

**SPECIAL REVIEW OF
CASH MANAGEMENT AND
CAPITAL BUDGETING PRACTICES**

**VIRGINIA DEPARTMENT OF TRANSPORTATION
RICHMOND, VIRGINIA**



EXECUTIVE SUMMARY

The Virginia Department of Transportation's recent cash shortages resulted from a lack of cash and project management, and not matching construction projects in the Six Year Program to available resources. Transportation does not have a systematic way to identify its maintenance needs, and therefore cannot reasonably determine or quantify these maintenance needs. Compounding these issues is a complex collection of automated systems that do not consistently exchange data, and do not provide timely and accurate information to support Transportation's management needs.

The comments below summarize the process outlined in Chapter 8, Best Practices. This chapter outlines a process for Transportation to change how management approaches planning, budgeting, reporting, and project and budgeting oversight. Transportation's implementation of these recommendations will require substantial time and effort as well as the cooperation of the Commonwealth Transportation Board, the General Assembly, the Governor, and other state agencies and institutions.

Transportation should make cash management and budgeting a priority for the entire agency. This includes budgeting for all cash inflows and outflows including construction, maintenance, and administrative program sources and uses. As a result of this budgeting change, the General Assembly may wish to consider establishing a reserve fund similar to the Commonwealth's Rainy Day Fund for Transportation to compensate for economic changes. The proposed budget method matches anticipated payouts against anticipated cash flow, and results in the Six Year Program becoming a six-year capital budget.

The Commonwealth Transportation Board (CTB) should develop a prioritization method for project selection as required by the General Assembly. Given a limited pool of resources, and a virtually unlimited list of projects, the CTB must have a process to balance resources against needs and desires. By prioritizing a list of statewide projects and having more realistic project cost estimates, the CTB can provide the public with a transportation plan that allows for construction within available resource.

To achieve accountability with the cash management and budgeting process for both Transportation and the CTB especially within the Six Year Program, we recommend Transportation assign a project management team that follows a project from its inception to its completion. This team has responsibility for the project's development, construction, and progress. The team also reports the project's progress to management and the CTB and includes both the engineering and financial management of the project. The CTB should prepare and present a report to the General Assembly outlining what the Six Year Program achieved and its shortfalls.

The project team concept extends to Transportation's entire operations including maintenance where there is also a need to implement an asset management system. Transportation needs a sound working asset management system to assess and set its funding needs. In addition, this system should allow management to establish the same level of accountability envisioned for the Six Year Program.

To make any decisions properly, Transportation needs timely and accurate information. For proper communication to exist, Transportation must have systems that can interact and exchange information. Data should be reliable and data fields designed for compatibility. Systems should be user friendly and should provide management with timely, accurate, and easily available management reports. Transportation has taken steps toward an interim solution to their information needs problems with the creation of the Data Warehouse; however, the best practice is ultimately an enterprise solution.

- TABLE OF CONTENTS -

EXECUTIVE SUMMARY

TRANSMITTAL LETTER	1-2
--------------------	-----

CHAPTER 1 - INTRODUCTION

Historical Financing Arrangements	3
Managing Cash Flow	3-5

CHAPTER 2 - CASH AND FINANCING RESOURCES

Revenue Collection, Forecasting, And Budgeting Responsibilities	8-13
Virginia Transportation Act	13-14
Transportation Debt	14-15
Impact Of Federal Reimbursement Anticipation Notes	15-17

CHAPTER 3 – ALLOCATIONS

Highway Maintenance And Operating Fund (HMO)	21-22
Transportation Trust Fund	22
Statutory Allocations	22-25

CHAPTER 4 - THE SIX YEAR PROGRAM

Six-Year Program Development Process	27-30
Secondary Six Year Plans Development Process	30-31
Communication Of Information	31-32
Cash Forecasting	32-34
Budgets Versus Allocations: Disconnect Between Cash Flow, Expenses, And Allocations	34-35
SYP Implementation And Monitoring	35-40

Project Estimates	41-47
Role Of The Commonwealth Transportation Board And The Six Year Program	47-50
20 Year Intermodal Transportation Plan And Its Relationship To The SYP	50-53
CHAPTER 5 - SYSTEMS ENVIRONMENT	
Introduction	55
System Structure Overview	55-56
Systems Needed To Provide Information In The Data Warehouse For Cash Management	56-62
Systems Development	62-64
CHAPTER 6 – CONSTRUCTION	
Construction Life Cycle	65-71
Project Estimation And Budget Monitoring	71-77
Project Management	77-79
CHAPTER 7 – MAINTENANCE	
Maintenance Payments To Cities And Towns	81-83
Maintenance Payments To Counties	83
Maintenance Budget Development And Distribution	83-84
Maintenance Needs	84-85
Maintenance Budget Monitoring And Cash Management	85-87
Crossover	87-88
Maintenance Projects And Contracts	88-89
Asset Management	89-92
Performance Measures	92

Maintenance Project Management	92-93
CHAPTER 8 - BEST PRACTICES	
Introduction	95
Six-Year Program Development	95-98
Six Year Program Implementation	98-99
Construction	99-100
Maintenance	100-101
Reporting	101-102
Flow Chart – Best Practices Six Year Program Development	103
Flow Chart – Best Practices Six Year Program Implementation	104
Flow Chart – Best Practices Construction	105
Flow Chart – Best Practices Maintenance	106
APPENDIX A - INTERNAL AND EXTERNAL REPORTS	107
APPENDIX B - LIST OF RECOMMENDATIONS	
Recommendations for Transportation	109-116
Recommendations for the Commonwealth Transportation Board	116-117
Recommendations for the General Assembly and the Governor	117-118
APPENDIX C – DEPARTMENT OF TRANSPORTATION’S RESPONSE	121
REVIEW TEAM MEMBERS	123

July 8, 2002

The Honorable Mark R. Warner
Governor of Virginia
State Capital
Richmond, Virginia

The Honorable Kevin G. Miller
Chairman, Joint Legislative Audit
and Review Commission
General Assembly Building
Richmond, Virginia

We have completed our operational and performance review of the Virginia Department of Transportation's cash management practices and construction and maintenance capital budgeting practices as requested by the Governor and are pleased to submit our report entitled **"Special Review of the Cash Management and Capital Budgeting Practices in the Virginia Department of Transportation."**

Objectives

We had eight objectives for our review of Transportation. These objectives were to:

1. Determine whether Transportation's cash flow analysis and projection procedures are adequate.
2. Determine whether Transportation's automated systems can provide the information required for management to make informed financial and operational decisions.
3. Document and review all of Transportation's funding streams, their uses, restrictions, and other encumbrances including the Federal Highway Reimbursement Anticipation Notes, the Priority Transportation Fund, and the Transportation Equity Act for the 21st Century.
4. Determine whether Transportation has a process to accumulate, compile, and assess the feasibility of the cost of projects in relation to funding availability before sending out the Request for Proposal and, if they do, whether the process is adequate.
5. Document, review, and determine the adequacy of Transportation's policies and procedures to decide which construction and maintenance projects to fund.

6. Document, review, and determine the adequacy of Transportation's process to commit to construction and maintenance contracts and to determine what role funding plays in this process.
7. Review and determine the adequacy and propriety of the Commonwealth Transportation Board's role in the contract commitment process and determine what information Transportation provides the Commonwealth Transportation Board members when awarding contracts.
8. Assess the need for legislation to govern Transportation's construction and maintenance contract commitment process by requiring a funding commitment before signing a contract.

Scope

In conducting this review, we examined several Joint Legislative Audit and Review Commission reports including: "Review of Construction Costs and Time Schedules for Virginia Highway Projects," "Adequacy and Management of VDOT's Highway Maintenance Program," and "Equity and Efficiency of Highway Construction and Transit Funding." We also reviewed the Governor's Commission on Transportation Policy's Final Report. We conducted interviews with Transportation personnel to document various processes related to funding and financing sources, allocations, development of the Six Year Program, cash flow and forecasting, construction and maintenance operations, and automated information systems. We researched the Code of Virginia and federal regulations for statutes that govern these processes. We also met with the Department of Motor Vehicles to document the revenue forecasting procedures.

We would like to thank Transportation's management and staff for their cooperation and professionalism throughout this review. Without their knowledge and contributions, this report would not be possible. We believe that the Transportation staff have the professional capability to implement our recommendations.

We discussed this report with Transportation's management and included their response in Appendix C.

AUDITOR OF PUBLIC ACCOUNTS

DBC:whb
whb:131

CHAPTER 1 INTRODUCTION

The Virginia Department of Transportation builds, maintains, and operates the state's roads, bridges, and tunnels. Virginia has the third largest state-maintained highway system in the United States with an annual budget of over \$3 billion. Transportation maintains over 56,000 miles of interstate, primary, and secondary roads and distributes state funds to help maintain over 10,000 miles of urban streets. Transportation not only maintains roads but also maintains more than 11,700 bridges, four underwater tunnels, two mountain tunnels, two toll roads, one toll bridge, four ferry services, 41 rest areas, and 107 commuter parking lots. Transportation has over 10,000 employees, making it one of the three largest state agencies in the Commonwealth.

HISTORICAL FINANCING ARRANGEMENTS

Transportation has relied heavily on a pay-as-you-go funding model for both maintenance and construction. Under this funding model, Transportation entered into contracts at a pace that ensured that annual revenue collections were sufficient to pay for most if not all projects undertaken. As Transportation increased the pace and number of contracts undertaken, their ability to pay decreased and the demands for funding gradually eroded Transportation's cash reserve.

The erosion of cash reserves by the increased number of projects has highlighted certain inherent issues within the structure of Transportation. These issues include project management both operational and financial, project estimation and budgeting, resource allocation between maintenance and construction, management structure and coordination, and various other issues.

Over the past several years, Transportation has been the subject of a series of studies both external and internal. Appendix A includes a list of these studies. In addition, the 2002 Session of the General Assembly adopted House Joint Resolution 211, which establishes a joint committee of the General Assembly to review the implementation of these study recommendations.

This report focuses on the current cash flow management practice and does not attempt to determine why Transportation elected to implement a particular process. We will try not to duplicate or repeat any of the recommendations in these other studies, where possible. In certain circumstances, this study may support or build upon one or more of these recommendations. Further, we believe Transportation can implement the recommendations in this report in combination with a number of policy and structure changes in the other studies.

MANAGING CASH FLOW

Transportation has experienced problems with cash flow sporadically since 1999. In the spring of 1999, Transportation ran low on cash as they neared fiscal year end. Transportation cited a mild winter in which construction projects continued uninterrupted and the passage of TEA-21, which permitted an increase in highway construction. Transportation conserved cash at year-end by restricting construction projects' spending and occasionally operating with a deficit cash balance until transportation revenues began flowing in again in fiscal year 2000 and operations returned to normal. Significant cash problems did not arise again until fiscal year 2001.

Transportation began experiencing cash flow issues, specifically in the Highway Maintenance and Operating Fund, in the second half of fiscal year 2001. One cause for this reduction in cash was due to a

change in legislation over the timing of gas tax revenue collections, which funds maintenance and construction expenditures. This change resulted in a 15-day delay in collecting taxes, but will not result in a reduction in total collections over time. The reduction in available cash also resulted from both weaker than estimated revenue collections and higher expenses.

Because of the cash flow issues, Transportation ended fiscal year 2001 with an insufficient cash balance in the Highway Maintenance and Operating Fund to operate during the months of July and August 2001. Consequently, Transportation had to borrow cash from other Transportation funds, including the Construction and Priority Transportation Funds. Transportation has since repaid the loan from the Priority Transportation Fund and is borrowing only from the Construction Fund to support the Highway Maintenance and Operating Fund. Transportation repaid these loans, including interest, before the end of fiscal year 2002.

Transportation has continued to have cash flow issues throughout fiscal year 2002. During the year, on-going economic downturns have affected the Commonwealth's overall revenue collections and budget, and these conditions and other factors have caused the adverse cash flow situation to continue. We identify these factors throughout this report. To try to increase current cash flow, Transportation has turned to the issuance of Federal Reimbursement Anticipations Notes (FRANs) as a solution. Transportation currently plans to issue FRANs through fiscal year 2007.

This study focuses primarily on Transportation's ability to forecast its cash resources, determine its priorities for the use of these cash resources, and relate its cash needs to resources by managing its cash in relationship to its needs, commitments, and contingencies. The study also looks at how certain actions will affect Transportation's future cash flow needs. To effectively manage cash resources, Transportation must be able to reasonably obtain reliable information, which is subject to the discipline of having both the systems and processes to provide timely and accurate information.

Two previous studies have commented on Transportation's ability to estimate the cost of construction projects and the need for an asset management system that provides sound analytical information for determining maintenance needs. Implementation of these study recommendations are essential elements to managing Transportation cash flows. Without implementing these recommendations, Transportation's ability to manage cash flow will only marginally improve.

Cash flow management techniques must be part of Transportation's project management, both with construction and maintenance. In order to improve cash management, Transportation will need to develop a construction project management process that assigns and tracks a project to either an individual or a team from the beginning through completion of the project. This approach is an essential change if Transportation seeks to maximize its cash flow usage and maintain minimal cash reserves.

Further, Transportation management will need to re-train and focus many of the maintenance and construction project managers on the importance of budgeting, contract cash management, and the relationship of their project or district to the total financial operations of the department. This retraining and focus will add a business dynamic to project management rather than an emphasis primarily on the technical aspect of the project.

Transportation's preparation of the Six Year Program is an integral part of improving cash management and should include needs determination, cash management, monitoring, communication, and accurate and reliable automated information systems. Until Transportation changes this process from a revenue allocation process to an expense based budgeting process, proper cash management will result in only nominal improvements.

In Chapter 2 through Chapter 7, we discuss cash and financing resources, the mandated allocation process, the Six Year Program development, the maintenance and construction programs, and the automated information systems that support these functions. Throughout these discussions, we provide recommendations for improving processes and controls. In Chapter 8, we provide a Best Practices model of how Transportation can implement the recommendations made throughout this report.

Page Left Intentionally Blank

CHAPTER 2 CASH AND FINANCING RESOURCES

Transportation receives both state and federal revenues that support the Commonwealth's transportation system. State revenues consist of various taxes and fees that support the primary Transportation Funds: the Highway Maintenance and Operating Fund and the Transportation Trust Fund. Motor vehicle fuel and sales and use taxes; motor vehicle license and registration fees; motor carrier fees and taxes; and hauling, highway, and mileage permit fees support maintenance efforts through the Highway Maintenance and Operating Fund.

The statewide Transportation Trust Fund accumulates revenues to fund all modes of transportation initiatives in the Commonwealth. In 1986, the General Assembly passed legislation to increase the sales and use tax from four percent to four and one-half percent, with the one-half percent increase going to the Transportation Trust Fund. In addition to the sales and use tax, motor vehicle rental tax, aviation fuel tax, public right of way use fees, and truck demo use permit fees fund the Transportation Trust Fund.

Transportation receives 78.7 percent of the Transportation Trust Fund revenues through an allocation set out in the Code of Virginia that allocates funds to all modes of transportation. Transportation further allocates its apportionment to constructing, reconstructing, and improving the interstate, primary, secondary, and urban road systems. We discuss this allocation process in more detail in Chapter 3, "Allocations."

In addition to funding from tax allocations, Transportation also has several direct sources of revenues. These direct sources include Federal Transportation Funds, toll revenues, and reimbursements from localities. Below is a discussion of each of these sources.

Federal-aid highway funds are a major source of revenue from the Federal Highway Administration (FHWA) to assist states in providing for construction, reconstruction, and improvement of highways and bridges on eligible Federal-aid highway routes and for other special purpose programs and projects. The Federal-aid Highway Program (FAHP) is an umbrella term referring to all activities funded through the FHWA and administered by States' highway or transportation agencies, or in some cases, by local transportation agencies.

Toll facilities provide a portion of Transportation's revenues and arise from the operation of three major toll facilities located in Northern Virginia, Central Virginia, and Hampton Roads. The facilities are the Omer L. Hirst – Adelard L. Brault Expressway (formerly Dulles Toll Road), the Powhite Parkway Extension Toll Road, and the George P. Coleman Bridge. Transportation uses the toll revenues from these roads to pay debt service on bonds issued to construct the roads and to fund daily operations of these roads. We discuss Transportation's debt and its effect on operations later in this chapter in the section, "Transportation Debt."

Transportation also receives reimbursements from cities, counties, and towns for participation projects. Participation projects occur when Transportation performs construction or repair work for localities, and the localities must pay a certain percentage of the construction costs.

Transportation has always been primarily special revenue funded. One exception is the General Fund appropriation provided in lieu of recordation taxes to fund debt service on Route 58 bonds. Another exception occurred in fiscal year 2001, when Transportation received General Fund appropriations for construction purposes for the first time through the Virginia Transportation Act, discussed later in this Chapter in the section, "Virginia Transportation Act."

Transportation's final resource of funding is debt. In the past, Transportation has issued debt to fund construction of specific roads or toll facilities. However, as a result of the Virginia Transportation Act,

Transportation began issuing Federal Highway Reimbursement Anticipation Notes (FRANs), a debt-financing instrument that permits issuers to pledge future federal highway reimbursements to repay investors. Transportation can use receipts from these debt issuances to finance various capital transportation projects throughout the Commonwealth.

REVENUE COLLECTION, FORECASTING, AND BUDGETING RESPONSIBILITIES

Several agencies have responsibility for collecting, estimating, and budgeting the revenue sources that fund Transportation as the table below illustrates.

Revenue Source	Collection and Forecast Responsibility
Motor Vehicle Fuel-Gas Tax	Motor Vehicles
Motor Vehicle Clean Special Fuel Tax	Motor Vehicles
Motor Vehicle Sales & Use Tax	Motor Vehicles
Motor Vehicle Rental Tax	Motor Vehicles
Motor Vehicle International Registration Plan	Motor Vehicles
Motor Vehicle License Fee	Motor Vehicles
Aviation Fuel Tax	Motor Vehicles
Motor Carrier Registration Fee	Motor Vehicles
Road Tax on Motor Carriers	Motor Vehicles
Weighing Fees and Violation Damages	Motor Vehicles
Sales & Use Tax ½%	Taxation
Hauling Permit Fees	Transportation
Highway Permit Fees	Transportation
Mileage Permit Fees	Transportation
Outdoor Advertising	Transportation
Public Right of Way Use Fees	Transportation
Truck Demo Use Permit	Transportation
Overload Permits	Transportation
Sale of Goods & Services to State Entities	Transportation
Sale of Land & Building	Transportation
Sale of Land & Building – Right of Way	Transportation
Sale of Land & Improvements – Right of Way	Transportation
Sale of Equipment	Transportation
Interest, Dividends, and Rents	Transportation
Fines, Forfeitures, Court Fees, etc	Transportation
Toll Revenue	Transportation
Proceeds from securities lending	Transportation
Receipts from cities, towns, counties	Transportation
Highway Planning	Transportation

Forecasting Process

The Forecasting and Analysis Office (Office), at the Department of Motor Vehicles (Motor Vehicles), estimates the motor vehicle related state taxes and fees that they collect outlined above. The Office consists of three economists who use an econometric model to estimate these revenues in the fall of each year and update the estimates throughout the year as necessary. In June 2002, this function transferred to the Department of Taxation. The Department of Taxation provides Motor Vehicles with an estimate for the one-half percent Sales and Use Tax and the state and national economic outlooks. Taxation provides two forecasts, the standard and the alternative. The purpose of these two forecast outlooks is to provide two distinct perspectives of the national economy with the alternative outlook typically being the more conservative forecast. Taxation subscribes to national economic forecasts developed by the WEFA Group and DRI, now DRI*WEFA. DRI*WEFA provides economic information for several regions and industries internationally, including state governments. The Governor's Advisory Board of Economists and Advisory Council on Revenue Estimates recommend the choice of the standard or alternative outlook to the Governor in independent assessments. In addition to the Governor's advisory groups, Motor Vehicles uses an ad hoc panel of government and private sector economists, the Transportation Revenue Advisory Panel (TRAP), who are familiar with the anomalies of transportation revenues and who provides specific advice on the state and national outlooks and likely implications for transportation revenues.

In developing the revenue estimate, Motor Vehicles considers a number of factors and variables, including the following: motor fuel prices, vehicle prices, personal income, motor fuel consumption, motor vehicle sales, new taxable titles, and vehicle registrations. Based on a combination of these factors and trends in transportation revenue collections, Motor Vehicle's economists recommend what they believe to be the best estimate to the Secretary of Transportation for approval. Typically, the revenue estimates released in December of each fiscal year reflect estimates for the current fiscal year and six years beyond. Transportation uses the results of this forecast process in the development of the budget as well as the six-year transportation plan, called the Virginia Transportation Six Year Program. We discuss the development of this plan in Chapter 4, "The Six Year Program."

Forecast Results

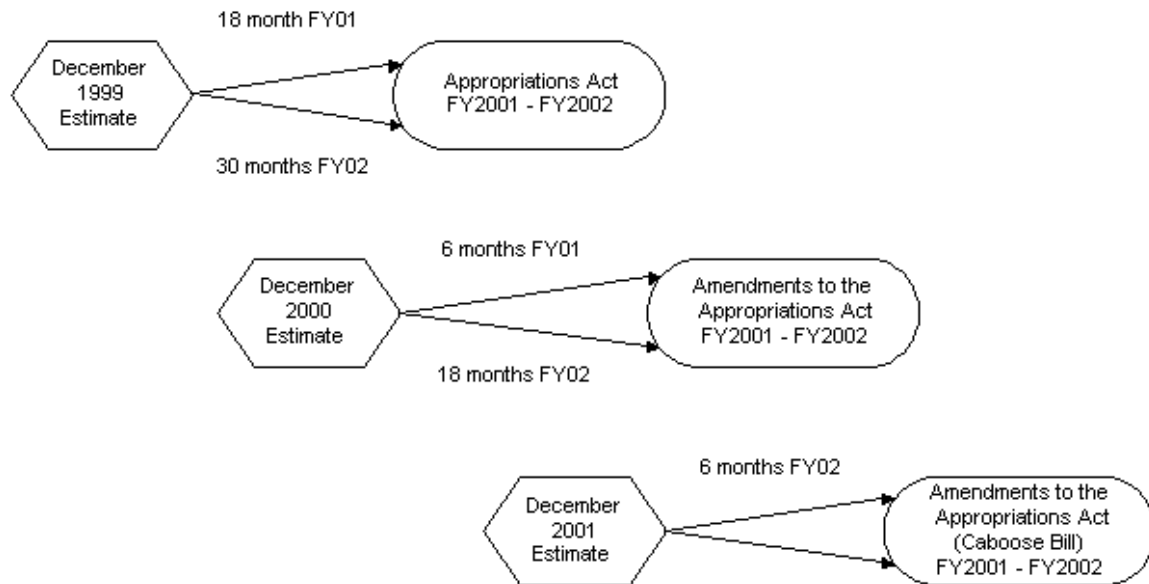
The economic outlook for transportation revenues developed by Motor Vehicles uses either the standard or alternative outlook for the state's economy as a whole. Typically, the Governor's Council on Revenue Estimates decides which outlook to use since it is the practice of the Commonwealth not to use different outlooks for different aspects of the budget. In estimating transportation revenues in the fall of 2001, Motor Vehicles recommended using the standard national outlook rather than the alternative outlook approved by the Governor's Council on Revenue Estimates. The alternative outlook was more conservative, calling for a four-quarter instead of a two-quarter recession. The Governor's budget released in December 2001 and revised in February 2002 used the official revenue forecast resulting from the alternative outlook. However, the transportation portion of the budget used the standard forecast. In February 2002, Motor Vehicles subsequently revised the transportation revenue estimate to reflect the alternative outlook.

Forecasting Accuracy

Transportation uses revenue estimates to prepare its budget on an annual, biennial, and six-year basis. The accuracy of these estimates is very important and can impact decisions as to how much and which construction and maintenance work Transportation schedules and accomplishes each year and throughout the Six Year Program. As noted above, Motor Vehicles, Taxation, and Transportation collect and forecast revenues that support Transportation. All of these estimates are part of the annual budgeting process for the Commonwealth. The Department of Planning and Budget prepares revenue estimates every December as the

basis for the next budget cycle. The December estimate affects the budget in different ways dependent on the stage of the biennial budget, as illustrated in Figure 1 below.

Figure 1



Changes in policy and in the economy cause changes in revenue estimates from cycle to cycle. As a general rule, the closer an estimate is to the date of collections, the more precise the estimate is.

Due to the importance of the revenue forecast that Motor Vehicles performs, we reviewed the accuracy of the revenue forecast. We determined accuracy based upon the percent variance between the forecasted amount and the actual collections for a given period. Additionally, we assessed the accuracy of the revenue forecast with the use of a performance target. For purposes of this study, we used a performance target of (+/-) 2 percent to assess the accuracy of Motor Vehicles' forecast, observing actual collections for fiscal year 1997 through fiscal year 2001 compared to the applicable 6-month forecast (See Figure 2). We also assessed Motor Vehicles' 18-month and 30-month revenue forecast accuracy for the same time period. We used performance targets of 5 percent and 7 percent, respectively. We selected these performance targets based on the Department of Taxation's performance measures established to evaluate the General Fund Revenue estimates. Taxation does not have a performance measure for the 30-month forecast; therefore, we established the 7 percent performance target based on judgment.

In addition, we compared the performance of Motor Vehicles' forecasting performance to that of the Governor's estimation of General Fund revenues as described in the Joint Legislative Audit and Review Commission (JLARC) Briefing on the Revenue Forecasting Process at their October 2001 meeting. Generally, we found that the accuracy of the forecasts parallel those results found by JLARC in its briefings. Similarly, we found that the closer to the actual date of the forecast, the more accurate the forecast.

Figure 2

(in thousands)

	<u>30 month Forecast</u>	<u>Actual Collections</u>	<u>Dollar Variance</u>	<u>Percent Variance</u>
FY 2001	\$ 1,800,297	\$ 1,933,736	\$ 133,439	6.90%
FY 2000	1,753,515	1,882,854	129,339	6.87%
FY 1999	1,666,251	1,771,386	105,135	5.94%

	<u>18 month Forecast</u>	<u>Actual Collections</u>	<u>Dollar Variance</u>	<u>Percent Variance</u>
FY 2001	1,816,000	1,933,736	117,736	6.10%
FY 2000	1,743,214	1,882,854	139,640	7.42%
FY 1999	1,698,847	1,771,386	72,539	4.10%
FY 1998	1,636,093	1,681,828	45,735	2.72%

	<u>6 month Forecast</u>	<u>Actual Collections</u>	<u>Dollar Variance</u>	<u>Percent Variance</u>
FY 2001	1,900,274	1,933,736	33,462	1.73%
FY 2000	1,815,867	1,882,854	66,987	3.56%
FY 1999	1,710,142	1,771,386	61,244	3.46%
FY 1998	1,656,649	1,681,828	25,179	1.50%
FY 1997	1,596,193	1,609,002	12,809	0.80%

Collections for these revenues exceeded expectations for each of the December estimates since 1996. In fiscal years 2000 and 2001, Motor Vehicles under estimated revenues in the 18-month estimate by more than our 5 percent performance target, and in fiscal years 1999 and 2000, Motor Vehicles under estimated revenues in the 6-month estimate by more than our 2 percent performance target. However, it is more conservative to under estimate revenues than to over estimate. As a result, revenue estimates have not negatively impacted Transportation's planning process.

To further analyze revenue estimates, we reviewed fiscal year 2002 estimates and collections through April 2002. We determined the percent of forecasted revenues collected through April 30 of each year and compared the percentages for each year to determine whether collections appear to be consistent with prior years' collection activity.

	<u>6-month Forecast</u>	<u>Actual Collections as of April 30</u>	<u>Percentage Collected</u>
FY2002*	\$ 1,915,877	1,567,060	81.79%
FY2002	1,976,133	1,567,060	79.30%
FY2001	1,900,274	1,525,939	80.30%
FY2000	1,815,867	1,484,909	81.77%

*Motor Vehicles revised revenue estimates in February 2002.

Based on the percentage of the forecast collected by April 30, it appears that revenues are coming in at approximately the same rate as they have in previous years in relation to the forecast.

Federal Revenues

Federal revenue is a large portion of Transportation's annual budget. Transportation receives federal revenue mainly from the Federal Highway Administration (FHWA) under the Federal-Aid Highway Program and TEA-21. In the past, Transportation has consistently over estimated federal revenues by budgeting for full apportionment authority.

The Federal-Aid Highway Program is a reimbursable program, which means the Federal Government only reimburses Transportation for costs actually incurred each year. There is not a direct relationship between apportionments, obligations, and reimbursements for federal revenues. Transportation has not considered this lack of correlation in the past resulting in over estimations of federal revenues.

The current federal legislation authorizing funding for state transportation programs is the Transportation Equity Act for the 21st Century, or TEA-21. This legislation governs highway funding for the six fiscal years -- 1998 through 2003. TEA-21 includes five major programs for highway funding: Surface Transportation (STP), Interstate Maintenance/National Highway System (IM/NHS), Minimum Guarantee, Bridge Replacement and Rehabilitation, and Congestion Mitigation and Air Quality (CMAQ). There are other smaller special programs, as well as the "high priority projects" category, which includes project-specific grants.

FHWA distributes federal funds through apportionments, which represent lines of credit upon which Transportation may draw as they advance federally assisted projects. However, FHWA limits the amount of Federal assistance that Transportation may obligate during a specified time period by establishing obligation authority. This limitation does not affect the scheduled apportionment of funds; it just controls the rate at which Transportation may use these funds. Any shortfall between the limit on obligation authority and the apportionment amount does not disappear because congressional authorization of federal-aid highway revenues represents a commitment to eventually make all authorized revenues available to states for highway purposes. Instead, the difference between obligation limitations and apportionment levels creates unobligated balances. Transportation has four years to obligate funds from the date of the apportionment. Since Transportation spends old apportionments before new apportionments, Transportation has not lost apportionments. Transportation has accumulated a considerable unobligated balance due to the continuous shortfall between obligation authority and apportionments. Transportation cannot obligate this balance until FHWA provides them with additional obligation authority based on available federal revenues.

TEA-21 included a new funding mechanism called revenue-aligned budget authority (RABA). RABA compares current estimates of highway account receipts with the amounts specified in TEA-21. The RABA calculation combines looking back at the prior fiscal year and looking ahead at the current estimate of receipts for the coming budget year. On the basis of that comparison, RABA adjusts both contract authority for the Federal-Aid Highway Program and the budget caps for the highway category.

The authoritative cycle of TEA-21 will end in fiscal year 2003. Transportation is considering several variables to forecast Federal revenues currently and beyond the TEA-21 legislation. Since fiscal year 1997, Transportation's obligation authority has been, on average, 13 percent less than the total apportionments for a given fiscal year. For federal revenue forecasting purposes, Transportation plans (beginning in fiscal year 2003) to budget using the obligation authority amount instead of the full apportionment amount. Beyond the authoritative cycle of TEA-21, Transportation anticipates forecasting federal revenue using the growth rate percentage of motor fuels consumption in Virginia, because the "motor fuels tax" is the basis for the majority of Federal funds dedicated to highway transportation. Transportation will use the average growth rate percentage of approximately 3 percent based upon the official estimate of the total taxable gallons of motor fuel consumption. For fiscal year 2003, Transportation reduced the federal revenue estimate by \$116 million

to account for the affect of RABA adjustments. After fiscal year 2003, Transportation reduced revenues estimates by a 5 percent reduction in obligation authority to account for the changes in the economy.

Since Federal reimbursements make up approximately 30 percent of the total revenue for Transportation, the revenue forecasting process Transportation used in the past was unreasonable. Budgeting for full apportionment overstates Transportation's anticipated revenues and could result in over committing Transportation on construction and maintenance contracts. Transportation's plan to budget considering obligation authority, RABA, and the growth rate of motor fuels consumption is more reasonable. However, Transportation should also consider projected reimbursements as a percentage of the apportionment to help bring the projection more in line with actual reimbursements. Transportation needs to document this process and make it part of its formal budgeting policy. In the past, Transportation has not properly used revenue and cash forecasts to make contracting and purchasing decisions. As Transportation begins to consider these factors, accurate and realistic federal revenue forecasts will become more important.

Recommendation #1: Transportation should continue to budget federal revenues based on obligation authority, RABA, and the growth rate of motor fuels consumption, but should also include projected reimbursements to help bring the projection more in line with actual reimbursements. Transportation should document this process and adopt the policy.

Other Revenues

Transportation's Financial Planning and Debt Management Division (Financial Planning) prepares revenue estimates for all other revenues that Transportation collects. The revenue forecasting procedures for the toll roads incorporate the use of a three-year moving average. However, up until fiscal year 2002, the forecasting procedures for the Coleman P. Bridge toll facility used a simple linear trend. The remaining revenues are miscellaneous taxes and fees. Financial Planning forecasts these revenues individually depending on their nature, however, these sources make up a small portion of Transportation's revenues.

VIRGINIA TRANSPORTATION ACT

In 2000, the General Assembly passed the Virginia Transportation Act of 2000 (VTA). The VTA provided Transportation with General Fund appropriations, established the Priority Transportation Fund (PTF), authorized the Commonwealth Transportation Board (CTB) to issue "Commonwealth of Virginia Federal Highway Reimbursement Anticipation Notes" (FRANs), and designated "priority transportation projects."

The legislation restricted the use of the General Fund appropriation to priority transportation projects designated in the VTA. In fiscal year 2001, Transportation received approximately \$236 million in General Fund appropriations for these projects. Of this amount, Transportation spent \$166 million on road construction projects and reverted \$70 million in unspent funds at the end of fiscal year 2001 to the General Fund of the Commonwealth. For fiscal year 2002, the VTA originally provided \$68 million in General Fund appropriations for priority projects. In addition, Transportation prepared their its budget based on the assumption that they would receive the \$70 million as re-appropriations in fiscal year 2002. However, due to changes in the economy, Transportation did not receive any general funds in fiscal year 2002. Transportation had committed these funds to construction projects. As a result, Transportation had to use other revenues on these projects to meet their commitments, which contributed to Transportation's cash flow problems in fiscal year 2001 and that continue to occur.

