NCHRP

SYNTHESIS 405

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Utility Location and Highway Design

A Synthesis of Highway Practice

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

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Utility Location and Highway Design

A Synthesis of Highway Practice

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

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NCHRP SYNTHESIS 405

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The members of the technical panel selected to monitor this project and to review this report were chosen for their special competencies and with regard for appropriate balance. The report was reviewed by the technical panel and accepted for publication according to procedures established and overseen by the Transportation Research Board and approved by the Governing Board of the National Research Council.

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Cover figure: AWV electric relocation.

FOREWORD

Highway administrators, engineers, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and unevaluated. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem.

There is information on nearly every subject of concern to highway administrators and engineers. Much of it derives from research or from the work of practitioners faced with problems in their day-to-day work. To provide a systematic means for assembling and evaluating such useful information and to make it available to the entire highway community, the American Association of State Highway and Transportation Officials—through the mechanism of the National Cooperative Highway Research Program—authorized the Transportation Research Board to undertake a continuing study. This study, NCHRP Project 20-05, "Synthesis of Information Related to Highway Problems," searches out and synthesizes useful knowledge from all available sources and prepares concise, documented reports on specific topics. Reports from this endeavor constitute an NCHRP report series, *Synthesis of Highway Practice.*

This synthesis series reports on current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals. Each report in the series provides a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems.

PREFACE

By Jon M. Williams
Program Director
Transportation Research Board

This study explores current practices in use by transportation agencies for consideration of utilities during the project development process, including where in the process the utility impacts are assessed and relocation decisions made; what policies, regulations, manuals, and guidelines are used; and how design decisions are influenced by utilities. The study includes both above-ground and below-ground utilities.

Information was gathered through a literature review, surveys of U.S. state departments of transportation and Canadian provincial transportation agencies, selected interviews, and case studies.

James H. Anspach, J.H. Anspach Consulting, Bend, Oregon, collected and synthesized the information and wrote the report. The members of the topic panel are acknowledged on the preceding page. This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As progress in research and practice continues, new knowledge will be added to that now at hand.

CONTENTS

APPENDIXES D AND E OF THIS REPORT CAN BE FOUND AT WWW.TRB.ORG, SEARCH ON “NCHRP SYNTHESIS 405.”

UTILITY LOCATION AND HIGHWAY DESIGN

SUMMARY

In an ideal world, highway improvement projects meet their transportation goals when design can proceed with no constraints; unobstructed and unlimited right-of-way; no streams, rivers, wetlands, or contaminated or geo-technically poor soils; and constant but gradual elevation changes. However, few projects meet these criteria, and almost all projects contain another design constraint: existing utilities strung overhead on visible structures or hidden below ground.

Historically, the most convenient strategy for the transportation designer was to ignore the utilities during design and make them relocate if they end up conflicting with the highway construction footprint. As such, highway projects are often designed with little or no consideration of utilities. Utilities are routinely relocated, often at great expense and often unnecessarily. The most difficult option for the designer is to accomplish the transportation improvement mission while leaving all of the existing utilities in place. Sometimes this is impossible. Somewhere between the extremes of relocating all the utilities and leaving all the utilities in place is a workable compromise that meets the highway construction scope and mission, while minimizing impacts to utility facilities. If this compromise can be found, there can be substantial savings in utility relocation costs and impacts, as well as overall savings to the project budget and timeline.

This study explores current practices in use by transportation agencies for consideration of utilities during the project development process, including where in the process the utility impacts are assessed and relocation decisions are made; what policies, regulations, manuals, and guidelines are used; and how design decisions are influenced by utilities. The study includes both below-ground and above-ground utilities. This study does not include the many related aspects of the practice of utility coordination; those details can be found in the 2009 SHRP 2 report *Integrating the Priorities of Transportation Agencies and Utility Companies*.

Information was gathered through a literature review, survey, and interviews. The survey was sent to the department of transportation (DOT) representative with utility responsibilities through the AASHTO Highway Subcommittee on Right-of-Way and Utilities. The DOT utility representative was asked to solicit feedback from others in their respective departments if warranted. The survey was distributed to the DOTs of the 50 states, Puerto Rico, District of Columbia, and 9 Canadian provinces; 45 responses were received. Review of the literature identified the issues potentially affecting the decision to keep utilities in place or to relocate them. This study explores in detail five specific practices: (1) consideration of utilities during design, (2) philosophies regarding design versus relocation, (3) knowledge of designers in utility issues, (4) procedures and practices for decision making, and (5) utility mapping (both overhead and underground). It includes case histories, best practices, and additional research needs.

