Final Report VTRC 08-R13

Virginia Transportation Research Council

research report

A Review of the Virginia Department of Transportation's Scoping Process and Options for Potential Improvements

http://www.virginiadot.org/vtrc/main/online_reports/pdf/08-r13.pdf

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Standard Title Page - Report on Federally Funded Project

1. Report No. FHWA/VTRC 08-R13	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle A Review of the Virginia Department of Transportation's Scoping Process and Options for Potential Improvements		5. Report Date May 2008
		6. Performing Organization Code
7. Author(s) Kenneth E. Lantz, Jr., John S. Miller, and Jason S. Beaton		8. Performing Organization Report No. VTRC 08-R13
9. Performing Organization and Address Virginia Transportation Research Council 530 Edgemont Road Charlottesville, VA 22903		10. Work Unit No. (TRAIS) 11. Contract or Grant No. 82240
12. Sponsoring Agencies' Name and Address Virginia Department of Transportation 1401 E. Broad Street Richmond, VA 23219 Federal Highway Administration 400 North 8th Street, Room 750 Richmond, VA 23219-4825		13. Type of Report and Period Covered Final 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

Transportation project scoping is a process where the project's purpose and need, budget, schedule, and scope are developed. Interviews conducted with 27 staff representing VDOT, FHWA, and regional planners, coupled with a review of related literature and federal legislation, suggested 10 options for improving Virginia's scoping process. Although implementation of the first 8 options may involve, to varying degrees, both central office and district staff, the decision regarding whether or not to implement them as a matter of policy rests with VDOT's Chief Engineer.

Six options regard *changes in process* that have already been implemented in some VDOT districts or are under consideration:

1. Select a monthly project day statewide.
2. Delineate scoping-day decisions from other activities in the scoping process.
3. Consider initiatives that have already been deployed successfully in one or more VDOT districts such as the use of a risk assessment page.
4. Allow electronic submission of the scoping report.
5. Provide resources to perform scoping prior to programming (and use this information to influence which projects are placed in the transportation program).
6. Support efforts to link planning and programming.

Two options regard specific *products:* (1) develop a single primer that explains to an outside audience how the scoping process influences project development and is designed to improve the quality of the discussion among VDOT, localities, and other agencies regarding project scoping, and (2) consider database enhancements suggested by interviewees.

The final two options regard suggestions for further research.

The report gives the rationale for each option, detailing interviewees' descriptions of how scoping is done, challenges that arise when scoping specific projects, and enhancements to scoping that have been considered in individual districts.

17 Key Words	18. Distribution Statement
Project management, project development, scoping, preliminary engineering, design	No restrictions. This document is available to the public through NTIS, Springfield, VA 22161.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	53	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

FINAL REPORT

A REVIEW OF THE VIRGINIA DEPARTMENT OF TRANSPORTATION'S SCOPING PROCESS AND OPTIONS FOR POTENTIAL IMPROVEMENTS

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Virginia Transportation Research Council
(A partnership of the Virginia Department of Transportation
and the University of Virginia since 1948)

In Cooperation with the U.S. Department of Transportation
Federal Highway Administration

Charlottesville, Virginia

May 2008
VTRC 08-R13

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The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Virginia Department of Transportation, the Commonwealth Transportation Board, or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

LIST OF ACRONYMS AND ABBREVIATIONS

AM-430	Form used by VDOT to document maintenance project scoping results including cost, work required, and reason for not providing bicycle/pedestrian accommodations if applicable
BRAC	Base Realignment and Closure
CE	Categorical exclusion
CEDAR	Comprehensive Environmental Data and Reporting System (a VDOT database
C.F.R.	Code of Federal Regulations (available electronically at http://www.gpoaccess.gov/cfr/index.html)
CMAQ	Congestion Mitigation and Air Quality (the CMAQ Improvement Program is a federal transportation funding program where the metropolitan planning organization has the main responsibility for selecting projects benefiting from these funds)
CSS	Context sensitive solutions
DEQ	[Virginia] Department of Environmental Quality
DHR	[Virginia] Department of Historic Resources
DOT	Department of transportation
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
Fed. Reg.	Federal Register (available electronically at http://www.gpoaccess.gov/fr/index.html)
EQ-429	Form used by VDOT to initiate the SERP (also called the Early Notification Form)
FALCON	A VDOT website that allows viewing of electronic plans for projects
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FONSI	Finding of No Significant Impact

FTA	Federal Transit Association
GIS	Geographic Information System (VDOT's internal GIS application is the GIS Integrator)
HTRIS	Highway Traffic Records Information System
iPM	Integrated Project Manager (a VDOT database containing scoping documents for some projects, accessible at http://isyp/development/)
LD-104	Form used by VDOT's Location & Design Division to request traffic information, such as a 20-year forecast of average daily traffic, from the district planner
LD-404	Form used by VDOT indicating if the final design advertised for construction matches the scope given in the LD-430 following the scoping meeting (also called PMO-Form-18)
LD-430	Form used by VDOT documenting construction project scoping results such as location, project termini, preliminary cost estimates, geometric design features, right of way, and results of the initial field review and initial plan review (also called PMO-Form-04)
MPO	Metropolitan planning organization (a transportation policy-making organization made up of representatives from local governments and transportation authorities)
NEPA	National Environmental Policy Act
PCES	Project Cost Estimating System (a VDOT software application used to estimate project costs, accessible through the iPM
PDC	Planning district commission (a regional body performing planning work on behalf of county and city governments within a region; PDCs often serve as staff for MPOs)
PE	Preliminary engineering
PEI	Preliminary Environmental Inventory (a form used by VDOT for documenting the results of the SERP)
RSTP	Regional Surface Transportation Program (a federal transportation funding program where the MPO has the main responsibility for selecting projects benefiting from these funds)

RW24	Form that records negotiations between VDOT and a landowner when purchasing right of way)
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SERP	State Environmental Review Process (identifies potential ecological and community impacts such as waterfowl refuges, air quality, relocations, and historic resources)
SPS	Statewide Planning System (a VDOT planning database maintained by VDOT's Transportation Mobility Planning Division)
STIP	State Transportation Improvement Program (includes all projects from the TIP and VDOT's SYIP that will be programmed within the next 4 years)
SYIP	Six-Year Improvement Program (the list of projects for which VDOT has set aside some amount of funding for use within the next 6 years)
TIP	Transportation Improvement Program (the list of projects within an MPO area that will receive federal funding over the next 4 years)
TMPD	VDOT's Transportation Mobility Planning Division
VDOT	Virginia Department of Transportation
VDRPT	Virginia Department of Rail and Public Transportation

KEY TO INTERVIEW NOTATIONS

To identify possible improvements to project scoping by the Virginia Department of Transportation, interviews were conducted with 27 staff representing five VDOT districts, one planning district commission, and the Federal Highway Administration's Virginia Division Office.

Throughout this report, the reader will encounter notations in parentheses such as "(I1)," "(I2)," etc. These notations signify the particular interview from which the information being discussed was taken.

The key for these notations is as follows:

Interview No.	Work Unit Represented	Number and Category of Interviewees[a]	Interview Focus
I1	Hampton Roads District	1 ENV, 1 L&D, 1 PE, 1 PLAN[b]	How VDOT districts perform scoping
I2	Lynchburg District	1 ENV, 3 L&D, 1 PLAN	
I3	Northern Virginia District	1 ENV, 1 L&D, 1 PE	
I4	Richmond District	1 AM, 1 ENV, 1 L&D, 2 PE	
I5	Hampton Roads PDC	4 staff	Scoping results as seen by an outside agency.
I6	Fredericksburg District	1 PE	Possible procedural improvements to scoping
I7	Richmond District	1 PE	
I8	Fredericksburg District	1 ENV	Environmental resources and requirements
I9	FHWA Virginia Division	2 staff	Federal requirements and observations of VDOT coordination with outside entities

VDOT = Virginia Department of Transportation; PDC = planning district commission; FHWA = Federal Highway Administration.

[a]Key: ENV (Environmental Division), L&D (Location & Design Division), PE (Preliminary Engineering), PLAN (Planning), AM (Asset Management); FHWA (Federal Highway Administration).

[b]An interviewee with VDOT's Scheduling & Contract Division also participated.

EXECUTIVE SUMMARY

This research effort sought to identify possible improvements to project scoping by the Virginia Department of Transportation (VDOT). Interviews were conducted with 27 staff representing five VDOT districts, one planning district commission, and the Federal Highway Administration's Virginia Division Office. Interview questions addressed the role of scoping in project development, the involvement of outside agencies, the use of documentation for tracking scoping-related decisions, and steps VDOT districts have taken to improve scoping. Because only some interviewees identified particular problems or recommended particular solutions, the adjective "potential" is used in this report.

Potential Problems Identified

Interviewees noted *potential* problems grouped into three topics: (1) the link between scoping and other processes, (2) the involvement of outside agencies in scoping, and (3) scoping itself. Some technological obstacles were identified, such as the need for a single database for all project information, but more challenges related to the process.

Three potential problems related to the link between scoping and other processes:

- the lack of a clear purpose and need statement from the planning process
- the alignment of planning cost estimates and scoping estimates
- the fact that some projects are scoped for which full construction funding is inadequate.

Two potential problems related to the involvement of outside agencies:

- Some outside agencies lack the staff to participate fully in the scoping process.
- Some outside agencies are not able to provide meaningful input until the project has been fully defined—a state that is achieved only after scoping is completed.

Five potential problems related to the scoping process itself:

- an insufficient number of personnel and/or insufficient experience of existing personnel
- a lack of clarity regarding what the scoping process should deliver
- a need for better higher level cost estimates especially for some types of projects
- a need to better document follow-up commitments and changes in scope that occur after project scoping day
- a need for a single user-friendly source for obtaining all project information.

Potential Solutions

Interviewees noted 10 *potential* solutions, some of which have already been implemented in one or more districts. Although implementation of the first 8 solutions may involve, to varying degrees, both central office and district staff, the decision regarding whether or not to implement them as a matter of policy rests with VDOT's Chief Engineer. As was the case with the potential problems, more solutions focused on the process rather than technology.

There were six process solutions:

- Establish (or continue) a monthly project day statewide.
- Use the initial scoping meeting to ask questions (thereby making the scoping meeting a "day of decision" regarding the project budget and scope rather than a day of seeking additional information).
- Consider initiatives suggested by individual districts such as the use of staff for conceptual plans, a risk assessment page, and a facilitator at the scoping meeting.
- Allow electronic submission of the scoping form.
- Provide an accounting mechanism that allows some scoping to be performed prior to the programming stage (thereby using those results to influence which projects are placed in the program).
- Strengthen the link between scoping and planning (through involving planners in scoping and/or having a clearer purpose and need from the planning process).

There were two product solutions:

- Develop a single primer that explains how scoping affects a project's outcome.
- Enhance VDOT databases such as making scoping data accessible to outside agencies.

Finally, there were two options for further research:

- Develop percentile-based cost formulas.
- Determine whether scoping performance measures would be useful or not.

As there are additional factors that influence these options, a "next step" is for VDOT to decide which merit implementation.

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INTRODUCTION

When a transportation project is first listed in the Virginia Department of Transportation's (VDOT) Six-Year Improvement Program (SYIP), the project will include a brief description, a cost, and an estimated construction year. By the time the project is advertised for construction, key design elements, a detailed budget, and a construction schedule will have been developed. The intervening process may informally be described as "project scoping" and is one that has attracted attention in Virginia and in other states because it affects the efficiency with which transportation projects are delivered. The study described in this report responded to this interest by documenting the role of scoping in project development, challenges encountered in scoping, and opportunities for improving the scoping process.

As is discussed later, an interview-based methodology was used to conduct this research where open-ended interviews with individuals who are involved with some aspect of project scoping provided the primary dataset.

Definition of *Project Scoping*

Formally, the word *scoping* has three definitions:

1. *For projects where an Environmental Impact Statement (EIS) is required, scoping* is defined as identifying which issues an EIS will address (VDOT, 2004a; I9).