The Priority Transportation Fund (PTF), a special non-reverting fund, is a component of the Transportation Trust Fund. Required deposits to the PTF include the following:

- additional revenues attributable to the Virginia Fuels Tax Act;
- Transportation Trust Fund and Highway Maintenance Operating Fund excess revenues over official estimates;
- beginning July 1, 2003, one-third of insurance license tax revenues; and
- any other appropriations that the General Assembly or Governor may provide.

Transportation may only use these funds to finance the priority transportation projects designated in the legislation. At the discretion of the CTB, Transportation may re-allocate funds designated to projects within a transportation district among other projects within the same transportation district as needed to meet construction cash-flow needs, if the funds can not be spent on the priority projects.

During fiscal year 2001, the PTF received \$35 million in excess revenues for fiscal year 2000 and net transfers of \$99 million. Transportation has identified \$31.6 million in excess revenues for fiscal year 2001, but Transportation has not transferred the funds to the PTF. Transportation has left the funds in the Construction and Highway Maintenance and Operating Funds so that they can use the available cash for ongoing projects. As of April 2002, Transportation has not spent any of the PTF funds. Transportation has also not spent all of their FRAN proceeds, as discussed below. Because of the federal regulations concerning “arbitrage” on unspent bond proceeds, Transportation has attempted to first spend the bond proceeds before spending the PTF funds. Transportation plans to transfer the fiscal year 2001 excess revenues to the PTF prior to the 2002 fiscal year end.

Transportation issued \$375 million in Federal Highway Reimbursement Anticipation Notes (FRANs), Series 2000, at a premium on November 1, 2000, receiving proceeds of \$386 million. The FRANs are a type of Grant Anticipation Revenue Vehicle, a debt-financing instrument that permits issuers to pledge future federal highway funds to repay investors. VTA authorized the issuance of these notes, limiting the amount outstanding at any one time to \$800 million and specifying eligible projects. The Acts of Assembly 2002 (Chapter 814) amended the VTA, increasing the amount of FRANs that may be outstanding at one time to \$1.2 billion. Under the VTA, the General Assembly identified approximately \$1.9 billion in transportation projects that may be funded in whole or in part from the FRANs. The former Secretary of Transportation decided to issue the Series 2000 FRANs without considering the readiness of the projects. Since most of the designated projects were not in the construction phase, Transportation cannot spend approximately \$163 million in FRAN proceeds. As of May 31, 2002, Transportation had spent approximately \$223 million in FRAN proceeds. The General Assembly later expanded this project list in the 2002 Acts of Assembly (Chapter 814), approved on April 8, 2002, providing Transportation more flexibility in how they spend the funds.

TRANSPORTATION DEBT

Transportation must issue debt pursuant to Section 9 of Article X of the Constitution of Virginia. This section of the Constitution of Virginia classifies each type of debt issuance as either 9(a), 9(b), 9(c), or 9(d). Section 9(a) debt represents debt issued to redeem previous debt obligations. Section 9(b) debt represents debt authorized by the citizens of Virginia through bond referenda, to finance capital projects. Section 9(c) debt finances capital projects which, when completed, will generate revenue to repay the debt. Section 9(a), 9(b), and 9(c) debt is tax-supported general obligation debt and is backed by the full faith, credit, and taxing power of the Commonwealth. The last type, section 9(d) debt is comprised of revenue bonds without a pledge of the full faith, credit, and taxing power of the Commonwealth.

At June 30, 2001, Transportation had outstanding \$56,585,000 in 9(b) general obligation bonds, \$126,318,645 in 9(c) general obligation bonds, and \$1,291,835,000 in 9(d) revenue bonds.

Transportation's section 9(b) bonds are comprised of the Powhite Refunding Bonds, Series 1993A, which Transportation issued to refund the 1986 9(c) Transportation Facilities Bonds. Toll revenue from the Powhite Parkway Extension funds debt service on these bonds. However, toll revenues have not always covered debt service payments, construction costs, and operations. As a result, the Toll Facility Revolving Fund and the Construction Fund have provided funds from other sources to cover all costs not paid for from tolls. Transportation will repay these other funds from future toll revenue, if these facilities generate money in excess of their existing costs.

Transportation's section 9(c) bonds are comprised of seven different bonds ranging in issuance dates from June 28, 1989 to February 1, 1998. Transportation issued these bonds to fund the construction, improvement, and operation of the Omer L. Hirst – Adelard L. Brault Expressway and the George P. Coleman Bridge. The source of the debt service payments on these bonds is the toll revenue generated by these roads.

Transportation's section 9(d) bonds are comprised of 13 different bonds ranging in issuance dates from April 23, 1992 to November 1, 2000. Transportation issued these bonds to fund the construction of State Route 28, U.S. Route 58, the Northern Virginia Transportation District Program, and the Oak Grove Connector. Transportation issued Series 2000 FRANs to finance various capital transportation projects throughout the Commonwealth pursuant to the Virginia Transportation Act of 2000, and they are also section 9(d) debt.

Tax district revenues from Fairfax and Loudoun counties repay the State Route 28 bonds. Recordation taxes in the Route 58 area fund debt service payments on the U.S. Route 58 bonds with any difference coming from the Highway Maintenance and Operating and Priority Transportation Funds. The state recordation tax and local revenues collected in the city of Chesapeake repay the bonds issued to finance the construction of the Oak Grove Connector. The bonds issued to finance the construction of projects in Northern Virginia Transportation District Program are repaid from the following sources:

- State recordation tax collected in Alexandria, Fairfax City, Falls Church, Manassas, Arlington, Fairfax, Loudoun, Manassas Park and Prince William
- Highway Maintenance and Operating Fund
- Priority Transportation Fund
- Public right of way use fees collected in Fairfax, Loudoun, and Prince William
- Local Contract Revenues.

Repayment of the Series 2000 FRANs are from appropriations of future cost reimbursements and payments received from the Federal Highway Administration for Federal-aid projects. In addition, repayment shall come from PTF as available.

IMPACT OF FEDERAL REIMBURSEMENT ANTICIPATION NOTES

Transportation has turned to the issuance of FRANs as a method to provide current resources for construction. Transportation currently plans to issue FRANs through fiscal year 2007, as outlined in Figure 3 below, to support the Six Year Program. The VTA limits outstanding principal on the FRANs to \$1.2 billion at any one time. Since annual debt service payment retires a portion of the principal, Transportation has

staggered the issuance of each Series so that the timing of the debt service payments will prevent the outstanding principal from exceeding the \$1.2 billion limit.

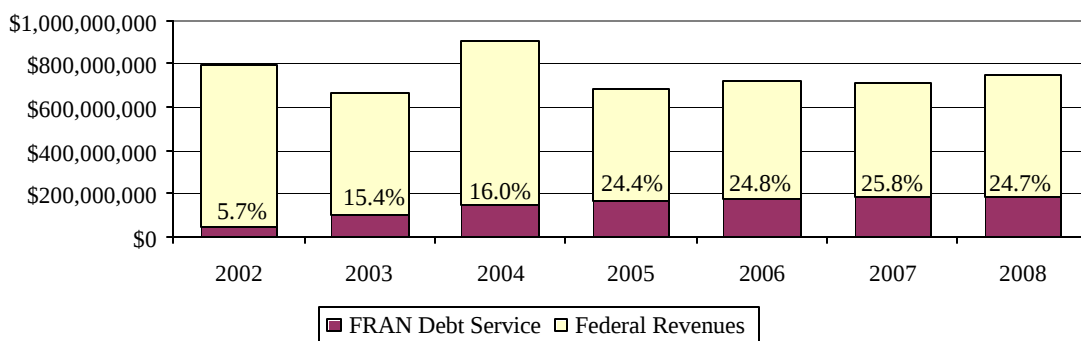
Figure 3

<u>Fiscal Year</u>	<u>Series</u>	<u>Issue Amount</u>	<u>Outstanding Principal At Fiscal Year-End</u>
2001	Series 2000	\$ 375,000,000	\$ 375,000,000
2002	-	-	375,000,000
2003	Series 2002A&B	495,950,000	870,950,000
2004	Series 2003	241,500,000	1,078,845,000
2005	Series 2004	139,500,000	1,142,955,000
2006	Series 2005	68,000,000	1,112,320,000
2007	Series 2006	30,500,000	1,028,145,000
2008	-	-	902,460,000
Total		<u>\$ 1,350,450,000</u>	

However, the issuance of FRANs is only a short-term solution to a long-term problem and can actually make the cash flow situation worse in the future. While the issuance of FRANs provides a significant increase in available funds in the years Transportation issues the notes, the effect of debt service payments partially counteracts this increase and reduces the amount of funds available for construction in subsequent years. Additionally, FRANs require Transportation to continue spending on federally approved construction projects that qualify for federal reimbursement. Therefore, to ensure the continued flow of federal revenue to meet FRAN debt service, Transportation will need to commit, and make as a priority, funding of those construction projects that will receive federal funding, and also direct state funds to these projects.

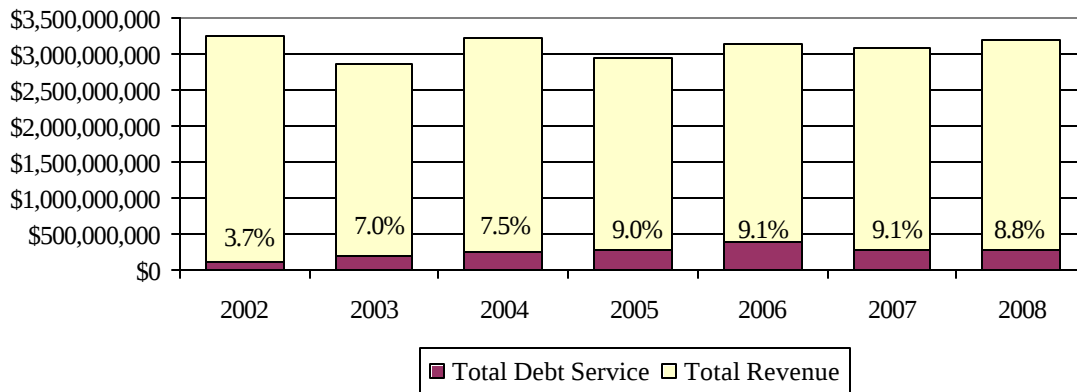
The graph located at Figure 4 below shows the impact the issuance of all of the FRANs will have on Transportation's future federal revenues. This graph shows projected federal revenues through fiscal year 2008 and the portion of federal revenues Transportation will have to spend on debt service for FRANs. If Transportation issues the FRAN Series described above, they will commit approximately 25 percent of federal revenues to debt service through fiscal year 2010. After that, debt service will taper off each year as Transportation completes the debt service payments for each Series through fiscal year 2017.

Figure 4
FRAN Debt Service as a Percentage of Federal Revenues



In addition, by issuing FRANs as described in Figure 3, Transportation will increase its total debt service requirements as outlined in Figure 5 below.

Figure 5
Debt Service as a Percentage of Total Transportation Revenues



By 2006, Transportation's total annual debt service requirements will exceed \$278 million. Out of a \$3 billion annual budget, Transportation will be spending over 9 percent of its budget on debt service. The Commonwealth, as a whole, uses 5 percent as the debt capacity limit to maintain an AAA bond rating. As Transportation considers issuing additional FRANs, they need to consider the amount of any proceeds remaining from previous FRAN issues, the readiness of projects to use the funds, and the impact the issuance has on current and future revenue streams.

***Recommendation #2:** Transportation should establish a policy on how to decide when and if to issue future FRANs. This policy should consider the amount of any proceeds remaining from previous FRAN issues, the readiness of projects to use the funds, and the impact the issuance has on current and future revenue streams.*

***Recommendation #3:** The General Assembly and the Governor may wish to consider having the Debt Capacity Advisory Committee review and recommend guidelines for Transportation to follow when issuing debt.*

Page Left Intentionally Blank

CHAPTER 3 ALLOCATIONS

Transportation uses the term “allocation” for both revenue distribution and budgeting. For purposes of our report, we will define “allocation” as a distribution of estimated revenues. When discussing estimating expenses, we will use the term “budget.” In order to distribute estimated revenues, Transportation begins with a pool of funds consisting of transportation revenues and uses the allocation process to distribute revenues to the various transportation agencies, highway maintenance program, administrative and support functions, highway systems, construction districts, counties, municipalities, and finally, individual highway construction projects. See figure 6 on page 20.

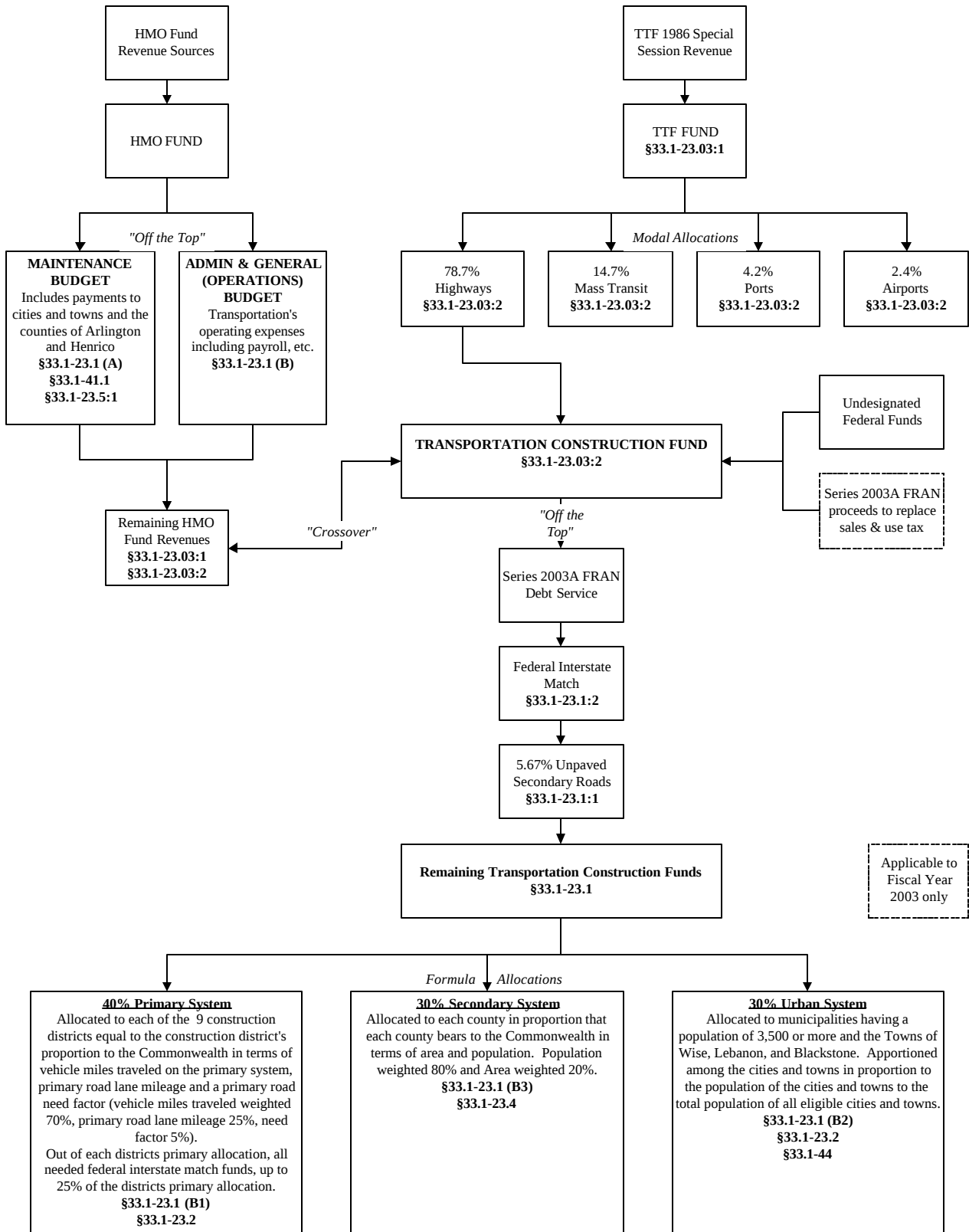
This chapter will address how Transportation makes the allocations of revenues to the various agencies and funds. We will not review the process of oversight exercised by the Department of Planning and Budget, the Governor’s Budget bill, and the actions taken by the General Assembly in appropriating funds.

An allocation represents a commitment to distribute estimated future revenues. At Transportation, it is the amount of revenue earmarked for a project, program, or administrative unit. The allocation process is an attempt to equitably distribute transportation revenues to the various transportation and highway systems and geographical areas throughout the Commonwealth. Transportation allocates estimated revenues to the various modes of transportation (Highways, Rail, Airports, and Ports) as modal allocation and to the road systems as formula allocations. The Sections 33.1-23 et al, 33.1-41.1 and 33.1-44 of the Code of Virginia prescribe Transportation’s statutory allocation requirements.

Some of Transportation’s funding flows through the formula allocation, and some does not. There are state and federal programs that are not part of the allocation formula, but directly fund designated programs. These include the Transportation District Improvement Fund, Industrial Access Program, Congestion Mitigation and Air Quality Improvement Program, Interstate funding (including Interstate Maintenance funds), National Highway System funds, and certain aspects of the Surface Transportation Program (STP). Transportation allocates “undesignated” or “non-program specific” federal funds through the formula. Examples of these funds are the Highway Bridge Replacement and Rehabilitation (HBRR) funds, a portion of the Surface Transportation Program (STP) funds, and a portion of the Minimum Guarantee funds.

Transportation revenues go primarily into two accounts, the Highway Maintenance and Operating Fund (HMO) and the Transportation Trust Fund (TTF).

Figure 6
TRANSPORTATION REVENUES AND ALLOCATIONS
PER THE CODE OF VIRGINIA



HIGHWAY MAINTENANCE AND OPERATING FUND (HMO)

The Highway Maintenance and Operating Fund (HMO) was the primary fund for all Commonwealth highway funding from 1923 until 1986, when the General Assembly created the Transportation Trust Fund to specifically fund highway construction. The HMO's primary function is the funding of highway system maintenance and Transportation's general and administrative expenses. The HMO fund is dedicated specifically to highways (Transportation) and receives revenues from various state taxes and fees and local sources. We describe these revenue sources in Chapter 2, "Cash and Financing Resources."

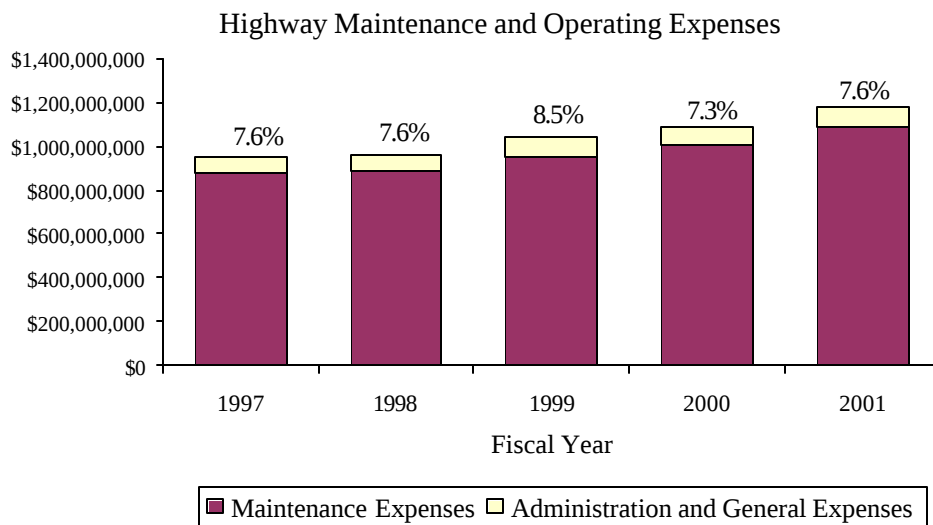
Budget Process: HMO Expenses

Transportation is statutorily required to fund highway maintenance first and then general and administrative expenses (Section 33.2-41.1 of the Code of Virginia). Once Transportation covers these expenses, they must transfer the remaining funds to the Transportation Trust Fund (TTF) for road construction (Sections 33.1-23.03:1, and 33.1-23.03:2 of the Code of Virginia).

The majority of the HMO revenues fund the highway maintenance program, which includes highway system maintenance (Transportation maintained systems), maintenance payments to localities, ground transportation regulation, ground transportation system planning and research, and ground transportation system safety. We discuss the budget process for highway system maintenance in Chapter 7, "Maintenance."

The remainder of the HMO revenues fund Transportation's administrative and support services expenses. These expenses consistently average 7 to 8 percent of all HMO expenses from year to year as seen in Figure 7 below.

Figure 7



The Financial Planning and Debt Management Division (Financial Planning) develops the administrative and support services budget. They develop the budget incrementally, beginning with the funding levels from the prior year of the Commonwealth's biennial budget (Appropriation Act). To determine the budget, Financial Planning considers administrative and support estimates for each organizational unit with an administrative budget, approved salary increases, and any new agency initiatives. For fiscal years 2003 and 2004, Financial Planning reduced the administrative programs' non-personal service

budgets by three percent of the fiscal year 2002 level as required in the final state budget. The personal services portion of the administrative budget includes the approved 2.5 percent salary bonus for fiscal year 2003, and a 2 percent salary increase in fiscal year 2004.

TRANSPORTATION TRUST FUND

The General Assembly created the Transportation Trust Fund (TTF) during its 1986 Special Session as codified in Section 33.1-23.03:1 of the Code of Virginia. The TTF is a special non-reverting fund created to provide dedicated sources of revenue for the transportation needs of the Commonwealth. We detail these revenue sources in Chapter 2, “Cash and Financing Resources,” but we will briefly describe them here. The special session revenues dedicated to the TTF were increases in existing taxes and fees, with the increase dedicated to the TTF. The largest of these revenue sources, the one-half percent state sales and use tax increase, represented a new source of funding for transportation while the other tax and fee increases represented increases in existing transportation sources.

The TTF funds four modes of transportation: highways, mass transit, ports, and airports. The Department of Transportation acts as the fiscal agent of the TTF and allocates the revenues as provided in the Code of Virginia. Transportation’s portion of the TTF revenues is in Transportation’s Construction Fund.

STATUTORY ALLOCATIONS

Modal Allocations

The term modal allocation refers to the statutory responsibility to allocate set percentages of the 1986 special session TTF revenues to Transportation and Mass Transit (Department of Rail and Public Transportation), Ports (Virginia Port Authority), and Airports (Department of Aviation). Section 33.1-23.03:2 of the Code of Virginia establishes the percentages shown below.

- Airports – 2.4 Percent
- Ports – 4.2 Percent
- Mass Transit – 14.7 Percent
- Highway Construction - 78.7 Percent

Transportation allocates these revenues before allocating any funds for the highway system. The process begins with the official revenue forecast for transportation revenues. Once received, Transportation determines the allocation amounts to the various modes using the above percentages. Transportation actually distributes the revenues to the other agencies as they become available throughout the year.

Formula Allocations

The term formula allocation refers to the statutory formula Transportation must use to allocate the transportation revenues that remain with them after the modal allocations. Transportation allocates these revenues, which include the 78.7 percent allocated to highway construction, any remaining HMO revenues, and certain federal funds, for highway construction to the various road systems, specifically the Interstate, Primary, Secondary, and Urban systems. We refer to these revenues throughout this chapter as “highway revenues.”

Current Formula Allocation Background and History

The General Assembly established the State highway system in 1918, and subsequently designated it as the “primary system” in 1938. The Byrd Act of 1932 established the secondary system, which today includes all state maintained county roads with the exception of Arlington and Henrico counties. The Byrd Act contained provisions for funding the construction of roads in cities and towns, but there is no provision expressly establishing the urban system. The primary, secondary, and urban systems are the basis for the formula allocations.

Transportation currently distributes primary system funds to nine construction districts. Eight of the nine construction districts use the 1922 Congressional district boundaries. The Northern Virginia district, created in 1984, uses the regional transportation boundaries. The districts are the basis for further distribution of the primary system allocations.

JLARC recommended the current allocation formulas, and the formulas for distribution of funds within the systems, to the General Assembly in 1984. The General Assembly enacted the formula for distribution both among and within the systems in 1985. The General Assembly has not modified either the proportional 40/30/30 split or the formulas for distribution within the systems since 1985.

Highway System Allocation Formula

The Code of Virginia prescribes the allocation formula and the specific order Transportation must use to distribute the estimated highway revenues. Transportation must first set aside funds, or take funds “off the top,” before the application of the formula. The remaining funds, after the “off the top” items, then flow through the formula. We visually depict the process in Figure 6: Transportation Revenues and Allocations on page 20. Transportation allocates the funds as follows:

1. “Off the Top” Items:
 - Series 2003A FRAN Debt Service
 - Interstate Matching Funds (required match for federal interstate funds)
 - 5.67 Percent of the remainder for Unpaved Secondary Roads
2. Remaining funds allocated using the following formula:
 - 40 Percent Primary System
 - 30 Percent Secondary System
 - 30 Percent Urban System

Transportation must further allocate the funds within each system as follows:

Primary

Allocated to each of the nine construction districts based on primary roads by weighted factors of 70 percent for vehicle-miles traveled (VMT), 25 percent for lane miles, and 5 percent for the primary road need factor.

Secondary

Allocated to each of the counties based on population and land area by factors weighted as 80 percent for population and 20 percent for land area.

Urban

Allocated to cities and towns with populations over 3,500 in proportion to the population of the cities and towns to the total population of all eligible cities and towns.

Transportation refers to these system allocations as either “formula allocations” or the “40/30/30 split.” Transportation uses the allocations to determine annual available funding for the systems, which forms the basis for the Six Year Program (SYP).

Future Allocation Issues

In accordance with Section 33.1-23.1 of the Code of Virginia, the Commonwealth Transportation Board (CTB) must first statutorily obligate all highway revenues it deems reasonable and necessary for maintenance. The CTB then funds the general and administrative expenses and then transfers the remaining HMO funds to the TTF for highway construction. HMO revenues have been sufficient in the past to fund maintenance and other administrative expenses.

Transportation is projecting that for fiscal 2003 to meet maintenance needs, the TTF will need to transfer funds to HMO. This process is known as “crossover” – the point where the TTF is contributing construction funds to the HMO for maintenance. We discuss “crossover” in further detail in Chapter 7, “Maintenance”.

In fiscal year 2003, the Commonwealth will use the one half percent state sales and use tax dedicated to the TTF to cover state budgetary shortfalls. The General Assembly authorized Transportation to issue Federal Highway Reimbursement Anticipation Notes (FRANs) to replace the lost sales tax revenue. Transportation will issue \$317 million in Series 2002A FRANs for this purpose. For fiscal year 2003, the Series 2002A FRANs will also flow through the allocation formula for distribution to the systems. Transportation will pay debt service for the Series 2002A FRANs from available General Funds first, with the balance coming off the top of the highway revenues before application of the formula. Although the General Assembly has provided some General Funds for debt service for fiscal years 2003 and 2004, Transportation must pay debt service for the next ten years.

In addition to the Series 2002A FRANs, Transportation, as described in Chapter 2, “Cash and Financing Sources,” plans to issue five additional series through fiscal year 2007 to fund eligible VTA highway construction projects. For these additional FRANs, Transportation plans to charge debt service to each district in proportion to the district’s dollar share of VTA projects to the total dollar value of VTA projects. In this case, Transportation will not distribute the funds as formula allocations. Transportation will use available Priority Transportation Fund revenues first for debt service, with the remainder removed from each district’s allocation.

Debt service affects the use of allocations. When there is one revenue stream that funds debt service for a project and its related debt, the effect on the allocations is clear. However, the effect debt service has on the allocation is less clear when more than one project benefits from the issuance of debt. The use of FRANs highlights these issues.

FRANs allows Transportation to issue debt and guarantee the payment of the debt service with future federal revenues. If Transportation could undertake a federal project and use the FRANs to fund the project today and bill the federal government overtime for the project, Transportation could maintain the one to one relationship. However, the use of FRAN proceeds today commits Transportation to funding future federal programs with other Commonwealth resources. Transportation then bills the federal government and uses the federal money to pay debt service.

FRANs create two problems within the allocation process. The first problem is whether debt service is a use of a county or district's allocation until retirement of the debt, or should Transportation deduct the debt service before making the allocation. The second problem is the commitment to use Commonwealth resources to fund future federal projects. While this commitment may not directly affect the allocation, it will affect the selection of projects.

Recommendation #4: The General Assembly may wish to provide guidance on how Transportation should pay debt service in relation to the allocation of resources within the Six Year Program.

Page Left Intentionally Blank

CHAPTER 4

THE SIX YEAR PROGRAM

Transportation's primary mission is the planning, construction, operation, and maintenance of highways. To accomplish this mission, Transportation annually prepares, updates, and publishes the Six Year Program (SYP) and the Counties' Secondary Six Year Plans (Secondary SYP), which the Code of Virginia requires each county adopt separately. The SYP includes the Primary, Interstate, and Urban systems, while the Secondary SYP includes only the Secondary system roads. The plans are Transportation's efforts to program highway construction projects.

The SYP and the Secondary SYP should show Transportation's commitment to start, continue, or complete projects during the six-year period. The origin of the SYP was as a planning and budget document on what projects Transportation could reasonably expect to undertake during the period.

Due to a 1981 JLARC study, Transportation began preparing a six-year period plan, which has evolved into the current SYP. During that time, Transportation developed a process that required a project to receive at least 70 percent of its allocations before it could go to advertisement. As with the current SYP, once projects entered the plan, the programming divisions staff were not involved in project monitoring; oversight occurred outside of the actual plan.

This chapter focuses on the current process for developing the SYP, but also explains the development process for the Secondary SYP. Over the past several years, Transportation has stopped requiring 70 percent of an interstate and primary project's allocation before going to advertisement, although Secondary and Urban systems still practice the 70 Percent Rule. Abandonment of this method for the primary and interstate systems is a primary cause for the cash shortages Transportation experienced. In addition, Transportation has added more projects to the SYP than it can afford. Many of these projects do not have the necessary funding for construction, and in many instances the cost estimates are unrealistic. Transportation did not attempt to determine if there was sufficient funding for completion of the projects before placement in the SYP. The SYP has included projects with no allocations or any expectation of an anticipated allocation within the SYP. Further, the CTB has approved the process of funding projects that commits a district's future allocations beyond a project's completion date.

This chapter also addresses how project estimation errors and overruns affect both the SYP and Transportation's ability to pay for projects. This chapter has several recommendations concerning individual portions of the process, and recommends a mechanism to improve the inclusion of projects in the SYP and, more importantly, includes several recommendations to improve accountability of the plan and general management of the process.

SIX-YEAR PROGRAM DEVELOPMENT PROCESS

Transportation updates the Six-Year Program (SYP) annually. The CTB allocates funds to the interstate, primary, and urban highway systems, public transit, ports, and airports for the immediate fiscal year and identifies the planned program funding for the next five years in the SYP. The SYP also identifies the secondary system statutory distribution of funds to the counties, the distribution of funds to items earmarked by the General Assembly, and bond-funded projects.

The Financial Planning and Debt Management Division (Financial Planning) begins the development process with the official revenue estimates and allocates these revenues to the required programs and activities. Programming divisions then perform a preliminary analysis for the updated program addressing the following items.

- Cost to complete financing of projects under way.
- Cost to finance continued project development and future implementation cost of improvements included in the current program.
- Remaining funds available for possible new projects from the statewide plan, transit technical studies, bridge deficiency ratings, secondary roads six-year plans, and improvements requested in the past by the public and local governing bodies.

Transportation holds pre-allocation hearings in the spring in each of the nine highway districts. These hearings initiate and encourage early public involvement that assists Transportation in determining SYP project additions. Transportation's programming divisions then select new projects for inclusion in the tentative programs and draft nine separate tentative six-year programs, one for each Transportation construction district. The Programming and Scheduling Division (Programming and Scheduling) reviews the draft programs and recommends allocations with individual CTB members; each member receives and reviews their district's plan. After making any necessary adjustments, the CTB formally approves the tentative allocations and SYP at the regularly scheduled May board meeting. Transportation distributes the tentative program throughout the Commonwealth for public scrutiny.

In June, Transportation holds the final two public allocation hearings before final board approval. Section 33.1-23.2 of the Code of Virginia requires these hearings, which Transportation normally holds on the same day at two locations for public convenience. The CTB assesses the hearing data, makes any necessary adjustments to the tentative program, and gives final approval at its June meeting. The result is the final allocations and program document that is the Six Year Program.

Final project approval ultimately rests with the CTB. Their selection is highly subjective, and they do not use objective criteria or statewide priorities as the basis for project selection. In addition, Transportation does not provide the CTB detailed project information, preliminary survey work, feasibility studies, or accurate cost estimates before project selection.

As discussed in Chapter 6 "Construction" and later here, actual design, cost estimation, and other detailed project work does not begin until after a project is included in the SYP. As a result, the CTB does not have sufficient information on these critical factors when deciding to include projects in the SYP.

Programming the Six Year Program

The Programming and Scheduling Division is responsible for the Interstate and Primary system projects, and the development of the SYP overall. They begin with a draft, which the CTB approves to become the tentative plan, and finally they produce the final Six Year Program. The programming divisions (Programming and Scheduling, Urban Roads, and Secondary Roads) use the annual allocations prepared by Financial Planning to develop the Six Year Program (SYP). Each district must use its formula allocations as distributed. The Six-Year Projections Spreadsheet computes the program allocations, by system, district, and locality. Programming and Scheduling use the spreadsheet and an Access database (SYP database) for program development. The SYP shows the annual allocations (the budget) as the first year of the program and shows the distribution of the program allocations to specific projects.

Programming and Scheduling begins its update each year by having the districts update cost estimates, date milestones, and other project information in the Program Project Management System (PPMS), an in-house mainframe system. Programming and Scheduling retrieves cost estimates and advertisement dates from PPMS, receives the preliminary funding (allocation) projections from Financial Planning, and retrieves actual project expenditure data from the Financial Management System II (FMSII). Programming and Scheduling uses this information, as well as the cost overrun report produced by the Construction Division as the basis for determining project allocations. The cost overrun report provides an estimate, by project, of actual costs compared to the project's budget, and estimated cost to complete. Once Programming and Scheduling determines which existing projects in the SYP require additional allocations, they then can determine what funding, if any, is available for new project additions.