There were few places in the literature that mentioned how and when decisions to relocate utilities rather than put forth an alternative design are made. Several state DOTs have begun to include a work category of "design analysis and conflict resolution" in their consultant contracts. The level of activity varies from identifying potential conflicts at the 60% design stage

for the selection of test holes to actually recommending changes to the highway design to accommodate select utilities.

DOTs expressed the desire to get utilities involved as early as possible. The nature of that involvement is diverse, but is mostly limited to determining what is there and where it is, rather than should it be considered important or costly enough to be a design issue. Twenty percent of DOTs get their utility personnel involved in the project planning stage. In a majority of cases it is primarily an identification of the utilities that may exist within the project limits. In some cases it includes a preliminary utility cost estimate, where the costs of moving utilities out of the way of the highway project are estimated. Philosophies on what to consider differ; the preliminary utility cost estimate can be either a worst-case scenario, a best-case scenario, or a most-likely case scenario. Ten percent of DOTs start getting utility information in the topographic survey stage, whereas 52% wait until the early design stage of a project. The remaining 18% wait until later in design, or sometimes just before construction. Almost 90% of DOTs consider the impacts of utilities on aerial versus underground utilities at the same time.

The Virginia, Pennsylvania, and Georgia DOTs indicated that they had developed some internal procedures and guidance in this matter. These three DOTs were interviewed and the results are documented in the body of the report. A synopsis follows.

The Pennsylvania DOT (PennDOT) assigns a project manager in the early planning stage who will be responsible for that project from that point on until construction is complete. An internal specialist in utilities is included as a part of the design team at the planning stage.

Before any design begins, the utility team member gathers utility owner records and makes a field visit to create a "best guess" utility map (using topo received at the 0%–5% design stage). A preliminary utility cost estimate is generated at this time and updated throughout the design process.

At the 30% design stage, there is a second field visit by the project team with plans in hand. At the 30% plan stage, design is sufficiently advanced so that large-scale design elements are shown in a "proposed" location. During this visit, the utility team member gives advice about relocation costs, time issues, and other utility issues to the design team for their consideration. It is at this point that the decision whether or not to use a subsurface utility engineering consultant is made.

The Virginia DOT (VDOT) assigns a utility coordinator to the project before the 30% stage. It is the responsibility of this coordinator to be familiar with the utility locations and issues, and bring design versus relocation issues to the attention of the designers. The utility coordinator produces quarterly updates on the expected utility relocation costs as design progresses. This provides assistance in getting attention paid to utility relocation alternatives.

The Georgia DOT (GDOT) performs a Utility Impact Analysis as soon as preliminary drainage, erosion control, staging, structures, and construction limits are available (30%–60% design stage). GDOT or its Subsurface Utility Engineering consultant review all potential existing utility conflicts with the proposed design and document recommended resolutions (utility relocation or adjust proposed design), determines if Quality Level A (QLA) test holes are needed, determines a utility impact with "ball-park" cost (as designed), and provides a benefit of resolution. Overhead and underground conflicts are both considered at the same time. These items are incorporated into a conflict matrix spreadsheet that is provided to the project manager/designer and the District Utility Office.

All state accommodation policies reviewed require the utility to relocate its facilities if they conflict with the transportation facility. A few state policies request designers to attempt to minimize relocations. Eighty-five percent of DOTs do not have any policies or guidance documents that affect a decision to relocate or to design around a utility conflict, other than for above-ground, clear zone safety issues. The logical assumption is that the decision to design around a utility or relocate the utility is derived from other factors. Approval for that decision is either through a normal "chain of command" process or a formal approval process of some type in 64% of the DOTs. This implies that even though there may be no formal decision policy, the decision is dependent on more senior management, but must first originate with the designer.

The DOTs of Virginia, Pennsylvania, and Georgia have all instituted significant changes and procedures to the ways in which they address utility and design issues and state positive results. All three states have subsurface utility engineering programs that include mapping, conflict identification, and limited utility coordination.

Pennsylvania has several unique statutes or findings that affect how PennDOT considers utilities. The first is a ruling that a contractor on PennDOT jobs is allowed to perform their own test holes at PennDOT expense if the contractor has reason to believe the utility information as shown on the plans is in error. This has led PennDOT to be much more proactive in controlling those potential contractor costs by requesting QLA data in the project design stage. The second is a rather recent One-Call statute revision that requires all projects in the state to use subsurface utility engineering mapping (ASCE 38-02), or justify why not, if the project construction cost is estimated to exceed $400,000.