2. *In the past, scoping* has been defined as "a systematic means of defining the purpose, need, and characteristics of proposed improvement projects" (Kyte et al., 2004).

3. *At present, scoping* is defined as a *process* where the project's purpose and need, cost estimate, budget, schedule, and scope are developed (VDOT, 2008c).

This report adopts the third definition. Thus *initial scoping* begins after the project has been programmed and funding allocations have been provided, and *final scoping* occurs when major design features, cost estimates, and the schedule are established (Lee, 2008). *Scoping* begins when the preliminary engineering (PE) phase is authorized (I3) and a VDOT district designates a project manager who oversees all subsequent work until the project is advertised for construction (I2, I7).

Relationship of Scoping to Project Development

Because scoping is not an end product or a specific point in time, scoping is best understood as a process that influences, and is influenced by, project development. This interdependence of scoping and project development is evident when the activities that occur prior to scoping, the activities that occur as part of scoping, and the outcome from project scoping are examined.

Activities Prior to Scoping

A regionally insignificant intersection improvement designed to improve air quality by reducing vehicle delay (and thus reducing idling emissions) may be considered as an example. During the planning phase, the regional planning district commission (PDC) defined the project as being the construction of a new westbound right-turn lane and the extension of an existing southbound right-turn lane. The PDC noted that the purpose of the project is to improve air quality, and the PDC has developed estimates of emissions reductions that will result from smoother traffic flow at the intersection.

The programming phase results in a VDOT SYIP allocation of $1.2 million, with $0.1 million for PE, $0.5 million for right-of-way acquisition, and $0.6 million for construction, all of which are funded through the region's Congestion Mitigation and Air Quality (CMAQ) Program funds.

Activities During Scoping

Continuing with the example, design decisions that are established in the scoping phase might include the width of the new lanes, the design vehicle (which, in turn, affects turning radii), the inclusion of sidewalks, and the type of drainage.

Site conditions that may not be known until project scoping (or possibly later when further progress has been made in designing the project [I3]) include the amount of right of way required, the extent to which utilities will need to be relocated, the presence of underground storage tanks, and whether historically significant features are affected.

During the scoping phase (and sometimes even later during the design phase [I3]), the design decisions are reconciled with the site conditions and available funds.

For example, the presence of underground storage tanks might mean that the project cannot be performed with the funds available. Resolution of the design decisions may involve an exception to a design standard (e.g., perhaps a narrower lane width than desired); a project budget that is larger than anticipated where extra funds are sought from the locale or metropolitan planning organization (MPO); or a modification to the project itself, such as the elimination of the southbound right-turn lane extension from the project. Thus, necessary tradeoffs among design, cost, and scope may not be evident until scoping is initiated, even though they are substantial. Some of these tradeoffs may also necessitate input from the entity that desired the project, such as the MPO or the locale. According to information gathered during one interview, additional funds are typically sought as the project sponsor has already committed publicly to the project (I3).

Results of Scoping

Although a total budget amount is established during the programming phase for PE, right of way, and construction, these dollars are further subdivided during the scoping process. For example, PE dollars might be subdivided into budget categories such as the roadway survey, roadway design, hydraulic design, materials, traffic control, utilities, environmental, and project management. The schedule developed during scoping reflects deliverables, dates, and responsible parties for the remainder of the development process until the construction project is awarded. Project deliverables might include the creation of construction plans, the development of a traffic control plan, acquisition of right of way, and relocation of utilities. Responsible parties are found within several VDOT functional units (e.g., right of way, utilities, environmental, materials, traffic engineering, and scheduling from the central office, district, and/or residency).

Summary

Table 1 summarizes the major steps of the project development process, from planning to construction, using a regionally insignificant intersection improvement as an example.

Influence of Scoping on the Project Development Process

The resultant project scope, budget, and schedule influence project development in two key ways: allocation of resources and public perception of progress.

The project scope dictates how design resources will be spent. As the project development process is one of incremental discovery, additional funds will be needed if additional information leads to the reversal of decisions made earlier in the process. For example, if several alignments are possible for a new proposed facility, ideally, there will be an agreement early in the process as to which alignments should be studied and which should be eliminated from consideration. As recounted by one veteran project manager, however, eliminating an alignment that decision makers later decide should be included can dramatically increase costs depending on how far the process has advanced (I6):

Table 1. Example Project Development Process for an Intersection Improvement[a]

Project Phase	Application to Regionally Insignificant Intersection Improvement
Planning (MPO Long-Range Regional Plan)	Does not apply because MPO Long-Range Plan shows only regionally significant projects
Planning (MPO CMAQ Project Selection)	PDC (or VDOT) staff use Highway Capacity Software (HCS) to estimate volatile organic compound (VOC) and nitrogen oxide (NO_x) reductions for projects including this intersection improvement
Programming (TIP)	Intersection improvement shown in TIP with cost of $1.2 million for adding one turn lane and extending another
Programming (SYIP)	Identical description appears in SYIP
Development (Scoping)	Concerns about underground fuel tanks at initial scoping meeting are found to be valid at scoping meeting 6 months later as noted in State Environmental Review Process (SERP); project scaled back to one turn lane to accommodate $1.2 million cost because MPO cannot find additional resources
Development (Preliminary Field Inspection)	Exact length of turn lane established
Development (Design Public Hearing)	Modification to proposed sidewalk based on public comments
Construction Planning (Pre-Advertising Meeting—Constructability Review)	Amount of earth moved for cut/fill section modified slightly
Construction Planning (Pre-Advertising Meeting— Bidability Review)	VDOT's Scheduling & Contract Division ensures that the advertisement is suitable for bid

MPO = metropolitan planning organization; CMAQ = Congestion Mitigation and Air Quality; PDC = planning district commission; VDOT = Virginia Department of Transportation; TIP = Transportation Improvement Program; SYIP = VDOT's Six-Year Improvement Program.

[a]Some terminology in the left column is based on terminology used by VDOT (2007a).

- *Prior to the scoping process*, a visit to the project site by two designers who spend half a day walking several proposed alignments may cost as much as $500.
- *After the project has been scoped but before a final alignment has been chosen*, a 5-day survey of additional alignments may cost as much as $6,500.
- *After a final alignment has been chosen*, development of an environmental study of a new alignment may cost as much as $100,000.

The costs shown may differ for some projects; for example, the initial site visit might be $5,000 rather than $500 because the entire team visits the site; the costs would be higher in an urban area; and the problem associated with the third bullet could be avoided if the environmental study was done concurrently (I3).

Scoping influences public opinion because the resultant project budget and schedule become the norm against which progress is measured as the project moves through the PE phase (which includes public involvement and environmental review) and into the right of way and construction phases (I3). Although projects are scoped with the intention that construction will eventually occur, it is possible that the scoping process will result in the selection of the no build alternative. For example, VDOT staff in one district noted that the most recent project in their district for which an EIS had been developed—the Outer Connector—had not moved forward because of the MPO's concerns (I8).

Recent Virginia Efforts to Improve Scoping

Over the past 10 years, Virginia has made several efforts to improve the scoping process:

- An internal review of VDOT's scoping process was completed in 1997 with the explicit goal of reducing scope creep (The Scope Review Team, 1997).
- VDOT developed several guidance documents and corresponding checklists designed to help the scoping process.
- The "pre-scoping" process has received attention in the form of an emphasis on initial scoping activities.

1997 Internal Review

This review recommended four changes to the scoping process: (1) provide a purpose and needs statement, (2) establish an electronic system for recording a project's approved scope and subsequent scope changes, (3) schedule multiple project scoping meetings on the same day, and (4) perform scoping prior to the project being introduced into VDOT's SYIP (The Scope Review Team, 1997). Generally, the first three recommendations have been implemented to some degree: projects may include a purpose and need, districts schedule multiple scoping meetings on the same day, and the Integrated Project Manager (iPM) was established to archive some scoping-related material.

Development of Guidance Documents and Checklists

VDOT's *Project Management Practices & Procedures Manual* (VDOT, 2005) identifies the roles of various entities in the project scoping process such as the project sponsor, the project manager, and specific VDOT work units. The emphasis on having relevant parties involved with scoping is emphasized in the VDOT Project Management Office's checklist for the scoping team meeting, which notes up to 22 work units including outside parties where applicable such as the Federal Highway Administration (FHWA), the Virginia Department of Rail & Public Transportation (VDRPT), utility owners, and the locale (VDOT, 2007d). VDOT's Structure & Bridge Division's Scoping Checklist (for maintenance projects) asks 20 questions pertaining to project management and construction feasibility, such as utility concerns, coordination with other VDOT divisions, consistency with features of other long-range plans (e.g., lighting, sidewalks, etc.), and drainage (VDOT, 2004c). VDOT's Environmental Division also uses a checklist that identifies key questions, such as whether a noise analysis is needed, whether water quality permits are required, and whether a Section 4(f) evaluation (which considers the impacts of takings from parks, recreational areas, historic sites, and wildlife refuges) is required (VDOT, 2006b).

The most authoritative source regarding the expectations of the scoping process is VDOT's Informational and Instructional Memorandum LD-210.4 (VDOT, 2006c). This memorandum notes that results of the scoping phase are formally recorded in two forms: the LD-430 (which contains results of the initial field review, project schedule, project cost, and

responsibilities) and the LD-404 (which certifies that the final project, just prior to right-of-way acquisition and/or construction, either has not deviated from the scope outlined in the LD-430 or has adequate justification for doing so) (VDOT, 2006c). These two forms are continuously updated. Subsequent to this research, the LD-430 and LD-404 are also referred to as the PMO-Form-04 and the PMO-Form-18, respectively (VDOT, 2008c).

Initial Scoping Activities

The process before scoping formally begins has received attention in the form of an emphasis on initial scoping activities, such as learning what type of opposition may arise for a particular project, establishing expectations with interested parties prior to the scoping meeting, and ensuring a clear project purpose has been stated (e.g., to decrease "run-off-the-road accidents [on a two-lane facility] by improving horizontal alignment and shoulder width as funding allows") (Winstead, 2004).

Summary of Status of Scoping in Virginia

Scoping is a challenging endeavor in any organization because the decisions made during the scoping process—the design of the project, the project budget, and the project schedule—are initial estimates that are prepared with only minimal information. Scoping may be difficult in VDOT in particular because information and assistance must be obtained from diverse functional units. As noted by one set of interviewees, the project manager has the responsibility for—*but not control over*—all project activities (I2).

Changes have been made to the scoping process over the past 10 years, some of which may have been prompted by earlier work by VDOT (The Scope Review Team, 1997) and the initiatives made at the district level. With increased devolution of responsibilities to the districts, some comments from VDOT staff suggest that scoping practices vary throughout VDOT. For example, some districts have a project management office and others do not (I1, I3). However, it is unknown whether additional changes should be made to VDOT's scoping process.

PURPOSE AND SCOPE

The purpose of this research was (1) to identify challenges to scoping and (2) to identify any lessons learned in the VDOT districts that may be suitable for deployment statewide. The scope of the research was limited to information that could be gleaned from interviews with those involved with VDOT's scoping process and a review of related literature.

METHODS

An interview-based methodology was used to conduct this research, where open-ended interviews with individuals who are involved with some aspect of project scoping provided the

primary data set. To render these interviews as productive as possible, five tasks were performed:

1. *Review scoping-related literature.* Improvements to the scoping process suggested in other states or at the national level were documented. Particular emphasis was placed on identifying procedural improvements followed by state departments of transportation (DOTs) after the project had been programmed (budgeted) and before the project had been constructed.

2. *Interview professionals involved with scoping.* The 27 professionals interviewed represented scoping and initial scoping activities in five VDOT districts (Fredericksburg, Hampton Roads, Lynchburg, Northern Virginia, and Richmond) and included staff from one PDC in Hampton Roads (HRPDC) and the FHWA Virginia Division office. Table 2 provides a summary of the work units represented. Except for one telephone interview, interviews were conducted at the offices of the interviewees.