Urban Roads

The Urban Roads division is responsible for project selection and development of the urban portion of the SYP. Urban Roads begins its update process each January. Because the municipalities in the Urban system must approve projects, Urban Roads works directly with the eighty-one municipalities to determine project priorities and selection. Urban Roads establishes priorities through contact with the municipalities, and the municipalities decide where they want to put their allocations. For the 11 areas with Metropolitan Planning Organizations (MPOs – discussed at the conclusion of this chapter), the urban six-year plan includes all projects in the area's federal Transportation Improvement Program (TIP) (also discussed at the conclusion of this chapter), but their TIP may also include additional projects that are not included in the urban six-year plan.

Because the Code of Virginia requires that the municipalities match 2 percent of the project's cost with local funds, the city or town councils must formally request, by resolution, that Urban Roads add a project to the plan. Ultimately, Urban Roads system project selection rests with the cities and towns.

Interstate and Primary Systems

Programming and Scheduling first determines available federal interstate funding and interstate needs. Programming and Scheduling selects interstate projects based on need and funding. These selections are not by district. After determination of the interstate needs, they program the primary system. The primary system project selection is subjective; Programming and Scheduling staff use institutional knowledge.

Once Programming and Scheduling gathers the information, they update the Six Year Plan database (MS Access database). Programming and Scheduling updates the previous SYP and adds new projects in the SYP database. Programming and Scheduling records the Tentative Plan into the SYP database and then extracts the information to produce the final plan. The Commonwealth Transportation Board approves the final plan, which can contain amendments from the tentative plan. For the 2003 – 2008 Program just adopted, the Commonwealth Transportation Board added 13 projects between the tentative approval and final SYP. Programming and Scheduling incorporates any Board amendments and distributes the final plan. Programming and Scheduling then enters the new projects and their estimates into PPMS.

Until this most recent SYP update, Financial Planning has not provided Programming and Scheduling, Urban Roads, and Secondary Roads with any cash flow projections, and there has never been an attempt to match project allocations and estimated project cash payout. The Six Year Program development and funding process did not compare planned results with actual financial revenues and expenses. The divisions have not communicated beyond the formula allocation amounts and have not attempted to program expenses to match available cash inflows.

During the 2003 – 2008 SYP update just completed, in an effort to match the Program to expected funding, Financial Planning did provide cash flow information. Financial Planning has also provided the project payout factors used in its Cash Forecast Model, but Programming and Scheduling did not use these factors during this update. Programming and Scheduling plans to use the project payout factors in the future.

***Recommendation #5:** Transportation’s programming divisions should incorporate estimated monthly project payouts and estimated monthly cash flow information into the project allocation process. This would allow Programming and Scheduling to match project allocations to a project’s cash needs and would mitigate the cash drain that the mismatch of cash and allocations has on Transportation’s cash account.*

***Recommendation #6:** Transportation should re-evaluate the necessity for the pre-allocation hearing. If the Six Year Program is truly to be a budgetary document, the CTB should draft the program using the official revenue estimate and available cash, and add the statewide priority projects that funding can support for the year. Transportation could provide this list to the public for input at the final allocation hearings. The CTB could, at that point, substitute other projects ready to proceed based on public input as long the projects were within the budget established.*

SECONDARY SIX YEAR PLANS DEVELOPMENT PROCESS

Section 33.1-70.01 of the Code of Virginia requires the development and publication of separate plans for the Secondary system of state highways. The County Boards of Supervisors, in consultation with Transportation District Resident Engineers, compile and approve the Secondary Six Year Plans (Secondary SYP) individually by county. There are currently ninety-four separate Secondary SYPs.

Transportation’s Secondary Roads division assists the district residencies as needed in updating the counties’ Secondary Six-Year Plans. The preparation process for the Secondary Six-Year Plans is on a different cycle than the SYP. Secondary Roads starts their update cycle in late August and concludes in December. The process begins with the Resident Engineers updating project cost estimates for their existing secondary projects. Unlike the other road systems, each Resident Engineer provides estimates for their own project costs. Secondary Roads provides guidance, such as inflation factors, and the Resident Engineers may also receive guidance from the Location and Design Division. However, each Resident Engineer develops their own cost estimation method, using knowledge of local conditions. While local variances may be a factor, the Resident Engineers should use a consistent estimation process that is the same estimation process adopted by Transportation as an organization.

The Resident Engineers use the following priorities when updating the plans and allocating funds.

- 1st - Completed projects requiring the use of allocations to pay off cost overruns
- 2nd - Projects with construction underway – whether or not funding is completed
- 3rd - Special funded projects that require Secondary fund match
- 4th - Projects being developed during the six-year period that have funding to cover the proposed phases

New project selection for the Secondary SYPs is less subjective because the law requires the County Boards of Supervisors to prioritize their project lists. Because of the priority lists, the Resident Engineer, working with the Board of Supervisors, can add or subtract projects as allocations increase or decrease.

The County Boards of Supervisors approve the plans between October and December. Even though the law provides for the County Boards of Supervisors to update the plans once every two years, Transportation administratively encourages the County Boards of Supervisors to update the plans annually so that Financial Planning can better estimate federal revenues. Once the County Boards of Supervisors approve the plans, the Resident Engineers update the Secondary Six Year Plan database for each county.

In updating each County's Secondary SYP, the Resident Engineer provides electronic data to Secondary Roads using the Secondary Six Year Plan database application, which includes each County's SYP and provides Programming and Scheduling with PPMS updates.

Transportation Planning requires the secondary plan information in order to update the federally required Statewide Transportation Improvement Program (STIP – discussed at the conclusion of this chapter). Transportation must meet federal STIP deadlines, which fall before December. In addition, Financial Planning begins their budget cycle in the spring; Resident Engineers do not update Secondary project estimates until the fall. During fiscal year 2002, Secondary Roads and the Resident Engineers did not update the Secondary SYP's because of the uncertainties regarding revenue estimates. Because of this, the Resident Engineers did not have approved lists of new county projects. For this year, Secondary Roads requested Resident Engineers to provide Transportation Planning a draft SYP for each county indicating their best estimate for new plan project additions.

***Recommendation #7:** Transportation should establish and adopt a new timeline for the addition of projects to the Secondary Six-Year Plan to align more closely with the SYP cycle and cash forecasting process.*

For the remainder of this chapter, we will refer to both the SYP and the Secondary SYP as the SYP. We discuss them separately only when the processes differ.

COMMUNICATION OF INFORMATION

Communication of information during the development of the SYP and later during its implementation is a key factor in ensuring that the SYP is deliverable and stays on track. However, the Transportation divisions do not effectively communicate information between and among themselves. Transportation's culture is very compartmentalized and hierarchical. Without communication among the various divisions, Transportation cannot produce a reliable SYP and alleviate cash shortages.

Financial Planning provides the revenue estimates and funding levels (allocations) to the Transportation programming divisions, Programming and Scheduling, Urban Roads, and Secondary Roads. Programming and Scheduling has overall responsibility for scheduling primary and interstate projects, and overall responsibility for production of the SYP. Urban Roads provides the urban portions of the SYP, and Secondary Roads coordinates the counties' plan updates, which are distinct and not part of the CTB's SYP. In addition, Location and Design and Construction must provide project cost and time estimate data. These divisions must communicate information freely and effectively to produce a viable construction program.

Until this most recent plan update, Financial Planning has not provided the programming divisions with any cash flow projections, and the programming divisions have not considered available cash or approximate project payouts. The Six Year Program development and funding process does not include the cash flow component of the financial planning process.

The divisions responsible for project design and construction do not always provide the programming and financial planning divisions with updated project cost and project time estimate data. Additionally, as discussed in Chapter 5 “Systems Environment,” Transportation’s systems do not all contain the same information, and in those cases where the data is similar, there is no assurance the divisions have maintained the information accurately. Further, accessibility to systems in other divisions is limited or prohibited. The lack of communication between the systems, as well as between the divisions, makes forecasting and monitoring accurate cash flow impossible.

During the 2003 – 2008 SYP Transportation just updated, in an effort to match the Program to expected funding, Financial Planning did provide cash flow information, as well as estimated project payout factors to Programming and Scheduling for use in the update as discussed in the next section. Programming and Scheduling attempted to use the information in developing the latest SYP.

In our review, we found no direct link between the SYP and the cash forecast in the past. However, Transportation does recognize this weakness and is attempting to address the problem. During May 2002, Financial Planning and Programming and Scheduling worked together to incorporate the cash forecast into the SYP process.

***Recommendation #8:** Transportation should open the lines of communication and establish procedures to ensure that necessary information flows between divisions. Transportation should institutionalize this communication process throughout the department.*

CASH FORECASTING

Until January 2002, Transportation had a cash forecasting model but did not use it to regularly make operating and financing decisions nor did they use it to develop the Six Year Program. Financial Planning ran the model semi-annually or annually to determine Transportation’s cash flow status. However, this analysis was at a high level and did not consider cash flow for individual projects as it related to allocations. This contributed to cash shortages in Transportation’s Construction Fund. In addition, the cash flow data was not timely enough to prevent cash flow related issues from occurring in Maintenance operations. To supplement the cash model, senior management used the daily cash reports to manage cash. While management was aware of the short-term cash situation, they failed to react to the long-term implications that various decisions had on cash. This short-term focus resulted in interfund borrowing. Not making cash forecasting an integral part of the planning process has contributed to Transportation’s cash shortages over the past year.

Upon creation of the Virginia Transportation Act, Transportation tried to modify the old forecasting model to include the new VTA funds. However, the old model did not properly distribute expenses to the individual funds. The model could not handle the new funding sources identified in the VTA, and Financial Planning had to adjust the information manually. The old model also had problems related to the timing of the TTF funds. Therefore, Transportation decided to acquire a new cash forecasting model that would work in their changing funding environment.

In January 2002, Transportation obtained a consultant, Accenture, to design and implement a new Cash Forecasting tool using the Adaytum toolset. Accenture built in monthly factors from Transportation's Research Council that consider overruns and predict the payout schedule according to the award schedule of the contract. The Cash Forecasting database updates the project payouts, takes the balance of the contract, and shortens or lengthens the project schedule to match the award amount. In addition, the new database is able to handle the multiple funding sources created by the VTA.

Transportation purchased the Cash Forecasting database for two purposes. The first purpose is to project cash flows and expenses based on revenue estimates and project payout cycles to develop the SYP. Transportation used the database for this purpose for the first time in May 2002 to create the 2003 – 2008 SYP. The Cash Forecasting database allowed Transportation to consider cash inflows and payout cycles instead of just revenue allocations to determine what projects they would include in the SYP. By doing this, Transportation was able to match cash with expenses to ensure that they could fund all projects in the SYP.

Transportation's second purpose for purchasing the Cash Forecasting database is to monitor and manage cash flow continually throughout the year to aid in making decisions. However, Transportation has not fully implemented the new Cash Forecasting database. Currently, Financial Planning runs the model monthly but does not routinely distribute the results to management. As noted above, the database compares actual payouts to budgeted payouts and changes the project schedule based on the status of the project. However, the database can only relate the percent of actual expenses to the percent of project completion based on the project schedule. For example, if a project has spent 50 percent of its budget within 20 percent of its schedule, the database assumes that the project is proceeding faster than expected and reduces the time schedule so that it appears the project will complete in a shorter time period. The database does not have the capability to determine that the project is actually going over budget and increase the amount of expenses in the future without additional information from Construction and manual manipulation of the results. Financial Planning should communicate the results to other divisions, such as Programming and Scheduling, Maintenance, and Construction, so that they can make operating and financial decisions based on the results. If Financial Planning does nothing with this information, the database and the cash forecasting process will serve no purpose.

Financial Planning must share the cash forecasting information with the other divisions so that they can use the information to make operating and financial decisions. For example, Construction should use the cash forecasting information each month to decide when to put construction contracts out for bid. Construction should use the information to make decisions relating to contract change orders. Construction should communicate changes in project schedules and budgets to Financial Planning for use in the database. Programming and Scheduling should compare budget to actual payouts for individual projects to determine the effect any overruns in time or expenses have on the rest of the cash flow. Based on this information, Programming and Scheduling should make decisions to change the timing of projects to ensure adequate funding is available.

Failure to forecast, monitor, and manage cash flow is at the center of Transportation's cash flow problems over the past year. Even though Transportation used the Cash Forecasting database to create the SYP, if they do not use it to manage cash continuously, Transportation will continue to experience cash flow crises in the future.

***Recommendation #9:** Transportation should continue to use cash forecasting to develop the Six Year Program and to balance expected cash inflows against anticipated project payout schedules.*

Recommendation #10: Transportation must develop and follow a policy to forecast, monitor, and manage cash continuously throughout the year. Transportation must establish lines of communication between Financial Planning and all of the other divisions to ensure that the divisions share and use the information.

BUDGETS VERSUS ALLOCATIONS: DISCONNECT BETWEEN CASH FLOW, EXPENSES, AND ALLOCATIONS

The funding mechanism in the Six Year Program, the project allocation process, does not account for planned project payouts or cash flow. As discussed above, managing and monitoring cash flow through a cash forecasting process is an essential process in keeping the SYP on track. Transportation funds projects by allocating a portion of their estimated revenues to them each year. The amounts allocated bear no relation to a project's expected payout and the resulting Six Year Program is not a budgetary document. Transportation does not have sufficient controls and processes in place to control the pace they spend cash. These issues have contributed both to Transportation's cash shortages over the past year and the creation of an undeliverable Six Year Program.

Allocations for Specific Projects

There is no relationship between the allocation of revenues, the timing of cash inflows, and the budgeting of construction payouts. There is a disconnect in these processes that Transportation must address to function effectively.

After determination of the formula road system allocation amounts, the programming divisions, through the Six Year Program and the Secondary System Six Year Plans, further distribute the road system formula allocations to specific projects. Allocations may provide the total funding for a project over many years, and each project in the plans will have a portion of the total road system allocation allotted to it. By allocating estimated revenues and meeting other operational criteria on a construction project, Transportation management may authorize spending.

Project allocations are based on the distribution of estimated available revenues, not a project's expected payout over the year. The allocation process provides a budgetary mechanism for revenue distribution among projects; it does not provide for the budgeting of project expenses. Transportation has a limited resource pool and allocates that pool to projects each year based on what funds are available, not on what each project may actually spend. If there are 100 projects to fund, and \$100,000 to fund them, each project will receive a portion of that funding. However, the portion of the funding that the project receives each year bears little to no relationship to what that project actually spends each year.

Because projects are long-lived and will not spend their allocation over one year but instead over several years, Transportation has not attempted to match allocations to expenses on an annual basis. Transportation has been using the assumption that by allocating the estimated highway construction revenues over time, eventually expenses should closely mirror the allocations.

Once Transportation authorizes and awards a project, the project spends funds at its own rate without regard for its allocation. Transportation does not budget or restrict projects to planned expenses each year, does not properly estimate project costs, and does not always provide allocations equal to 100 percent of a project's cost by completion. As a result, total cost of the project will not equal total allocations in many cases.

Transportation also does not allocate cash. Although Transportation can estimate a particular area or system's share of the current and future years' revenues at July 1 of each year and that area or system receives its allocation, that allocation does not represent cash at July 1 or the flow of resources received during the year. This situation is comparable to an individual's annual salary. Every year an individual knows they will receive their annual salary in increments throughout the year and bases the timing of their purchases and expenses on the periodic amounts they will receive. Transportation must begin to do the same.

***Recommendation #11:** Transportation must carefully monitor and link the timing of cash receipts and expenses to all projects currently authorized. This may result in increased cash balances as Transportation matches their current and anticipated road construction expenses to forecasted cash. To accomplish this, Transportation will need to budget for construction payouts.*

***Recommendation #12:** Transportation should begin the systematic process of budgeting for the Construction Program. The budget should consider anticipated contract payout against anticipated cash flow. Transportation's Six Year Program should be a six-year capital budget. Currently, it is a revenue distribution document. This process will be central to Transportation's success in developing a deliverable, financially constrained construction program based on statewide needs and priorities.*

SYP IMPLEMENTATION AND MONITORING

Transportation does not have adequate procedures to properly implement and monitor the SYP. One of the biggest decision points in the SYP implementation is when to advertise a project for construction. Transportation does not have a reasonable method for determining when adequate funding is available to advertise a project for construction and, as a result, does not fully fund projects in the SYP. Transportation is not accountable for the success or failure of the SYP. Transportation's deficiencies in these areas have significantly contributed to Transportation's cash shortages and their inability to deliver the projects in the SYP.

Six Year Program and the Seventy Percent Rule

As discussed in the introduction to this chapter, Transportation previously used what they termed "The 70 Percent Rule" for the primary, interstate, and urban systems. The 70 Percent Rule is a method for determining when to advertise and begin construction projects based on allocations. Following this rule, when a project received allocations amounting to 70 percent of its estimated cost, Transportation advertised the project. During the early 1980's, Transportation realized that on average, they could only advertise approximately 70 percent of the projects scheduled for construction in the Program that year. Transportation knew that only 70 percent of the projects would be advertised, therefore 30 percent of the funding allocated was not used as planned, they devised the 70 percent Rule. The Rule actually caused the Program to contain more projects that could be 100 percent funded, but allowed Transportation access to the 30 percent of funding allocated to projects that they would not advertise. Transportation estimated that if they allocated 70 percent of the costs for each project before advertisement, there would be sufficient cash built up to cover all highway construction expenses. Transportation used the 70 Percent Rule to help manage funding and it appeared effective as long as cash flow was sufficient.

For the past several years, in an effort to expand the construction program, Transportation abandoned the 70 Percent Rule on the interstate system, primary system, and some large projects. The Urban Roads and Secondary systems retained the 70 Percent Rule. Transportation advertises interstate and primary projects based merely upon inclusion in the Six Year Program, regardless of the percentage of the project's cost allocated. Currently, Programming and Scheduling determines advertisement schedules based on information in PPMS. Each month, Programming and Scheduling lists all projects that have completed all milestones before construction. Programming and Scheduling compares the listed projects to their estimated costs and SYP allocations. If Programming and Scheduling expects that there are sufficient current and projected allocations to equal project costs by completion, they certify the project for advertisement. The process is very subjective. Programming and Scheduling provides these projects to Construction, who develops the construction estimates and advertises the project.

At the time Programming and Scheduling provides the certification to Construction, the estimate in PPMS is the 100 percent Design estimate. Construction calculates its own estimate for control against the contractors' bids; this estimate will closely match the award amount. Even if there is a significant difference between the 100 percent Design estimate and the construction control estimate, Construction does not notify Programming and Scheduling; Construction may not be aware of this because there is not a policy to compare the two estimates. This situation can negatively affect cash flow. Programming and Scheduling has funded and certified the project, with allocations, using the 100 percent design estimate. If there is a slight variance between the design estimate in the SYP and the project award amount, Programming and Scheduling can adjust allocations between projects or delay some projects to account for the differential. If there is a significant difference between the design estimate and the award amount, cash flow becomes an issue. That awarded project will begin to spend funds in excess of its current allocation in the SYP. Programming and Scheduling will adjust for this difference using future allocations in the next year's SYP update cycle, but it still affects the current year's cash flow.

In addition, once certified, the project proceeds to advertisement and award without further controls. Neither Programming and Scheduling nor Construction verify the award amount against allocations or cash. Programming and Scheduling receives a document, the "Fund Distribution," that lists the projects and the recommended award amounts. Programming and Scheduling receives this document just before CTB approval. It is possible to stop the awarding of the contract at this point, but Transportation has stated that this rarely, if ever, happens.

Causing additional drain on cash flow are CTB approved projects placed in the SYP that have little or no funds allocated to them. Transportation has frequently added a project to the plan at the request of the CTB, even when sufficient funding was not available. In these cases, the project advances and work starts without sufficient allocations to cover cash payments. Projects have gone to award with little or no construction funding and have drained already strained cash resources. Chippenham Parkway in the Richmond District is one such project that went to award and proceeded with construction before receiving an allocation. Even though construction is complete, an unfunded balance remains on the project that extends beyond the six-year timeframe in the 2003 - 2008 SYP, and the project did not receive an allocation during the SYP.

The CTB also approves projects for placement in the Plan that have no allocations over the six years. The CTB approves these projects even though there is no available funding. These projects often remain in the SYP for years with no allocations and without moving into construction. The Louisa Bypass is an example of a project that continues to appear in the SYP with no funding.

Many of the decisions to start or add projects appear to have been motivated more by a project's popularity or the desire to begin as many projects as possible. Transportation staff and the CTB do not use objective criteria to determine project selection and authorization. They have not considered available cash

and project funding. Transportation staff did not make these decisions; policy makers encouraged this environment and the construction program expanded dramatically. One result was the expansion of the Program beyond what Transportation could reasonably accomplish, and the inclusion of under funded, under estimated projects that did not have sufficient funding available to see them through to completion. (See section below on allocation deficits for further explanation.)

***Recommendation #13:** The CTB should prioritize project lists for inclusion in the Plan. This would alleviate outside pressure to add more projects in the plan than for which there is adequate funding. Transportation would apply available funding in the project's priority order until no further funding was available. The CTB should determine the priorities, and the Programming Divisions should apply the funding.*

Secondary System Seventy Percent Rule

The discussion above does not include the secondary system allocations and plans; it refers to the SYP processes for the interstate, urban, and primary systems. The secondary system, according to Section 33.1-70.01 of the Code of Virginia, develops six-year plans individually by county. The Secondary Roads division does use the 70 Percent Rule. Secondary Roads requires that each phase of a project be 70 percent funded, or have allocations equivalent to 70 percent of that phase's estimated cost, before authorizing work on that phase. Secondary Roads applies the 70 Percent Rule in the following manner:

- Projects reviewed at budget stage to assure that the preliminary engineering phase is 20 percent funded before opening them to charges.
- Projects reviewed at scoping (initial survey work) to assure that the preliminary engineering phase is 70 percent funded.
- Projects reviewed at the right of way stage to assure that the preliminary engineering phase is 100 percent funded and estimated right of way costs are 70 percent funded.
- Projects reviewed at the construction stage to assure that the preliminary engineering and right of way phases are 100 percent funded and estimated construction costs are 70 percent funded.

Each new phase must have 70 percent funding before beginning that phase, and the previous phase must have 100 percent funding.

Even using the 70 Percent Rule, the Secondary System still has deficits – completed projects without allocations totaling 100 percent of the construction costs. If a county has a deficit large enough, they may be unable to develop any new projects or to continue work on existing projects, until they repay the deficit by restricting their annual allocations to cover completed projects.

Under Funded Projects and Allocation Deficits Negatively Impact Transportation's Cash Flow

Not fully funding (allocating) all costs by project completion and under estimating project costs during construction has resulted in allocation deficits. Allocation deficits occur primarily because project expenses occur before the project receives sufficient allocations. Allocation deficits can appear in the SYP as negative allocations, reductions of future allocations, or can commit allocations beyond the project completion date. Allocation deficits negatively affect cash and are a primary cause of Transportation's cash shortages.

Transportation has no formal policy to completely fund projects by year of completion, and they have no reliable process for accomplishing this. Even while using the 70 Percent Rule, Transportation did not require the allocation process to provide the remaining 30 percent funding until as much as two years after completion of the project. This practice results from Transportation spending cash for projects before committing estimated revenues to fund the project.

A negative allocation can result from the addition of too many projects to the SYP. There has been an inherent incentive over the past several years to keep the project cost estimates low in order to add as many new projects as possible each year. One result of this practice is insufficient allocations in relation to true project costs in the program. For instance, in the secondary system, Transportation allocates the funds by county, and each county Board of Supervisors, in conjunction with Transportation, develops their own Six Year Plan. As projects progress and cost estimates increase, a county may find that its project expenses exceed its allocations. This may appear as a “negative” allocation in a subsequent year because the county has spent more than it will receive in the current, and possibly future, years. The effect is to “borrow” from future years’ allocations to “pay” for the overspent allocation in the current year. This reduces or eliminates the county’s ability to commit to projects in the future due to its reduced or negative future allocations.

Similarly, Transportation can also commit future allocations beyond project completion if a project costs more over its time to complete than available allocations over that same period. This situation commits future year’s allocations to pay for the project beyond the project’s actual completion date. For instance, for the primary system Transportation allocates to the nine districts throughout the state. If an approved project for a district will take five years to complete, but the estimated cost of the project is more than estimated available allocations for that same five-year period, the district will have to commit its future available allocations to that project until estimated allocations match estimated expenses. This may result in the district committing its allocations several years beyond the project’s completion date and preclude the addition of any new projects for the district. The Route 288 project in the Richmond District is a good example of this. When the project lost its anticipated General Fund revenues, it committed the Richmond District’s allocation for many years beyond the expected completion date of the project.

Both of these situations affect Transportation’s cash flow adversely, and Transportation’s failure to control these situations is a primary cause of their recent cash flow problems. Transportation has no control to stop payments once expenses exceed allocations, and Transportation holds no one group or individual accountable for project expenses. Although a district, county, or municipality may have over-committed or overspent their allocations and reduced their ability to add new projects in the future, Transportation continued to pay out cash for these unplanned project costs. If a county, district, or municipality overspends, they have in essence taken out an interest free loan that Transportation must fund. While the county has committed future revenues in advance, they have actually spent cash, Transportation’s cash, in the present.

This situation escalates with Transportation using cash to pay for current unplanned expenses, borrowing from one fund to cover expenses in another, until a cash shortage occurs. As cash comes in, Transportation must use it to cover expenses already incurred rather than the planned allocation of the revenue. It is imperative that Transportation recognizes that it must use planned expenses as the basis of their project funding decisions. They must budget for project expenses.

The revenues allocated represent a future commitment on cash. Over committing or under allocating those revenues results in cash shortages that hamper future construction and commit future revenues. Transportation must pay all bills and must fund all projects.

In developing the federally required State Transportation Improvement Program (STIP) (discussed at the conclusion of this chapter), the *United States Code Title 23§135* requires that projects included in the plan be fully funded by the year of completion:

“Requirement of Anticipated Full Funding:

The program shall include a project, or an identified phase of a project, only if full funding can reasonably be anticipated to be available for the project within the time period contemplated for completion of the project.”

Transportation must develop a reliable method for determining how a project progresses and when a project is advertised in relation to available cash. Transportation should ensure that all projects included in the Six Year Program have a reasonable expectation of receiving full funding by project completion and that sufficient cash exists for planned project expenses each fiscal year. In 1999, as part of their goals and related strategic outcome areas, Transportation developed the following goal:

“By 2002, VDOT will deliver a six-year highway construction program that is appropriately resourced, scheduled, implemented, and completed on time and within budget.”

Today, Transportation is attempting to distribute allocations to projects based on anticipated project payouts and have projects fully funded by the year of completion. Financial Planning has provided Programming and Scheduling with factors (developed for the Cash Forecasting model) to approximate actual project payouts by fiscal year. Programming and Scheduling should attempt to provide allocations to projects based on their anticipated annual expenses, to better match allocations and expenses, and to have the project fully funded by year of completion. Programming and Scheduling has not yet started using the factors for project allocations. We commend Transportation for this goal, and concur with the objective. However, Transportation needs to develop a written implementation plan to ensure that they meet this goal.

***Recommendation #14:** Transportation must develop a financially constrained Six Year Program based on anticipated project payouts. To do this, Transportation should develop a method to ensure that the projects added to the Six Year Program have sufficient allocations to complete planned work each year and that the full cost of the project has been allocated to it by the year of project completion. The method should allocate revenues to projects based on expected project payout each year, and should be reconciled to anticipated cash flow. Transportation should only add new projects to the extent that there is sufficient cash to pay for them. When developing the Six Year Program, Transportation should begin with a district’s, county’s, or municipality’s allocation, remove any outstanding debt service, and subtract anticipated existing project payouts. Transportation can use the remaining funds, if any, to add new projects as long as project payouts equal cash inflows.*

Once developed, Transportation should adopt this method as a written policy and institutionalize it throughout Transportation. This will require accurate project estimates, addressed below, and tight controls over cash flow. The budgeting, programming, and operational (construction) areas will need to develop open lines of communication and work closely toward delivering a financially constrained achievable program for this to occur.

Transportation Revenue Reserve Fund

This report concludes that revenue forecasting for the Transportation Trust Fund parallels the accuracy of the forecasts for the General Fund and the Commonwealth budget process as a whole. In addition, the report recommends the development of a Six Year Planning process that creates a capital project budget using cash flows as the basis for including projects in the SYP.

Therefore, just like the Commonwealth's overall budget, the Transportation budget will be subject to economic fluctuations, but will not have the cash balances that existed before in the SYP. Further, as shown with the current SYP implementation, economic conditions can have a substantial impact on the plan and available cash.

In recognition of this situation within the Commonwealth's budgeting process, the General Assembly created the Revenue Stabilization Fund (Rainy Day) to provide funding for such economic downturns. The recent use of the Rainy Day Fund reduced some of the short term effects of the economy and allowed both the Governor and General Assembly to address more permanent solutions to the current conditions.

No such reserve fund exists within the Transportation Trust Fund, and therefore, when recently faced with cash shortfalls and slowed revenue collections, Transportation management began a process of halting work on contracts and re-ordering priorities. Using the cash flow approach to capital funding without creating a reserve fund potentially increases the risk of having to halt or even cancel contracts.

Further, just creating a reserve fund may not solely reduce the risk of insufficient funding in an economic down turn. Like the Rainy Day Fund, there must exist a mechanism to prevent the diversion of these funds from construction or maintenance projects to other purposes.

Recommendation #15: During development and implementation of the new process, Transportation should determine an appropriate minimum cash balance to maintain as a reserve. The cash reserve is necessary for economic downturns where revenues are less than anticipated as well as to provide a cushion for Transportation while they work to develop and refine new processes.

Recommendation #16: The General Assembly may wish to create a Transportation Revenue Reserve Fund that would act like a Rainy Day Fund for the Transportation Trust Fund. Additionally, the General Assembly may wish to restrict availability of these funds from other uses.

SYP Monitoring and Accountability

Transportation does not track and monitor the progress of the projects in the SYP. In addition, Transportation does not have to report on the progress and success or failure of the SYP to anyone, resulting in Transportation not being accountable for the results. Transportation should report to the General Assembly on the programmatic and financial progress and results of each project included in the SYP periodically. Transportation should explain any variances in how projects progressed compared to expectations.

Recommendations #17: The Governor and the General Assembly may wish to consider amending the Code of Virginia to require Transportation to report on the progress and success or failure of the SYP to the Transportation and Finance committees annually.

PROJECT ESTIMATES

Transportation's project cost estimates contained in the Six Year Program (SYP) understate the true costs of the SYP. The Joint Legislative and Audit Review Committee (JLARC) conducted a review of Transportation's cost estimates in a report published January 9, 2001, entitled "Review of Construction Costs and Time Schedules for Virginia Highway Projects." In that report, they discuss various aspects of Transportation's cost estimates, including their methodology and the various milestones at which they develop estimates. JLARC selected and analyzed a sample of projects and determined the accuracy of Transportation's cost estimates from the various estimation points to final design, contract award, and project completion. JLARC concluded that Transportation's cost estimates considerably underestimated actual project costs, but that the estimates were more accurate as the design plans progressed.

Our purpose is not to re-present JLARC's findings, or describe in detail Transportation's cost estimation methods. We refer the reader to the JLARC report for those items; the Report provides an excellent background and analysis of the situation along with recommendations for improvements. We will provide a brief overview of cost estimates in this section.

Background

Transportation prepares cost estimates at several key milestones for each of the three phases of a construction project. The SYP lists these estimates by phase. Transportation develops cost estimates at the following major project milestones:

Initial Project Estimate – Location and Design prepares the first estimate before any design work in order to get the project in the SYP. Location and Design develops the estimate for the purpose of allocating funds to a project in the SYP. They know very little, if any, information at this point.

Scoping Estimate - Location and Design bases the estimate on a site visit to the project and input from Transportation staff; however, there are no plans, and they have not developed any quantities.

Preliminary Field Review Estimate - Location and Design develops these estimates when the plans are 20 to 30 percent complete. At this point, Transportation can estimate material quantities needed for further refinement of the estimates using the PES module of Trns*Port.

Estimate at Field Inspection – The design plans are approximately 50 to 60 percent complete at this stage and material quantity estimates are further refined.

Approval of Right of Way Plans – Design plans are approximately 75 percent complete and there is approval of right of way acquisition. There are no major design changes anticipated and only incidental item quantities remain.

100 Percent Design Estimate – Location and Design prepares this final project cost estimate. They know precise quantities. The designs are now complete and ready for submission to Construction.

Construction Control Estimate –Construction prepares the final construction phase estimate, the construction control estimate. Transportation uses the estimate to evaluate the reasonableness of contractors' bid amounts. Construction bases the estimate on final plan quantities and a combination of average and actual prices.

At each of these milestones, Transportation provides three estimates, one for each of the three phases of a project. The first two phases represent design, and the final phase is actual project construction.

Preliminary Engineering (PE) Estimates

Location and Design estimates preliminary engineering costs in one of two ways, depending upon the stage of the project. For early estimates, usually the initial estimate and the scoping estimate, Location and Design calculates PE as a percentage of the construction estimate for that milestone. Transportation designers use a standard form, the Engineers Estimate Worksheet Summary, to develop their estimates. Preliminary engineering estimates range from 10 to 20 percent of the construction estimate depending on whether the project is designed in-house or contracted out, project length, and project complexity.

Location and Design uses the second method when sufficient information is available. These estimates are based primarily on the number of person hours needed to perform the design work (design man-hours), as well as estimates from Traffic Engineering, Environmental, Materials, Traffic Planning, and other involved disciplines. Location and Design updates these estimates at each of the key milestones during design.

Right-of-Way and Utilities (ROW) Estimates

Location and Design prepares the initial ROW estimate, calculated as a percentage of estimated construction costs. The right of way estimates are 25 percent, 50 percent, 60 percent, or 100 percent of the construction estimate depending on if the project is rural, residential/suburban low density, outlying business/suburban high density, or central business district, respectively.

