.
Lucretia S. Farago
Mark S. Fleming
Gary T. Henry
Kirk Jonas
R. Jay Landis
William E. Landsidle
Philip A. Leone
Joseph H. Maroon
Barbara A. Newlin
Ray D. Pethel
Walter L. Smiley
Patricia G. Smyth
Ronald L. Tillett
Glen S. Tittermary
Susan L. Urofsky
Karen F. Washabau
Mark D. Willis
William E. Wilson

Administrative Staff

Debbie Armstrong
Sandy C. Davidson
Phyllis M. Dyer
Sharon L. Harrison
Joan M. Irby
Betsy M. Jackson
Kim Rexrode

910 CAPITOL STREET — SUITE 1100 — RICHMOND, VIRGINIA 23219 — (804) 786-1258