Table 2. Summary of Work Units Represented in the Scoping Interviews

Interview No.	Work Unit Represented	Number and Category of Interviewees[a]	Interview Focus
I1	Hampton Roads District	1 ENV, 1 L&D, 1 PE, 1 PLAN[b]	How VDOT districts perform scoping
I2	Lynchburg District	1 ENV, 3 L&D, 1 PLAN	
I3	Northern Virginia District	1 ENV, 1 L&D, 1 PE	
I4	Richmond District	1 AM, 1 ENV, 1 L&D, 2 PE	
I5	Hampton Roads PDC	4 staff	Scoping results as seen by an outside agency.
I6	Fredericksburg District	1 PE	Possible procedural improvements to scoping
I7	Richmond District	1 PE	
I8	Fredericksburg District	1 ENV	Environmental resources and requirements
I9	FHWA Virginia Division	2 staff	Federal requirements and observations of VDOT coordination with outside entities

VDOT = Virginia Department of Transportation; PDC = planning district commission; FHWA = Federal Highway Administration.
[a]Key: ENV (Environmental Division), L&D (Location & Design Division), PE (Preliminary Engineering), PLAN (Planning), AM (Asset Management); FHWA (Federal Highway Administration).
[b]An interviewee with VDOT's Scheduling & Contract Division also participated.

A complete list of interview questions is provided in the Appendix and may be summarized as follows:

- *The scoping process itself.* Areas of exploration were whether cumulative impacts and safety should be included in scoping, the involvement of non-VDOT personnel, criteria for project rescoping, databases used for scoping, and suitable scoping performance measures.

- *Potential problems with the scoping process*. Areas of exploration included adequacy of scoping documentation, the tracking of follow-up tasks and third party commitments, and challenges with involving outside agencies in scoping.

- *Potential solutions for improving the scoping process*. Areas of exploration included the use of conceptual plans, the delineation of scoping from related project development processes, and the use of a single project day for the scoping meeting.

Although most interviewees were asked most questions, deviations from this list were made based on the interviewee's area of expertise. The two interviews with individual VDOT PE staff emphasized details of how scoping is done for specific projects. By contrast, the interview with a single VDOT environmental staff member focused on the permitting process, National Environmental Policy Act (NEPA) requirements, and environmental management systems. Because HRPDC staff are not directly involved with scoping activities, their interview focused on the scoping result rather than VDOT's process. The interview of FHWA Virginia staff focused on federal requirements, NEPA-related guidance, and the interviewees' observations of VDOT interactions with outside agencies. A common theme for the interviews was potential scoping improvements based on improvements interviewees had made or problems they had observed.

3. *Verify interview summaries.* Responses from interviewees were typed and sent back to the interviewees for verification.

4. *Review the most recent federal reauthorization and related rules.* Provisions of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) pertaining to the long-range transportation planning, programming, and environmental review processes were examined to determine if the new 2005 federal reauthorization and related rules affect the scoping process.

5. *Revise the document, summarizing the results of Steps 1 though 4 after considering multiple levels of review comments.* On October 24, 2007, the draft report based on Steps 1 through 4 was provided to only one set of interviewees who, in Step 3, had indicated that some of the conditions pertaining to scoping had changed since the interviews had been conducted. After the draft report was revised to address their comments, it was provided to the remaining eight sets of interviewees on December 19, 2007, for review. Comments from that review were incorporated into a subsequent version that was presented for an executive review on March 3, 2008. This review yielded additional comments, one of which was that the 10 options for improving scoping at the end of the draft report should be re-examined by VDOT staff such that their implementation could be facilitated. Comments received by these staff on March 21 were used to modify the options, subject to the constraint that they remain consistent with the findings from the interviews.

RESULTS AND DISCUSSIONS

Literature Review

Project scoping has national attention, especially in terms of (1) changes in costs between scoping and construction, and (2) the length of the project delivery process. For example, a comparison of projected costs to actual costs showed that most Missouri projects (70%) deviated from the initial cost estimate by more than 10% (Missouri DOT, 2003) and that Virginia projects increased on average by 74% from scoping to design (Joint Legislative Audit and Review Commission, 2001). A U.S. General Accounting Office (GAO) statement before the U.S. Senate's Committee on Environment and Public Works reported that a study of six medium and large highway projects required between 6.6 and 15.3 years to complete, not including the planning phase—and only two of these projects required an EIS (GAO, 2002). (One set of interviewees noted that delay may often be attributed to funding being taken from projects, local land use decisions, and political activity [I3]). Thus much, but not all, scoping-related literature has addressed the challenges of completing projects in a timely manner and accurately predicting this length of time.

Some literature focused on the environmental requirements that influence project development and strategies states can use to reduce associated delays. For example, most state DOTs provide some type of funding to other state or federal agencies to "facilitate environmental review and approval" (GAO, 2002). States have also developed formal partnerships (e.g., through memoranda of understanding to establish the length of time to review environmental aspects of projects) with environmental agencies (American Association of State Highway & Transportation Officials [AASHTO], Standing Committee on Quality and FHWA, 2003). States have also sought to steer projects toward the more timely categorical exclusion (CE) category and away from the more time-intensive environmental assessment (EA) category (Dye Management Group, 2004). For example, VDOT and the FHWA Virginia Division now have an agreement as to the amount of documentation required for certain CE activities, which simplifies the NEPA process for these activities (I3). If a project will use federal funds or a federal permit, it must undergo one of three processes: a CE, an EIS, or an EA; an EA will result in either a FONSI (Finding of No Significant Impact) or a decision by FHWA (or the Federal Transit Association [FTA]) to require an EIS.

Another strategy for reducing the time associated with environmental reviews is to develop the project purpose and need early in the process and to ensure that all relevant information is transferred from the planning process to the project development process (Overman and Phillips, 2001). One reason for this emphasis is to garner agreement regarding what the project should accomplish. Pennsylvania's transportation project development process handbook notes: "Throughout project development, it is important to build **consensus** at key points in the process. Perhaps the most critical point is project needs" (emphasis in the original) (Pennsylvania DOT, 1996). Literature related to context sensitive solutions (CSS) suggests that a clearly documented decision process will reduce costs by avoiding the need to re-examine earlier decisions (Neuman et al., 2002). A related reason for developing the purpose and need earlier is that the details from the planning process, such as specific origin-destination travel demand for a facility and the resultant comparison of demand with a facility's capacity, should

explicitly support the statement of purpose and need (Emerson and Hoeffner, 2006). It has been suggested that the purpose and need from planning can be linked to the purpose and need in NEPA (Perez, 2006).

Not surprisingly, differences of opinion between transportation and environmental stakeholders are noted: 64% of environmental stakeholders felt they were not included sufficiently early in the review process, compared with 19% of transportation stakeholders who held the same viewpoint (GAO, 2003). One approach for bringing environmental and transportation professionals into closer agreement—in addition to the aforementioned suggestion of developing a purpose and need statement earlier in the planning process—is to assess environmental performance measures explicitly throughout the planning, project development, and even post-construction periods, a process described as "system monitoring" (Meyer, 2005). The implication is that by increasing agreement earlier in the process, productive directions can be identified and unproductive directions can be avoided.

States have recognized the project management principles that apply to scoping and like Virginia (VDOT, 2005) have published manuals to assist project managers navigate the project development process (Arizona DOT, 2004; Florida DOT, 2006; New York DOT, 2004; Texas DOT, 2004). These manuals include guidance regarding project management concepts such as delegation of authority, team building, and communications skills (Florida DOT, 2006); effective public involvement and the role of CSS (New York DOT, 2004; VDOT, 2006a); how to interpret conflicting requirements based on the legal hierarchy of the source (e.g., a requirement based on the U.S. Code has precedence over a requirement in the Federal-Aid Policy Guide) (Texas DOT, 2004); and specific responsibilities for individual functional units such as district engineers, the right of way division, and the project manager (Arizona DOT, 2004). A methodology that helps assess the quality of various data elements required during scoping (e.g., preliminary traffic control plan, equipment location drawings, etc.) has been developed in Texas to assist project managers with identifying, at various stages during the scoping process, which design aspects require greater attention (Caldas et al., 2007). Thus, several states have rather extensive documentation of the procedural steps within the scoping phase.

Finally, although reduced delay and increased forecast accuracy of schedule and costs are the predominant focus of scoping literature, they are not the only topics. An additional aspect of scoping that has received attention includes the consideration of safety earlier in the process, including during the scoping phase. An example is quantifying the expected crash impacts for various capacity improvements and using that information to modify the project's scope (e.g., changing the type of interchange design based on an analysis of the weaving that will result, where the interchange is part of a proposed freeway widening) (Kononov and Allery, 2004).

Interview Narratives

Results from the 27 staff interviews (see Table 2) are summarized across the three following sections: (1) an overview of the scoping process, (2) potential problems with the scoping process, and (3) potential solutions for improving the scoping process.

Overview of Scoping Process

Interviewees were asked to give an overview of how projects are currently scoped, what scoping should deliver, what types of changes have been made to project scoping, and whether it would be feasible to make further changes to the scoping process. Although many questions were open-ended, interviewees were also asked about specific areas of concern, such as whether there was sufficient time for project scoping and what performance measures would be appropriate. Their comments may be grouped into 11 questions:

1. Is sufficient time allotted for project scoping?
2. What databases are used in project scoping?
3. How are discussions and follow-up items documented?
4. What other agencies should be involved in scoping?
5. Should scoping include indirect and cumulative impacts, mitigation, and safety?
6. When should a project be rescoped?
7. What performance measures should be used to assess project scoping?
8. What is the status of project management practices and procedures?
9. Are post-construction meetings held?
10. What VDOT manuals and processes would require revision if scoping were changed?
11. Would it be feasible to modify the scoping process?

1. Is sufficient time allotted for project scoping?

Interviewees gave a range of answers for the duration of project scoping, but all answers were between 3 and 6 months (I1, I4, I5). The actual scoping meeting itself is typically 1 hour, although a half-day may be required for controversial projects (I6). Although there are no legal deadlines associated with scoping (I9), there are some practical ones: Estimates by the U.S. Army Corps of Engineers for stream mitigation are valid for only 1 year (I1); a new state law requires that CMAQ funds be spent within 4 years (I5); and for consultant-design projects, procurement cannot begin until scoping is completed, which delays getting a design firm under contract (I3). This last point is salient in the Northern Virginia District where 90% of the design work is done under contract (I3). Accordingly, one individual suggested that the same design consultant (1) develop the information needed for scoping, (2) use that information as the evaluation criteria for selecting an alternative, and (3) finalize the scope (I3).

Generally there is sufficient time for project scoping (I2, I4, I9) provided the project manager follows established procedures and the information needed at scoping is organized (I5). There may be insufficient time if there is no project manager—a situation that tends to arise for CMAQ projects outside the urban area (I1). Other factors that may contribute to delay include lack of a planning study prior to the project (I1); the need for comments from state and federal environmental agencies (I3); and the need to have the scoping report approved by VDOT's central office, which some interviewees suggested did not add value (I2).

There are some constraints on the scoping process. Generally, the length of time to complete the State Environmental Review Process (SERP) determines the length of time required for scoping: completion of scoping cannot be done until the SERP is completed (I1, I2,

I4), and at least some information is needed to complete the SERP (I3). A SERP typically requires 3 to 4 months (I3), and a SERP is delayed when the Early Notification Form is submitted late (or a charge number for the project is not available); the late submittal of the Early Notification Form will delay the entire project development process (I3). [The Early Notification Form (EQ-429) is used to initiate the SERP (VDOT, 2008b).] Within the SERP, archaeological sites are particularly challenging as they require more field work than other sites (I8). (It was clarified that actual field work is done after the completion of the SERP, which primarily uses data from information systems rather than field data, and thus should not delay it.) Finally, scoping cannot be undertaken until funding for PE has been established (I1, I2). As is discussed later, this has implications for efforts to conduct scoping prior to a project being placed in VDOT's SYIP.