Beginning at the scoping stage, the Right-of-Way and Utilities Division prepares the ROW estimates based on estimated costs for land acquisition and utilities relocation. The ROW estimate incorporates a 10 percent annual inflation factor for increasing land values based on the number of years until right of way acquisition begins. Location and Design updates these estimates at each of the key milestones during design.

Construction (CN) Estimates

As with the PE estimates, Location and Design uses two methods to estimate construction costs. In the early stages of the project, before Location and Design knows quantities, the designers use the Statewide Cost Plan Estimates Table to estimate the cost of the project. The table provides rough estimates of the total construction costs based on the type of project.

Beginning at preliminary field review, Location and Design prepares the construction estimates based primarily on the designers' calculation of the quantities of materials needed to complete the project. Construction prepares the final CN estimate, the construction control estimate, which is used to evaluate the construction contract bids, and is based on the final plan quantities and a combination of average and actual prices. Contingencies should also be included in this estimate (See Chapter 6 "Construction" for discussion of contingencies in project estimates.)

Project Costs in the Six-Year Program are Underestimated

Transportation's initial project estimates are the most inaccurate, but possibly the most crucial, in the Six Year Program. JLARC cited the initial project estimate as being the least accurate estimate for a project. Because this estimate is the first estimate to appear in the Six Year Program, it is often the basis for initial funding decisions and initial project allocations. The initial estimates for most projects are prepared before

any design work. Transportation usually calculates these estimates using historical data on the typical cost per mile of road construction.

There are several reasons for the inaccuracy of these initial estimates

- Inconsistencies in:
 - Sources of estimates
 - Preparation of estimates
 - Inclusion of contingencies
- SYP development and approval process
- Lack of preliminary site work and project specifications

The Research Council also reviewed Transportation's initial cost estimation in an October 2001 Technical Assistance Report: Highway Project Cost Estimating Methods Used in the Planning Stage of Project Development. According to the Research Council report, "cost estimation must become a major focus during the initial project development phase. This will, in turn, force the transportation agency to better manage its budget, causing projects to remain in scope and on time throughout the development process. The need to solidify the estimation process can be seen through four areas: (1) the state financial plan; (2) the creation of public satisfaction and a positive response; (3) project control; and (4) the problems presently being encountered." The report further cited the primary problems facing cost estimation as data storage, changes in scope, unforeseen field conditions, schedule delays, and the lack of a constant estimating process.

We concur with the Research Council assessment and address the problems cited by the Research Council both below (lack of a constant estimating process and unforeseen field conditions) and in Chapter 6 "Construction" (changes in scope and schedule delays).

Inconsistencies in the Estimation Process

Several possible sources exist for the initial estimates. Location and Design calculates estimates for most interstate, primary, and urban projects. The Resident Engineers provide estimates for the secondary system. In some cases, for a locally requested project, the locality may have completed some preliminary work and provide a cost estimate.

The Transportation Planning division developed project pricing tables that Location and Design uses to statistically derive most initial project estimates. These tables, the Statewide Plan Cost Estimate Tables, use historical bid prices for projects on record. From these bid prices, Transportation Planning developed median costs per mile estimates for typical road sections. Transportation, state contractors, and consultants widely use the tables, developed in 1993 and last updated in January 2002, as a statewide cost estimating tool. However, Transportation does not require staff to use these tables and the programming division does not request the source of estimates or question their accuracy.

As discussed above in the Secondary Six Year Program section, Transportation does not require the Resident Engineers to use a uniform cost estimation method when developing their secondary system project estimates. This could result in as many as 45 different cost estimation methods just for the secondary system. While we agree that local cost variances should be considered, the Resident Engineers should use a uniform method.

We have found that Transportation does not consistently include contingencies in project estimates, although the Statewide Plan Cost Estimate Tables state they include a 20 percent factor for contingencies. Transportation has stated it is their policy to include contingencies, but they have admitted that the rates are not consistently included. We address this issue in Chapter 6 "Construction."

Six-Year Plan Approval Process and Lack of Preliminary Work Produces Inaccurate Estimates

The development and approval process for the Six Year Plan contributes to the inaccuracy of initial estimates. Transportation cannot perform preliminary site work or spend any funds on a project before its approval and placement in the Six Year Program. Indeed, the act of placing the project in the Program provides the project approval. However, because a project must have an estimate before going into the plan, Transportation must estimate project cost using the barest of information. There is virtually no information gathered about a project before the initial cost estimate and placement in the SYP. This approval process itself leads to inaccurate estimates.

Placement of the project in the SYP and Transportation management's approval provides the authorization to begin preliminary engineering, and the allocation, based on the initial cost estimate, provides the authority to spend. Prior to this occurring, Transportation has no method to charge expenditures for any type of preliminary engineering work or feasibility studies. Once placement occurs, Transportation can then charge expenses against the project.

At this point, Transportation has very little information available about the feasibility of the project, the scope of the work, and therefore, very little information about the estimated cost of the project. When a project is proposed, only the barest information is known: the work to be completed, for instance, widen Route 7 to four lanes between mile marker 121 and 132 or add a turning lane at a particular intersection. Transportation knows the location for existing roads, but for proposed new roads, Transportation only knows an estimated location.

Transportation cannot perform preliminary work because they cannot charge any project expenses before approval. Without the ability to perform basic site work such as preliminary surveys, estimating location, preliminary soil samples, and environmental planning, Transportation cannot produce an accurate estimate.

Because Transportation allocates its available highway construction revenue pool to individual projects, an inaccurate initial project estimate, specifically one that is too low, leads to over-committing limited resources. Without accurate estimates, Transportation cannot make reasonable, informed decisions as to how to allocate its limited resources.

Recommendation #18: We recommend that Transportation complete basic preliminary engineering work, such as scoping, soil tests, environmental permitting, and surveys, prior to approving projects and placing projects in the SYP. We concur with the Governor's Commission on Transportation Policy's recommendation that Transportation should create a mechanism for funding scoping work on projects before CTB approval for inclusion in the program. However, we do not recommend the creation of a separate fund receiving separate appropriations. We believe the creation of a cost center or a budgetary "pool" of funds would be the most practical choice. Preliminary work before project approval would allow for more realistic initial project estimates and the CTB would benefit by having more information available for decision-making purposes. Prior to authorization, Transportation could eliminate projects that are not feasible or whose estimated costs are too high to be practical.

Additional Factors in Low Estimates

We noted two additional problems with cost estimation in the later design milestones. The first is the system used to estimate item quantity costs. As the design plans progress, usually beginning at the preliminary field review estimate, the designers use a module of Construction Trns*Port system (See Chapter 5 “Systems Environment”) called PES (Proposal and Estimating System) to estimate construction costs. This module estimates costs based on quantities of materials. PES contains historical data based on bid prices. The estimate uses an average of all low bid prices for a particular item, by item code. Transportation averages older low bid prices with new bid prices, and this can skew the results, especially during inflationary times.

The second problem is Right of Way (ROW) estimates. JLARC noted that ROW estimates could increase significantly as the project progresses. Currently, right of way property acquisition does not begin until the design plans are 70 percent complete and approved. Until this stage, the Right of Way Division must use rough estimates because they do not know the approved alignment. During this time, the anticipation of the completed construction project itself may significantly increase land values. This causes the ROW estimates to severely underestimate actual land acquisition costs. We recommend possible solutions for ROW estimates in our discussion of the Right of Way construction phase in Chapter 6 “Construction.”

Effects of Project Underestimation

The underestimation of cost, coupled with the lack of budgetary control over project expenses, and the failure to match monthly expenses to monthly cash flow, led to a SYP that was a “wish list” – a program that contained many more projects than could be delivered with available cash and revenues. Without accurate estimates, Transportation cannot properly budget available revenues and properly forecast cash usage.

Underestimating costs also resulted in a commitment of future years’ allocations for current or completed projects once Transportation knew the true cost of the projects. By committing future years’ allocations, some districts, counties, or municipalities may not be able to add any new projects until they have sufficient allocations to cover those projects not 100 percent funded, even though those projects may be complete. Had Transportation known the true costs of the projects, decision-makers would have been better informed and better able to assess their true wants and needs in relation to cost and available funds. Perhaps Transportation would have chosen different or less expensive projects. In either case, the decision-makers lost the option to make an informed decision concerning project choice. We discuss project allocations in more detail below in the Section titled “Budgets versus Allocations.”

Transportation Initiatives to Improve Project Estimate Accuracy

Transportation is aware that there are problems with their project cost estimates. In an effort to temporarily “fix” the program estimates, Transportation developed and applied growth factors to the construction phase estimates appearing in the 2003 - 2008 program. Transportation developed the percentage factors for each milestone estimate, and Location and Design applied these factors to all Interstate, Primary, and Urban systems projects currently in PPMS. Transportation did not apply the factors to the secondary system projects. Transportation used these updated cost estimates as the basis for the 2003-2008 SYP.

As part of their “Review of Construction Costs and Time Schedules for Virginia Highway Projects” (January 2001), JLARC also developed growth factors. For comparison purposes, we present the JLARC growth factors below next to the Transportation developed factors. We had to re-estimate the JLARC factors below because the JLARC report calculated the growth factors at three points: to 100 percent design, to contract bid award, and to final cost, rather than just to final cost as Transportation did.

Construction Estimates

<u>Stage of Development</u>	<u>Transportation</u>	<u>JLARC</u>	<u>Difference</u>
Scoping to Final	186%	200%	(14%)
Field Inspection to Final	143%	156%	(13%)
Right of Way to Final	121%	136%	(15%)
First Submission to Final	113%	115%	(2%)

These factors are multipliers; they do not represent percentage changes. The average percent change calculated by Transportation from cost estimate point to final cost is 86 percent, 43 percent, 21 percent, and 13 percent for scoping, field inspection, right of way, and first submission respectively. As we calculated for JLARC, the percent changes are 100 percent, 56 percent, 36 percent, and 15 percent.

We reviewed Transportation's methodology for developing these growth factors and found several potential problems. First, Transportation did not use completed projects for their analysis, so they did not know the final project costs. Transportation estimated that final project costs were, on average, 40 percent more than contract award amounts. To estimate the final cost, Transportation multiplied the contract award price by a factor of 1.4 (140 percent). Without final project costs, it is not possible to determine the percentage amount that each estimate differs from the actual cost.

Second, complicating matters further is that Transportation did not apply these factors to secondary system projects. The Resident Engineers are responsible for the secondary system project estimates; therefore, Transportation allowed Resident Engineers the option of whether or not to apply the factors. Some applied the factors, some applied their own, and most did not change their estimates. Transportation should have consistently applied the growth factors across all systems.

Third, Transportation only applied the factors to construction estimates in the Project Program Monitoring System (PPMS) and the SYP. While the construction estimates represent the bulk of the cost of a project, PE and ROW costs can often be significant as well. JLARC found that PE and ROW estimates were substantially less than the 100 percent Design estimate. According to JLARC, at the Scoping stage for all roadway systems, the average percentage cost estimate change from scoping to 100 percent Design for PE was 114.2 percent and for ROW was 151.9 percent. These are actual percentage differences, not growth factors, which would require an additional factor of 1, or 100 percent to arrive at the multiplier to compare to Transportation's growth factors above then, for comparison purposes, the growth factors above would be 214.2 percent and 251.9 percent for PE and ROW respectively. The exclusion of these growth factors may continue to underestimate program costs in the SYP.

Transportation is aware that these growth factors were an interim "patch" in order to try to publish a more realistic Six Year Program for the 2003-2008 period. Transportation appears to be taking steps to find a permanent solution.

Transportation's recently appointed Commissioner selected a group from the Research Council, working in concert with Transportation staff, to explore the estimation process and make recommendations for how to better estimate project costs in the future. They expect to have the recommendations completed between September and October 2002.

Recommendation #19: We concur with the Research Council recommendation that Transportation should develop and employ a more rigorous cost estimation process, and allocate more resources (front loading) to the development of cost estimates during the planning process, thereby yielding more refined and more accurate project concepts. We believe Transportation has taken a step in the right direction with the formation of the group to study cost estimates. We strongly urge Transportation to closely monitor their progress and ensure the development and application of a reasonable, realistic, and consistent cost estimation method.

ROLE OF THE COMMONWEALTH TRANSPORTATION BOARD AND THE SIX YEAR PROGRAM

Commonwealth Transportation Board Background

The General Assembly established the Commonwealth Transportation Board (CTB) as the State Highway Commission in 1906. Its original mission was to advise the counties (who at that time had responsibility for the roads) on planning, funding, and administrative issues. Today, the CTB is primarily responsible for locating routes, approving construction contracts, creating traffic regulations, naming highways, and administering and allocating the Transportation Trust Fund (TTF).

The Governor appoints and the General Assembly confirms the 17 members of the CTB. The Secretary of Transportation serves as Chairman of the CTB, and the Commonwealth Transportation Commissioner acts as Vice-Chairman. The Director of the Department of Rail and Public Transportation (DRPT) also serves as a non-voting member. The Governor selects one member from each of the state's nine highway districts and five members as at-large members. State law limits CTB members to two successive four-year terms, although, the Governor may appoint a member to complete an unexpired term, and the member is still eligible to serve two full terms.

Although the geographic district structure is the basis for appointment of nine members, state law assigns all members duties on a broader basis; that is, they are to represent the state as a whole, not solely the districts from which they are appointed.

Legally Required Duties

Section 2.2-2100 of the Code of Virginia classifies executive branch Boards as either advisory, policy, or supervisory. The CTB is a policy Board. Policy Boards are statutorily required to promulgate public policies and regulations. The Code of Virginia requires that the statutes governing a board must explicitly describe which powers a board can exercise. Policy boards are not responsible for supervising agencies or employing personnel. For Transportation, all powers not specifically assigned to the CTB rest with the Commonwealth Transportation Commissioner. The Commissioner's power includes undertaking all acts necessary or convenient for constructing, improving, and maintaining the roads in the Commonwealth.

Section 33.1-12 of the Code of Virginia specifies the legal powers and duties of the CTB. The legislation contains sixteen specific powers and duties, which include:

- Location of routes
- Approval of all construction contracts
- Coordinating the planning for financing of transportation needs as provided in Section 33.1-23.03 of the Code of Virginia
- Administration, distribution, and allocation of funds in the TTF as provided by law
- Approval of all maintenance contracts equal to or greater than \$250,000

Chapter 349 of the Acts of Assembly of the 2001 session of the General Assembly amended Section 33.1-12 of the Code of Virginia to include an additional duty. The section charges the CTB *“To recommend to the General Assembly for their consideration at the next session of the General Assembly, objective criteria to be used by the Board in selecting those transportation projects to be advanced from the feasibility to the construction stage.”* These objective criteria are to apply to the interstate, primary, and urban systems. As of June 2002, the CTB has not recommended objective criteria for project selection and advancement.

Section 33.1-23.03 of the Code of Virginia also requires the CTB to develop and update a Statewide Transportation Plan as follows (we discuss the Statewide Transportation Plan at the conclusion of this Chapter):

“The Commonwealth Transportation Board shall conduct a comprehensive review of statewide transportation needs in a Statewide Transportation Plan setting forth an inventory of all construction needs for all systems, and based upon this inventory, establishing goals, objectives, and priorities covering a twenty-year planning horizon, in accordance with federal transportation planning requirements.”

Chapter 639 of the Acts of Assembly of the 2001 Session of the General Assembly amended Section 33.1-23.03 of the Code of Virginia to also include the following language:

“It is the intent of the General Assembly that this plan assess transportation needs and assign priorities to projects on a statewide basis, avoiding the production of a plan which is an aggregation of local, district, regional, or modal plans.”

The General Assembly has clearly expressed their intent that the CTB establish objective criteria for project selection and prioritization and that the CTB maintain a statewide transportation focus.

Recommendation #20: *The Commonwealth Transportation Board should immediately establish and implement objective criteria for construction project selection and prioritization. Both the Transportation Research Council and the Governor’s Commission on Transportation Policy have recommended project selection and prioritization criteria.*

Recommendation #21: The focus of the Six Year Program should remain on the statewide needs of the Commonwealth as a whole; it should not focus on districts. The current process of presenting individual district's tentative plan to the Board members from those districts distracts from the statewide focus and instead encourages the district focus. Transportation and the CTB should focus on statewide needs, as is statutorily required of the CTB, when reviewing and approving the Six Year Program. Transportation and CTB should change their presentation and review process.

Accountability

By prioritizing statewide transportation needs, designating projects for inclusion in the SYP, and approving the SYP, the CTB commits a considerable amount of Commonwealth resources for transportation programs. The Commonwealth accepts a certain level of business risk in delegating this responsibility. Without significant improvements in cash and project management, the CTB runs the risk of improperly committing the Commonwealth's resources in the future. The Appropriation Act clearly states the responsibilities and liabilities of anyone who intentionally incurs a deficit or obligates the Commonwealth to the point that it will incur a deficit. Below is Section 43.01 b. of Chapter 899 of the 2002 Acts of the Assembly.

UNAUTHORIZED: If any agency contravenes any of the prohibitions stated above, thereby incurring an unauthorized deficit, the Governor is hereby directed to withhold approval of such excess obligation or expenditure. Further, there shall be no reimbursement of said excess, nor shall there be any liability or obligation upon the state to make any appropriation hereafter to meet such unauthorized deficit. Further, those members of the governing board of any such agency who shall have voted therefor, or its head if there be no governing board, making any such excess obligation or expenditure shall be personally liable for the full amount of such unauthorized deficit and, at the discretion of the Governor, shall be deemed guilty of neglect of official duty and be subject to removal therefor. Further, the State Comptroller is hereby directed to make public any such unauthorized deficit, and the Director, Department of Planning and Budget, is hereby directed to set out such unauthorized deficits in the next biennium budget. The Governor is hereby directed to report any such unauthorized deficit to the Chairmen of the House Appropriations and the Senate Finance Committees. In addition, the Governor is directed to bring this provision of this act to the attention of the members of the governing board of each state agency, or its head if there be no governing board, not later than the date this act becomes effective.

The above provision applies to the Transportation Commissioner, but not the Commonwealth Transportation Board, who is considered a Policy Board and not a governing or supervisory board.

Recommendation #22: Since the actions of the Commonwealth Transportation Board significantly commit the resources of the Commonwealth, the General Assembly may wish to extend the provisions of this Section to the Commonwealth Transportation Board.

Once the CTB approves the Six Year Program, the projects move through the three phases of the road construction without further CTB involvement except for location, design, and contract approval. The CTB is statutorily required to approve the location of routes and construction contracts (§33.1-12), but the CTB is currently approving all road construction design plans as well. According to the Governor's Commission on

Transportation Policy, “The CTB currently reviews all project designs and approves them. The law does not require this review, which adds 30-60 days to each project. The CTB approves most projects as presented. The Board does not have the technical expertise to review designs, and this causes unnecessary project delays.”

Recommendation #23: We concur with the Governor’s Commission on Transportation Policy recommendation that the CTB should discontinue the practice of reviewing and approving design plans.

The CTB currently approves all professional service contracts. The Code of Virginia does not require CTB approval for these contracts. The Governor’s Commission on Transportation Policy stated that this process creates a thirty to sixty day delay per project and further, the CTB approves most contracts as presented.

Recommendation #24: The CTB should discontinue the practice of reviewing and approving professional service contracts.

20 YEAR INTERMODAL TRANSPORTATION PLAN AND ITS RELATIONSHIP TO THE SYP

Federal Planning Background

Transportation must comply with federal planning requirements in addition to state requirements. Some state requirements mirror the federal requirements, while others are in addition to the federal requirements. We developed our Best Practices in Chapter 8 to incorporate federal planning requirements; therefore, we provide a brief description of the major federal requirements.

The Federal Highway Administration (FHWA) requires that transportation planning occur at regional and statewide levels for federally supported surface transportation expenses. At Transportation, Urban Roads and the Transportation Planning division work with regional federally defined planning areas, Metropolitan Planning Organizations (MPOs), to develop the federally required planning programs. Section 33.1-23.03:1 of the Code of Virginia authorizes MPOs to develop and approve transportation plans and improvement programs. The regional MPO programs are combined into Transportation’s SYP, which also forms the federal statewide transportation improvement program.

The FHWA requires both the MPOs and the State to develop long and short-range plans for federal transportation expenses.

The Long-Range Transportation Plans

MPOs

The long-range transportation plans are fiscally constrained multi-modal 20-year plans. The MPOs prepare and periodically update the plan for its metropolitan area. The MPO long-range transportation plan must contain a financial plan that demonstrates how the MPO can implement the long-range plan.

Statewide

The statewide long-range transportation plan is a minimum 20-year multi-modal long-range plan. Each state develops a plan to cover all areas of the state. The state must develop the plan in consultation with municipalities and may include a financial plan. Virginia's long-range transportation plan is the **Statewide Multimodal Long-Range Transportation Plan**.

Transportation Improvement Programs

These are the short-range components of the long-range plans.

MPO Transportation Improvement Program (TIP)

The short-range TIP is a three to five year prioritized multi-modal agenda of federal projects, developed by the MPO in cooperation with the State, compiling a short-range component to the long-range plan. The TIP should be updated at least once every two years, be consistent with the long-range plan for the area, and be fully funded. The programs must contain funding estimates and financial plans.

In Virginia, all projects included in the Urban System in the SYP must be included in the TIPs; however, the TIPs may contain additional federal projects that are not included in the SYP.

Statewide Transportation Improvement Program (STIP)

This is the statewide component of the TIP and includes a compilation of the MPO TIPs. The plan is a three to five year prioritized multi-modal list of federal projects, consistent with the long-range transportation plan. Each project included should be identical to a project described in a MPO TIP and must be fully funded. A financial plan is optional.

Virginia combines the MPO TIPs and Six Year Improvement Program to compile the STIP, which Transportation annually updates and provides to the federal government. The STIP is a federal programming document. All projects contained in the SYP are also included in the STIP.

Long-Range Transportation Plan (20 Year Plan)

For purposes of our review, we focused our attention on Transportation's Statewide Multimodal Long-Range Transportation Plan (20 Year Plan) and the needs assessment Transportation performs to compile the 20 Year Plan. Transportation has not developed a definition of "need" or objective criteria for evaluating transportation needs. They have not produced a financially constrained long-range plan incorporating those needs into a realistic multi-year agenda of projects matched with forecasted available funds over the 20 year horizon. Lack of a concrete, realistic long-range planning document based on statewide needs and deficiencies has contributed to the Six Year Program's perception as a "wish list" rather than a deliverable program. Transportation currently has no project prioritization criteria for inclusion in the Six Year Program; inclusion in the SYP is entirely subjective.

Development of the 20 Year Plan is both a federal and state requirement. The Transportation Equity Act for the 21st Century (TEA-21) establishes procedures for statewide Transportation planning and Section 33.1-23.03 of the Code of Virginia directs the Commonwealth Transportation Board (CTB) to prepare a statewide plan. The purpose of the 20 Year Plan is to provide a coordinated transportation planning document that identifies highway needs on a statewide basis. Transportation Planning develops the plan, which encompasses all modes of transportation.

Transportation Planning last produced the “State Intermodal Long-Range Transportation Policy Plan” (20 Year Plan) in 1995. It is a policy plan that states the policies that Transportation will use to address their transportation needs. The 1995 20 Year Plan does not list deficiencies, priorities, or projects.

As adopted in 1985, Section 33.1-23.03 of the Code of Virginia originally required Transportation to perform a “quinquennial review of construction needs,” or a five-year needs assessment. The assessment was a comprehensive review of the statewide construction needs of all the highway systems. During the 2001 and 2002 Sessions, the General Assembly passed legislation significantly amending Section 33.1-23.03 of the Code of Virginia, which requires the incorporation of the needs assessment into a 20 year statewide transportation plan “setting forth an inventory of all construction needs for all systems, and based upon this inventory, establishing goals, objectives, and priorities covering a twenty-year planning horizon.” Chapter 639 of the Acts of Assembly, approved April 6, 2002, additionally requires the CTB “to assess needs and assign priorities on a statewide basis” in developing the 20 Year Plan. The Transportation Planning Division has responsibility for meeting all the requirements of this legislation and has a plan to do so, with the first phase scheduled for December 2002.

It is clearly the General Assembly’s intent for Transportation, specifically the CTB, to establish and prioritize highway systems needs on a statewide basis. However, the current statutory allocation process Transportation must follow limits the selection of statewide prioritized projects. Therefore it may not be possible to start the top project due to the allocation of funding by district and locality. We concur with the General Assembly that the CTB and Transportation should focus on statewide project prioritization.

Recommendation #25: Transportation should develop a clear definition of “need” for assessing statewide transportation deficiencies. Once defined, Transportation should establish criteria for evaluating highway needs for the quinquennial needs assessments. As part of the needs assessment, Transportation should attempt to estimate costs for total highway needs identified.

Recommendation #26: Transportation should use the 20 Year Plan as the foundation for statewide Transportation planning. The 20 Year Plan should use the results of the statewide needs assessment, should contain prioritized projects, and should be financially constrained. The 20 Year Plan should contain all projects eligible for placement in the SYP, and Transportation should base their SYP project selection decisions on the priorities outlined in the 20 Year Plan.

Use of Allocations and Restrictions

Current practices in the Six Year Program, discussed in this chapter, and some of the recommendations in this report will require a re-examination of the use of allocations for setting project priorities.

Currently, the Commonwealth Transportation Board (CTB) allows projects to go to contract that commit either a municipality, county, or district’s allocations beyond the SYP period, or that have no allocation provided in the SYP. Under the current model, this situation reduces future contracting capacity. However, using a cash flow capital budget model, this approach would reduce funding directly to other districts, counties, or municipalities.

While the use of allocations could continue, we believe the effect would be similar to the hesitancy of smaller jurisdictions to commit to bridge repairs and replacements. Transportation personnel related the situation that localities do not undertake bridge repairs or replacement because of the high cost. If a locality agreed to undertake bridge repairs or replacement, the cost typically would commit their entire future allocation several years beyond the project. Therefore, localities defer bridge projects in favor of less expensive road projects.

Continuing to use allocations as the only means of setting priorities may lead to the undertaking of smaller projects rather than those that would have more benefit. Also the use of allocations with the cash flow approach is equivalent to creating a mortgage that will require payment over an extended time.

Recommendation #27: The General Assembly may wish to re-examine the use of allocations for setting construction project priorities and funding. While the General Assembly has established that the Commonwealth Transportation Board must establish a method for setting statewide priorities, the General Assembly may wish to provide them some guidance on factors that the CTB should consider in establishing this process.

Recommendation #28: Transportation may not be able to achieve a program based on statewide needs and priorities using the current method for project allocation to districts, counties, and cities and towns. The General Assembly may wish to amend the Code of Virginia to change the current allocation system so that Transportation can truly base their priorities and criteria on statewide needs rather than by district, county, and city.

Page Left Intentionally Blank

CHAPTER 5 SYSTEMS ENVIRONMENT

INTRODUCTION

This chapter discusses Transportation's systems that gather and keep information necessary to both manage projects and plan and monitor cash flow. Effective management of projects and cash require timely, accurate, and consistent information about budgets, time schedules, accounting information, and commitments. Without the proper level of detailed information from all sources, there exists the risk that projects will exceed budget and cash will not be available to meet commitments or that opportunities to use cash more effectively will be lost. Effective project and cash flow management depends on information and systems that gather and keep this information.

While systems did not create the current cash management problems within Transportation, properly operating systems providing timely and accurate information are part of the long-term solution to the situation. The proposed cash flow management recommendations in this report heavily depend on Transportation and state government leaders receiving timely and accurate information to make cash flow and, therefore, operating decisions.

SYSTEM STRUCTURE OVERVIEW

Transportation was one of the first state agencies to introduce automation to its processes in the 1950's. Because of this leadership role, Transportation's systems have evolved to meet the needs and demands of individual divisions. This evolutionary process along with Transportation's highly compartmentalized organizational and operational structure has created an environment without departmental-wide system standards, procedures, or processes.

Most systems within Transportation meet the individual needs and requirements of a division, while at the same time most of these systems cannot exchange or share basic information. In some cases, where the exchange of data can occur, if the receiving division does not need or use a portion of the information, the receiving division has no responsibility for ensuring the data integrity of the information it does not use.

Contributing to this data exchange issue are the multiple operating platforms, system, and program configurations and networks that have evolved at Transportation. Further, there is no common understanding of what basic information is necessary to operate the entire department and who has responsibility to gather and maintain this information.

Transportation has recognized that its ultimate goal is the need to create and address an enterprise-wide system approach. This enterprise approach will provide a long-term plan to address and consolidate data gathering, information exchange, storage, and usage. However, in the interim, Transportation needs to undertake and address minimum system requirements and data standards to have accurate information to operate and manage its resources.

Data standards call for a common data dictionary and data elements for all automated systems and databases within an organization and provide common reporting, exchanging, and sharing of information. The creation of the Data Warehouse is part of Transportation's interim solution to have information available from the various divisions. This warehouse should provide a common and uniform database to store information from various sources and allow users to create reports and programs to extract information.

The Data Warehouse is a sound interim solution to many of Transportation's information needs. The following sections will describe the systems and information, which should come into the warehouse. For each of these systems, Transportation needs to assign and hold accountable the division responsible for gathering and maintaining this information. Inaccurate, untimely, and inconsistent information will very quickly compromise the usefulness of the Data Warehouse.

One common problem between the various systems that may require some re-programming of existing systems is the use of Project Number and its definition. Each of the existing systems and divisions has a somewhat unique definition of this data element. The difference in definitions is especially apparent between the preliminary design and construction phase of a project. For the Data Warehouse to provide meaningful historical information and to allow for on-going comparison and monitoring, there needs to exist a common definition of this data element.

***Recommendation #29:** If the Data Warehouse is to provide a sound interim solution, management must, for each of these systems, assign and hold accountable each division responsible for gathering and maintaining this information. Without this accountability, inaccurate, untimely, and inconsistent information will very quickly compromise the usefulness of the Data Warehouse.*

SYSTEMS NEEDED TO PROVIDE INFORMATION IN THE DATA WAREHOUSE FOR CASH MANAGEMENT

As part of Transportation's Data Warehouse project, the seven systems below can provide information for improving and maintaining cash management information. Three of the systems are already part of Transportation's Data Warehouse and the addition of the FMSII, Six Year Plan (SYIP), Secondary Six Year Plan, and the Cash Forecasting databases would provide a complete set of information.

- Program Project Management System (PPMS)
- Right of Way and Utilities Management System (RUMS)
- Trns*Port
- Financial Management System (FMSII)
- Six Year Improvement Plan (SYIP) database
- Secondary Six Year Plan database
- Cash Forecasting database

Following is a description of each of the systems and the information that the system either does provide or should provide to the Data Warehouse. It is important to note that some of the systems exchange information with other systems, which ultimately put information into the Data Warehouse. If the systems exchanging information do not transfer all the data or data in the exchange is wrong, the Data Warehouse has incomplete and inaccurate information.

Program Project Management System

The Program Project Management System (PPMS) is a customized mainframe application implemented in 1985. PPMS is a tracking system that can track projects from preliminary engineering (PE) authorization to project completion and records fund allocations and authorizations. PPMS tracks project milestones or target dates in order to meet the proposed advertisement date. PPMS has two modules:

environmental and traffic engineering. Primary users are Programming and Scheduling and Location and Design.

Many users do not like using PPMS, because it is a menu driven, mainframe system. As a result, users often extract data from PPMS and then create their own spreadsheets or desktop databases to track their projects. Users put their efforts into maintaining their own information instead of updating information in PPMS; therefore, PPMS does not consistently contain accurate and timely data.

PPMS can exchange information with other applications, including FMSII, RUMS, Trns*Port, and the Highway and Traffic Records Information System (HTRIS). FMSII provides actual expense data whereas RUMS and Trns*Port provide status information. More specifically, FMSII supplies the project expenses by three phases (PE, Right of Way, and Construction). RUMS provides the right of way estimates, and start and end dates for Right of Way project activities. Trns*Port provides the bid opening date, execution date, estimated completion date, construction start date, and completed construction date. HTRIS provides the bridge sufficiency ratings and bridge structure identification numbers. PPMS also downloads all of its data nightly to the Data Warehouse.

The interfaces between PPMS and the other systems are not true automatic data exchange interfaces, but require several manual processes that include the creation and exportation of text files for importation into the other application. With some of the systems, the determination of what data goes into what field is sometimes a problem because the systems do not have a standard data structure to allow them to exchange similar data.

PPMS staff have created reports to verify the exchanged data and determine the completeness of the exchange. If errors occur during the exchange, the systems personnel receiving the data must then manually enter the missing information.

Right of Way and Utilities Management System

The Right of Way and Utilities Management System (RUMS) was custom developed and implemented in 1999. The client/server application uses an Oracle database with a Visual Basic user interface. Primarily, Transportation's Right of Way and Utilities Division (Right of Way) uses RUMS. RUMS tracks the detail information on Right of Way projects from beginning to end encompassing the appraisal, negotiation, relocation, utility relocation, title examinations, and closing activities. RUMS has additional features including the ability to track the management and disposition of residual parcels and surplus right of way, automation of work assignments to staff, and document management capability. The document management function assists Right of Way staff in generating, customizing, storing, and retrieving appraisal forms, letters of correspondence and other documentation, thus alleviating duplicate correspondence and documentation.

Generally, Right of Way activities relate to the preliminary engineering phase of the construction process. RUMS serves as the official system for Right of Way projects. RUMS has information on property acquisitions and some financial related data that is critical to Right of Way personnel, Programming and Scheduling personnel, fee appraisers, residence personnel, and various consultants in managing right of way acquisitions.

RUMS exchanges information with several other applications. RUMS exchanges data with PPMS through a bi-directional exchange. Since a project originates in PPMS, RUMS receives the Project Identification Number and then begins to accumulate the information. RUMS then transfers the actual target dates, projected target dates and parcel estimates to PPMS. In exchange, RUMS receives items such as

accomplishments, milestones or projected dates, and project status information back from PPMS to complete the record in their system. This interface occurs on a daily basis.