2. What databases are used in project scoping?

Individual districts have their own servers that may contain complete information on a particular project (e.g., photographs, discussion points, forms, and documents), and a portion of this information may be available within VDOT's iPM, accessible at http://isyp/development/. Environmental documentation for projects, such as the Preliminary Environmental Inventory (PEI) (VDOT, 2006d) which identifies a project's potential impacts in terms of population displacements, hazardous materials sites, underground storage tanks, air quality, public recreation areas, waterfowl and wildlife, floodplains, historical resources, etc., is stored in the Comprehensive Environmental Data and Reporting System (CEDAR), an environmental database run by VDOT. For specific projects, CEDAR information is accessible through the iPM.

Interviewees generally noted that multiple databases are relevant to scoping but that there is no single source for all scoping information (I1, I2, I3, I4). These databases include the aforementioned CEDAR for environmental data (I1, I2); FALCON project design data; the Highway Traffic Records Information System (HTRIS) for geometric standards, bridge sufficiency ratings, bridge inspection reports, accident reports, and traffic counts (I2); orthophotographic area maps (I1); VDOT's internal geographical information systems (GIS) database (GIS Integrator), the Project Cost Estimating System (PCES), Federal Emergency Management Agency (FEMA) floodplain data (I3); and VDOT's Statewide Planning System (SPS) run by VDOT's Transportation Mobility Planning Division (TMPD) (I1). [Except for the FEMA data source, these data are available through VDOT systems.] A concern was expressed that staff time must be devoted to entering environmental information into CEDAR that is not necessary for environmental documentation (I8); however, FHWA noted that VDOT's CEDAR system places it ahead of most states (I9). VDOT does rely on the project manager for the project description that is entered into CEDAR (I3). External environmental databases are also available; for example, the Virginia Department of Game and Inland Fisheries has a statewide database of critical wildlife habitats (I9).

3. How are discussions and follow-up items documented?

The interview comments suggest that the districts have similar procedures for documenting scoping decisions but slightly different areas of emphasis. Multiple interviewees

mentioned the LD-430/AM-430 for documenting the scoping discussion (I1, I2, I8); creation of a scoping meeting narrative summary (I1); use of comment sheets with responses to those comments as a way of resolving issues (I3, I4, I6), including posting comments and their resolution within the database connected to the iPM (I3); and the use of the CEDAR database to record some environmental commitments (I4, I8). Interviewees also agreed on the importance of documenting the scoping results, such as the purpose and need, budget, and schedule (I5, I6), and tracking changes in scope (I3, I8). There were differences in emphasis: some interviewees emphasized the project manager's responsibility to document the minutes of the discussion (I2), and one explained that the record of the scoping meeting should be "a couple of pages of decisions, not ten pages of discussion" (I6).

4. What other agencies should be involved in scoping?

Most interviewees generally agreed that outside participation was beneficial, citing the three reasons of regulatory influence, local government support, and public support.

First, external entities have regulatory influence over certain aspects of project development. Environmental examples are permits from the Department of Environmental Quality (DEQ) and the U.S. Army Corps of Engineers (I9) and the requirements of the SERP (I3). In fact, when outside environmental agencies are sought but do not participate, VDOT's environmental staff must guess what the opinions of these outside agencies will be (I6). Interviewees noted that VDOT's environmental staff should thus be involved early in the process (I9), and one interviewee noted that they are able to understand the concerns of outside agencies but, in contrast to some outside resource agencies, also work to find a solution that will move a project forward (I7). Federal regulations are also a factor: with two-thirds of VDOT projects using federal funding (I5), FHWA's presence is needed at scoping (I2, I4). For example, FHWA can help determine the types of federal environmental documents required at scoping, such as an EIS versus an EA (I9) and coordinate the input of resource agencies (I3). FHWA expects VDOT to gather this information (e.g., the final scope, the SERP PEI, etc.) that will help it determine the amount of documentation required to comply with the NEPA process for a given project (I3). In some cases, VDRPT or local transit agencies should be involved (I2, I3, I4, I5), with VDRPT extending the invitation to the railroad operator (I4). Representatives of utilities may be invited to participate in the scoping discussions if utility information is not available (I9), but VDOT's utility engineer generally is able to make the contacts prior to scoping, perform a site visit, and discuss with utilities how a project will affect their infrastructure (I2, I4, I6). One set of interviewees noted that consultants are invited to scoping meetings (I3).

Second, VDOT and the locale need to be in agreement (I7). Interviewees generally agreed that local governments should participate in the scoping meeting and they are routinely invited (I1, I2, I3, I4, I7, I9). Some interviewees noted that local governments do participate in scoping (I3, I6)—thereby improving the process and identifying other individuals who need to be consulted (I9))—and it is the role of the VDOT resident administrator to invite local governments to the scoping meeting (I4,I7). It was further recommended that these local governments be represented by staff—rather than elected officials—at the scoping meeting (I4). Some interviewees also felt that PDC or MPO staff should be involved with scoping (I2,I4) in part because of their relationship to local government. Others noted, however, that MPOs and

PDCs are already represented because they included the project in the Transportation Improvement Program (TIP) (I6) and they are a creation of local governments (I9) who are already involved with scoping.

Third, involving the general public in some form is productive (I2, I6, I9) in order to understand the level of community support (I9) or to modify the project to accommodate a community's needs. One interviewee noted that a controversial secondary project was opposed until one individual made just one statement: a local fire and rescue official noted that crashes occur weekly at the site—and that statement made the project move forward (I6). Most interviewees noted that such involvement should occur prior to, rather than during, the scoping meeting (I6), whether through the planning process (I2) or through early citizens' information meetings (I4) [held prior to the scoping meeting]. Interviewees also noted that this general public involvement piece describes the public involvement process that occurs at location and/or design hearings (I1).

There is greater external involvement for major projects, especially when different alignments are under consideration (I8, I9).

5. Should scoping include indirect and cumulative impacts, mitigation, and safety?

Interviewees' answers to this question were generally only to the extent that (1) information about these impacts is known, (2) these impacts are integral to the specific project, and (3) their discussion can lead to an early decision (I2, I3, I4, I5, I9). Some interviewees noted that indirect impacts could be discussed (e.g., noise walls will be needed) but that cumulative impacts need not be discussed at scoping (I9). It was also noted that cumulative effects rarely inform decision makers (I9).

Select interviewees' responses, shown in Table 3, demonstrated that it was critical to delineate the depth with which topics can be addressed. For example, it is appropriate to discuss stormwater management areas at scoping because that discussion informs the audience as to the amount of right of way that may be required (I9); however, specific approaches for stormwater management require too much detail to be resolved at the scoping stage (I6). In the absence of detailed environmental information, the worst case scenario is typically assumed when estimating costs (I1) or environmental impacts (I8). Accordingly, there has been discussion as to how to develop more accurate estimates for the environmental costs of a project where these cost estimates could evolve as more details are collected during the project development process (I3). Interviewees also noted that fatal flaws and community expectations should be discussed at scoping (I3).

6. When should a project be re-scoped?

Only one set of interviewees noted the existence of guidelines (specifically, those interviewees mentioned page 6 of Informational and Instructional Memorandum LD-210.3 (I1)) indicating when a project should be re-scoped, although they explained that it is not clear when those guidelines are applicable (I1). [This memorandum was superseded by IIM 210.4 (VDOT, 2006c) and then by IIM 210.5 (VDOT, 2008c).] Some interviewees suggested that some type of

Table 3. Examples of Topics That May Be Included or Excluded from Scoping Discussion

Topic	Discuss at Scoping	Do Not Discuss at Scoping
Context sensitive solutions	Base Realignment and Closure (BRAC) decisions on land use (I3)	Whether project will enhance "smart growth" (I8)
Safety	Relationship of project to Strategic Highway Safety Plan (I5)	Truck lane restrictions (I6)
Scope of project	Modifications to Purpose and Need (I5)	Exact alignment and project limits (I4)
Environmental requirements	• Results of SERP (I3), e.g., whether CE or EA, required permits, hazardous materials locations (I6) • Cultural or historic resources (I3)	EIS level projects (I3)
Public involvement	Type of public involvement hearing that will be used (I6,I8)	Input from VDOT public affairs staff unless major project (I1, I2, I3, I4)
Mitigation	• Whether creation of wetlands is needed to mitigate project (I6) • Mitigation for noise or hazardous material contamination (I3)	Details of wetlands mitigation

SERP = State Environmental Review Process, CE = categorical exclusion, EA = environmental assessment, EIS = environmental impact statement, VDOT = Virginia Department of Transportation.

guidance would be beneficial regarding when projects should be re-scoped (I1, I2, I7). Although specific thresholds are not necessarily feasible (I2, I3), interviewees noted that conditions requiring a re-scoping included the following (I2, I4, I6):

- changes in purpose and need (or when they are unclear)
- when the project does not address the purpose and need (because either the project has changed or the sponsor's purpose has changed)
- major changes in design, cost, or funding
- when the scoping is more than 5 years old
- when the environmental documentation is no longer valid
- when the number of adversely impacted properties changes.

It was also suggested that cost, schedule, and previous commitments—in addition to the factors listed—should determine if a project will be rescoped (I3).

7. What performance measures should be used to assess project scoping?

Almost all interviewees identified potential scoping performance measures such as the following:

- changes in the budget or scope between conception and construction (e.g., number of plan submissions) (I4, I5, I9)
- extent to which sponsor's goals were achieved (I4)
- extent to which results of the scoping process were used to develop the project
- change in performance (e.g., capacity) per dollar expended during the scoping process (I5).

Although interviewees noted that performance measures could improve the scoping process (I4) and address critical problems such as scope creep (I1, I5), interviewees also noted

that the use of performance measures is not a panacea. Notably, costs may increase because of inflation (I1) (e.g., a project manager in 2002 could reasonably be expected to use some estimate of inflation but could not be expected to forecast the growth in oil prices) or unit costs in the PCES may change (I3). It was noted that a large number of plan revisions might be beneficial if they led to cost or schedule reductions (I9) but that strict adherence to deadlines might be counterproductive. The advertisement of a particular project was delayed by 2 months, making it "red" on the [VDOT] Dashboard in terms of construction advertising. [The VDOT Dashboard is a database that reports transportation performance to the public across a variety of areas such as safety, pavement condition, and timeliness of construction projects (VDOT, 2008a).] The reason for the delay, however, was to incorporate design changes and proffers that reduced the overall cost and shortened the construction period by 8 months (I3). Finally, given that the no build alternative and other alternatives that will mitigate environmental impacts are alternatives that are considered as part of the NEPA [or state environmental] process (I3), it is reasonable that a project might, in some cases, simply not be built or be significantly different from the alternative that was envisioned prior to scoping.

8. What is the status of project management practices and procedures?

VDOT has made efforts to improve scoping in the individual districts. Some interviewees noted better communication between various disciplines (I2), especially in terms of increased information exchange for accommodating bicyclists and pedestrians (I8). Other interviewees noted regular monthly reviews of schedules, budgets, Dashboard status, resource issues, PE expenditures, authorizations and budgets, and project status reports using the iPM (I3); however, one interviewee noted that not all project managers are consistently using iPM (I3). One district has drafted guidelines clarifying who has project responsibility at each step of the project development process and a change management policy (I4). Finally, some interviewees noted that development of a project manual had not been feasible because processes are continuing to change (I2). Interaction between scoping and planning has increased in one area in particular: the implementation of the Secretary of Transportation's bicycle/pedestrian policy (VDOT, 2004b) which has resulted in revisions to the LD-430 (I1).

At the state level, FHWA noted that VDOT has received a grant to streamline the planning and the NEPA process and is developing six recommendations to that effect (I9); a review of these recommendations by VDOT's TMPD (VDOT, 2007c) suggests they are intended ensure that environmental data used in planning will have some applicability in the NEPA process. TMPD's guidance should assist VDOT's Environmental Division with developing purpose and needs statements (Mannell, 2008); further, VDOT has issued CSS guidance that addresses the role of public involvement as it relates to project scoping (VDOT, 2006a). FHWA also noted that TMPD has developed guidance for MPOs and PDCs to coordinate planning efforts with state and federal resource agencies (I9). In addition, VDOT has added steps to the latter part of its project development process (such as a "right-of-way re-evaluation" (I9) and an "environmental certification checklist" (I9)) that are designed to ensure that the project being advertised matches the project as originally scoped (I9). VDOT has a project scoping committee, but the committee had not met for 3 years at the time these interviews were conducted (I6).

9. Are post-construction meetings held to evaluate scoping?

No interviewees noted specific examples of conducting a post-construction review of a project to determine its efficacy, attributable in part to the fact that if a project changes substantially (in terms of budget, schedule, or what it will deliver), it will be rescoped (I6). However, interviewees suggested projects that might be beneficial to review in terms of best practices, such as the Cat Point Bridge in Warsaw because of its early public involvement (I8), the I-64/Battlefield Boulevard or I-64/Mercury Boulevard interchange reconstruction in the Hampton Roads construction district, the Hampton Roads Third Crossing Study (VDOT, 2007b), the Route 60 improvements in James City County, the Springfield Interchange in Northern Virginia, and the proposed improvement of Kempsville Road and Princess Anne Road in the Hampton Roads construction district (I5).

10. What VDOT manuals and processes would require revision if scoping were changed?

Interviewees explained that any change in the scoping process would affect several VDOT guidance documents or processes, described by interviewees as district level concurrent engineering progression manuals or concurrent engineering process (I1, I2, I3, I4), the project management manual (I4), the *Road Design Manual* (I1, I2, I3), the concurrent engineering process (I2,I3), various informational and instructional memoranda (I1, I2, I3, I4, I8), and a variety of other processes such as PCES (I2) and SERP (I3). Although FHWA does not have specific scoping manuals, changes in scoping may influence "existing FHWA-VDOT environmental stewardship and efficiencies agreements" (I9). [Since the interviews were conducted, many of these processes and documents have been updated on the VDOT website (http://www.virginiadot.org); examples are IIM 210.5 (VDOT, 2008c), the *Road Design Manual* (VDOT, 2008e), and various project management documents (VDOT, 2008d).]

11. Would it be feasible to modify the scoping process?

The interviews did not reveal many surprises regarding the feasibility of making a change in the scoping process. Staff sizes are not likely to increase, so changes that require additional staff (or staff time) are likely to be difficult or infeasible (I2,I9). If new software or processes are introduced, appropriate training should be provided and dialog with scoping staff should be undertaken early and often (I2,I4). The comprehensive manual "developed for the GEOPACK software" (I4) was cited as a positive example of how training should be provided (I4). Interestingly, one set of interviewees noted that because staff have worked in a "constantly changing" environment, new processes or software should not be difficult to adopt (I2), and one interviewee noted that non-VDOT entities would likely not oppose a change that VDOT makes to the scoping process (I9).

Potential Problems with Scoping Process

Interviewees noted ten *potential* problems with the scoping process. Not all problems were identified by all interviewees, suggesting that some of the solutions proposed in individual districts may address these challenges. Potential problems interviewees noted were:

1. The purpose and need are not firmly established prior to scoping.
2. There needs to be a stronger link between planning and scoping.
3. Projects are scoped for which full construction funding is inadequate.
4. There may be an insufficient number of personnel and/or insufficient experience.
5. It is not always clear what the scoping process should deliver.
6. Better higher level cost estimates are needed.
7. Documentation of scoping decisions may be improved.
8. Outside agencies do not participate in the scoping process to the degree necessary.
9. Outside agencies do not participate effectively in the scoping process.
10. There is no user-friendly single source for obtaining all project information.

1. The purpose and need are not firmly established prior to scoping.

At the initiation of the scoping phase, projects do not have a solid definition of the purpose and need (I1, I3, I4, I9), especially if the project is initiated by a locale (I1). Problems that may result include a lack of consensus among stakeholders (I4) and scope creep (I1). As an example of the latter, a project that began as replacing a bridge escalated to replacing a bridge at a new location, resulting in a substantially higher project cost (I1). Accordingly, the purpose and need should be defined within the transportation planning process (I9), and this purpose and need should carry over to the scoping process. At present, except for the completion of the LD-104 and LD-430, planners have limited involvement with scoping for VDOT-administered projects (unless they are involved with the corresponding long-range plan) and no involvement with locality-administered projects (I1). [The LD-104 is the form used by VDOT's Location & Design Division to request traffic information, such as a 20-year forecast of average daily traffic, from the district planner.]

2. There needs to be a stronger link between planning and scoping.

One set of interviewees suggested that a stronger relationship between the planning process and the scoping process is needed in terms of planning-level estimates of the project's cost and scope (I3), and another interviewee noted that VDOT, localities, and PDCs must have prioritized projects prior to their reaching the scoping stage (I6). [One reason for this prioritization is that at the scoping stage it may be discovered that funds are insufficient for a particular project as intended, in which case options such as seeking additional funds, modifying the scope of the project, or moving forward with another project are all options that should be considered by VDOT and its local partners; another reason for this prioritization logically should be clarification of the purpose and need statement.] In addition, VDOT's planning level costs have been updated to reflect recent construction cost increases and variation by VDOT district (Mannell, 2008).

3. Projects are scoped for which full construction funding is inadequate.

Some projects are scoped even though there is insufficient funding for the subsequent phases of right of way and construction (I9). For example, for one project with a total estimated cost of $150 million, only $5 million had been allocated in the current program. Staff cannot simply elect to avoid scoping such projects: once they are listed in the program and funds have

been allocated, VDOT must scope them (I3). Another set of interviewees similarly noted projects that appear in VDOT's SYIP with insufficient funds for all design work, citing an example of a $30,000 PE allocation for an intersection improvement that, although probably sufficient for at least some of the PE tasks, would not be sufficient for all engineering and environmental studies (I1). Some projects must be rescoped because of the passage of time (I8). Given districts' observations there are too many projects for each project manager (I1, I3), a better approach would be for VDOT's programming process to yield a smaller number of adequately funded projects to scope.

4. There may be an insufficient number of personnel and/or insufficient experience.

Two interviewees noted that they are understaffed: one district noted that a project manager in VDOT's Location & Design Division can manage 3 to 5 projects but that district managers have 15 to 20 projects (I3); another district noted five engineers and two district location and design section project managers for 70 projects (I1).

5. It is not always clear what the scoping process should deliver.

Clarification regarding the outcomes of the scoping process is needed, such as implementation guidance for concurrent engineering (I7) and training for scoping (I4). Cited problems were the lack of a specific person responsible for leading the discussion, scoping attendees being unable to make a decision, clarification of what the disciplines need from the project sponsor, and confusion about which items are addressed at scoping and which items are addressed during the preliminary field review (I4). Finally, it was noted that the scoping process often does not include—but should include—a traffic mitigation plan (I5).

6. Better higher-level cost estimates are needed.

Better cost estimates are still needed (I1, I6, I8), especially for MPO-programmed projects using Regional Surface Transportation Program (RSTP) and CMAQ funds (I1). It was also suggested that this research effort address the role of scoping in locally administered projects (I9). Interviewees noted that because the true "scope" of the project is not known, such as design exceptions or a change in the termini of the project, the current scoping process may not produce an accurate estimate (I2). Although the PCES is helpful, the timeliness of the unit prices is not known (I3).

Two sets of interviewees recommended presenting cost estimates as ranges rather than as point values, both in the long-range plan when estimating land acquisition costs for mitigation sites (I8) and for specific projects (I6). Ideally, cost estimates should be presented with statistically based probabilities (e.g., project *x* has an 80% chance of exceeding $420,000 but only a 10% chance of exceeding $500,000) (I6). To implement this suggestion, one interviewee suggested replicating a process VDOT's Fredericksburg District has followed of archiving actual costs for various projects, enabling one to determine costs based on general features such as the project length, the drainage type, the number of traffic signals, and the type of grade (I6). Another set of interviewees noted that being able to compare the costs of current projects with similar historical projects was a needed but currently unavailable capability (I2).

7. Documentation of scoping decisions may be improved.

There is not a consistent, statewide process for documenting scoping discussions (I4, I6, I7) or for tracking third party commitments such as proffers (I2, I4). The decisions that are made as a result of the scoping process—and changes that occur after scoping has been completed—are not always well documented for two reasons. First, some project documentation is not readily accessible because of incompatible computer systems or, in the case of third party commitments, because it may be stored in different places (I2). Second, existing tools, such as the LD-430, are not adequate because they do not capture the "essence" of the project (I1, I7) or they lack the space to document broad environmental changes (I8). Interviewees thus suggested that documentation of scoping decisions and these additional tasks needs to be improved (I2, I8, I9), citing four examples of processes influenced by scoping: proffers, conformity analysis, environmental justice analysis, and the need for a rescoping.

1. *Proffers*. Information on proffers must be obtained from the locale, the VDOT residency (I3, I4) or the district planner (I2), with the possible exception of right-of-way discussion information, which is available on Form RW24 (I4). [Form RW24 records negotiations between VDOT and a landowner when purchasing right of way (VDOT, undated).]

2. *Conformity analysis*. District planners must work with MPO staff concerning projects that are funded through CMAQ/RSTP that may require modifications to the TIP or STIP (I1).

3. *Environmental justice*. One interviewee noted that third party commitments should be tracked and gave an example of how such tracking was necessary to ensure environmental justice issues are addressed (I1). [Environmental justice is part of Executive Order 12898 (Forkenbrock and Sheeley, 2004), which requires that transportation improvements not have a disproportionately negative impact on minority and low-income populations relative to the population at large.] The example is that in terms of noise abatement, VDOT allows a maximum of $30,000 per residence, although the actual costs of noise walls may be greater. Although wealthier neighborhoods may be able to pay the difference through homeowners' association levies, poorer neighborhoods may not have such resources. Thus, there may be an environmental justice issue in that certain transportation improvements are affecting low income neighborhoods disproportionately (I1). These interviewees noted that the GIS Integrator could be used to address environmental justice impacts by relating the location of transportation improvements to schools, shopping centers, employment centers, and demographic information (I1).

4. *Need for rescoping*. One interviewee noted that changes frequently occur after scoping but that there is not a "trigger" for documenting when a change in scope has occurred (I7). This matches others' statement that rescoping guidelines would be beneficial (I1, I2). [Instructional and Informational Memorandum LD 210.3 was authorized in August 2006 (I1) as some of these interviews were being conducted; it was superseded by IIM 210.4 (VDOT, 2006c) and then IIM 210.5 (VDOT, 2008c).]

It was also noted that documentation of scoping decisions may benefit processes other than the four named, such as the environmental process (I9). For example, several alternative interchange designs were considered as part of the draft EIS for improvements to I-495, and each time a proposed design was rejected, a form was completed that documented the rationale for rejecting the design (I9).

Two related solutions emanated from the interviews. One interviewee suggested that VDOT develop a common statewide storage protocol for project-related documents, noting the Fredericksburg District's example of email templates that consistently list each project by location, name, and other pertinent data (I6). That interviewee noted the [internal] site http://codevbiz/isyp/scoping as an example. A second solution is to include responses to comments as part of the iPM database (I1, I9) and to provide appropriate guidance for how responses should be developed (I4). This should also include the development of guidelines for tracking third party commitments such as proffers (and their inclusion within iPM). The reader may recall that one individual mentioned that not all project managers are consistently using iPM (I3).

8. Outside agencies do not participate in the scoping process to the degree necessary.

Often, outside parties do not participate fully in the scoping process because of limited staff (I8). For example, FHWA's staff has been reduced to five engineering and three environmental staff for all nine VDOT districts (I9). Thus whereas FHWA's area engineers participated in scoping meetings in the 1980s, they rarely attend such meetings at present (I9). The U.S. Army Corps of Engineers and the U.S. Fish & Wildlife Service have just one staff person assigned to Virginia, and the U.S. Environmental Protection Agency (EPA) has no Virginia project-specific staff (I9). Because these agencies have limited staff, they may simply give a summary comment relating to SERP [rather than giving a more detailed comment] (I3). One interviewee further noted that although scoping might be a useful information exchange, it is simply difficult to bring all outside parties together (I8).