While the RUMS-PPMS interface does electronically transfer information, PPMS staff must determine where the data fits into PPMS. This process results from Transportation not having data standards. Additionally, no formal reconciliation of data exists between the systems. Right of Way considers their system as the source system and, therefore, ensures that the information sent out is valid, but they do not verify entry into PPMS.

RUMS also exchanges limited information with the Data Warehouse. This transfer is historical rather than transactional in nature. Due to the constantly changing information, Transportation decided to transfer the information from RUMS only when the project reaches a stagnant point, a notice to proceed/stop or certification of the project. The RUMS-Data Warehouse interface occurs daily and is an automated transfer. Currently, there is no reconciliation of data when transfers occur.

Trns*Port

Construction uses the mainframe system Trns*Port to track awarded construction projects after design completion. The system has five modules and exchanges information with an external application called the Construction Workbook. Trns*Port also transfers payment processing information to FMSII, Transportation's financial accounting system, and transmits data to the Data Warehouse.

The first of the five modules, the Proposals and Estimates System (PES), assists the Location and Design engineer in preparing detailed estimates for construction projects and assists the Construction staff in combining projects into proposals and selecting a group of proposals for the bid-letting package. Construction staff input all designed projects in this module.

In place of the Cost Estimating System module, Construction uses the ESTIMATOR, a software application that provides refined estimate information for the process of developing the proposals. This application also contains information on manpower rates, material prices, and equipment rates. Transportation uses this software rather than the Cost Estimating System module, because the module does not meet Transportation's needs.

The Letting and Award System (LAS) receives information from PES, and Construction uses it to assist in advertising the bid packages. Construction puts all bids into this module and then uses the information in the system to evaluate the bid proposals. LAS can produce a Final Detailed Cost Estimate report and a Contract Schedule of Prices report from the awarded contractor's prices.

The information from LAS goes to the Construction Administration System (CAS). The CAS module manages the contract information and contractor payments. Payment requests from vendor invoices transfer to the Financial Management System (FMSII) for payment processing. This module can track modifications to the original contract specifications including change orders and supplemental agreements and can follow subcontractor and supplier information and payments. CAS can evaluate the information to determine whether awarding the subcontract would exceed the user specified contract or vendor capacity limits. CAS passes subcontractor data to DSS and other information to the Data Warehouse for generating reports.

The fifth module is the Decision Support System (DSS). This module is a storage device for information collected from the other modules. This information assists in the development of estimates in the PES module and bid evaluations in the LAS module. Construction also uses this information for collusion

detection, contractor analysis, item price estimations, and planning and budget development. DSS contains more than ten years of historical data pertaining to costs.

The Construction Workbook (CWB) is an external application used by the Inspectors in the field. Inspectors log information from their inspection, including the status of the project, date of inspections, and material quantities. Inspectors also use CWB to record reasons for budget overruns and progress delays. CWB transfers financial information gathered from the contractors' materials receipts to Trns*Port to assist with the payment process. However, CWB does not transfer reasons for budget overruns and progress delays back to Trns*Port. Inspectors must report this information separately in a spreadsheet or communicate it verbally to the district office.

Transportation plans to replace the CAS module and the CWB application in January 2003 with a new product called SiteManager (See Development Section later in this chapter for detailed information). The new application is a client/server based system, and because Trns*Port is a mainframe system, Transportation may encounter problems exchanging information from the client/server to the mainframe.

Financial Management System II

Financial Management System II (FMSII) is a PeopleSoft Financial and Human Resources application implemented in 1998. The client server-based application resides on an Oracle Database running on an IBM RS6000 and several Windows NT Servers. FMSII is Transportation's central accounting system. The PeopleSoft application consists of Accounts Payable, Accounts Receivable, General Ledger, and Purchasing modules. Transportation also custom developed a Project Accounting module and a Time Entry module for employee timesheets.

The General Ledger module includes general record maintenance and update, allocations, journal entries, budgetary accounting, and financial reporting. The Purchasing module includes record maintenance for items and vendors, requisitions, phone quotes, purchase orders, administration of vendor and consultant contracts, and receiving reports. The Accounts Payable module includes record maintenance for vendors, vendor payment, petty cash management, employee travel payments, right of way payments, and other batch invoices. The Accounts Receivable module allows the user to maintain customer and receivable accounts, enter receivables, manage billings and payments, and track customer correspondence. The Project Accounting module defines projects, manages federal funds, defines project accounting distributions, and manages grants, agreements, and disasters. The Time Entry module involves managing employees and equipment, performing time entry, administering leave, tracking performance measures, and recording fuel tickets.

Transportation decided that FMSII would be the official system for generating project identification numbers. The identifier for any given activity is the universal project code identification number (UPC ID #). Each division and system uses the UPC ID# but defines it in different ways. Therefore, a "project" might encompass multiple UPC ID #'s, State identification numbers, and PPMS identification numbers. In addition, multiple contracts may exist against any given UPC ID #; therefore, it is difficult to accumulate "project" information without knowing all this information. This issue relates back to Transportation not having data standards.

FMSII exchanges data with numerous systems which include Trns*Port, and PPMS. Both of these are automated nightly interfaces. The FMSII-PPMS interface exchanges expense data from the project accounting module to PPMS. The FMSII-Trns*Port interface exchanges vendor payment and contract information. Currently, no reconciliations occur between FMSII and either PPMS or Trns*Port.

Six Year Improvement Plan

Transportation developed the Six Year Improvement Plan (SYIP) application in-house several years ago. SYIP is an Access database with a Visual Basic front end. The application's purpose is to assist Programming and Scheduling and Urban Roads with producing the Six Year Plan. SYIP tracks and records the PPMS identification number, UPC ID#, the State project number (SYP # - detailed descriptor), district identification, work information (type, length, description, funding, phase), and allocations including funding sources.

The first year Transportation used the database, they used information from PPMS to acquire current projects. Now, Transportation determines new projects and project modifications from a PPMS report. Programming and Scheduling requests the various departments to update the cost estimates in PPMS for their respective divisions. Once departments complete their updates, Programming and Scheduling retrieves milestones, engineering cost estimates from the three phases, and advertisement dates from PPMS from a manual report. Programming and Scheduling takes the changes or new projects and manually enters them into the SYIP database. Programming and Scheduling uses FMSII to gather the actual project costs and expenses. As with PPMS, Programming and Scheduling uses a manual report to review and update the costs and expenses. This process is labor intensive and can lead to data entry errors and missed projects. The SYIP application maintains current project information but includes the financial information only annually.

After final approval of the plan, PPMS staff manually enter all allocation and funding information into PPMS from the official hard copy printout. Due to the limited staffing in Programming and Scheduling and the intense manual entry, updates from this year's Six Year Program may take six months to complete. Thus, the lag time means that they have not updated this year's plan before they are getting ready to work on the next year's plan.

Secondary Six-Year Plan Database

The Resident Engineers develop the Secondary System Six Year Plans, using an internally developed Microsoft Access software program titled the "Secondary Six Year Plan." Each residency uses the software to update, manage, and report the secondary six-year plans and construction budgets. Each of the 45 residencies maintains its own database for its counties and there are approximately 150 users statewide who have access to the software.

Each residency database contains the priority lists of projects for each of the counties, project cost estimates, and estimated completion dates for the projects. The Resident Engineers update the information each year and the Central Office keeps a historical file of each year's plan on a server.

While the Secondary Roads Division developed the data fields for compatibility with the other Programming databases, the software does not share information with other systems. Secondary Roads prepares project update information, such as estimates and time schedules, from information contained in the database and provides that information to Programming and Scheduling. Programming and Scheduling uses that information to update PPMS.

Secondary Roads sends the Fiscal Division financial information, such as allocations as a Microsoft Word file. The Fiscal Division uses the information to update FMSII. Secondary Roads directly enters any date changes into FMSII.

The Financial Planning and Debt Management Division (Financial Planning) does not use the database. Programming and Scheduling enters the information from the secondary database into PPMS. Financial Planning then uses PPMS to access secondary projects for cash forecasting.

Cash Forecasting Database

In January 2002, Transportation began using a commercial software package from Adaytum for the Cash Forecasting system. This application allows Financial Planning to project and monitor cash flow needs for the Six Year Program and both maintenance and administration and general expenses.

Financial Planning produces cash forecasts for construction, maintenance, and administration by using historical trends and adjusting them monthly for differences between the forecast and actual. The division forecasts revenues and expenses for construction, maintenance, and administrative activities. For each item, there is a comparison of actual to budget and anticipated cash flow to actual cash flow.

The Cash Forecasting application uses information originating from several sources that include FMSII, PPMS, and the Six Year Plan database. Financial Planning receives information from FMSII and the Project Cash Forecasting Application (PCFA). The PCFA is an Access database created for Programming and Scheduling to track project awards and advertisements. Once Financial Planning updates all the data inputs, spending patterns and factors, the division produces the Cash Forecast. The Cash Forecasting package is a powerful tool that allows Transportation to run cash flow models under a number of different scenarios.

Financial Planning obtains information from other systems, some of which comes from the Data Warehouse. Financial Planning must spend significant resources to verify and correct inconsistencies in the information between systems. As noted earlier, Transportation needs to establish accountability for the accuracy of data if it is to successfully use the Cash Forecasting application.

In total, the above systems have all the critical information for project and cash management; however, the degree of accuracy, completeness, and timeliness of data varies greatly, and failure to maintain information in one system can affect the reliability of information in another system. Additionally, the lack of reconciliations or other form of verification when the systems interface and transfer information increases the risk that there is an incomplete transfer of information.

Recommendation #30: Transportation should identify all of the critical data elements in the systems necessary for project and cash management. After identification, Transportation should implement a program of data integrity to ensure that the critical elements undergo update in all systems as needed. This program of data integrity should especially address those individuals that extract information from a system and use the data independently of the system such as users of PPMS.

Recommendation #31: Transportation should examine the reasons for data exchange errors and determine if reconciliation or some re-programming could reduce the errors that occur during data exchanges.

Recommendation #32: Transportation needs to develop a common identification number and definition for projects so that systems and users have a method to match information with the project. Effective cash management cannot occur if budget, expenses, and oversight data does not agree and have common standards of information to review.

Recommendation #33: Transportation should review the manual processes such as transferring information from the Six Year Improvement Plan database and consider developing an automated interface to update and exchange this information with other systems.

Recommendation #34: Transportation needs to establish policies regarding utilization of critical systems to ensure accuracy and completeness of source system data. The policies should address usage and update requirements.

SYSTEMS DEVELOPMENT

Transportation has identified the risks associated with having so many different systems. It has become the norm at Transportation to request system development or changes without much consideration given to the effect on the other divisions. In the recent past, users could make informal requests for new systems or changes to existing systems outside of Transportation's organization-wide development and implementation plan. The result has been that there are many systems in use, but the various types of systems and programming differences has made communication between some of them almost impossible. This communication is essential because it helps to transmit project information to divisions outside the construction and maintenance divisions, like Financial Planning.

To address the problem of having too many systems that cannot communicate, Transportation has developed a plan, "An Enterprise Perspective on VDOT Information Technology Investments" to develop systems and continue with changes to existing systems only as they can provide the most return on investment and that are the most relevant to departmental needs. This will enable Transportation to evaluate both its current and proposed investments in system development and maintenance and to weigh them to determine the best fit to strategic needs and business improvement priorities. The eventual goal is to move to an enterprise system, that will provide communication from one system to another, improving communication between divisions.

To assist in the long-term development and implementation of an enterprise system, some of the recommendations deal with common issues such as data standards and interfaces. Development of data standards will provide valuable information for the enterprise system and begin to have Transportation users come to a common agreement on basic information needs.

Recommendation #35: Transportation should establish data standards and use these standards as the basis for future systems development. This will facilitate the transfer of information between systems.

Recommendation #36: Transportation should develop a department-wide information technology plan that focuses on what Transportation needs to accomplish its mission. Transportation should evaluate all system development requests against this plan. Transportation should only approve and fund systems and system changes that support Transportation's mission.

Recommendation #37: Transportation should implement a Development and Maintenance Plan that addresses how Transportation will handle system and information needs before implementing an enterprise system. Management should strictly enforce this policy by defining system development versus system maintenance projects and the procedures for each area.

Recommendation #38: Transportation, after addressing its interim need, should complete its work on developing a systematic approach to addressing its enterprise information and systems needs.

Asset Management System

Transportation, as discussed in Chapter 7 “Maintenance,” is undertaking the development of an asset management system. Several systems are in various stages of development or implementation. A sound asset management system and methodology is key to Transportation planning, assessing, and controlling maintenance costs.

The integration of these systems to provide information for project management, cost controls, and cash management is an important objective for Transportation. It does not appear that the systems development designs and efforts fully addressed these other uses of these systems.

Recommendation #39: Management should have the Asset Management project teams work as a group to ensure that the asset management systems have common data exchange standards and incorporate the same types of information necessary to provide the same cash management information as that coming from the Data Warehouse.

Site Manager

Site Manager is a major development effort for Construction. This system is currently being tested to combine the Construction Administration System (CAS) module of Trns*Port with the Construction Workbook application. Site Manager will enhance the information that field personnel have for managing contracts.

Transportation proposes to phase in the use of Site Manager both for training purposes and overall use. The initial plans anticipate testing and use of Site Manager in September 2002 through December 2002 in Hampton Roads. During 2003, there will be other tests in various parts of the state. Eventually, Transportation will place all new projects on Site Manager and phase out the use of CAS and the Construction Workbook.

During the phase-in period that has not been determined and until Transportation concludes work on these projects, field personnel will continue to enter information into the old mainframe applications for projects that started before implementation of Site Manager. Transportation has not developed an electronic exchange for Site Manager with the mainframe applications. As a result, there is a risk that staff will use Site Manager for the old projects and, therefore, compromise the accuracy of information on the mainframe or fail to keep information updated.

*Recommendation #40: Transportation should consider developing an electronic exchange of information between Site Manager and the Trns*Port application.*

CHAPTER 6 CONSTRUCTION

To understand cash management of construction projects, it is necessary to review Transportation's life cycle of a construction project. In reviewing this process, we refer to several reports previously issued by the Joint Legislative Audit and Review Commission (JLARC). This chapter covers this material because estimation and construction project management are the fundamental building blocks of cash management.

Under Transportation's current procedures, the project construction process does not begin until a project becomes part of the Six Year Program (SYP). Transportation will not begin design work on a project until it becomes part of the SYP, and therefore, the initial project cost estimates have no realistic basis for the amount shown. The most realistic cost of a project does not occur until Transportation receives the bids from the contractors on the project.

In order to build quality projects, on time, and on budget, numerous Transportation divisions must share and coordinate information. The main divisions include Location and Design, Right of Way and Utilities (Right of Way), Materials, Urban Roads, Environmental, Bridge and Structure (Bridge), Traffic Engineering, Construction, Programming and Scheduling, Secondary Roads, and Financial Planning and Debt Management (Financial Planning). Transportation's current culture and business practices do not support the processes to provide accurate project estimates, adequate quality assurance programs, continuous communication and coordination of information between all necessary divisions, and clear accountability for a project.

The current process is similar to an assembly line approach. The projects move down the line through each department and remain in the department until completed. Like some assembly lines, if an assembly point finds and flags an error from previous assembly points the product continues on the line towards completion. As a result, error correction occurs after the fully assembled product reaches the end of the line. This makes error correction expensive and time consuming, which drives the cost of the product up, especially if the error occurs early on the line. Preferably, a project, especially large undertakings, would be the work of a team with representatives from all of the divisions who would work to resolve issues and problems as they occur. To address these issues, Transportation started the concurrent engineering process in July 2000. Concurrent engineering is in the early stages of development at Transportation.

CONSTRUCTION LIFE CYCLE

The construction life cycle of a project consists of three phases: Preliminary Engineering, Right of Way, and Construction. Respectively, those phases involve project design, right of way acquisition and utility relocation, and physical construction. Though there are technically three phases, the term "preliminary engineering" generally refers to all activities that occur between project inception and advertisement for a construction contract, including the Right of Way phase activities.

Preliminary Engineering Phase

Preliminary engineering involves several divisions to varying degrees. Location and Design determines a project's location, conducts surveys, performs hydrological studies, designs roadway plans, and manages the project development process. Environmental Division performs environmental studies, obtains appropriate permits, and prepares environmental documents. Materials Division performs soil surveys. Bridge provides bridge plans when required. Traffic Engineering gives traffic control recommendations. Right of Way provides right of way and utility relocation data. Programming and Scheduling, Urban Roads, Secondary Roads, and Financial Planning coordinate schedules and funding. Construction provides planning

input as well. While Transportation has initiated some concurrent activities, a communication gap continues to exist between the involved divisions because the culture of Transportation is for each division to assert control over their activity, complete it and then turn the information over so that the next activity can be performed by another division, instead of working as a team. Movement away from this culture will be a very difficult process, but very important.

Transportation is implementing a process referred to as “concurrent engineering,” which promotes performing activities at the same time, with design disciplines beginning their work as soon as input information is available. If functioning correctly, this process should increase the efficiency in which projects are developed by improving the on-time performance, establishing regularly scheduled communication and coordination points throughout the project development process, enabling a “team” approach to project development, and improving the quality of the project. Implementation is in the early stages, with the most progressed projects at the 30 to 40 percent design complete stage, entering public hearings. Concurrent engineering encompasses only the preliminary engineering activities of a project. As such, Location and Design still manages the preliminary engineering phase, and Construction manages the construction phase. We discuss project management later in the section “Project Management.”

Traditionally, during the preliminary engineering phase Transportation holds public hearings when a project’s design is 60 to 70 percent complete. Any changes resulting from the hearings often require time-consuming revisions. Transportation will hold the public hearings when the design is 30 to 40 percent complete in the concurrent engineering process. The public will see a less complete design, but changes should be easier to incorporate.

Design Quality

Design quality is an important part of a successful construction project. The primary reason why construction costs exceed budgets is plan errors and omissions. Plan errors and omissions encompass the entire preliminary engineering process and thus include errors and omissions caused by Environmental, Materials, Location and Design, Bridge, and so on. Plan errors and omissions result in quantity overruns, work orders, and force accounts in the construction phase. It is the responsibility of Construction to decide whether proposed changes are necessary for the safety and intended functionality of the project. In addition, at times Transportation makes changes to satisfy its constituents even though the changes are not necessary for the safety and functionality of the project. The Final Report of the Governor’s Commission on Transportation Policy reported that district staff stated that design revisions were required on over 50 percent of all projects.

Quality plans reduce errors and omissions that lead to additional costs in the construction phase. Location and Design has a quality control process but does not follow it to the extent that they must to ensure quality designs. Location and Design is currently working on revising and improving the process, but steps toward this are in the early stages.

Our findings indicated several reasons why design quality suffers. The Final Report of the Governor’s Commission on Transportation Policy identified many of the same problems as we found:

- Quantity Estimating Errors: Because of workload, Location and Design does not always perform on-site field inspections, they do not always use construction personnel to point out obvious quantity overlooks or constructibility issues, and they make mathematical mistakes. However, Location and Design uses construction personnel on major projects. Contractors recognize quantity errors and omitted items and often adjust their unit bid prices in order to increase their

profit because they know that the project will require the additional quantities and items not listed.

- High Demand: Due to the pressure over the past few years to get plans to meet their advertisement date, the risk of errors has increased. In addition, under aggressive deadlines even when Location and Design detects errors early in the process, they do not review the plans or do not resolve the errors before moving on with the process. Meeting advertisement dates is an important factor in completing all planned projects as scheduled, but Transportation should not take focus away from the quality of plans in order to do so.
- Staffing Levels and Expertise: There is an industry-wide problem of expertise due to turnover, seasoned engineers retiring, and fewer people entering the civil engineering field. Designer workloads are too heavy to allow them to invest the amount of time they need to design a quality product. Designers also serve as both project managers (managing the design) of a project and as project engineers (designing the plan). Most designers are only qualified for one or the other position, but not both. Also, this diminishes the checks and balances control because designers are essentially certifying their own plans.
- Communication Gap: Sometimes Location and Design does not effectively communicate the intended design to the consultant designer. Communication between disciplines is lacking as well.
- Outdated Plans: Sometimes Location and Design sends outdated plans to advertisement before making any updates.

In the report, “Review of Construction Costs and Time Estimates for Virginia Highway Projects,” JLARC found that many of the projects reviewed had major design errors that substantially increased project costs. They also found that undiscovered field conditions resulted in substantial cost increases. JLARC reported that it appeared that some of the work orders and cost overruns appear to have been detectable if Transportation had performed a more thorough review prior to construction. JLARC recommended that “VDOT should examine how the field inspection process can be improved to ensure that detectable conditions that would impact the design plans are discovered before projects advance to the construction phase. Central office management needs to ensure that field inspections are being conducted in the field instead of in offices, and that they are sufficiently thorough to detect conditions that may significantly impact project construction.” In some districts, Construction Inspectors review design plans to identify obvious problems in design or quantity errors before Location and Design sends the plans to Construction for advertisement. The inspectors are discovering problems, which is reducing cost overruns in the construction phase.

Recommendation #41: Transportation should continue its efforts towards improving the quality control process to ensure accuracy of design plans, including improvement of the field inspection process. Transportation should consider using Construction personnel to review design plans before advertisement as part of that process.

Right of Way Phase

After changes resulting from public hearings are incorporated and the Commonwealth Transportation Board approves the project design, the Commissioner gives authorization for Right of Way to proceed. This happens around the 60 to 70 percent design complete stage. Right of Way begins acquiring necessary right of way and utility easements and begins entering into agreements with utility companies for utility relocation. At this point, Right of Way is the driving force in the process because the right of way and utility easements are acquired before construction begins and it sometimes take two to three years to acquire everything. Waiting for this stage of plan design to begin the right of way phase causes two things to occur: Right of Way cannot accurately estimate the cost of land during preliminary engineering because they have no clear alignment, and the cost of land is steadily escalating due to inflation and the commercial value of the road project itself.

The concurrent engineering process moves public hearings to an earlier point in the project development. By holding the public hearing earlier in the design phase, Right of Way will be able to start acquiring right of way earlier in the process. This will allow for earlier, more accurate right of way cost estimates as well as earlier land acquisition, thereby, mitigating the inflationary costs and decreasing Transportation's acquisition cost. None of the projects that started this process beginning in 2001 have made it to this stage yet, so the process is untested.

Utility companies do not begin relocating utilities until the design plans are nearly complete, around the 90 to 95 percent stage. While Right of Way is obtaining right of way and easements and having utilities relocated, Location and Design puts the finishing touches on the plans before they submit them to Construction.

The relocation of utilities causes delays in the construction phase. Utility delays are the largest cause of submitted claims, in both quantity and monetary values. Transportation often must pay additional dollars to the construction contractor for idle time or contract extension due to delays. Right of Way secures almost all right of way and utility easements before project advertisement, but the actual utility relocations are only complete on about 50 percent of the projects, prior to advertisement. Right of Way does enter into relocation agreements with utility companies prior to advertisement, but it often takes time for the utility companies to relocate the utilities.

The JLARC report, "Review of Construction Costs and Time Estimates for Virginia Highway Projects" and our findings indicate that the respective utility companies primarily handle utility relocation, and for the most part, the relocation is not within Transportation's control. The JLARC report indicated that utility companies have been reluctant to proceed with utility relocation, including ordering the necessary materials, until Transportation finalizes project plans and advertises the project. This results in project delays. Our findings indicate that Transportation's relocation needs are not a top priority of utility companies; therefore, utility companies are often slow to act and even slower to act when they need to be brought back because of miscalculated depths or missed utilities. In addition, records obtained from cities, towns, localities, and utility companies are generally very poor, if they exist at all. The records often do not show all utilities or have inaccurate depths. This results in delays as well.

The former Chief Engineer instituted a policy that no projects will go to bid until Transportation has acquired all the right of way and easements, cleared the right of way, and relocated all utilities. The policy impacted all new projects started late in 2000 and any other projects not scheduled to go out for advertisement of the construction bids until after July 2002. According to Transportation, Right of Way will have almost all, if not all, utility relocations complete for those projects advertised after July 1, 2002.

Transportation does not currently have inspectors available to monitor the utility companies, document their work, and determine whether they are on schedule. The Final Report of the Governor's Commission of Transportation Policy recommended that Transportation work closely with the utility companies to ensure that Transportation clearly communicates its designs, priorities, and changes in project deadlines. That report also recommended that Transportation add several positions in each district for utility inspectors in the District Right of Way section.

Our findings indicate that the Northern Virginia district is the only district with a dedicated group of inspectors assigned to monitor utility relocation activities. The inspectors report to Construction, not Right of Way. However, having a dedicated group has proven very beneficial in helping move the relocation process along. Traditionally, Right of Way acquires all right of way parcels and utility easements and then utility companies start relocation. In Northern Virginia, since there is a dedicated team of utility inspectors, the utility companies begin relocation as soon as Right of Way obtains individual easements. They do not wait for Right of Way to obtain all easements. This practice is also helping to speed up the process.

Recommendation #42: Transportation should continue to work toward implementing the policy that all right of way be acquired and all utilities relocated prior to advertisement. This will save project costs due to utility relocation delays.

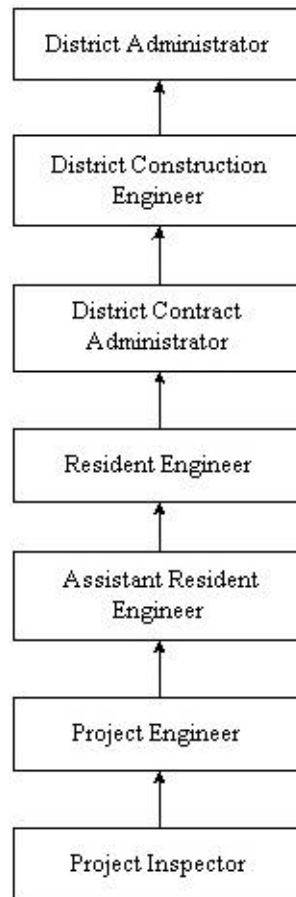
Recommendation #43: We concur with the Final Report of the Governor's Commission on Transportation Policy that Transportation should work more closely with utility companies by assigning utility inspectors.

At this point in the process, Location and Design submits 100 percent design complete plans to Construction who performs a high-level constructibility review. During the constructibility review, Construction looks at the plans to determine if: the project is constructible; there is enough information in order to write a Request for Proposal (proposal); quantities are summarized; and plans and quantities match. They also evaluate plan notes because those will be enforceable under a contract. Construction sends the plans back to Location and Design with revision recommendations. Location and Design revises the plans and sends them back to Construction. The plans are then ready to advertise for a construction contract. Construction writes a Proposal and puts the construction contract out for bid. The concurrent engineering process will require a formal constructibility review; however, Transportation has not developed a formal process yet.

Construction Phase

Once Transportation awards a contract, the construction phase begins. Administration and management of the contract and the physical construction occur in the districts. District construction positions include the District Administrator, District Construction Engineer, District Contract Administrator, Resident Engineer, Assistant Resident Engineer, Project Engineer, Inspector Senior, Inspector, and Inspector Trainee. Responsibilities related to these positions vary by district because there are no written expectations of what Transportation wants as each position's responsibilities. Most promotions are from within Transportation and district personnel learn what they are responsible for by their experience in the district. All of these positions are involved in some aspect of managing the construction phase but accountability is hard to determine because of the lack of defined responsibilities and the lack of control and authority that construction personnel have over the construction process.

The key district construction personnel are depicted below. This chart does not represent reporting relationships.



The Chief Engineer assigns the contract/project to the District Construction Engineer of the district where the project is located. District Construction Engineers work with Project Engineers on a daily basis to aid in decision-making. They also have oversight over the district preliminary engineering sections of Right of Way, Location and Design, and Materials and are involved in a project from its inception.

District Construction Engineers assign the project to the Resident Engineer of the residency in which the project is located. Resident Engineers are Transportation's representative to individual cities and counties. They keep the cities and counties informed about maintenance and construction projects. As such, Resident Engineers spend very little time on the day-to-day management of a project. They rely on Assistant Resident Engineers and Project Engineers for daily project management. Resident Engineers get involved in areas of public concern or on large issues. For the secondary road systems, Resident Engineers develop estimates for all phases of a project and for programming enough money to cover all the costs. Boards of Supervisors view the Resident Engineer as the responsible party for secondary road projects meeting deadlines and staying on budget.

Resident Engineers assign the project to a Project Engineer. The Project Engineer is the first line of management and administration of a project. They generate all work orders, are responsible for correspondence with the contractor, communicate with other divisions needed during the project, keep Resident Engineers abreast of the progress and problems on a project, and supervise the inspection activities on a project or group of projects. This entails making assignments, supervising, and providing technical

advice to project inspectors. Inspectors inspect daily work, document daily activities for purposes of payment, and ensure that the contractor is following *Transportation's Road and Bridge Specifications (Specifications)* and the contract. *Transportation's Road and Bridge Specifications* handbook becomes a part of every construction contract. The handbook contains a mixture of legal and technical specifications necessary to construct a project.

District Administrators are responsible for the management of a district and its entire operations and are not very involved in the actual construction process. District Contract Administrators are mainly involved for preparing vouchers to pay contractors.

Construction Quality

Transportation's Resident Engineer is responsible for accepting a road construction project. Accepting a project means that it is in compliance with specifications and therefore quality is implied. However, there are mixed feelings as to who the responsible individuals are for ensuring quality. Some feel that Inspectors are because they are responsible for ensuring that contractors are adhering to the *Specifications* and the contract. Others feel it is the responsibility of a residency as a whole, or a district as a whole, and various other combinations of individuals. Transportation needs to decide which individuals are accountable for quality and the ways in which they are responsible. Transportation should also determine a way to evaluate quality, and make this part of the implementation of project management.

Transportation does have a Construction Quality Improvement Program (CQIP). The program utilizes a series of questions to identify the compliance level of Transportation with the *Specifications* and with the contract, on selected projects. The questionnaire evaluates the compliance of all parties involved in the construction phase. The overall *Specification* compliance percentage for fiscal year 2000/2001 was 89.6 percent, which is close to the former Chief Engineer's strategic goal of 90 percent.

***Recommendation #44:** In developing an aggressive project management plan, Transportation needs to clearly articulate its vision of a quality assurance program and the roles that staff play in ensuring quality over construction.*

PROJECT ESTIMATION AND BUDGET MONITORING

Cost Estimation

As stated earlier, Transportation does not begin any work on a project until it is included in the SYP. While there is a preliminary estimate of project cost so that the project can go into the SYP, the discussion below is the process for developing project costs after the projects original inclusion in the plan. The degree of sophistication of estimating the initial cost varies widely. Because of the lack of any information, plans and other basic information, these initial cost estimates are typically very inaccurate.

Transportation prepares project cost estimates at several key milestones for each of the three phases: preliminary engineering, right of way, and construction. The SYP lists total cost of a construction project by the three phases of a project. Location and Design has the primary responsibility for developing cost estimates during the design phase of a project, while Construction prepares the final construction estimate prior to project advertisement. This estimate is not available to the public. We discuss the project estimation

process in detail in Chapter 4, “The Six Year Program.” We discuss matters related specifically to the construction process below.

The first two phases, preliminary engineering and right of way, comprise the design phase of the project. During these two phases in the project’s development, Transportation estimates project costs for preliminary engineering, right of way, and construction at the following major milestones.

- Initial Project Estimate
- Scoping Estimate
- Preliminary Field Review Estimate
- Estimate at Field Inspection
- Estimate at Approval of Rights of Way Plans
- 100 Percent Design Estimate
- Construction Control Estimate

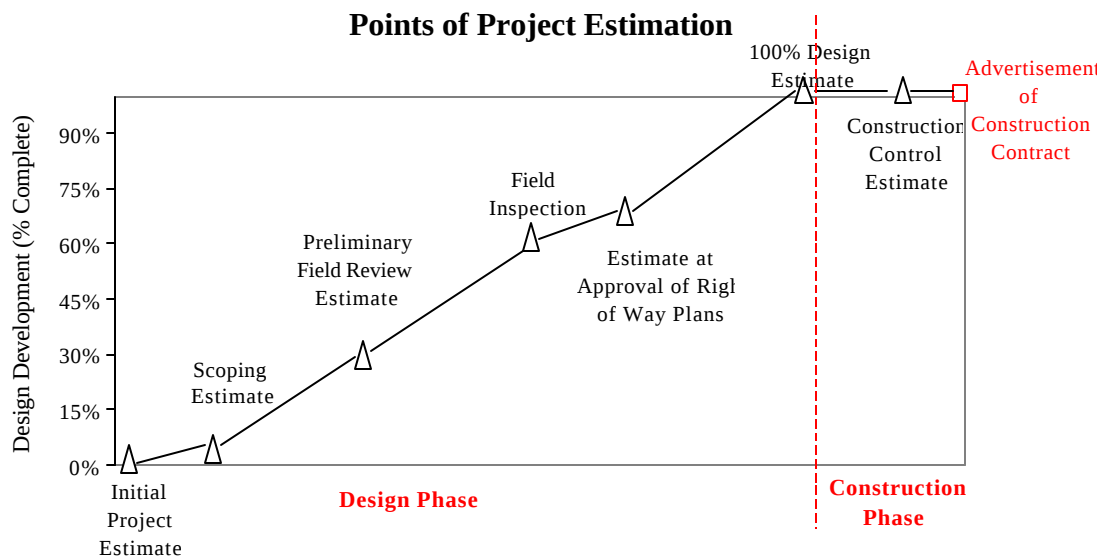
Location and Design prepares the construction estimates for each of the milestones during the preliminary engineering and right of way phases based primarily on the designers’ calculation of the quantities of materials needed to complete the project. Construction prepares the final construction estimate, called the construction control estimate, which Transportation uses to evaluate the construction contract bids. Construction uses the final plan quantities and a combination of average and actual prices to develop this estimate.

Location and Design updates the design phase construction estimates at each of the key milestones during design, but they do not update the construction control estimate and do not place it in the SYP. Once Transportation awards a contract and proceeds to construction, they replace the construction estimates with the bid price of the contract, plus the contingency factors.