9. Outside agencies do not participate effectively in the scoping process.

When outside agencies and localities do participate in the scoping decisions, there may be two conditions that adversely impact the scoping process. First, in some cases, the persons attending the scoping meeting do not have the authority to make a decision on behalf of their agencies; instead, they must transmit information back to their agency and await a decision (I1), and it may be difficult to distinguish between an agency's official position and the comments of an agency's staff member (I8). Thus, an adverse consequence of involving extra parties is delay (I1).

Second, although the project may not be well defined during the scoping process, resources agencies, such as the U.S. Coast Guard, the U.S. Army Corps of Engineers, and DEQ, require well-defined plans and project limits in order to provide comments (I2, I3, I4, I6, I8, I9). One interviewee emphasized that resource agencies such as the EPA and the Corps of Engineers should not be involved too early simply because they cannot provide accurate input early into the process (I1). For example, if a permit will be required, the Corps of Engineers cannot provide a

true answer until the permit is formally requested (I1)—an early answer, prior to the permit request, may not generate accurate information. One interviewee noted, upon reviewing this report, that agency staff do not necessarily understand the scope of the project and may require additional information during project development (I3).

10. There is no user-friendly single source for obtaining all project information.

Once information for a project has been obtained, it is stored within the iPM, but better linkages to project documents and files are needed (I4). In terms of obtaining information from VDOT, interviewees explained that VDOT's internal website (known as "InsideVDOT") has much data but it is not user-friendly (I1), leading interviewees to note the need for a Windows-based database linking all project information sites (I2). [As a clarification, the "InsideVDOT" interface was redesigned in January 2008 after these interviews were conducted.]

Potential Solutions to Problems Regarding the Scoping Process

Interviewees identified eight potential improvements to the scoping process. Not all interviewees suggested all solutions. Instead, the solutions presented either have been put in practice or were proposed in response to a specific challenge. These solutions were:

1. Raise questions at the initial scoping meeting; make decisions at the scoping meeting.
2. Run the scoping meeting effectively.
3. Do not use charters but consider related streamlining agreements.
4. Do not rely on checklists.
5. Consider the use of in-house staff to create conceptual plans.
6. Consider performing some scoping prior to programming.
7. Consider possible database enhancements.
8. Consider using a "risk assessment page."

1. Raise questions at the initial scoping meeting; make decisions at the scoping meeting.

Interviewees who used initial scoping (I2,I6) emphasized its value; some environmental concerns through SERP have been identified as early as the initial scoping stage (I2). It was also mentioned that spending extra time at the beginning of project development can reduce overall costs (I9). In the exact words of one interviewee (I6):

> The difference between the pre-scoping [initial scoping] meeting and the scoping meeting cannot be overemphasized. The former is a day of questions that identifies what tasks a project will entail. Thus the outcome of the pre-scoping [initial scoping] meeting might be several questions, such as those shown below, with assignments for specific staff:
>
> - What public involvement process do we need? (For example, are artist's renderings required for public meetings? Do we need to verify that other stakeholders are supportive of the project?)
> - Are there unique environmental hazards, such as underground storage tanks?
> - Which bridge piers are the best balance of design and aesthetics?
> - When will field visits be made and who needs to attend?
> - Are the people involved now those who can formally approve the project's scope at the upcoming scoping meeting?

- Which alternatives need to be analyzed?
- Will mitigation be required, such as the provision of additional wetlands?

> By contrast, the scoping meeting is where decisions are made. Prior to that meeting, a pre-scoping [an initial scoping] report should have been generated. At the conclusion of the scoping meeting, the project schedule and budget are finalized.

Others who did not mention initial scoping directly still reinforced the view that the scoping meeting was a day of resolution rather than a day of addressing new issues (I3). For example, in one district, the project manager receives (and responds to) comments from the various functional units (right of way, traffic engineering, construction, etc.) prior to the scoping meeting such that decisions can be made at the scoping meeting (I3). Interviewees also clarified that although some joint site visits clearly added value (e.g., a project that had been delayed for 2 years moved forward within 3 months after VDOT and the county jointly visited the site [I1]), it is not productive to hold large scale meetings at the project site because of safety concerns (I1) and the tendency of larger groups to break into smaller ones and thus for some participants not to hear the entire discussion (I2). Instead, site visits transpire prior to the scoping meeting. Typically, the time between the initial scoping and scoping meetings is between 30 and 90 days (I6).

2. Run the scoping meeting effectively.

Four criteria were noted to run the scoping meeting effectively and have a decisive outcome (I6):

1. *Each discipline should have reviewed information prior to the scoping meeting*. For example, a representative of VDOT's Right of Way and Utilities Division will have reviewed information pertaining to gas, power, water and telephone, and cable television lines and be prepared to make decisions at the scoping meeting.

2. *All and only those persons with authority to make a scoping decision should be included.* For example, for the project described in Table 1 where an intersection improvement sought by the MPO with its CMAQ funds cannot be undertaken with the funds available, the scoping meeting will result in a decision either to seek additional funds (thus possibly delaying the project) or to scale back the improvement (thus not making the emissions impact that was sought). Clearly, a PDC representative (since it staffs the MPO) should be at the meeting—unless the PDC takes the position that it defers to the locale's wishes, in which case a local representative should be present.

3. *A facilitator other than the project manager should run the meeting*. This facilitator should (1) have credibility with the audience, (2) understand the technical and process discussions that will arise, and (3) not let the meeting end without a decision being made. Examples of facilitators might be the district PE manager, the district location and design engineer, or other persons who meet the three criteria. The facilitator may not be necessary for all projects (I3).

4. *A single statewide project scoping day should be implemented.* One interviewee stated if this research could result in only one process change, this would be his suggestion (I6). Given that the scoping day can require more than a dozen disciplines from the district office alone, finding a way to have all disciplines represented at the meeting is essential. It was later noted that a scoping day of the second Wednesday has been adopted but that some others in VDOT still schedule meetings on this day (I3).

3. Do not use charters but consider related streamlining agreements.

Two interviewees directly commented that charters are not useful tools for scoping (I2, I6). Because of the charter's nonbinding nature, the time is better spent developing relationships between interested parties for specific projects (I6). However, interviewees noted that a memorandum of understanding (MOU) or a memorandum of agreement (MOA) is helpful (I6, I8), citing the example of an MOU developed for the state fair project that included the U.S. Army Corps of Engineers, FHWA, the State Fair, and the Virginia Department of Historic Resources (DHR) (I8). One set of interviewees noted that charters are useful if they are taken seriously (I3).

One interviewee noted that VDOT has established long-term agreements with other agencies (I8). An example is the U.S. Army Corps of Engineers, where VDOT identifies wetlands; the role of the Corps of Engineers is simply to confirm VDOT's findings; no other state agency has a similar relationship with the Corps of Engineers. Other examples have included VDOT funding positions at the DHR and the DEQ and a former partnership with The Nature Conservancy on a particular project. Another interviewee noted that in the past VDOT funded a DEQ position but found that the individual was not devoting all of his or her time to VDOT projects (I9).

4. Do not rely on checklists.

Almost all interviewees noted checklists already in use, such as the PEI for the SERP (I2, I8), the LD-430 (I1, I6), the "Quality Assurance/Quality Control list" (I2), and checklists generally (I3, I4, I5, I7, I9). Some interviewees noted that the existing checklists may be useful in an informal role such as educating new staff, ensuring key issues are not omitted, and possibly standardizing the scoping process (I1, I2, I4, I5, I6, I9). One reviewer of this report noted: "Checklists are great tools and some should be exactly that: tools [are] not mandatory documents" (I3).

Generally, interviewees cautioned against relying on checklists as a way of improving project scoping per se. Checklists are not a good communications instrument and thus cannot address documentation issues cited previously, such as the need to track commitments (I8) or describe major issues (I1), and they can become too long if they are not well organized (I2). Checklists also need to have "buy-in" as to their purpose in order to be effective (I3).

Most significant, however, interviewees noted that checklists were not a good substitute for experienced project managers, a field review of the project, and coordination with other

functional units (I1, I9). Concern was also expressed that a checklist could "dumb down" the process (I3, I9) and not challenge staff to develop innovative solutions. Instead, interviewees emphasized the need for quality level guidance, such as how to conduct the scoping process (I7) or how to standardize the agenda (I4). Interviewees specifically noted that the scoping process should not be a "paper exercise" (I1).

5. Consider the use of in-house staff to create conceptual plans.

All interviewees who mentioned the use of conceptual plans (also known as renderings or 3D/4D visualizations) spoke positively of their use (I2, I3, I6, I9) [for the purposes of public involvement or determining project impacts on other features], although two warnings were given. The first warning is that at the scoping stage, many design features have not been determined; thus, the public must be informed that a given rendering is subject to change (I9). The second warning is that as these conceptual plans also have a cost; they are required for only some projects—such as location studies (I3). Two interviewees suggested that VDOT staff can produce these renderings (I2,I6): one noted that 36-inch by 36-inch drawings were provided by a VDOT graphics person for about $1,000 each—about one seventh of the cost of having the work done by an outside consultant (I6). However, one interviewee noted that the district simply still does not have the resources to do this (I3).

6. Consider performing some scoping prior to programming.

Interviewees generally favored the suggestion of conducting some portion of the scoping process before the project is placed in VDOT's SYIP (I1, I2, I3, I5, I9). Interviewees noted that by performing scoping earlier, those projects that are unlikely to be built because of higher than expected costs, public opposition, or environmental concerns could be eliminated (I3, I9). One individual wrote: "It is perhaps PE [preliminary engineering] work and RW [right of way] purchase for these unmanageable projects which causes PE and RW expenditures to consume half of VDOT spending in one district"(I5). With a clearer purpose and need, it would be easier to prioritize projects and eliminate from the program those that are not as critical to the region's needs (I5). In practice, an informal version of pre-programming scoping already occurs for a certain subset of projects: the district provides to resident engineers a scope for several possible *secondary* system improvement projects, and the residency use these scopes in discussions with the county board of supervisors to select which secondary projects should thus enter the secondary SYIP (I2). To test further how project needs can be addressed earlier in the process, interviewees suggested examining major investment studies (I5). One set of interviewees noted that VDOT's 2010 Statewide Highway Plan (VDOT, 1989) was a "great needs assessment document" (I1) that might be expanded with the proposed 2035 state plan to provide rankings [which could help with scoping].

Several budgetary and practical considerations for performing scoping earlier in the process were noted. Some funds (perhaps an administrative budget or set aside) would need to be established for such early scoping activities [the reader will recall that scoping cannot begin until PE funds have been authorized], and there are implications for how VDOT manages projects under the Public-Private Transportation Act (since such projects tend to be awarded after programming; in this report, it is proposed that some scoping might be done before

programming) (I1). Further, district management might not want to see additional charges being placed in the administrative budget (I3). Thus, it is not clear how scoping work can be done before a charge number for scoping has been established (I3), given that this charge number is given after, rather than before, programming.

Some problems might simply be moved from the scoping stage to the programming stage (I1). Details pertaining to the exact location and design of a project are also lacking at the planning phase, which can hinder the assessment of environmental imperatives needed for scoping (I8). One interviewee noted that "it depends" as to whether scoping should precede programming, noting that one project had not moved forward despite substantial effort toward environmental, location, and scoping studies (I8). Interestingly, some interviewees suggested extending the concept of scoping to Intelligent Transportation Systems (ITS) projects, noting that VDOT had encountered difficulties regarding the cost and schedule for these projects (I5).

7. Consider possible database enhancements.

Interviewees suggested two ways to change how databases are used in project scoping. First, VDOT could provide database access to PDCs and vice-versa. VDOT and PDCs do not have access to each other's databases (I1); interviewees further suggested that scoping might benefit from the use of databases and maps produced by PDC staff (I5). Second, some databases might be used more frequently. These include SPS (I2); data from the Virginia Port Authority for projects where freight movement is a key reason for the project (Florin, 2008); and, for the explicit purpose of determining transportation and land use impacts, the local comprehensive plan or real estate information (I3). Although VDOT's GIS Integrator is routinely used for specific projects, one set of interviewees suggested using GIS at the regional level to determine the extent to which proposed and completed projects have been consistent with [county and regional] long-range plans (I1).