Construction’s estimating section prepares the construction control estimate. The construction control estimate is a cost-based estimate, whereas the Location and Design 100 percent design estimate is a statistical estimate. Construction is using a software program called ESTIMATOR. The software produces average prices, based on actual prices entered, for item quantities in the construction plans. Staff members have a copy of the ESTIMATOR software on their computers, which are not part of a network; therefore, they have responsibility for keeping their program up to date with current price information. There is no policy as to when or how frequently the estimators should perform the price updates. This results in estimators using inconsistent and out dated information to prepare estimates. However, the estimators contacting suppliers for actual prices as explained below minimize errors generated from this process.

The Estimating section not only uses the software to produce average price estimates but also calculates actual cost estimates for each contract. These estimates use the most current data available for the project’s particular geographical area. Using the final design plans, the estimating section contacts suppliers in the project’s geographical region and obtains prices for the quantities needed of certain items. Transportation’s general policy is to obtain actual estimates for 20 percent of the items comprising 80 percent of the cost. Transportation uses the construction control estimate as a control to determine if contractor bids are reasonable.

As stated above, Transportation uses this estimate to evaluate bid prices; it does not appear in the SYP. The accepted contract bid plus the contingency allowance and the construction engineering allowance discussed below replace the latest project estimate as the estimated cost for construction in the SYP. The graph below summarizes the timing of project estimation throughout the construction project life cycle.



Transportation bids its construction contracts on a fixed price basis. Based on the quantities listed in the proposal, contractors submit a price per unit for each unit type listed. Contractors include labor as part of the unit prices. The contract amount is the value of all quantities multiplied by unit price. Transportation determines the construction contract budget by taking the contract award amount and adding a 10 percent contingency allowance and an 8 to 15 percent construction engineering allowance. The allowances are a percentage of the awarded contract amount.

Transportation includes a contingency allowance in the budget to cover any aspect of constructing the project that is different from the contract as bid. At the completion of a project, the actual contingency amount is any amount above the awarded contract amount (not including construction engineering charges). Some projects involve more risk than others because of their size, complexity, location, or some other factor. Therefore, the chance of unforeseen changes increases, as do unanticipated costs. A generic contingency rate is not adequate to address this fact. Transportation should establish a contingency rate for each project based on set criteria that consider the factors above.

Construction engineering covers administration and inspection expenses including inspector time, inspector's truck, travel expenses, miscellaneous supplies, field office costs, construction surveys, materials testing and inspection, final estimate surveys, final estimate preparation, federal regulation compliance, and pro-ration of indirect costs.

Pro-rations are a way to allocate costs that are too difficult to associate with individual projects. There are 14 categories of pro-rations, including costs such as supervisory and administrative salaries, computer support, advertising, telecommunications, and training. The fiscal year 2002 estimates for the pro-rations are over \$60 million, with 81 percent (or \$48.6 million) of that pro-rated to construction projects and the remainder to maintenance projects. There is one FMSII cost center that captures all of the charges made to each of the different categories of pro-rations. Monthly, FMSII distributes the charges to projects based on the percentage of state labor hours charged to the project for that day. This results in a disproportionate amount of charges distributed to small projects whose labor force is 100 percent state forces in comparison to larger projects, which normally have a contracted labor force. On many smaller projects, the pro-ration distribution alone exceeds the entire construction engineering contingency amount.

Transportation has not consistently included contingency and construction engineering rates in their cost estimates. We found and JLARC reported, as part of their “Review of Construction Costs and Time Schedules for Virginia Highway Projects” (January 2001), inconsistent application of contingencies to project cost estimates. During the design phase, depending on the project manager estimating the costs, contingencies and inflation rates were not consistently included in project estimates. To address the problem, in February 2002, Location and Design revised the Engineers Estimate Worksheet Summary to include the contingency rates detailed in the section below. Transportation hopes that this will alleviate the confusion and create consistency in the estimation process for design phase contingencies.

Location and Design currently adds the following percentages to the project’s construction cost estimate for construction engineering:

\$0 - \$100,000	15%
\$100,000 – \$5,000,000	12%
>\$5,000,000	8%

Location and Design currently adds the following percentages, dependent upon the stage of the project, for contingencies:

Scoping	40%
Design Approval	25%
First Submission	10%

Transportation has not always included the contingency rates and inflation factors in the post-award construction estimates used in the SYP. Because the program was a public document, Transportation did not want to provide the contractors’ access to Transportation’s total estimated project cost. This omission contributed to the subsequent issues relating to cash flow problems and an unrealistic six-year program. We discuss these issues in more detail in the Chapter 4 “The Six Year Program.”

Recommendation #45: We concur with JLARC’s recommendation that Transportation should consistently include contingency rates in their project estimates. Transportation should enforce a written policy and provide training to all individuals estimating project costs to ensure consistent application of the rates used at all milestones for the construction estimates.

Recommendation #46: The Construction Division should develop a policy detailing the frequency and timing for updating ESTIMATOR data and ensuring that staff are following the policy.

Recommendation #47: Transportation should ensure that contingency and inflation factors are consistently included in the SYP estimates.

Recommendation #48 – Transportation should re-evaluate the methodology used to distribute prorated charges. In addition, Transportation should annually budget for prorated charges and develop an estimating factor for estimators to use in determining pro-rate costs for a project.

Recommendation #49 – Transportation should establish a set of criteria by which to evaluate projects in order to determine a reasonable contingency rate for each project basis and apply rates in that manner.

Budget Monitoring

Transportation evaluates total project cost at the end of the construction phase, when the project is complete. Because Construction manages the construction phase, it often appears that it is their fault when projects exceed their budgets. The largest overruns do occur in the construction phase, but Construction does not cause all overruns. In order to avoid excessive cost overruns in the construction phase, Transportation must set realistic budgets, establish controls over expenses, avoid project delays and unnecessary additions, and design a set of quality plans.

JLARC found in their “Construction Costs and Time Schedules” Report, for all design projects, the average percentage change in project costs from contract award to completion is 11.1 percent. Eleven percent represents the amount the final contract cost exceeds the contract award amount after inclusion of the 18 to 25 percent contingencies (10 percent contingency plus 8 to 15 percent for construction engineering). JLARC stated that actual project construction costs exceeded the contract price in excess of the 10 percent contingency budgeted and that the cost of construction engineering exceeded the amount allocated.

JLARC’s analysis, and our interviews show, that the amount by which construction costs tend to exceed the contract award amount is the result of higher than anticipated project construction and construction engineering costs. These cost overruns are primarily the result of inadequate preliminary engineering site work, inadequate designs (due to both lack of design review and as a result of the inadequate site work performed), and utility relocation. We discussed these issues in detail earlier in this chapter in the sections “Preliminary Engineering Phase” and “Right of Way Phase.”

There are several ways in which a contract budget is exceeded: Scope Changes, Work Orders, Force Accounts, Claims, Quantity Overruns, and Other Additional Items:

- Scope Change – Any change not within the original geographic limits or anything outside of what the project was intended to do. Approval must come from the Chief Engineer or the State Construction Engineer. Approved scope changes become work orders.
- Work Order – A means to add extra work and/or time to a project when a condition in construction is different than originally anticipated. Various levels of construction personnel have approval authority based on certain dollar thresholds.
- Force Account – A situation where Transportation and a contractor agree that the contractor will perform extra work but the two do not agree on the price. The contractor completes the work and Transportation pays them in accordance with

the *Specifications*. At the project's completion, the contractor may file a claim if he is dissatisfied with the compensation he received for completing the work on a force account.

- Claim – A procedure contractors use to seek additional time and/or monetary compensation for disagreement in interpretation of contract requirements and/or the performance of extra work.
- Quantity Overrun – Transportation's regulations allow this type of overrun, if the quantities listed in a contract can overrun and be paid for in accordance with the contract as long as the alterations or changes in quantities do not significantly change the character of the work to be performed under the contract. If a quantity overrun significantly changes the character of work, the *Specifications* require an approved work order. The term "significant change" applies only to the following circumstances:
 - ◆ When the character of the work as altered differs materially in kind or nature from that involved or included in the original proposed construction;
 - ◆ When a major item of work, as defined elsewhere in the contract is increased or decreased more than 25 percent of the original contract quantity. Any allowance for an increase in quantity shall apply only to that portion in excess of 125 percent of original contract item quantity, or in case of a decrease below 75 percent, to the actual amount of work performed; or
 - ◆ When overruns and underruns of piling amount to more than 25 percent of the original bid quantity, whether or not such item has a designation as a major item.
- Other Additional Items – Certain items, such as items needed to meet certain safety requirements do not require a work order.

Financial Planning, Secondary Roads, Urban Roads, and Programming and Scheduling do not monitor project expenses once a budget is established. Construction routinely approves work orders and force accounts without verifying with Financial Planning that there are sufficient allocations or cash available. Construction does not communicate the values of work orders, force accounts, quantity overruns, or other additions to Financial Planning, and Financial Planning does not ask for updates. Financial Planning requests updates of the awarded project amounts in conjunction with the SYP update. Although, the cash forecast includes a factor for contract overruns, Financial Planning should compare the factor and original award amounts to actual to ensure the cash model contains accurate data.

By not considering the effect that contract budget additions have on cash availability, allocations, and the financial condition of Transportation as a whole, Transportation impairs their ability to meet their financial commitments on a daily basis. This situation has been a major cause of Transportation's recent cash shortages. As the costs on one project increase, Transportation needs to be able to make informed decisions of how to compensate for those costs. With proper communication, Transportation can slow or stop certain projects in order to free up cash to pay for additional expenses on current projects.

Recommendation #50 – Transportation should establish and enforce policies to include Programming and Scheduling, Secondary Roads, Urban Roads, and Financial Planning Divisions in the decision-making process over contract budget additions. They should consider the effect the changes would have on allocations and cash management. This process should be formalized and documented for all changes that exceed a threshold determined by Transportation.

PROJECT MANAGEMENT

Transportation's project management is disconnected. Location and Design manages a project during preliminary engineering, including the right of way phase, and Construction manages it through completion. This structure makes it hard to establish clear accountability for an entire project. It also makes it difficult to enforce accountability because Location and Design project managers have no authority over the Right of Way staff and there is no feedback process between Location and Design and Construction. There are no clearly defined responsibilities for those involved in the process.

The current project management process is compartmentalized and control, authority, and responsibility only exist within the individual divisions. In addition, this approach does not provide continuity over the project; therefore, the hand-off of the project between preliminary engineering and construction does not provide those individuals in the preliminary engineering process with any meaningful assessment of the soundness of their work.

This current approach contributes to the problem of having projects in the SYP that include unrealistic cost estimates and do not compare Transportation's commitment of resources with the actual use of those resources.

The movement toward "cradle to grave" project management, in which an individual or group of individuals is responsible for the success or failure of a project, will establish accountability and, ultimately, result in more successful projects. Project success will mean that a project is a quality product, built on time, and on budget. Project success will require good project estimates, reasonable budgets, attainable schedules, open communication with Programming and Scheduling and Financial Planning, and open communication between all other divisions involved. Transportation's new concurrent engineering process should help to establish open communication during preliminary engineering, but the communication concepts of concurrent engineering need to reach into the construction phase as well.

Transportation needs to use concurrent engineering concepts to develop a feedback process between the preliminary engineering and construction phases in order to improve the quality and efficiency of the entire construction process. The concepts of cradle to grave project management and concurrent engineering will require a cultural change that Transportation employees need to be willing to accept in order to make them successful.

Transportation has recently taken a step to begin establishing accountability. The District Construction Engineers are now responsible for ensuring that the projects scheduled for advertisement in the 2003 fiscal year of the SYP are advertised on time. This is going to require communication and coordination between numerous individuals. Transportation needs to provide the District Construction Engineers with the appropriate authority to accomplish this goal and communicate this authority to those involved in the process. In addition, Transportation needs to define the duties and responsibilities of everyone involved in the project.

Recommendation #51 – Transportation should increase its efforts to implement the concurrent engineering process, develop ways in which to measure the impact of the process, and identify accountable parties. Transportation should also create a formal constructibility process to help reduce design errors and omissions.

Recommendation #52 – Transportation should develop an aggressive plan to implement cradle to grave project management in an effort to establish accountability for and improve the quality of the entire construction process. This plan could involve single individuals as project managers, project management teams, or a combination of the two. Transportation should clearly define responsibilities and give the appropriate authority to the responsible individuals.

Construction Industry Best Practices

Much of Transportation’s approach to construction management and practices comes from the on-the-job training most project managers receive. Within this structure, project managers need to have a set expectation to measure their performance against. Using a total project management approach that may involve several individuals over a long period of time will set the need for these individuals to have a common understanding of expectations.

Setting performance expectations can take many forms and approaches. One approach is establishing best practices against which the team can measure its performance. Illustrated below is a partial list of best practices taken from a study performed by the Federal Facilities Council: “Adding Value to the Facility Acquisition Process: Best Practices for Reviewing Facility Designs.” This study incorporated the best practices found in both the government and private sectors. The other reason for use of this study is the best practices are generic to overall project management.

The American Association of State Highway and Transportation Officers and some other trade associations have more detailed lists of practices in many specific areas. However, these we believe provide a reasonable start for an internal listing.

- Advance Planning:
 - Focus attention at the front end during the conceptual planning and design phases, where the ability to influence the ultimate cost of the project is greatest.
- Benchmarking:
 - Measure results achieved by the design process. Document both unusually good and bad performance. Successful benchmarking requires an organization to identify relevant performance characteristics, measure them, and compare results against either established industrial norms or against similar measured characteristics of other organizations recognized for their excellence.

- Teamwork and Collaboration:
 - o Use teambuilding and partnering techniques to build good working and communicative relationships among the participants, as well as to align all participants toward common objectives and expectations.
 - o Ensure that all interested parties participate in design review processes. Use senior, experienced staff to evaluate the evolving design and guide the review process.
 - o Use senior, experienced personnel who understand the relationship of a facility to meeting the agency's overall missions and who can effectively evaluate the evolving design and guide the review process.
- Role of Owner:
 - o Be a smart buyer. Facility acquisition processes (including review of designs) work best when the owner has sufficient in-house expertise to qualify as a smart buyer. A smart buyer is one who retains an in-house staff that understands the organization's mission, its requirement, and its customer needs and who can translate those needs and requirements into a corporate or strategic direction.
 - o Develop a scope of work that clearly and accurately defines the owner's expectations regarding facility cost, schedule, performance, and quality. The owner's standards, more than those of any other entity involved in the acquisition process, will set the tone for all aspects of design review activity. The owner should use the scope of work as the yardstick against which to measure performance.

The study found that effective design review practices result in fewer change orders to correct design errors and omissions and thus, lower project construction costs. The study also indicated "the team should participate in and contribute to design-related activities associated with each phase of the facility acquisition process, from conceptual planning through start-up."

Recommendation #53 – Transportation should develop best practices for project management both as a training tool and performance measure for its managers.

Page Left Intentionally Blank

CHAPTER 7 MAINTENANCE

Transportation maintains all roads on the interstate, primary, and secondary systems, except for secondary roads in the counties of Arlington and Henrico. Transportation does not directly maintain local streets in the urban system, but provides payments to the localities for such maintenance. Transportation also maintains four underwater tunnels, two mountain tunnels, over 11,700 bridges, two toll roads, one toll bridge, four ferry crossings, 41 rest areas, and 107 commuter parking lots.

In accordance with Section 33.1-23.1.A of the Code of Virginia, “the Commonwealth Transportation Board shall allocate each year from all funds made available for highway purposes such amount deemed reasonable and necessary for the maintenance of roads within the interstate system of highways, the primary system of state highways, the secondary system of highways and for city and town street maintenance payments made pursuant to § 33.1-41.1 and payments made to counties which have withdrawn or elect to withdraw from the secondary system of highways pursuant to § 33.1-23.5:1.” Other code sections require Transportation to allocate the remaining funds for administration and general expenses and for the construction program. Although the Code of Virginia does not provide specific guidelines for determining a target amount for the maintenance allocation, it does prioritize maintenance over other activities, including construction. Maintenance of Transportation’s existing infrastructure is to come first.

The organization of Transportation’s maintenance program has nine districts, 45 residencies, 244 area headquarters, as well as the central office in Richmond. Transportation’s Maintenance Division sets policy for the Highway Maintenance Program, interprets such policy, and ensures consistent statewide application of the policy. Maintenance staff act as a resource and as support to the districts, and they interact with other Transportation divisions as necessary.

MAINTENANCE PAYMENTS TO CITIES AND TOWNS

Section 33.1-41.1 of the Code of Virginia authorizes the Commonwealth Transportation Commissioner to make payments to qualifying cities and towns for maintenance, construction, and reconstruction of roads and streets meeting specific criteria and under certain conditions. The Code of Virginia establishes base rates of payment per the number of moving-lane miles of highways available to peak-hour traffic for fiscal year 1986 of \$7,787 for principal and minor arterial roads and \$4,572 for collector roads and local streets. Transportation must establish a statewide maintenance cost index (MCI) of unit costs for labor, equipment, and materials used on roads and bridges for 1986 and to use changes in the MCI to determine annual adjustments to payment rates. Transportation makes equal quarterly payments to the cities and towns upon approval of the Commonwealth Transportation Board.

Cities and towns that qualify for assistance include:

- All incorporated towns having more than 3,500 inhabitants according to the last preceding U.S. census;
- All incorporated towns that have attained a population of more than 3,500 since the last preceding U.S. census;
- All incorporated towns, which on June 30, 1985, maintained certain streets under § 33.1-80 as then in effect;
- All cities operating under charters designating them as cities; and
- The towns of Wise, Lebanon, and Blackstone.

Maintenance calculates the MCI on an annual basis. The MCI consists of a list of items in three classes, which are equipment, materials, and labor. The fiscal year 2001 MCI formula included 14 specific types of equipment, nine specific types of materials, and two labor classifications. The formula brings the unit costs of these items together, weighted by their relative importance. The MCI measures cost changes of the items from the base year, 1985, to the current year. Transportation set the MCI at 1.00 for 1985, and then determined costs for 1986 in order to show the increase between 1985 and 1986. As Transportation planned for the index to work, it used the 1986 MCI to determine the 1987 payment rate. The following formula represents the composite MCI:

$$\begin{aligned} \text{MCI} = & (\text{Labor Index} \times \text{Labor Weight}) \\ & + (\text{Equipment Index} \times \text{Equipment Weight}) \\ & + (\text{Materials Index} \times \text{Materials Weight}) \end{aligned}$$

Transportation has not updated the MCI formula since 1986. The Virginia Transportation Research Council performed a review of the MCI in August 1998 and recommended a new way of calculating the MCI; however, Transportation did not approve the new formula. During January of each year, the Financial Planning and Debt Management Division (Financial Planning) forecasts the MCI and the increase in city and town street mileage. Financial Planning then uses this forecast to develop the city and town maintenance payment budget estimate for submission to the Department of Planning and Budget. The cities and towns use this forecast when they develop their local budgets, which they do before Transportation determines the actual MCI. Maintenance calculates the actual MCI as close to the end of the preceding fiscal year as possible and then sends the MCI to Urban Roads. Urban Roads then uses the MCI to determine the actual maintenance payments to cities and towns.

Recommendation #54: Transportation should periodically review the MCI formula to ensure that it is reflective of current maintenance practices and associated changes in costs.

Cities and towns must maintain the principal and minor arterial roads at a standard satisfactory to Transportation in order to receive payments. Within sixty days of the close of the fiscal year, Transportation requires each municipality to report total street payment money available and the amount spent. In addition, the city or town must prepare an annual report accounting for all expenses and certify that it spent money only for eligible activities. The annual reports are included in the scope of the annual audit of each municipality. Section 33.1-44.1 of the Code of Virginia requires the Certified Public Accounting firm auditing the municipality to report any improper use of the maintenance payments. In the event that a municipality's total maintenance payments from Transportation exceed the combined total of eligible expenses for the fiscal year, the municipality has sixty days to refute the audit finding. Otherwise, Transportation will deduct the overpayment from future payments. Transportation may use up to four payments to recover the under-expenses. If a municipality has contractual obligations that have anticipated payouts after the end of the fiscal year, then it can get authorization to carry the outstanding amounts over to the next fiscal year. Transportation may authorize extraordinary maintenance requirements on a case-by-case basis. However, the general rule is that municipalities should spend the money in the year Transportation makes the maintenance payments.

Transportation keeps an inventory of all roads and streets eligible for street payments in each municipality. The inventory includes all roads and streets previously determined to be eligible as a result of a comprehensive field survey. Transportation makes additions, deletions, and changes in functional classifications to the inventory on a continuous basis. Each fiscal year, Transportation sends municipalities a

complete inventory of eligible roads and asks them to check for omissions or errors and advise Transportation of any changes or corrections needed.

MAINTENANCE PAYMENTS TO COUNTIES

Arlington and Henrico counties are the only two counties in the Commonwealth that have elected to withdraw from the secondary system of highways. As a result, they maintain the secondary roads in their respective county. Transportation provides Arlington and Henrico with quarterly maintenance payments to help fund their maintenance efforts. Transportation's Secondary Roads Division calculates the quarterly maintenance payments for those counties. Section 33.1-23.5:1 of the Code of Virginia establishes the base lane-mile payment rates for Arlington and Henrico counties' highway maintenance. The base rate for Arlington County is \$7,201, and the base rate for Henrico County is \$3,616. Transportation determines the final payment by multiplying the base lane-mile rate by the MCI. The Northern Virginia District and the Sandston Residency offices submit information regarding changes in eligible lane-miles for Arlington and Henrico counties, respectively. Transportation submits the maintenance payments along with construction payments for Commonwealth Transportation Board approval at the September Board meeting. Upon approval by the Board, Transportation processes and makes the first quarterly payment. Transportation makes the remaining quarterly payments throughout the fiscal year, with the last payment made in July.

MAINTENANCE BUDGET DEVELOPMENT AND DISTRIBUTION

In the past, Transportation based the maintenance program budget solely on historical data. However, Maintenance's goal is to do needs-based budgeting in which it sets priorities and distributes resources based on these priorities. Currently, Transportation develops the maintenance budget based on historical allocations and additional needs, which are prioritized based on documented criteria. This is not a zero-based budgeting process.

The districts and central office divisions that use maintenance funds provide input to help determine the supplemental amount for additional needs beyond last year's maintenance allocation. The District Maintenance Engineer submits a list of additional needs. The list includes a detailed explanation of the requested projects, including the dollar amount per year. Program Managers who have a stake in the maintenance program, such as those from Traffic Engineering, Intelligent Transportation Systems, Structure and Bridge, Environmental, and other sections of Maintenance, also submit items to support their respective missions from the additional needs. The Decision Support and Program Analysis Section within Maintenance then compiles the list of all needs and combines like needs. We discuss the process for determining these needs in the section entitled "Maintenance Needs" below.

Maintenance then presents the list to the Maintenance Program Leadership Group (MPLG), who determines what is a reasonable and necessary program increase for the next biennium using the methodology described below. In addition, Financial Planning provides Maintenance with a target budget amount to help determine the reasonableness of the total maintenance budget amount. Financial Planning inputs the additional amount into the base budget submitted to Virginia's Department of Planning and Budget after Transportation's executive management approves the increase. In the past, the Secretary of Transportation has made this decision. Once the General Assembly approves the biennial budget, the numbers become a part of the appropriated annual budget.

Although the Code of Virginia does specify that the Commonwealth Transportation Board is to allocate each year from all funds available for highway purposes such an amount as it deems "reasonable and necessary" for maintenance, the Code of Virginia does not provide guidance on how the annual allocation

should be distributed within the maintenance program. The MPLG has the responsibility of allocating those funds within the maintenance program by district, and within each district, the District Maintenance Program Leadership Group (DMPLG) distributes those funds to the residencies and area headquarters.

The MPLG acts as an advisory group to Maintenance. Maintenance formed the MPLG in the mid-1990s in order to move the decision-making authority regarding the maintenance budget from the central office to the field units. MPLG members include all nine District Maintenance Engineers, the State Maintenance Engineer, the Senior District Maintenance Analyst – Hampton Roads District as a non-voting member, and one additional non-voting member of Maintenance. The MPLG distributes funds within the maintenance program, using the objectives and goals of the state and maintenance program as a whole. The MPLG makes all decisions on a consensus basis. All members must agree, disagree, or at least agree to work with the decisions reached, including those decisions made when grouping and ranking maintenance requests.

During the spring and summer months of the odd years, the MPLG incorporates the biennial budget process into its monthly meetings. The MPLG has developed a methodology to rank proposed maintenance requests. The MPLG established budget criteria to better determine what the maintenance program needs to maintain the road system adequately. The MPLG considers the asset's life cycle costs, mandates, Transportation's strategic direction, the foundation budget, and a consistent level of statewide service when ranking requests. The MPLG has assigned criteria weights as follows:

Mandates	0.28
Impact on Foundation Budget	0.21
Strategic Direction	0.19
Life Cycle Costs	0.18
Consistent Level of Statewide Service	<u>0.14</u>
	<u>1.00</u>

MAINTENANCE NEEDS

Identifying maintenance needs begins at the area headquarters level. Area Headquarter Superintendents, along with the Area Headquarter Supervisors, perform an individual assessment of area maintenance needs based on a visual inspection of the roadway surfaces, structures, and drainage items. During these assessments, they physically travel the roadways and make notes of needs as they see them. The Superintendents also review the prior year's needs to determine if any needs remain. This is a largely subjective approach for determining maintenance needs. Superintendents base funding requests for the needs on historical costs as well as increases for labor, equipment, and materials. The Superintendent reports a list of needs for the area to the residency.

Residency Operations Managers also perform a physical review of the needs identified by the Area Headquarter Superintendents to ensure that the needs are justified. However, the Operations Managers place most of the responsibility of identifying and prioritizing maintenance needs with the Superintendents. Transportation typically addresses maintenance needs on a "worst-first" basis. Superintendents and Operations Managers also give a great deal of consideration to safety when prioritizing needs. Operations Managers play a bigger role in the prioritization process if a special maintenance need, rather than an ordinary maintenance need, is involved. Operations Managers use the automated Pavement Management System (PMS) to help determine annual pavement schedules. At the district level, bridge crews identify bridge needs using the automated Bridge Management System (BMS). Again, this process of identifying and prioritizing needs is largely subjective.

There is a District Maintenance Program Leadership Group (DMPLG) within each district that consists of Residency Operations Managers, the District Section Managers, and the District Maintenance Engineers who serve as chairpersons. The group meets regularly, usually at least quarterly, and makes decisions on funding allocations to the residencies based on consensus. The District Maintenance Engineer is the final authority on all decisions made. The DMPLG distributes funds according to the highest priority needs. The District Maintenance Engineers, budget assistants, and materials administrators visually inspect the highest priority roads to ensure the needs exist for pavement overlay requests. They identify structure and bridge needs similarly. The DMPLG may base funding for the residencies on the lane miles in each residency, and it may also consider historical allocation trends. Each DMPLG may review and prioritize maintenance needs in a different way. There are no documented procedures in place for all districts to use. The District Maintenance Engineer takes the agreed upon needs for the district and presents the requests to the Maintenance Program Leadership Group for consideration in establishing statewide priorities and funding levels.

Recommendation #55: Transportation should implement an objective means of identifying and prioritizing maintenance needs, namely an asset management approach. See the section entitled “Asset Management” for more details. Transportation should use an automated system to record data and should prioritize needs based on an objective set of criteria.

MAINTENANCE BUDGET MONITORING AND CASH MANAGEMENT

Transportation expects districts to work within their respective maintenance budgets. The MPLG gives each district a target budget, and then each of the residencies and area headquarters receive targets. In order to monitor their budgets, the districts use a separate computer program entitled “The Budget Program,” which allows them to distribute their target budget to the individual maintenance assets. There are six categories of maintenance assets, which include pavement, pipes and drainage, roadside, traffic devices, structures and bridges, and special facilities. Maintenance has established one database for each district. Starting at the area headquarter level, the districts budget by individual asset types. Therefore, if unplanned maintenance work involving one asset type occurred, the area headquarters have the flexibility to reduce the amount in another asset type, as long as they stay within the total budget amount. Using “The Budget Program,” districts can change any input from the residency and area headquarters levels if deemed necessary. The central office also has authority to change input from the district level, but there is typically no need to do so. The central office uses the information to perform analysis and ensure that the budget balances. The Information Technology Division then ensures accuracy and loads the information into FMSII, which is Transportation’s financial management system.

Districts also have the ability to monitor their budgets and expenses using various FMSII reports. There are a number of standard reports in FMSII, as well as hundreds of standard queries. Districts also use the Budget and Expenditure Report (the MPLG report), which is prepared for the monthly MPLG meetings. The MPLG report includes the following: a fiscal year allocations summary by district, a supplemental funding detail by district, the current allocation compared to actual expenses to date by district, actual expenditures by asset group to date by district, expenditures by account category to date by district, maintenance program related UPCs (Universal Projects Codes) to date by district, snow prep and removal authority compared to actual numbers to date by district, statewide and central office cost center expenditures to date, a graph comparing five-year average expenditures to the current year, fiscal year major emergency expenditures by district, and graphs showing expenditure trends by asset. Maintenance primarily uses reports generated from FMSII to prepare the MPLG report. Both the districts and the central office use this report as

a tool for monitoring expenditures. Maintenance staff has put forth the effort to better understand and use FMSII; therefore, they are able to retrieve a great deal of the information needed to generate useful reports.

Financial Planning uses the maintenance budget as the forecast for maintenance costs in its cash flow model. Financial Planning estimates monthly cash payouts for maintenance program expenses based on a three-year historical trend. Financial Planning uses the three-year trend to create a payout curve in order to get a percent for each month. There has been some discussion between Financial Planning and the MPLG with regards to planning for maintenance expenses during the summer months. Transportation performs a large portion of maintenance work during the summer months due to the cyclical nature of the work.

In the past, Transportation was able to build up cash during the winter months in order to fund work later in the year. However, mild winters during recent years have not enabled Transportation to build up this cash balance. Transportation was able to continue work throughout the year; therefore, spending patterns changed and there was a cash shortfall for the maintenance program during July and August of 2001. Financial Planning has discussed with the MPLG the possibility of making quarterly allotments to the districts in order to better control spending at the district level. However, it is challenging for them to come up with an amount when comparing estimated revenues by quarter to estimated expenses.

Maintenance did make adjustments during fiscal year 2002 when it learned that revenues would be lower than originally estimated. The original fiscal year 2002 maintenance program allocation was set at \$871,630,900, but the MPLG adopted an adjusted allocation in September 2001 of \$827,019,100, which represents the prior year allocation. Maintenance asked districts to reassess their spending plans to come in under the adjusted allocation. Maintenance also asked the districts to try to manage the amount of expenses by fiscal quarter, spending 20 percent in the first quarter, 25 percent in each of the second and third quarters, and 30 percent in the fourth quarter. Maintenance made this decision in response to the new spending patterns of the maintenance program and the cash shortfalls experienced during the summer months of fiscal year 2002, as discussed above. Transportation hopes to more closely follow the pattern of revenue coming in by managing expenditures by quarter.

Recommendation #56: Transportation should recognize the changing spending patterns of the maintenance program and continue to take the pattern of incoming revenue into consideration when planning maintenance work, thus helping prevent cash shortfalls in the maintenance program.

Expenses for highway maintenance and financial assistance to localities have significantly increased over the past decade. During the first half of fiscal year 2002, Transportation projected no increase in maintenance allocations for fiscal years 2004 through 2007. This was an executive management decision. Except for financial assistance to localities, management instructed Financial Planning to hold the maintenance budget flat. In effect, this inflated the amount available for construction, improperly allowing more construction projects to enter the SYP. This flat line projection also did not take into account likely increases in maintenance costs such as labor, materials, and fuel. It is logical to assume that as the road inventory increases and ages, maintenance needs will likely increase as well. Transportation can also expect financial assistance to localities to increase because the formula that drives this allocation reflects annual changes in fixed costs such as labor, materials, and equipment.

In January 2002, Transportation revised the maintenance allocations projections to increase by nearly four percent for the next six years. This increase relates to inflation increases in maintenance allocations and reflects historical trends. This increase does not consider the actual maintenance needs of the assets.

Maintenance expenses have increased by roughly six percent each year over the last ten years, though marked with large fluctuations during that period. Financial Planning confirmed that the maintenance budget has grown at nearly the same rate as expenses; therefore, it is logical to assume that the increase in expenditures is only reflective of the maintenance budget and not the true growth rate of expenses based on needs of the maintenance program.

Maintenance does closely monitor its budget and expenses; however, it lacks cash management tools. It does not perform any cash flow analysis of its own before scheduling maintenance work or entering into contracts. Maintenance depends on Financial Planning and the Fiscal Division to perform any cash analysis and/or cash management. Financial Planning periodically makes Maintenance aware of cash flow issues by means of verbal communication.

Recommendation #57: The Maintenance Division needs to consider cash flows when scheduling maintenance work and entering into maintenance contracts. The Maintenance Division should work with Financial Planning to monitor cash and expenditure cycles.

CROSSOVER

‘Crossover’ is the point at which maintenance funding will take dollars out of construction. Crossover requires a transfer from the Transportation Trust Fund to the Highway Maintenance and Operating Fund. Under the normal scenario, maintenance and general and administrative expenses receive funding first and any excess revenues are transferred to construction.

Transportation has anticipated the occurrence of crossover for nearly ten years. However, during that time, normal revenue growth far surpassed any projected revenue shortfalls, thereby, meeting the maintenance funding needs. This is currently not the case. Transportation will experience crossover for fiscal year 2003 and all the way through fiscal year 2008. Financial Planning included this in its Six-Year Projection, which it presented to the Commonwealth Transportation Board for approval in June 2002. Financial Planning has projected the crossover amount for fiscal year 2003 to be nearly \$147 million, and it expects crossover to continue at least through 2008. The total amount of crossover for fiscal years 2003 through 2008 approaches \$900 million.