Interviewees also suggested that new applications could be developed to support scoping. A financial tracking system that allows the comparison of project expenditures and design progress was suggested (I2); it was also suggested electronic submission, rather than paper submission, of the scoping report to VDOT's Central Office be allowed to reduce delays (I3). One set of interviewees also suggested the development of a scoping team site with applicable scoping information.

8. Consider using a "risk assessment page."

VDOT's Northern Virginia District reported success with its risk assessment page (I3), which identifies uncertainty in the various aspects of a particular project such as public involvement and soil conditions. The value of this risk assessment is that it engages the diverse disciplines and forces them to identify issues that may affect the project scope and to agree that a project can move forward given the level of risk in these areas; e.g., the risk assessment page can help contrast available internal staff and consultant services (I3). An interviewee noted that this page needs and does not have, however, a way of measuring [e.g., quantifying] the risk (I3).

Impact of Recent Rules Promulgated under SAFETEA-LU on the Project Scoping Process

Since the passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991, Congress has enacted two federal reauthorizations: the Transportation Efficiency Act for the 21st Century (TEA-21 in 1997) and SAFETEA-LU in 2005. Although the language in those reauthorizations is somewhat broad (e.g., the phrase "project scoping" does not appear anywhere in the 836-page SAFETEA-LU), recent regulations promulgated under these reauthorizations do have a limited impact on project scoping.

On February 14, 2007, FHWA adopted new statewide transportation planning and metropolitan transportation planning regulations for the first time since 1993 (72 Fed. Reg. at 7266). (Citations from the Code of Federal Regulations [C.F.R.] are used when referring to a legally binding regulation; citations from the *Federal Register* [Fed. Reg.] are used when referring to the legislative history of a regulation.) Although much of the updated regulations still pertain exclusively to the planning process, the new planning regulations do have a limited impact on the project scoping process.

Several sections in the new regulations relate to the linkage between the transportation planning process and the NEPA project development process. Although the new regulations do not mandate a change in the preparation of the EIS, they *encourage*—but do not require—a tighter link between the scoping and the planning process in two distinct ways directly relevant to interview comments.

1. *Provide adequate detail at the scoping stage such that this information may be used directly within the NEPA process.* The regulations encourage, but do not require, VDOT to ensure that adequate detail is provided at the scoping stage such that this information may be used directly within the NEPA process. Several sections of the new regulations emphasize performing the scoping process in sufficient detail such that some of the analysis that would otherwise be needed under the NEPA process need not be repeated. First, 23 C.F.R. § 450.212(a) states that "the results or decisions of [corridor or subarea planning studies] may be used as part of the overall project development process consistent with the National Environmental Policy Act." Similarly, § 450.212(b) allows for this material to be "incorporated directly or by reference into subsequent NEPA documents in accordance with 40 C.F.R. 1502.21, if . . . the [study] is conducted with documentation of relevant decisions in a form that is identifiable and available for review during the NEPA scoping process and can be appended to or referenced in the NEPA document."

The use of the word "may" in § 450.212 means that Virginia is *not* required to use corridor or subarea planning studies as part of the project development process, but it *may choose* to do so. Incorporating this material into the subsequent NEPA process may be desirable since it could reduce the cost of the NEPA process by reducing duplicative work and by providing for smoother transition between the planning process and the NEPA project development process. However, if Virginia decides to incorporate those studies into subsequent NEPA documentation, it may do so only if relevant planning decisions are documented with

sufficient detail as to be identifiable and reviewable by relevant parties during the NEPA scoping process.

Finally, in 23 C.F.R. 450.322(f)(6), the regulations do provide that "the metropolitan transportation plan shall, at a minimum, include . . . design scope descriptions of all existing and proposed transportation facilities in sufficient detail, *regardless of funding source*, in nonattainment and maintenance areas for conformity determinations under the EPA's conformity rule" (emphasis added). Further, "in all areas (regardless of air quality designation), all proposed improvements *shall* be described in sufficient detail to develop cost estimates" (emphasis added). However, § 450.322(f)(6) is unchanged from its previous versions, so it does not place any new requirements on the planning or scoping process (72 Fed. Reg. at 7245).

2. *Adequately document changes made during the scoping process such that an outside reader can determine, from this documentation alone, how a project's current scope evolved.* Question 4 of Appendix A of the regulations asks: "What is the procedure for using decisions or analyses from the transportation planning process?" The answer notes that a "robust scoping/early coordination process (which explains to Federal and State environmental, regulatory, and resource agencies and the public the information and/or analyses utilized to develop the planning products, *how the purpose and need was developed and refined*, and how the design concept and scope were determined) should play a critical role in leading to informed decisions by the lead agencies on the suitability of transportation planning information, analyses, documents, and decisions for use in the NEPA process (emphasis added)" (72 Fed. Reg. at 7281).

As an example, if a project that initially required a widening from two to four lanes was scaled back to three lanes because of cost considerations, documentation at the scoping process might include the fact that underground storage tanks precluded the addition of a turning lane because the costs of the environmental remediation were too high. However, the answers provided in Appendix A are "intended to be *non-binding* (emphasis added)" and are provided merely to provide "additional information to explain the linkage between the transportation planning and project development/National Environmental Policy Act (NEPA) processes" (72 Fed. Reg. at 7280). Thus, the appendix is meant only to clarify the circumstances under which "transportation planning level choices and analyses can be adopted or incorporated into the process required by NEPA" (72 Fed. Reg. at 7280).

In their section-by-section discussion of the regulations, FHWA and FTA note that they "continue to be staunch advocates of addressing NEPA issues and initiating the formal project level environmental analyses as early as practicable in the overall project development framework, including the transportation planning process" (72 Fed. Reg. at 7242-43).

CONCLUSIONS

The scoping process is an influential yet intermediate step in project development that has not been evaluated in VDOT since 1997. Responses from interviewees knowledgeable about

this process provide a unique opportunity to document some of the common problems faced in project scoping and some possible solutions. These responses, and related literature, support the following conclusions:

- *Although SAFETEA-LU does not require changes in how project scoping is done, related rules provide an opportunity to link scoping to the later NEPA process.* These rules encourage—but do not mandate—state DOTs to document decisions made throughout the scoping process in such detail that they may be suitable for use in NEPA, a theme consistent with some of the recent scoping literature (Perez, 2006).

- *Because it relies on results from the planning and programming processes, imperfections in these processes adversely affect scoping.* Scoping relies on a purpose and need from the planning process as emphasized by both interviewees and the literature (Emerson and Hoeffner, 2006; Overman and Phillips, 2001); however, sometimes this purpose and need is not adequately documented. Although a project is assigned a project manager at the initiation of scoping, the project manager may not have been familiar with the planning and programming process that led to the project as presented, and planning staff may not necessarily be involved with the project once it is scoped. A project must be scoped if funds for it are placed in the transportation program; however, sometimes the programmed funds are inadequate for the project.

- *Although the involvement of external agencies (e.g., localities, DEQ, EPA, and FHWA) is essential to successful scoping, this involvement has been difficult to obtain.* Reasons cited were a lack of available external staff (e.g., EPA has just one staff person for the entire Commonwealth) and an inability, in some cases, for such external staff to provide meaningful input for a project while many design aspects have not been finalized (which is the case while a project is being scoped). Public involvement is thus another "external" process that affects scoping.

- *Although the iPM and scoping team sites provide some information, some database applications are still needed.* There is at present no systematic information technology application that records third party commitments (such as proffers made to a local government that would have occurred during the planning phase). Additional applications that are needed include a way of recording design changes that are made subsequent to the scoping process and a record of costs. (The LD-430 by itself does not fully capture all information pertinent to the project.)

- *Several initiatives might improve project scoping.* Process-based initiatives include clearly separating the initial scoping and scoping meetings, taking steps to ensure that the scoping meeting results in a decision rather than the need for additional information, using existing tools such as a risk assessment page, ensuring that a project manager is identified for each project, and performing some scoping prior to the programming stage in an effort to identify those projects that should receive the highest priority for scoping. A proposed product-based initiative was to present statistically defensible cost ranges rather than point values (e.g., "there is 95% confidence that this improvement will be between $*x* and $*y*).

- *It is possible to make changes to scoping that are counterproductive*. There are several initiatives that interviewees recommended either not doing or doing with caution. These included project charters (which should be avoided as they are time-consuming and nonbinding), checklists (which may be used to ensure no critical agenda items have been omitted but that should not become additional forms that need to be completed), and performance measures (which can be developed—five were identified—but that should be carefully administered lest scoping efficiency be prioritized higher than project delivery).

- *Field experience remains essential*. Interviewees *explicitly* stated that field experience is essential: some noted that a lack of such experience had been detrimental, and others noted having this experience had been beneficial. Interviewees *implicitly* supported the importance of field experience by describing situations where no formal guidance is available (e.g., such as determining when a project should be rescoped (I1, I2, I7) and noting that checklists, although helpful, cannot replace such experience (I1, I9).

RECOMMENDED OPTIONS FOR IMPROVING THE SCOPING PROCESS

The results and conclusions of this study suggest a menu of 10 options for improving the scoping process; some are already in place or under consideration in some VDOT districts. Although implementation of the first 8 options may involve, to varying degrees, both central office and district staff, the decision regarding whether or not to implement them as a matter of policy rests with VDOT's Chief Engineer. Options 9 and 10 are directed toward the research community at the state and national levels, and thus implementation of these rests with that audience.

None of these 10 options is a panacea. For example, regarding Option 7, as one interviewee explained (I1), early involvement of external environmental staff does not guarantee success when permits are sought: such staff may not be able to forecast their response accurately until they are presented with a detailed request. In short, the advantage of these options is that they are largely initiatives that VDOT can undertake with or without external cooperation; however, their efficacy is affected by external influences.

Process-Based Options

1. *Select a monthly project day statewide.* A critical requirement of the scoping meeting is that all parties who have decision authority need to be present at this "day of decision" (I6), when the project's schedule, budget, and scope are finalized. These parties include diverse functional units inside and outside VDOT as identified by the project manager.

2. *Delineate scoping-day decisions from other activities in the scoping process:*

   - Define the purpose and scope during the planning stage (e.g., the Constrained Long-Range Plan, TIP, and VDOT's SYIP).
   - Use an initial scoping meeting to raise key questions.
   - Ask each discipline (e.g., utilities, right of way, etc.) to collect necessary information prior to the scoping day.
   - Administer the scoping meeting in such a manner that a definitive decision results.

   Using the example of Table 1, the planning stage identifies potential intersection improvements (extend an existing turning lane, add a new turning lane) and the scoping stage either eliminates one of these improvements or seeks additional funds to reconcile the project scope and the project budget.

3. *When appropriate for a specific project, consider initiatives that have been successfully employed in one or more VDOT districts*. These include using (1) a risk assessment page, (2) in-house staff who can create 3D/4D visualizations if sufficient funds are available (I3) and needed for the purposes of public involvement or understanding project impacts, (3) memoranda of understanding or agreements that have *specific binding* clauses, (4) existing databases such as TMPD's SPS, and (5) a facilitator distinct from the project manager. Initiatives that interviewees did not recommend included (1) a project charter and (2) additional detailed checklists (except as possibly an agenda item). These initiatives are at the discretion of the project manager and may or may not be appropriate based on the complexity of the project.

4. *Allow electronic submission rather than paper submission, of the scoping report to VDOT's Central Office in order to reduce delay.*

5. *Consider providing resources to perform scoping prior to programming*. Interviewees strongly advocated performing scoping prior to programming in order to prioritize projects entering into the program. Rules promulgated under the SAFETEA-LU reauthorization support, but do not require, such an initiative, and this was the only of four initiatives not implemented from the VDOT review conducted a decade ago (The Scope Review Team, 1997). VDOT should consider providing some funds to perform scoping before projects are placed in the program; such funds should be separate from the "administrative" category as charges to such a category are discouraged and some accounting controls are necessary such that these funds are used for their intended purpose. The extent to which this change would result in a cost savings depends on the extent to which these pre-programming scoping activities reduce the number of projects that are scoped after programming but that never move forward to construction.

6. *Support efforts to link planning and scoping*. Some interviewees noted a weak link between the planning phase and the scoping phase. Since the interviews were conducted, however, VDOT has begun a formal process to link planning and scoping (VDOT, 2007c). At this stage, therefore, the most appropriate recommendation is to support these efforts actively until more experience with this initiative is obtained. For example, the first recommendation

from that effort is to ensure that planning documents contain a "purpose and need information at an appropriate and useful level of detail" (emphasis in the original) (VDOT, 2007c). Active support might include modifying the LD-430 to provide additional detail relevant to the purpose and need and/or actively working with planning staff to refine further the purpose and need for a particular project. (In the interviews, challenges noted were the link between planning and scoping and an unclear purpose and need.)

Product-Based Options

7. *Using one or more case studies, develop a single primer that explains to an outside audience how the scoping process influences project development.* Scoping requires difficult tradeoffs pertaining to project cost, schedule, purpose, and impact. Successful scoping requires *input on these tradeoffs—not just comments*—from persons outside VDOT: localities, PDCs/MPOs, and resource agencies. Yet garnering the attendance of outside persons at the scoping meeting is difficult, and when they are able to attend, the project uncertainty hinders meaningful input. A primer with a few real examples should be developed to convince outside parties that their attendance at the scoping meeting is worthwhile. These examples should also clarify the role of scoping, given comments from one reviewer (I5) that the purpose and definition of scoping are not clear and comments from another reviewer that sometimes internal (as well as external) staff have difficulty providing meaningful input to the scoping process when design aspects are not finalized (I3). This primer would not be the responsibility of the project managers or the district; rather, it would be a single document that VDOT could use as a public relations instrument to make external participation in the scoping process more productive. Lessons learned from making other processes (e.g., major investment studies) understandable to an outside audience may be a starting point for developing a primer that explains scoping to an outside audience.

8. *Consider enhancements to the iPM or scoping team sites as recommended by interviewees.* Several enhancements were recommended; at this stage it is not clear if these should be done as part of the iPM or as part of the scoping team site. Listed in order from most important to least important, these enhancements are:

    - a way of tracking responses to comments, changes in scope, and third party commitments such as proffers (I1, I4, I9)
    - a financial tracking system that compares project expenditures and design progress (I2)
    - a common statewide protocol for storing project-related documents (I6).
    - a template that enables persons to trace decisions made throughout the project development process
    - a means of making select VDOT scoping data available to outside agencies and vice versa (I1, I5)
    - a link to the local and regional comprehensive plans so that it is possible to determine the extent to which projects are consistent with these plans (I1)
    - possibly a team site that stores all forms and guidance in one location (I1), with such guidance possibly indicating guidelines for when a project should be rescoped (I7).

These enhancements are not independent; for example, a common statewide protocol for storing project documents (third bullet) can become a template that enables outside readers to understand how a project evolved through the project development process (fourth bullet). As noted by interviewees, all project documents need to be entered/downloaded into iPM (I1) and iPM should be used consistently to establish "an official project document record" (I3).

Options for Future Research

9. *Develop percentile-based cost formulas that will enable analysts to say "projects of type x have a 90% probability of costing between y and z."* Such formulas should be based on records of actual project costs archived over time (I6). This percentile-based cost formula should be shared with MPOs, regional planning groups, and localities because of their involvement with RSTP and CMAQ projects.

10. *Investigate the utility of scoping performance measures.* Interviewees identified four performance measures, suggesting that performance measures are *feasible*. Interviewees asked whether these metrics could have unintended consequences, thus suggesting that performance measures may or may not be *useful*. Given that interviewees recommended that the scoping history for certain successful projects be considered (e.g., Warsaw's Cat Point Bridge and James City County's Route 60 improvements), the utility of performance measures could be assessed by using such projects as case studies.

COSTS AND BENEFITS ASSESSMENT

Table 4 summarizes the potential benefits and potential costs of implementing the 10 options. In most cases, the cost and benefits cannot be accurately quantified as a dollar value because the full cost is not known (e.g., improvements to an information system as per Option 8). Table 4 may assist decision makers with choosing which recommendations are the most feasible (in terms of cost) and productive (in terms of benefits).

Table 4. Potential Benefits and Costs Associated with Implementing Options for Improvement

Option No.	Description	Potential Benefit	Potential Cost
1	Select and encourage monthly project day statewide.	Increased likelihood that all parties will be present on scoping day, thereby increasing this meeting's efficiency	No monetary cost, but less flexibility for other parties that need to schedule meetings
2	Delineate scoping-day decisions from other activities in the scoping process.		Increased workload for project manager
3	Consider initiatives used in some districts, such as risk assessment page.	Reduced overall costs during scoping process	Increased costs at specific points where funds may not be available (such as staff time to create or enhance such a page)
4	Allow electronic submission of scoping report.	Faster submission of scoping report	None identified
5	Consider providing resources to perform scoping prior to programming.	Should reduce overall costs to extent that this change would result in certain projects not being programmed	Requires special charge number—not overhead—to which scoping for such not-yet-programmed projects can be charged
6	Consider providing resources to perform scoping prior to programming.	Better use of planning data at scoping stage (or more informed planning decisions based on scoping results)	Cost of modifying LD-430 and possibly associated training for planning staff
7	Develop primer explaining to outside audience how scoping process influences project development; base primer on one or more case studies.	Potentially clarifies for staff in resource agencies and localities what types of information (and input) they can provide that will influence scoping process	Cost of collecting detail for suitable case study; figure of 100 person hours is suggested; cost may be lower or higher depending on availability of archived data
8	Consider enhancements to iPM or scoping team sites.	Reduction in time to extent that having one central site will yield benefits	Administrative cost of training; technical cost of modifications to existing systems
9	Develop percentile-based cost formulas.	Provide cost estimates as range rather than point value (thereby clarifying degree of uncertainty associated with project).	Cost of collecting these data and performing analysis; cost will be lower if archived data are readily available
10	Investigate utility of scoping performance measures.	Identifies whether PMs are/are not useful in this particular area	Cost of collecting archival data and developing project managers; cost may be reduced if done in conjunction with Options 7 and 9

ACKNOWLEDGMENTS

This work could not have been accomplished without the insights offered by persons who were interviewed for this effort: Cathy Arrington, John Carwile, Rob Case, Brian Casto, Shannon Cotulla, William Cuttler, Emmanuel Darko, Dwight Farmer, Nick Froelich, Dean Groome, Sam Hayes, Thomas Holmes, Jeff Kessler, Michael Kimbrel, Harry Lee, John Lynch, Jack McCambridge, John Muse, Ken Myers, Steven McNeely, Bob Pickett, Rich Prezioso, Camelia Ravanbakht, Robert Scott, Eric Stringfield, Ed Sundra, and Jim Utterback. This work was guided by a steering committee composed of Jim Utterback (chair), Jeff Florin, Harry Lee, Ben Mannell, John Mazur, Barbara Nelson, and Bob Pickett. Comments from these individuals and additional review comments from Emmett Heltzel, Adam Jack, Brent Sprinkel, and Jim Zeller were helpful in modifying select recommended options. Responsibility for the accuracy of the contents herein, however, rests with the authors.

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APPENDIX: INTERVIEW QUESTIONS

These questions served as a rough guide of the questions interviewers asked; however, questions were added and deleted based on the interviewee's expertise. For example, PDC and FHWA staff were not asked about VDOT's internal databases but were asked about SAFETEA-LU implications for scoping.

General Questions Interviewers Asked Most Interviewees

1. What are the problems with the current scoping process & how might it be improved? What techniques and practices have you found helpful in improving the level of detail or quality of project information offered at the first scoping meeting? What techniques and practices have proven ineffective?

2. Within the project development timeline, is sufficient time allowed for the scoping process? Sufficient funding?

3. Are the discussions, follow up items and issues that arise at the scoping meeting adequately documented? If not how might this be improved?

4. How receptive are you to using checklists at scoping? What concerns do you have? Could a checklist enhance the quality of the initial project presentation?

5. How could the use of technology enhance the scoping process?

6. What on-line resources should be available to the scoping team?

7. What is the status of the implementation of the project management practices & procedures in your district?

8. Should indirect and cumulative impacts, mitigation and safety effects be discussed at scoping? What other topics should be part of the discussion?

9. What performance measures should be used to assess the effectiveness of the scoping process?

10. What other VDOT manuals and processes would require revision with a change in the scoping process?

11. When should a project be re-scoped?

12. Could you provide me with copies of a typical project charter and a change control document?

13. How can third party commitments, agreements and requirements be tracked as part of scoping?

14. How can follow-up tasks that arise at scoping be tracked?

15. How important are conceptual plans or renderings to the scoping discussion? Should a standard format be adopted across the state?

16. How significant are the following barriers, risks and strategies to the enhancement of scoping:
    - Development of a new process may take longer than expected
    - The process may take longer than the legally required timeframe
    - Additional staff may be required
    - Need to obtain buy-in from partners, staff & agencies
    - Need for training on new tools
    - Need for new tools
    - Difficulty in transitioning
    - Unrealistic expectations
    - May not yield intended outcomes

17. What are the advantages and disadvantages of involving the following entities in the scoping discussions:
    - General public
    - Local governments
    - MPO & PDCs
    - Utility companies
    - State & federal resource agencies
    - Railroads
    - VDRPT
    - DEQ
    - Corps of Engineers
    - Coast Guard
    - VDOT District Public Affairs office
    - Other

Examples of Specific Questions Interviewers Asked Only a Few Interviewees

18. What has been the extent of the Virginia Division Office's participation in scoping and project day discussions? What factors have influenced the office's decision to attend or not attend a scoping discussion?

19. How does the office view its responsibilities for project coordination and development under SAFETEA-LU? What has been the role of the office in coordinating the review and input of federal and state resource agencies at scoping?

20. What factors limit resource agency participation in the scoping process? How receptive is the FHWA to the use of mediators or facilitators to resolve issues that arise during scoping or throughout the NEPA process?

21. Is GIS used for the early identification of historical properties & environmental resources? What other layers are contained in the database? Does this database contain information from other local, state, and federal agencies? Can outside agencies and functional units within VDOT simultaneously access the same graphic data? What other databases (e.g. CEDAR), plans and resources are consulted during scoping?

22. What information is developed through the SERP?

23. Are time frames or deadlines for the NEPA process & environmental reviews established at scoping?

24. Is delegation of review and permitting authority established at scoping? Early coordination and permit identification and application?

25. Is information developed on a project's potential environmental impacts during the planning phase, and if so, is it used during the PE stage? How can the SAFETEA-LU requirement that long-range plans must include a discussion of potential environmental mitigations areas and activities be fed into the scoping process? Would an enhanced or earlier scoping process require changes in the long-range planning process?

26. Does VDOT have a formal MOU with the FHWA, Corps of Engineers, or other federal and state departments of environmental and natural resources?

27. Does VDOT have formalized ongoing partnering arrangements with permitting and regulatory agencies? Are these arrangements subject to regular reviews and evaluations? Is there a built-in dispute resolution process? Is Virginia a party to an alternative dispute resolution process?

28. Does VDOT have any cost sharing agreements with the federal permitting agencies?

29. Does VDOT have any partnering agreements with nongovernmental organizations such as the Sierra Club? Industry groups?

30. Is the interagency communications process discussed at scoping? Is a formal communications plan developed?

31. Are post-design/construction meetings held to discuss scoping successes and failures and identify ways to improve the process? How are these "lessons learned" documented?

32. Should scoping be conducted earlier (i.e. as part of the STIP development process or prior to prioritization and programming)?

33. Is the scoping process linked to any of VDOT's management systems or databases?