However, as noted earlier, the maintenance budgeting process uses historical costs and projected increases. The maintenance budget is not a need-based process. Currently, Transportation performs maintenance work equal to the amount of its budget. Without an asset management system to determine the maintenance needs, Transportation cannot accurately state that their needs are causing crossover. Crossover is occurring because Transportation is projecting maintenance expenses to increase four percent each year for the next six years. Since there is no systematic way for Transportation to identify its maintenance needs, it is difficult to determine whether the maintenance program is truly under-funded or over-funded. Until Transportation implements asset management, they will not know the true maintenance needs and cost.

Transportation currently has no long-term plans in place to manage crossover in the future. Two obvious options are that Transportation could spend less or receive additional revenue. At this time, however, Transportation has included the crossover amounts as part of the six-year budget process.

Recommendation #58: Transportation should implement asset management as recommended in Recommendation #55 to determine the true maintenance needs of the Commonwealth's roads and the relative cost and to determine whether crossover actually exists and to what extent. Then, Transportation should determine how to handle crossover in the future, whether it be by obtaining additional funding or maintaining assets at a lower service level.

MAINTENANCE PROJECTS AND CONTRACTS

There is no clear agency definition as to when a project goes from being a maintenance project to a construction project. Transportation's usual policy is that if it is replacing an asset "in kind," then it considers the project to be maintenance. For example, if Transportation has always maintained a specific two-lane bridge at a certain level of service and is repairing or replacing portions of that bridge, then it is a maintenance project. If, however, Transportation is adding another lane to the bridge thus changing its original nature, then it is a construction project. In some cases, Transportation performs major maintenance even if construction is the better choice due to the construction process itself. Transportation would have to approve the project for the SYP, and construction may not take place for several, if not many, years. For sake of effectiveness and potential safety reasons, Transportation performs major maintenance to keep the asset at an acceptable level of service, even though construction would have provided for an asset with more capability and a longer life cycle.

It is not general practice for Transportation to use maintenance allocations for construction projects. However, there have been instances in which Maintenance has joint-funded a project to get the construction project scheduled. This might include the asset that would benefit more from construction rather than maintenance. For example, if it is going to cost \$150,000 for Transportation to perform maintenance on a bridge that would benefit more from actual construction at a cost of \$300,000, then Maintenance may opt to contribute \$150,000 towards the construction project to get the project scheduled and underway. This is not standard practice, but Maintenance has made this decision in the past.

The Commonwealth Transportation Board must approve all maintenance projects in excess of \$250,000. This dollar threshold requires that a great deal of maintenance projects go through the Commonwealth Transportation Board approval process. Administrators from the Administrative Services Division or Construction, depending on the type of project involved, are responsible for presenting project information to the Board.

The maintenance program is highly decentralized; therefore, depending on how specialized the maintenance work is, any level of the maintenance program may make decisions on whether to perform maintenance work using state forces or to contract out. For instance, the Maintenance Superintendent at the area headquarters level could make this decision for routine maintenance work such as mowing and litter pickup. The decision-making authority would move to the residency and district levels as the work becomes more specialized. Residencies and districts may establish teams to help determine which maintenance projects to contract out and which to complete in-house. They typically make decisions based on the nature of the work, the response level needed, and cost. Districts have procurement authority up to \$100,000.

Transportation does contract for a significant portion of its maintenance work. During the past ten fiscal years, contracts have accounted for over 40 percent of maintenance work based on total expenses. Transportation contracts for all of the annual overlay paving work, which represents approximately 25 percent

of a district's allocation. Transportation also contracts for a number of routine maintenance activities such as mowing, litter pickup, and ditch cleaning.

Presently, Transportation does not have a make-versus-buy model to assist in making the decision of whether to perform work in-house or contract out. Transportation feels that it is necessary for it to have a system, or systems, in place to assist in these decisions. Transportation is waiting on the implementation of the Integrated Maintenance Management System (IMMS), which will include an automated make-versus-buy model. Transportation feels that the Business Decision Making Model (BDM) will serve as an important tool for making many make/buy decisions and act as an interim make-versus-buy model. The BDM is a two-day course that offers basic skills training necessary to improve decision-making and accountability. Transportation is actively rolling it out now and has scheduled implementation through 2004. The BDM teaches a broad conceptual way of thinking. There is no plan to require use of the model, and although it stresses consistent follow-up and feedback on previously made decisions, there are no specific guidelines on how to follow-up. Basically, the BDM teaches decision-makers how to make decisions based on information rather than simple intuition. The BDM is a good decision-making tool, but it cannot serve as a true interim solution for the lack of an actual make-versus-buy model.

Recommendation #59: Transportation should develop policies and procedures to standardize the decision-making process of whether to contract out or use state forces. Transportation should implement the use of a make-versus-buy model. Transportation should consider another interim solution specifically for make/buy decisions rather than depending on the Business Decision Making Model. Transportation should consider this solution as soon as possible and should not wait for the implementation of IMMS, which has an uncertain time frame for implementation.

ASSET MANAGEMENT

As discussed previously, Transportation currently identifies and prioritizes maintenance needs using a subjective approach. In general, Transportation allocates funds to address the highest priority needs, which staff sometimes refers to as a "worst-first" process. Key to managing maintenance is an Asset Management system. We believe that Transportation needs to implement such a system to control and effectively budget maintenance. Below is a discussion of Transportation's progress on implementing an asset management system and what such a system should include.

Transportation is trying to replace its current process with an objective approach known as asset management. Through proper asset management, Transportation could make more effective investments and get the most benefit out of limited resources. An asset management approach for the maintenance of infrastructure assets would allow Transportation to prioritize and monitor assets using a preventive strategy that is also cost effective. Maintenance is starting to incrementally implement asset management. Transportation's goal is to move from an activity-based approach to an outcome-based approach.

According to the Federal Highway Administration's Office of Asset Management, an asset management system should include the following.

1. Strategic goals
2. An inventory of assets (physical and human resources)

3. A valuation of those assets
4. Quantitative condition
5. Performance measures, that measure how well strategic goals are being met.
6. Usage information,
7. Performance-prediction capabilities
8. Relational databases to integrate individual management systems
9. Consideration of qualitative issues
10. Links to the budget process, engineering and economic analysis tools, useful outlooks effectively presented, and continuous feedback procedures.

For Transportation, there are five systems in varying stages of development and implementation that they consider critical to the full implementation of asset management. Those systems are the Integrated Maintenance Management System (IMMS), the Pavement Management System (PMS), the Bridge Management System (BMS), the Inventory and Condition Assessment System (ICAS), and the Virginia Operational Information System (VOIS). As discussed above, asset management requires an inventory of assets, the condition of the inventory, and engineering and economic tools to perform analyses. ICAS records the inventory and condition of the assets. PMS and BMS provide the engineering tools, and IMMS provides the economic tools. VOIS acts as a communication system, and Transportation can use it as a feedback tool. Currently, Transportation is not certain how the systems will interrelate with one another because the systems are in various stages of development and implementation. Transportation is certain that IMMS is the 'integration' piece, and its current plan is to at least get all of the databases into one data repository.

Transportation sees the development and implementation of IMMS as the foundation for the asset management system. IMMS will include economic tools and models that will allow Transportation to pull information together in a way that helps it determine how to best use its funds. IMMS should allow Transportation to determine the resources needed and to develop a budget and interface and incorporate information from other automated systems outside of maintenance, such as the Financial Management System (FMSII) and the Highway and Traffic Records Information System (HTRIS). Transportation has developed the IMMS request for proposal (RFP). However, in June 2001, the Transportation Commissioner halted the acquisition or implementation of all automated business systems in order to support a new enterprise business strategy, discussed in the Chapter 5 "Systems Environment."

In keeping with the asset management goal, Transportation has been developing the Inventory and Condition Assessment System (ICAS) since 1998. ICAS is a database that can hold asset inventory and the condition of the assets for the statewide transportation network. ICAS also provides a virtual network by which users can visualize the assets and more easily identify problems versus looking at a table of numbers and drawing conclusions. ICAS is currently up and running in three counties as a pilot project. Those counties are Augusta, Fauquier, and Fairfax. The pilot project required Transportation to collect a complete asset inventory on the interstate, primary, and secondary roads in the three counties. Data collection involved a very complex process requiring a great level of detail. For several reasons, in part due to the contractor, the project is at least two years behind schedule. The contractor is not solely to blame. The ICAS contract used a technology contract and neither Transportation nor the contractor had a complete understanding of what it was going to take to collect the data. Transportation sees the ICAS pilot project as a learning process for both parties. Transportation has not penalized the contractor or taken legal actions because it made business sense

for them to come to a fair resolution. Transportation now has the data it originally asked for at a higher level of accuracy than expected, which lends credibility to the data. Transportation may have even collected more data than is necessary to implement basic asset management.

Transportation has clarified the data necessary for asset management and can specifically collect this data throughout the Commonwealth when they implement the project statewide. Transportation will conduct further analyses and negotiations between completion of the pilot project and statewide rollout. Transportation projects completion of the pilot project by the end of June 2002. Transportation will be collecting a “strategic data set” on a statewide basis that will include the needs, attributes, and conditions of inventory absolutely necessary for it to go forward with asset management. Currently, Transportation is awaiting MPLG approval of the data set.

The Pavement Management System (PMS) is one of the two engineering analysis tools that Transportation has implemented. Transportation is refining PMS and still needs to implement the “decision tree” piece and collect better data. The contractor for the ICAS project was supposed to collect statewide data for PMS as well. The contractor has failed to deliver this requirement of the contract; therefore, Transportation has not paid the contractor for such work. Transportation has negotiated with the contractor to make modifications to the original contract and hire someone else to collect the data. In the meantime, Transportation is using state forces to collect data. During the past several years, Transportation has developed pavement schedules based on “windshield surveys.” A windshield survey consists of trained employees traveling the state highways and rating various pavements. The vans used to perform the surveys have certain features such as video recorders to aid the process. However, Maintenance would like to purchase vans equipped with special sensors as well as video recorders that will enable surveyors to collect data not only on the pavements, but also on other assets such as signs and drainage systems. Although trained individuals perform the process as it is now, it does leave room for subjectivity. Transportation records the windshield survey data in PMS at this time, and Maintenance is currently working to reconfigure the PMS software to use the data as a baseline for future analysis. Currently, Transportation is not using PMS on a statewide level, but there are individual projects that are using PMS as a tool.

The Bridge Management System (BMS) is the other engineering analysis tool that Transportation will use to determine and document allocations for bridge maintenance by combining information available in Transportation’s three existing automated bridge condition and safety inspection databases. Bridge staff run one of the BMS modules, which is where they enter data for the assessments they conduct. Maintenance gets a copy of the database and performs the engineering analysis. As with PMS, Transportation is still refining the analysis piece of BMS. Also, BMS was a customized system for the state of California; therefore, the costs in BMS are based on California bridge maintenance costs. Transportation is currently going through the system to analyze those costs and make changes where necessary to properly reflect costs in Virginia. Transportation has used BMS to do some work on a statewide level and many of the districts are using BMS for individual projects, but it is not used below the district level.

The Virginia Operational Information System (VOIS) is a communications system that allows citizens, as well as other states, to access accurate and timely information concerning highway incidents and emergencies. Transportation has implemented this portion of VOIS and is in the process of implementing another piece of VOIS within the next two years that will track customer requests. This will allow Transportation to see how well it is responding to customers and to identify any problems that are routinely arising at certain times of the year.

Recommendation #60: Transportation should make the implementation of asset management a priority, with or without the automated systems fully in place to support it. Transportation should make continuous efforts towards this goal and ensure that all maintenance staff, including those from the area headquarters level and up, understand the changes that will come with asset management. Transportation should recognize that there is no way to appropriately fund the maintenance program without an asset management system to provide sound data and decision-making tools.

PERFORMANCE MEASURES

Transportation does not have formal, documented performance measures for maintenance work. Transportation is trying to put in place performance targets for all asset groups. The performance targets would establish the minimum acceptable level of an asset's condition and allow Transportation to more realistically develop the maintenance budget based on the condition of the asset. Performance targets are essential for an asset management system. Transportation wants to use outcome-based measures instead of activity-based measures. For example, Transportation would measure work by the outcome achieved by completing the project rather than by the tons of asphalt and number of labor hours used to complete the project. Transportation would be using the preventive approach to maintenance by maintaining assets at a certain level or condition. The above mentioned system, ICAS, can provide the information necessary to implement the use of performance measures.

The MPLG and the Maintenance and Operations Strategic Outcome Area (SOA) have established performance targets for bridges and the interstate and primary pavements; however, the maintenance program is the only user of these performance targets. They have not set performance targets for other assets. Transportation establishes Strategic Outcome Areas to address critical issues and reviews them with each new administration. Transportation updates the Strategic Outcome Areas so they are in keeping with Transportation's Strategic Plan, which also may change with each new administration. The MPLG may change the performance targets at any time; hence they are not permanent in nature and lack credibility. If Transportation were to set true performance targets, then not only could the maintenance program use them, but the General Assembly could also use them to help determine funding for the maintenance program.

Recommendation #61: Transportation should establish performance targets for all maintenance asset groups as soon as possible and use those targets to identify needs and develop the budget. Performance targets are critical to an asset management system.

MAINTENANCE PROJECT MANAGEMENT

There are basically three types of maintenance contracts, which include contracts for maintenance service activities, contracts for construction related maintenance activities, and those involving hired equipment. Service activities include, but are not limited to, mowing, tree trimming, and street sweeping. In order for a contract to qualify as a service contract, more than 50 percent of the cost of the service must be for labor. Service contracts are typically long-term contracts that can include renewal options. The Administrative Services Division procures service contracts. Construction advertises those maintenance contracts that involve construction related activities for Maintenance.

There are two processes for construction related maintenance depending on funding sources and other special considerations. If the contract is a Regular Advertisement and Award Process (RAAP) contract, then it will go straight to Construction. All Federally funded projects must come through the RAAP process. If the contract is a Special Advertisement and Award Process (SAAP) contract, then it will come through Maintenance first, at which point Maintenance will check it for accuracy and then send it to Construction for advertisement. Transportation uses RAAP contracts for regularly scheduled work that it plans every year. Transportation uses SAAP contracts, on the other hand, when unplanned, unscheduled maintenance work arises.

The third type of maintenance contract that involves hired equipment can be a source of some confusion. There are *hired equipment for services contracts* that Transportation still considers service contracts as discussed previously, and there are simply *hired equipment contracts*, which are not intended to be long-term in nature and do not include renewal options. When Transportation contracts for hired equipment for services, it follows the Administrative Services Division procurement process, but the districts are responsible for advertising, selecting, and awarding these contracts. Transportation uses these contracts when it needs to augment its resources in order to complete a job. The contract may be long-term or on an as-needed basis, and it may have renewal options. On the contrary, Transportation procures hired equipment contracts only for a specific location for a short duration. Transportation may use these hired equipment contracts for snow removal or when the work requires specialty equipment.

The requestor of any maintenance project is responsible for administering the contract after the appropriate division or district advertises it. The requestor can be anyone with supervisory approval or that person's designee. A person with supervisory approval is one who manages a budget and is, therefore, responsible for paying the vouchers associated with the contract. In order for the contract process to proceed, Transportation needs the authorized signature of the person with supervisory approval. Many of the district level requests come in via electronic requisition and the entire procurement process occurs electronically.

Transportation does have contract standards by which it holds contractors accountable. For construction related maintenance contracts, contractors must meet Road and Bridge Standards as specified in Transportation's *Road and Bridge Specifications Manual*, and they are held under the same standards as any other construction project. The residencies work with Construction with regards to the scope of the maintenance work. Service related maintenance contracts, which the Administrative Services Division procures, include standard language as well as any specific project requirements by which Transportation would hold the contractors accountable. In the event that the contractors do not complete the maintenance work or do not complete it to Transportation's standards, then Transportation's actions follow the remedies established in the contract. These remedies may include default, a reduction in price, or replacement of the substandard work.

Transportation has no formal project management over maintenance activities. Maintenance managers and engineers stay involved with projects and track expenses for those projects; however, there are no formal guidelines to follow in doing so. There is not one person, or project manager, to see an entire project through to the end. At this time, there is not a documented plan in place for implementing project management over maintenance projects.

Recommendation #62: Transportation should implement a formal project management plan over maintenance activities, which would include cash management techniques. This could help alleviate the maintenance program's cash shortfalls.

Page Left Intentionally Blank

CHAPTER 8 BEST PRACTICES

INTRODUCTION

Throughout this report, we have made recommendations for improving Transportation's current processes. We believe Transportation's implementation of these recommendations would enable Transportation to better control and manage its cash flow, to use its limited resources more effectively, and to accomplish its primary mission of building and maintaining roads. Transportation's implementation of these recommendations will require substantial time and effort as well as the cooperation of the Commonwealth Transportation Board, the General Assembly, the Governor, and other state agencies and institutions. As a conclusion to our review, we have attempted to determine best practices for Transportation to accomplish its mission. We have read studies and reports, we have researched relevant literature, and we have conducted numerous interviews with Transportation personnel, gaining an understanding of past problems, current processes, and insight on how Transportation might improve. We offer this as our Best Practices Model through the narrative below and the flow charts on pages 96 through 99.

SIX-YEAR PROGRAM DEVELOPMENT

Needs Assessment

The Commonwealth Transportation Board (CTB) has not developed a prioritization method or objective criteria for project selection. Given a limited pool of resources, and a virtually unlimited list of projects, the CTB must have an objective process to balance resources against needs and desires. We believe this begins with the five-year (quinquennial) needs assessment process. We believe that an accurate and objective needs assessment forms the basis for a statewide list of transportation priorities. Section 33.1-23.03 of the Code of Virginia requires a new needs assessment by 2005 as part of the statewide plan efforts.

To clarify the process, Transportation should first develop a clear definition of "need." Once defined, Transportation should establish criteria for evaluating transportation deficiencies. The statewide needs assessment should be a true assessment of all transportation needs and should not be financially constrained. Transportation should, however, attempt to estimate a cost for the total needs identified and to prioritize the deficiencies identified. The cost of the deficiencies in relation to projected available funding would allow legislators to see the true cost of transportation needs and make rational determinations for funding those needs. The needs assessment may show the necessity for additional transportation revenue streams. This needs assessment then forms the basis for the Twenty Year Plan.

20 Year Plan

Both the state and federal government require, at a minimum, the development of a twenty year plan. The General Assembly has clearly shown its intent through legislation that Transportation should prioritize the plan and focus on the needs of the state as a whole. The General Assembly placed the responsibility for the development of the priority criteria with the CTB, and the CTB should assume this role.

The 20 Year Plan should be a financially constrained prioritized list of projects containing estimated project costs. The CTB should develop the list from the needs assessment, giving the highest priority to the needs with the highest deficiency ratings. The CTB should balance the list against 20 year revenue projections, with only those projects that the CTB reasonably expects to fund over the next 20 years included. At this point, Transportation should be working with Metropolitan Planning Organizations (MPOs) and other planning organizations, districts, counties, cities, and towns to determine their project priorities. If

Transportation cannot place needed or desired projects in the Plan due to their cost, this would clearly show the need for additional funding before starting projects.

The plan will not be static, and placement in the 20 Year Plan does not commit the CTB, city, county, or MPO to a project; placement in the plan denotes a project as a priority. During subsequent needs assessments, if more pressing projects arise, the CTB should add the projects to the priority list in the order in which they rank.

The 20 Year Plan should be the foundation for statewide transportation planning and for the SYP. The 20 Year Plan should contain all projects eligible for placement in the SYP, and Transportation should not place any project in the SYP without first prioritizing it in the 20 Year Plan. By prioritizing a list of projects statewide along with their estimated cost, the CTB can truly plan for transportation needs with available funding. The General Assembly will clearly see the needs balanced against the cost. If sufficient funding for those needs does not exist, legislators and decision makers will have enough information to decide if there is a need for a new revenue stream to fund Virginia's transportation systems or to establish priorities within existing resources.

Development

We believe Transportation should begin project development early in the process. By beginning scoping and project design before project placement in the SYP, Transportation will be able to better estimate project costs to use in committing resources in the SYP. By assigning a project manager or project management team and developing better cost estimates, Transportation will encourage more accountability for budgets and construction quality.

Scoping

Based on priorities set in the 20 Year Plan, the CTB should select the highest priority projects to begin scoping work; the CTB could consider those projects it could feasibly add to the Six Year Program within the next two years. The CTB should do this every year, so that they add new projects to the scoping list and work continues. Transportation should budget for this scoping work each year and charge the cost to a separate cost center as opposed to individual projects. These activities should be funded from revenues that have not been distributed through the allocation formula. The General Assembly may need to offer guidance or authorize this change in process. Transportation, in their Statewide Cost Tables, estimates that preliminary engineering is approximately 10 to 20 percent of the construction cost of a project, so the costs should not be prohibitive.

When the CTB adds a project to the scoping list, Transportation should assign a project manager or project team, depending on the size and complexity of the project, to the project. The project manager is responsible for the project budget and all aspects of scheduling the project.

Placement of the project on the scoping list does not commit the CTB to the project. The purpose of the list is to perform feasibility studies, soil tests, survey work, environmental work, and other necessary actions to properly estimate cost, time, and feasibility. Transportation should also start preliminary design plans in order to approximate quantities and location. This would allow the CTB to determine project feasibility and would provide a more realistic project estimate. The CTB should use the pool of scoped projects to select projects for the SYP. This pool of projects replaces the development phase of the current two-phase SYP.

Funding Decisions and Proposed Plan

We believe that for Transportation to be successful in completing its mission, Transportation should make cash management a priority for the entire agency. This includes budgeting for all cash inflows and outflows including maintenance funding sources and uses, administrative budget sources and uses, and construction program sources and uses, using the Cash Forecast Model. Before developing the Six Year Program (SYP), Transportation must determine its revenue streams so that it can predict cash inflows and budget accordingly. Before issuing debt, such as Federal Revenue Anticipation Notes (FRANs), Transportation should consider the impact that the issuance will have on current and future revenue streams and cash flows. This is extremely important because the amount of revenue available to fund projects directly affects the number of new projects that Transportation can construct and the standard at which Transportation can maintain completed projects.

Transportation, in consultation with the Secretary of Finance, must formulate a debt issuance policy, incorporating debt capacity and ratios. This policy should provide for all debt, including FRANs. Transportation must determine the appropriate level of debt and develop debt issuance guidelines before issuing any future FRANs, and project cash flows including debt service and maintenance requirements.

Transportation should carefully monitor and link the timing of cash receipts and payouts to all projects currently authorized. Financial Planning, after determination of the formula allocation amounts and other available funding, should provide the Year One allocations, as well as estimated allocations for the remaining five years, to Programming and Scheduling. For each update cycle, Programming and Scheduling should update realistic cost and time estimates and estimate cash payouts for existing projects in the SYP using the project payout factors in the Cash Forecast Model. Programming and Scheduling should begin with a district, county, or municipality's allocation, remove any outstanding debt service, and subtract anticipated existing project payouts. Any funds remaining are then available for allocation to new projects as long as project payouts equal cash inflows. This becomes the "Construction Program Budget" for the CTB. The budget considers anticipated project payouts against anticipated cash flow, and the Six Year Program becomes a six-year capital budget.

At this time, the projects that have advanced to the scoping list should, based on their estimated project costs, also have their monthly project cash payout estimated using the Cash Forecast Model. Transportation should provide the CTB with the project payout projections so that they can objectively compare available funding to projected expenses to aid in the decision process for project selection. Using this information, the CTB should select the new project additions for the Proposed Six Year Program.

Finalized Six Year Program

Transportation is statutorily required to hold a public allocation hearing before finalization of the SYP for final input on project allocations in the program. Transportation should hold these hearings in the late spring. This provides the districts, counties, cities, and towns with an opportunity for comment on selected projects. If a region prefers one project to another, the CTB could consider substituting projects, as long as the new project remains within the cost parameters and is on the prioritized list. The public should understand the budgetary limitations in order to make rational decisions concerning which projects to move forward.

At this point the MPO and other regional federal plans should also be finalized, as well as county plans, and the CTB can consider the priorities in those plans as well. We have recommended moving the Secondary Six Year Plans update cycle to align with that of the SYP; however, Transportation will have to work with the counties to determine if this is possible. After making any requested adjustments, the CTB approves the proposed list and it becomes the Six Year Program.

Accountability

Transportation, and more specifically, the CTB should be accountable for achieving the goals outlined in the Six Year Program. Fundamental to this accountability process is Transportation's commitment to assign a project management team that follows the project from its inclusion in the scoping process above to its completion. This team has responsibility for the project including making sure the estimates are realistic, there are controls over changes, and the project delivers the expected outcomes.

Transportation should provide monthly information to the CTB on project status, specifically for high dollar, high visibility projects. Transportation should provide the CTB with monthly cash inflow and outflow projections to allow them to make rational decisions concerning SYP implementation. To hold the CTB accountable, they need timely information.

Each year, Transportation should prepare and present to the CTB an annual comparison outlining what the SYP achieved, what it did not, and the reasons why. This session should include presentations by the project management teams for the larger projects and those experiencing budgetary problems. Using this information, the CTB should prepare and present a report to the General Assembly outlining what the Construction Program achieved, and where it fell short. Included should be a budget to actual comparison, comparing allocations at the beginning of the year to actual cash payouts for the fiscal year and inception to date. The CTB should provide explanations for significant deviations and variances.

SIX YEAR PROGRAM IMPLEMENTATION

After a project enters the Six Year Program, Transportation completes its design, acquires necessary right of way and easements, moves utilities, constructs the project, and maintains it over its useful life.

Part of the Project Team's responsibilities is assisting Transportation in implementing a successful design review program, holding designers accountable for poor design quality and costly errors. It is critical that Transportation ensures the project design is of high quality and free from as many errors and omissions as possible before advertising the project. This requires the knowledge of not only project designers, but of all other disciplines needed to build a project. The more changes required during the construction phase due to inadequate designs, the longer other planned projects are delayed in order to manage cash flow and the longer the current project may take, depending on the type of changes necessary. This results in Transportation completing fewer projects than originally planned and public disappointment. Because there is the chance that Transportation may put fully designed projects on hold for some time, it will also be very important to revisit the designs of those projects before they go to advertisement in order to include any needed updates.

According to the General Accounting Office (GAO) report: **"Abridgment of the Federal Facilities Council Study on Facility Design Reviews,"** early and effective design review practices can significantly impact project cost and success:

"According to the FFC study, opportunities exist to significantly reduce total project cost (TPC) by conducting an effective design review process. The study found that effective design review practices result in less rework on the part of the construction contractor, fewer change orders to correct design errors and omissions, and lowering the cost of belatedly adding project upgrade features that should have been addressed in the original design. FFC reported that, historically, 30 to 50 percent of all construction change orders result from errors in the design documents directly related to improper interfaces between design disciplines (civil, structural, architectural, electrical, and mechanical)."

Transportation should ensure that they acquire all necessary right of way and relocate utilities before advertising the project in order to help deliver a project as scheduled once it gets to the construction phase, and to reduce additional costs paid to contractors for down time incurred while waiting for utility relocation. Transportation should continue implementation of the concurrent engineering process (discussed in detail in Chapter 6 “Construction”) to aid in the acquisition of right of way and utility relocation as early in the process as feasible. If functioning properly, the process will also aid in producing a higher quality project design because of its high emphasis on communication and teamwork.

Transportation prepares a twenty-four month Advertisement Schedule. This schedule identifies when Transportation staff believe projects will be ready for advertising over the next two years. Transportation uses this schedule as a planning tool to deliver projects in the SYP. Before Transportation approves the Ad schedule, Financial Planning should update the cash forecasting model to determine if cash is available to support the schedule.

After Transportation has fully completed project design, right of way activities, and met any additional requirements, a project is then ready to advertise so that Transportation can award a construction contract. Transportation performs a monthly review to identify projects ready for advertisement. As Transportation prepares the projects for advertisement, Transportation should re-evaluate the availability of cash to pay for the project before advertising for it. Once Financial Planning determines there is available cash, Transportation should advertise the projects. In addition, Transportation should establish dollar thresholds for current construction project expenses in excess of award that may have additional funding needs and that would require adjusting the Ad Schedule.

Transportation should then hold bid letting for projects ready for advertisement. The CTB is statutorily required to approve all construction contracts before contract award. If the CTB decides not to award a contract, Transportation needs to be re-bid the contract. Once the CTB approves a construction contract for award, Transportation awards the contract and construction begins.

CONSTRUCTION

The three key processes during the construction phase are Monitoring, Making Project Changes, and Payment. Transportation must develop and monitor construction project budgets. Information must be available and easily obtainable to properly monitor the project budget and to determine if it is on schedule. Transportation should only make changes if the changes are necessary for the proper functioning and safety of the project. Because of this, Transportation must make funding available when these types of changes occur. Transportation should not make changes until they verify funding availability. When overruns from changes result, Transportation must update project schedules and budgets so that the most current and accurate information is available for developing and amending the Ad Schedule for other projects so that Transportation can maintain an adequate cash flow.

Transportation should only make payment for quality work. Transportation should implement a quality assurance program to ensure quality project management and evaluate construction quality. It is critical that the operating divisions provide Financial Planning with timely project payout information for the Cash Forecast Model or the Model will not be a useful tool in managing cash flow.

Overlying this entire process is the concept of project management. We did not attempt to determine the best method for project management implementation. Transportation should decide if cradle to grave or some other type of project management would work best for their needs. What we emphasize is accountability. Transportation must hold an individual, group, or team accountable for delivering projects on

time and on budget. Transportation must maintain tight control over their resources; this is not possible without effective project management at all stages of a project.

Proper project management is essential for successful construction program delivery. Transportation should clearly define roles and responsibilities, establish accountability, delegate necessary authority, and open critical lines of communication so that information flows. The implementation of project management and concurrent engineering will greatly enhance Transportation's ability to do these things. Teamwork and communication are essential to successful project management because project managers must facilitate communication between necessary individuals in order to complete projects on time, on budget, and in a quality manner. Communication should not be limited to those involved in designing and building projects, but is essential between those individuals responsible for project selection and funding. Project management should begin when a project is at the Scoping stage and carry through until project completion. Proper project management will improve the efficiency and quality of the construction process.

MAINTENANCE

We recommend that Transportation make the implementation of asset management a priority. Transportation should make continuous efforts towards this goal and should recognize that there is no way to appropriately fund its maintenance needs without an asset management system to provide sound data and decision-making tools.

An asset management system first requires that Transportation collect a complete, up-to-date inventory of the six asset groups for the interstate, primary, and secondary systems. Those asset groups are Pavement, Pipe and Drainage, Roadside, Traffic Device, Structure and Bridge, and Special Facilities. Transportation must then perform a condition assessment of each of these assets and record the quantitative and qualitative condition and value of each.

Transportation should then perform analyses to identify its true maintenance needs on a statewide level. Transportation should establish qualitative performance targets for each of the assets within the interstate, primary, and secondary systems. Transportation should consider the maximum useful lives of the assets and the life cycle costs of those assets. Transportation should also analyze the costs and benefits of various investment options.

Transportation should prioritize the identified needs based on a set of objective criteria that includes, but is not limited to, safety, mandates, life cycle costs, return on investment, level of service, and user priorities. Transportation should base the list of critical needs upon predetermined performance levels, and it should address those needs that have the optimal impact on the maintenance program.

After Transportation has identified and prioritized the maintenance needs, it should present the list of needs and their associated costs to Financial Planning. At this point, Transportation will be able to develop the maintenance budget based on the prioritized needs and available revenues. Transportation is statutorily required to fund highway maintenance first from available Highway Maintenance and Operating (HMO) funds.

Transportation is statutorily required to make maintenance payments to qualifying cities and towns and to the counties of Arlington and Henrico. Transportation allocates the remaining highway system maintenance funds to the nine districts based on the list of prioritized needs. Transportation may further allocate these funds to the residency and then area headquarters level.

Transportation should run both the maintenance budget and the administrative and general expense budget through its Cash Flow Model to help determine cash availability for the agency as a whole. Transportation should then prepare work plans based on the list of prioritized needs and anticipated monthly cash flow. Transportation must also consider other available resources, such as human resources. When planning work, Transportation should take into consideration the changing spending patterns of the maintenance program and the pattern of incoming revenue to help prevent cash shortfalls. As Transportation performs and completes maintenance work, it should continuously monitor both monthly and anticipated expenses and cash flow.

Transportation should perform a make-versus-buy analysis when determining whether to use state forces or contract out, taking into consideration the costs and benefits associated with each option. Transportation should develop policies and procedures to standardize this decision-making process.

It is important that Transportation assess maintenance work upon completion in order to realize fully the benefits of the asset management system. Transportation should determine useful outputs of the work performed and then determine whether it achieved the desired level of service and return on investment and whether the work stayed within budget and ensured the maximum useful life of the asset. Assessing the work will help Transportation plan future work. This feedback loop is the basis of an asset management system.

As with the Construction process and the Six Year Program, Transportation needs project management to establish accountability for contract and project management in this area. Project managers should understand that they have budgets and must understand cash flows and reporting on the status of their work. While many of the projects are smaller and less costly, the volume of activity in this area makes project management just as important.

REPORTING

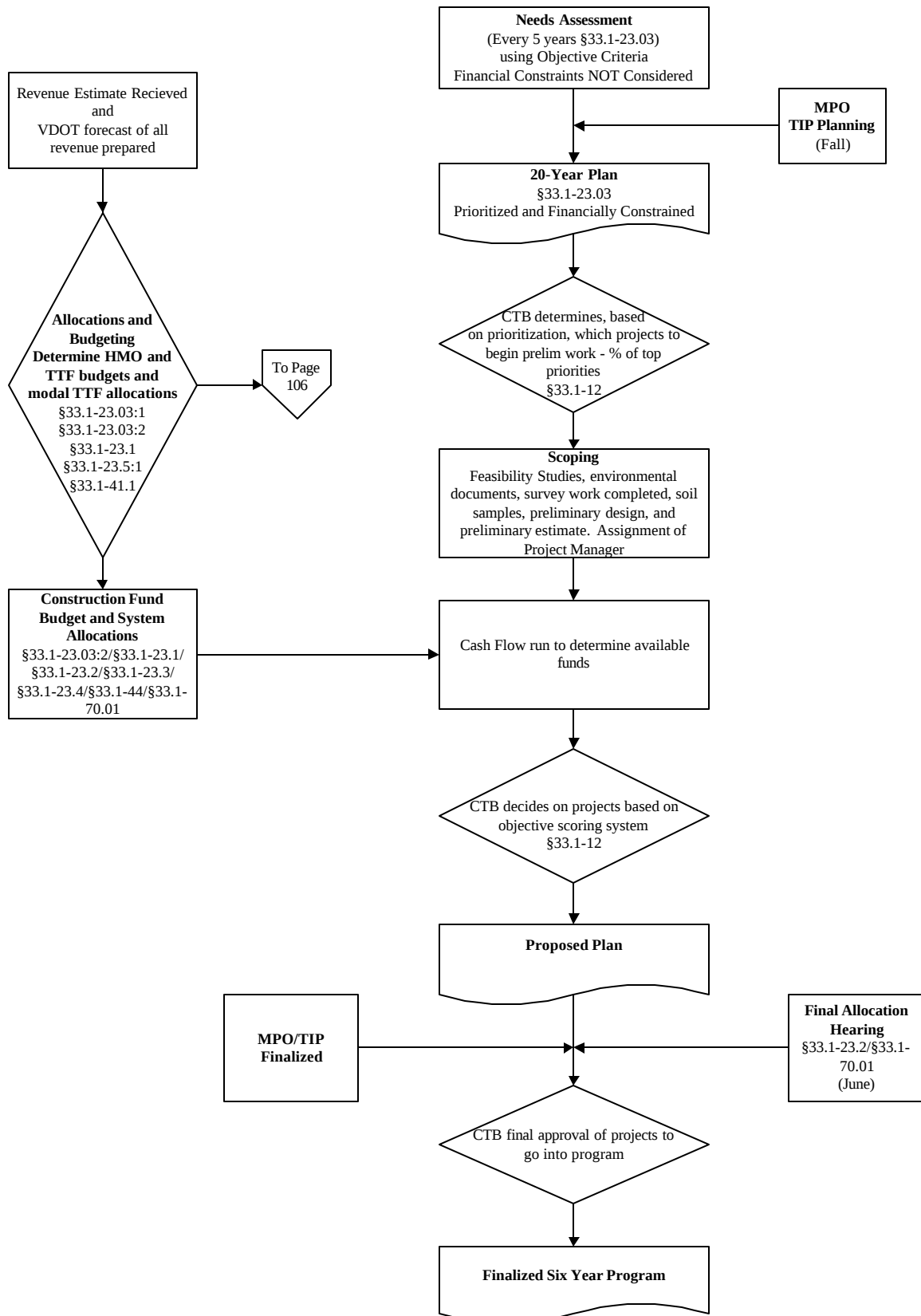
Reporting is an important part of ensuring the success of the Best Practices Model. Proper reporting will allow Transportation to examine its weaknesses so that it can work toward a solution. Reporting will also help to keep informed those responsible for decision making, as well as the public. Some necessary reports include the following.

- Phase Budget to Actual Reports – Comparisons of estimated costs of each phase (design, right of way, construction) to the actual cost of each phase at its completion.
- Monthly Update on Top Projects – An update on the largest projects (based either on total dollar or taking the top X percent of projects) to be presented to the Commonwealth Transportation Board on a monthly basis to keep them informed on the progress of the projects, including budget and time overruns.
- Yearly Update on All Projects – Similar to the Monthly Update on Top Projects but done for all projects in the Six Year Program, presented to the Commonwealth Transportation Board and made public.
- Estimated Project Cost & Cash Payout Report – For help in determining which projects to add to the Six Year Program, the CTB should be provided a report of estimated project costs for the list of scoped projects, as well as the estimated monthly cash payout for those projects.

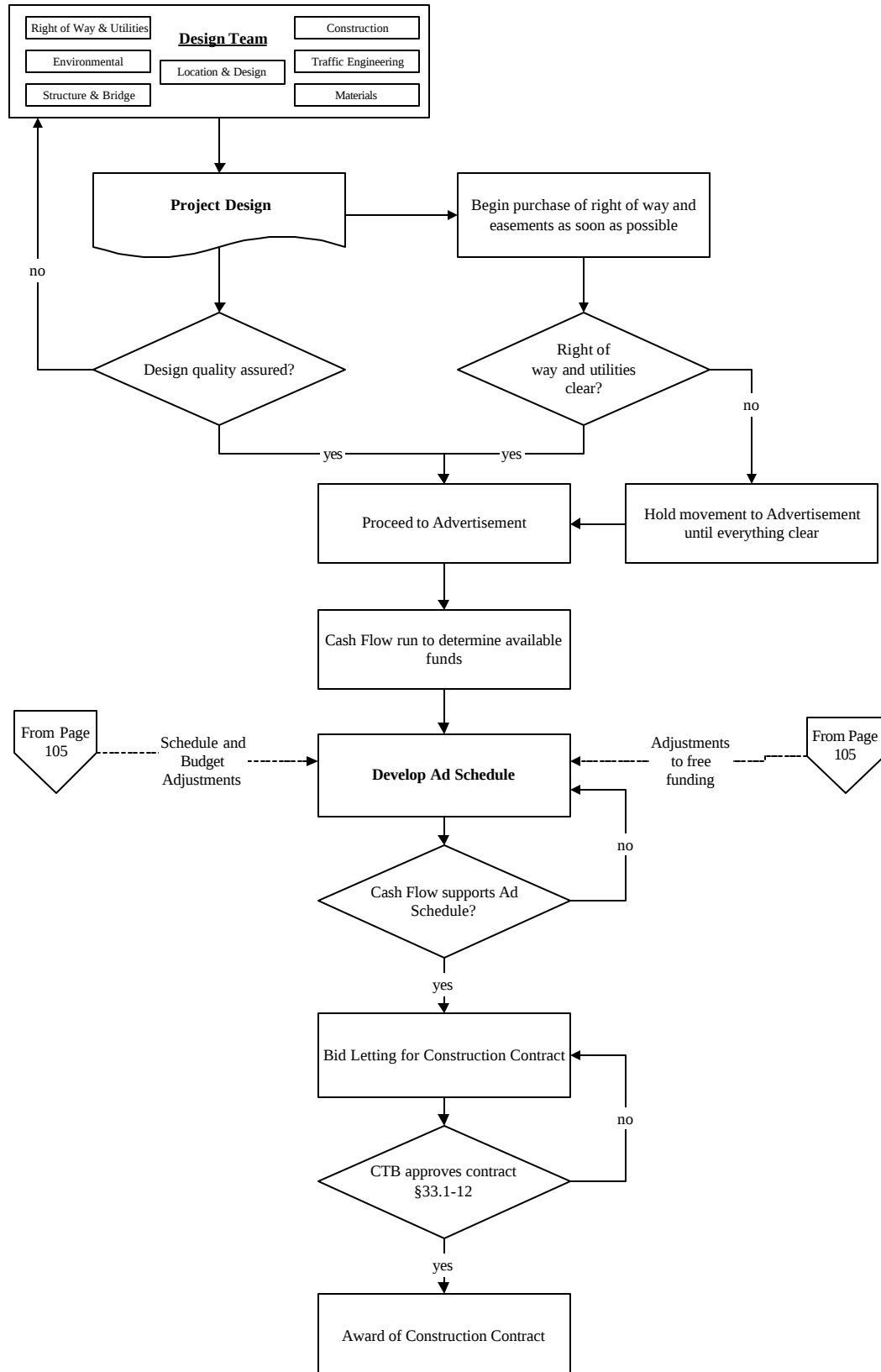
To make any decisions properly, Transportation needs timely and accurate information. For proper communication to exist, Transportation must have systems that can interact and exchange information. Data should be reliable and data fields designed for compatibility. Systems should be user friendly and should provide management with timely, accurate, easily available management reports.

Transportation has taken steps toward an interim solution to its information needs problems with the creation of the Data Warehouse; however, the best practice is ultimately an enterprise solution.

BEST PRACTICES SIX YEAR PROGRAM DEVELOPMENT

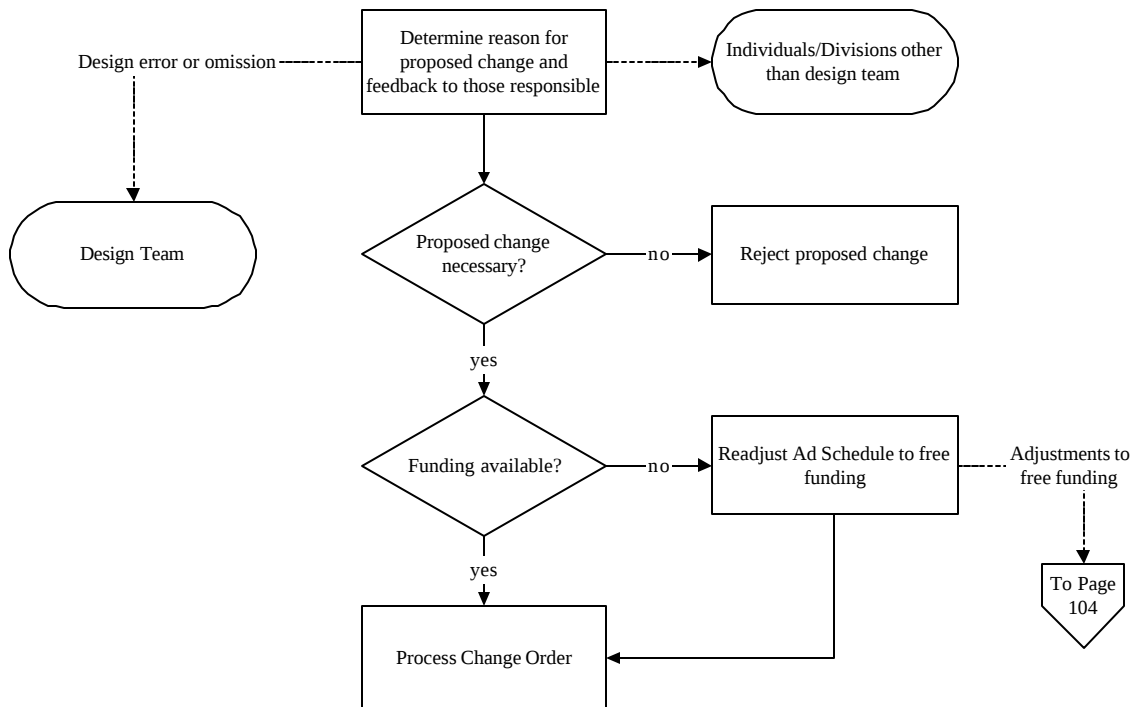


BEST PRACTICES SIX YEAR PROGRAM IMPLEMENTATION

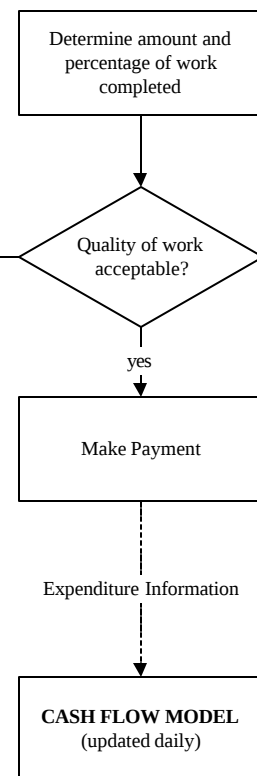


BEST PRACTICES CONSTRUCTION

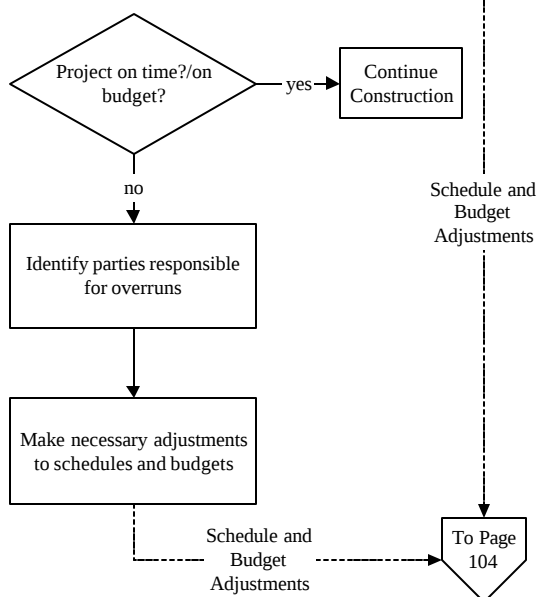
Making Changes



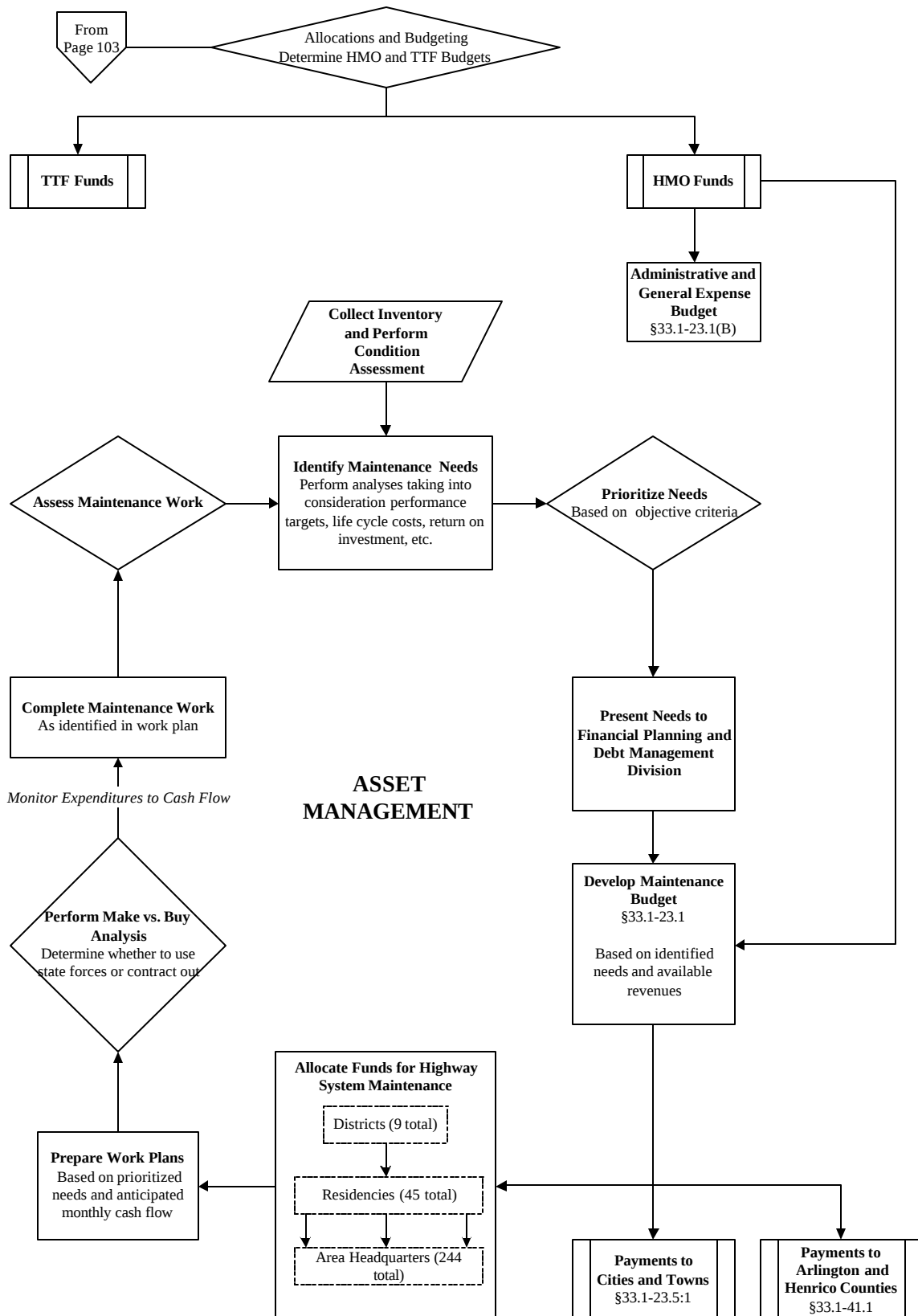
Making Payment



Monitoring



BEST PRACTICES MAINTENANCE



**APPENDIX A
INTERNAL AND EXTERNAL STUDIES
OF
THE DEPARTMENT OF TRANSPORTATION**

Joint Legislative Audit and Review Commission Reports

- “Review of Construction Costs and Time Schedules for Virginia Highway Projects” – January 2001
- “Adequacy and Management of VDOT’s Highway Maintenance Program” – January 2002
- “Equity and Efficiency of Highway Construction and Transit Funding” – December 2001

“The Governor’s Commission on Transportation Policy Final Report” – December 2000

Transportation Research Council Technical Assistance Reports

- “Highway Project Cost Estimating Methods Used in the Planning Stage of Project Development” – October 2001
- “A Survey of State Highway Needs Assessment Practices” – November 2001

Virginia Department of Transportation

- “Quinquennial Review of Highway Construction Needs 2000 – 2020” – January 2000

Page Left Intentionally Blank

APPENDIX B LIST OF RECOMMENDATIONS

Recommendations for Transportation

Recommendation #1: Transportation should continue to budget federal revenues based on obligation authority, RABA, and the growth rate of motor fuels consumption, but should also include projected reimbursements to help bring the projection more in line with actual reimbursements. Transportation should document this process and adopt the policy.

Recommendation #2: Transportation should establish a policy on how to decide when and if to issue future FRANs. This policy should consider the amount of any proceeds remaining from previous FRAN issues, the readiness of projects to use the funds, and the impact the issuance has on current and future revenue streams.

Recommendation #5: Transportation's programming divisions should incorporate estimated monthly project payouts and estimated monthly cash flow information into the project allocation process. This would allow Programming and Scheduling to match project allocations to a project's cash needs and would mitigate the cash drain that the mismatch of cash and allocations has on Transportation's cash account.

Recommendation #6: Transportation should re-evaluate the necessity for the pre-allocation hearing. If the Six Year Program is truly to be a budgetary document, the CTB should draft the program using the official revenue estimate and available cash, and add the statewide priority projects that funding can support for the year. Transportation could provide this list to the public for input at the final allocation hearings. The CTB could, at that point, substitute other projects ready to proceed based on public input as long the projects were within the budget established.

Recommendation #7: Transportation should establish and adopt a new timeline for the addition of projects to the Secondary Six-Year Plan to align more closely with the SYP cycle.

Recommendation #8: Transportation should open the lines of communication and establish procedures to ensure that necessary information flows between divisions. Transportation should institutionalize this communication process throughout the department.

Recommendation #9: Transportation should continue to use cash forecasting to develop the Six Year Program and to balance expected cash inflows against anticipated project payout schedules.

Recommendation #10: Transportation must develop and follow a policy to forecast, monitor, and manage cash continuously throughout the year. Transportation must establish lines of communication between Financial Planning and all of the other divisions to ensure that the divisions share and use the information.

Recommendation #11: Transportation must carefully monitor and link the timing of cash receipts and expenses to all projects currently authorized. This may result in increased cash balances as Transportation matches their current and anticipated road construction expenses to forecasted cash. To accomplish this, Transportation will need to budget for construction payouts.

Recommendation #12: Transportation should begin the systematic process of budgeting for the Construction Program. The budget should consider anticipated contract payout against anticipated cash flow. Transportation's Six Year Program should be a six-year capital budget. Currently, it is a revenue distribution document. This process will be central to Transportation's success in developing a deliverable, financially constrained construction program based on statewide needs and priorities.

Recommendation #14: Transportation must develop a financially constrained Six Year Program based on anticipated project payouts. To do this, Transportation should develop a method to ensure that the projects added to the Six Year Program have sufficient allocations to complete planned work each year and that the full cost of the project has been allocated to it by the year of project completion. The method should allocate revenues to projects based on expected project payout each year, and should be reconciled to anticipated cash flow. Transportation should only add new projects to the extent that there is sufficient cash to pay for them. When developing the Six Year Program, Transportation should begin with a district's, county's, or municipality's allocation, remove any outstanding debt service, and subtract anticipated existing project payouts. Transportation can use the remaining funds, if any, to add new projects as long as project payouts equal cash inflows.

Once developed, Transportation should adopt this method as a written policy and institutionalize it throughout Transportation. This will require accurate project estimates, addressed below, and tight controls over cash flow. The budgeting, programming, and operational (construction) areas will need to develop open lines of communication and work closely toward delivering a financially constrained achievable program for this to occur.

Recommendation #15: During development and implementation of the new process, Transportation should determine an appropriate minimum cash balance to maintain as a reserve. The cash reserve is necessary for economic downturns where revenues are less than anticipated as well as to provide a cushion for Transportation while they work to develop and refine new processes.

Recommendation #18: We recommend that Transportation complete basic preliminary engineering work, such as scoping, soil tests, environmental permitting, and surveys, prior to approving projects and placing projects in the SYP. We concur with the Governor's Commission on Transportation Policy's recommendation that Transportation should create a mechanism for funding scoping work on projects before CTB approval for inclusion in the program. However, we do not recommend the creation of a separate fund receiving separate appropriations. We believe the creation of a cost center or a budgetary "pool" of funds would be the most practical choice. Preliminary work before project approval would allow for more realistic initial project estimates and the CTB would benefit by having more information available for decision-making purposes. Prior to authorization, Transportation could eliminate projects that are not feasible or whose estimated costs are too high to be practical.

Recommendation #19: We concur with the Research Council recommendation that Transportation should develop and employ a more rigorous cost estimation process, and allocate more resources (front loading) to the development of cost estimates during the planning process, thereby yielding more refined and more accurate project concepts. We believe Transportation has taken a step in the right direction with the formation of the group to study cost estimates. We strongly urge Transportation to closely monitor their progress and ensure the development and application of a reasonable, realistic, and consistent cost estimation method.

Recommendation #25: Transportation should develop a clear definition of "need" for assessing statewide transportation deficiencies. Once defined, Transportation should establish criteria for evaluating highway needs for the quinquennial needs assessments. As part of the needs assessment, Transportation should attempt to estimate costs for total highway needs identified.

Recommendation #26: Transportation should use the 20 Year Plan as the foundation for statewide Transportation planning. The 20 Year Plan should use the results of the statewide needs assessment, should contain prioritized projects, and should be financially constrained. The 20 Year Plan should contain all projects eligible for placement in the SYP, and Transportation should base their SYP project selection decisions on the priorities outlined in the 20 Year Plan.

Recommendation #29: If the Data Warehouse is to provide a sound interim solution, management must, for each of these systems, assign and hold accountable each division responsible for gathering and maintaining this information. Without this accountability, inaccurate, untimely, and inconsistent information will very quickly compromise the usefulness of the Data Warehouse.

Recommendation #30: Transportation should identify all of the critical data elements in the systems necessary for project and cash management. After identification, Transportation should implement a program of data integrity to ensure that the critical elements undergo update in all systems as needed. This program of data integrity should especially address those individuals that extract information from a system and use the data independently of the system such as users of PPMS.

Recommendation #31: Transportation should examine the reasons for data exchange errors and determine if reconciliation or some re-programming could reduce the errors that occur during data exchanges.

Recommendation #32: Transportation needs to develop a common identification number and definition for projects so that systems and users have a method to match information with the project. Effective cash management cannot occur if budget, expenses, and oversight data does not agree and have common standards of information to review.

Recommendation #33: Transportation should review the manual processes such as transferring information from the Six Year Improvement Plan database and consider developing an automated interface to update and exchange this information with other systems.

Recommendation #34: Transportation needs to establish policies regarding utilization of critical systems to ensure accuracy and completeness of source system data. The policies should address usage and update requirements.

Recommendation #35: Transportation should establish data standards and use these standards as the basis for future systems development. This will facilitate the transfer of information between systems.

Recommendation #36: Transportation should develop a department-wide information technology plan that focuses on what Transportation needs to accomplish its mission. Transportation should evaluate all system development requests against this plan. Transportation should only approve and fund systems and system changes that support Transportation's mission.

Recommendation #37: Transportation should implement a Development and Maintenance Plan that addresses how Transportation will handle system and information needs before implementing an enterprise system. Management should strictly enforce this policy by defining system development versus system maintenance projects and the procedures for each area.

Recommendation #38: Transportation, after addressing its interim need, should complete its work on developing a systematic approach to addressing its enterprise information and systems needs.

Recommendation #39: Management should have the Asset Management project teams work as a group to ensure that the asset management systems have common data exchange standards and incorporate the same types of information necessary to provide the same cash management information as that coming from the Data Warehouse.

Recommendation #40: Transportation should consider developing an electronic exchange of information between Site Manager and the Trns*Port application.

Recommendation #41: Transportation should continue its efforts towards improving the quality control process to ensure accuracy of design plans, including improvement of the field inspection process. Transportation should consider using Construction personnel to review design plans before advertisement as part of that process.

Recommendation #42: Transportation should continue to work toward implementing the policy that all right of way be acquired and all utilities relocated prior to advertisement. This will save project costs due to utility relocation delays.

Recommendation #43: We concur with the Final Report of the Governor's Commission on Transportation Policy that Transportation should work more closely with utility companies by assigning utility inspectors.

Recommendation #44: In developing an aggressive project management plan, Transportation needs to clearly articulate its vision of a quality assurance program and the roles that staff play in ensuring quality over construction.

Recommendation #45: We concur with JLARC's recommendation that Transportation should consistently include contingency rates in their project estimates. Transportation should enforce a written policy and provide training to all individuals estimating project costs to ensure consistent application of the rates used at all milestones for the construction estimates.

Recommendation #46: The Construction Division should develop a policy detailing the frequency and timing for updating ESTIMATOR data and ensuring that staff are following the policy.

Recommendation #47: Transportation should ensure that contingency and inflation factors are consistently included in the SYP estimates.

Recommendation #48 – Transportation should re-evaluate the methodology used to distribute prorated charges. In addition, Transportation should annually budget for prorated charges and develop an estimating factor for estimators to use in determining pro-rate costs for a project.

Recommendation #49 – Transportation should establish a set of criteria by which to evaluate projects in order to determine a reasonable contingency rate for each project basis and apply rates in that manner.

Recommendation #50 – Transportation should establish and enforce policies to include Programming and Scheduling, Secondary Roads, Urban Roads, and Financial Planning Divisions in the decision making process over contract budget additions. They should consider the effect the changes would have on allocations and cash management. This process should be formalized and documented for all changes that exceed a threshold determined by Transportation.

Recommendation #51 – Transportation should increase its efforts to implement the concurrent engineering process, develop ways in which to measure the impact of the process, and identify accountable parties. Transportation should also create a formal constructibility process to help reduce design errors and omissions.

Recommendation #52 – Transportation should develop an aggressive plan to implement cradle to grave project management in an effort to establish accountability for and improve the quality of the entire construction process. This plan could involve single individuals as project managers, project management teams, or a combination of the two. Transportation should clearly define responsibilities and give the appropriate authority to the responsible individuals.

Recommendation #53 – Transportation should develop best practices for project management both as a training tool and performance measure for its managers.

Recommendation #54: Transportation should periodically review the MCI formula to ensure that it is reflective of current maintenance practices and associated changes in costs.

Recommendation #55: Transportation should implement an objective means of identifying and prioritizing maintenance needs, namely an asset management approach. See the section entitled “Asset Management” for more details. Transportation should use an automated system to record data and should prioritize needs based on an objective set of criteria.

Recommendation #56: Transportation should recognize the changing spending patterns of the maintenance program and continue to take the pattern of incoming revenue into consideration when planning maintenance work, thus helping prevent cash shortfalls in the maintenance program.

Recommendation #57: The Maintenance Division needs to consider cash flows when scheduling maintenance work and entering into maintenance contracts. The Maintenance Division should work with Financial Planning to monitor cash and expenditure cycles.

Recommendation #58: Transportation should implement asset management as recommended in Recommendation #55 to determine the true maintenance needs of the Commonwealth’s roads and the relative cost and to determine whether crossover actually exists and to what extent. Then, Transportation should determine how to handle crossover in the future, whether it be by obtaining additional funding or maintaining assets at a lower service level.

Recommendation #59: Transportation should develop policies and procedures to standardize the decision making process of whether to contract out or use state forces. Transportation should implement the use of a make-versus-buy model. Transportation should consider another interim solution specifically for make/buy decisions rather than depending on the Business Decision Making Model. Transportation should consider this solution as soon as possible and should not wait for the implementation of IMMS, which has an uncertain time frame for implementation.

Recommendation #60: Transportation should make the implementation of asset management a priority, with or without the automated systems fully in place to support it. Transportation should make continuous efforts towards this goal and ensure that all maintenance staff, including those from the area headquarters level and up, understand the changes that will come with asset management. Transportation should recognize that there is no way to appropriately fund the maintenance program without an asset management system to provide sound data and decision-making tools.

Recommendation #61: Transportation should establish performance targets for all maintenance asset groups as soon as possible and use those targets to identify needs and develop the budget. Performance targets are critical to an asset management system.

Recommendation #62: Transportation should implement a formal project management plan over maintenance activities, which would include cash management techniques. This could help alleviate the maintenance program's cash shortfalls.

Recommendations for the Commonwealth Transportation Board

Recommendation #13: The CTB should prioritize project lists for inclusion in the Plan. This would alleviate outside pressure to add more projects in the plan than for which there is adequate funding. Transportation would apply available funding in the project's priority order until no further funding was available. The CTB should determine the priorities, and the Programming Divisions should apply the funding.

Recommendation #20: The Commonwealth Transportation Board should immediately establish and implement objective criteria for construction project selection and prioritization. Both the Transportation Research Council and the Governor's Commission on Transportation Policy have recommended project selection and prioritization criteria.

Recommendation #21: The focus of the Six Year Program should remain on the statewide needs of the Commonwealth as a whole; it should not focus on districts. The current process of presenting individual district's tentative plan to the Board members from those districts distracts from the statewide focus and instead encourages the district focus. Transportation and the CTB should focus on statewide needs, as is statutorily required of the CTB, when reviewing and approving the Six Year Program. Transportation and CTB should change their presentation and review process.

Recommendation #23: We concur with the Governor's Commission on Transportation Policy recommendation that the CTB should discontinue the practice of reviewing and approving design plans.

Recommendation #24: The CTB should discontinue the practice of reviewing and approving professional service contracts.

Recommendations for the General Assembly and Governor

Recommendation #3: The General Assembly and the Governor may wish to consider having the Debt Capacity Advisory Committee review and recommend guidelines for Transportation to follow when issuing debt.

Recommendation #4: The General Assembly may wish to provide guidance on how Transportation should pay debt service in relation to the allocation of resources within the Six Year Program.

Recommendation #16: The General Assembly may wish to create a Transportation Revenue Reserve Fund that would act like a Rainy Day Fund for the Transportation Trust Fund. Additionally, the General Assembly may wish to restrict availability of these funds from other uses.

Recommendations #17: The Governor and the General Assembly may wish to consider amending the Code of Virginia to require Transportation to report on the progress and success or failure of the SYP to the Transportation and Finance committees annually.

Recommendation #22: Since the actions of the Commonwealth Transportation Board significantly commit the resources of the Commonwealth, the General Assembly may wish to extend the provisions of this Section to the Commonwealth Transportation Board.

Recommendation #27: The General Assembly may wish to re-examine the use of allocations for setting construction project priorities and funding. While the General Assembly has established that the Commonwealth Transportation Board must establish a method for setting statewide priorities, the General Assembly may wish to provide them some guidance on factors that the CTB should consider in establishing this process.

Recommendation #28: Transportation may not be able to achieve a program based on statewide needs and priorities using the current method for project allocation to districts, counties, and cities and towns. The General Assembly may wish to amend the Code of Virginia to change the current allocation system so that Transportation can truly base their priorities and criteria on statewide needs rather than by district, county, and city.

APPENDIX C
DEPARTMENT OF TRANSPORTATION'S RESPONSE

Page Left Intentionally Blank



COMMONWEALTH of VIRGINIA

DEPARTMENT OF TRANSPORTATION

1401 EAST BROAD STREET
RICHMOND, VIRGINIA 23219-2000

PHILIP A. SHUCET
COMMISSIONER

July 8, 2002

Walter J. Kucharski
Auditor of Public Accounts
P. O. Box 1295
Richmond, VA 23218

Dear Walt,

Thank you for the opportunity to review APA's draft report, Special Review of Cash Management and Capital Budgeting Practices. The report is a fair and accurate assessment of the Virginia Department of Transportation's (VDOT's) financial practices.

This independent assessment of the Department confirms recommendations in other studies and identifies new recommendations to improve VDOT's financial operations. In addition, the recommendations to be implemented by the Department are reasonable. Therefore, I have directed that an action plan be prepared within 30 days to implement those recommendations under VDOT's authority. Chapter 8 of the report, Best Practices, is excellent and will be very useful as we continue to examine and reengineer our business processes.

The recommendations on page 116 through 118 of the report that are directed to the Commonwealth Transportation Board, the General Assembly and the Governor will require a broader change in culture and philosophy, and the cooperation of many organizations in order to be implemented. While changes in culture and philosophy are challenging, the end products of accountability, public trust, and good business practices are worth the investment.

Walt, this report will be used to proactively reform VDOT's financial practices, and I commend you and your staff on a job well done.

Sincerely,

A handwritten signature in dark ink, appearing to read "P. Shucet", written in a cursive style.

Philip Shucet

cc: Secretary Whittington W. Clement

Page Left Intentionally Blank

REVIEW TEAM MEMBERS

DeAnn B. Compton
Audit Director, Property and Materials Management

Nannette H. Williams
Audit In-Charge, Property and Materials Management

Melanie D. Andrews
Auditor, Reporting and Standards

Patricia A. Campbell
Audit Specialist, Data Analysis

Zoe S. Cobb
Auditor, Performance, Budgeting and Forecasting

Kristen L. Epperson
Audit Specialist, Information Systems Development

Christopher J. Lee
Auditor, Financial Management

Kellie M. Peters
Auditor, Acquisition and Contract Management

Patrick M. Pugh
Auditor, Performance, Budgeting and Forecasting

Wendy Baker
Computer Support Technician