VDOT has put into place several other procedures that assist in getting attention paid for "relocation versus design-to accommodate" decisions. One of these is a VDOT pilot program, in place since 2000, where the agency pays the utilities for the costs of their engineering and design regardless of prior rights. In support of this program, VDOT has hired outside consultants to assist it in designing utility relocations if the utility owners choose not to use their own designers or cannot meet the project time frames. These outside consultants are also versed in highway design and, as such, are tasked with making recommendations on design changes if it appears to make more sense than relocation. VDOT estimates that this procedure increased its ability to hit target dates by 15%, and decreased the project timelines by 5% to 10%. On specific projects, its time savings are estimated to be in excess of one year.

VDOT is able to negotiate the easements of the utility owner as long as the utility owner already has a prior right. The utility still pays for the easement, but the negotiation is at state labor cost and the timing is controlled because the state has better power of eminent domain than the utility.

GDOT developed a Utility Redline Software that facilitates the transmitting of utility plan markups in electronic format for GDOT construction projects and is provided to GDOT's utility industry at no cost. The benefits of this new software are:

- Saves both GDOT and utility owner's printing costs,
- Increases construction plan quality,
- Facilitates project utility coordination efforts,
- Speeds up project plan development, and
- Aids utility companies and GDOT in the implementation of geographic information system applications.

Additionally, GDOT developed a training program, Avoiding Utility Project Impacts, which was created to provide useful tools to help designers and project managers avoid many utility-related problems, thereby reducing project delays by identifying and resolving utility conflicts early in the design process.

There is general consensus from the existing literature on how to make better decisions regarding "relocation versus design-to accommodate." Accurate and comprehensive utility location data, access to utility relocation cost data, informed and trained designers, and timely and frequent communication between designers and utilities are common themes. There are several sources of DOT/utility issues best practices, although a majority of DOTs surveyed reported that they pay limited attention to them as they are constrained by state statutes, departmental policies and philosophies, and historical ways of conducting business. Indeed, fewer than 30% of DOTs reported using AASHTO's Best Practices for Right-of-Way and Utility Issues. The best practices compiled by others and pertinent to this study are nonetheless listed in the report.

Several state DOTs have developed a "Conflict Analysis" spreadsheet that assists decision making on design versus relocation by relating estimated costs of relocation to conflicts. This practice is the focus of an ongoing SHRP 2 research project, R-15B Identification of Utility Conflicts and Solutions.

The survey disclosed reasons why designers might not consider keeping utilities in place. Sixty percent of DOTs consider their project costs as more important than the relocation costs to the utility ratepayers. Seventy-three percent of the DOTs said they do not consider cost or time factors as part of the relocation and design decision. Sixty percent of DOTs surveyed reported that their designers were not trained in utility issues, another 16% were not sure, and only 2% had training in utility relocation costs, giving little ability for cost comparisons. That makes coordination, cooperation, and early involvement of a state's utility unit or utility specialists essential to making informed decisions.

Perhaps the single most important step in dealing with utility issues is the knowledge of what and where utilities are present. There are diverse ways in which the existence of a utility is discovered and its location mapped onto highway design plans so that relocation and design decisions can be made. As utility location data become more comprehensive and accurate better decisions can be made, and there is less risk that unforeseen problems with utilities will emerge at the construction phase.

This study reiterates the findings of several other viable studies that illustrate a positive cost-benefit to the notion of getting the best possible location information through subsurface utility engineering mapping practices. The most recent subsurface utility engineering study by Penn State University showed a 2,200% return on investment ($22 savings for every $1 spent) on ten randomly selected PennDOT projects when using professionally obtained subsurface utility engineering field mapping over utility owner records correlated to surveyed topo features.

Other best practices fall into several major categories. Training of DOT, utility, and consultant personnel is one of them. Another is incorporating new technologies throughout the project development process. A third category involves the development of databases and spreadsheets to assist the designer in knowing where the potential conflicts are, and the costs and time associated with resolving those conflicts. A final category involves the early placement of someone well versed in utility issues on the design team at the earliest opportunity.

The concepts of altering a highway design to accommodate existing utilities are not as well represented in the literature or in past studies as might be imagined, given the pervasiveness of utility issues and highway design. That is now recognized, and several research projects with bearing on the problem are underway or planned for the near future. The SHRP 2 program has five of these projects dealing with the broad topics of utility data storage and retrieval, utility locating and mapping technologies, and utility coordination and conflict identification.

CHAPTER ONE

INTRODUCTION

It is customary for states to extend the use of highway rights-of-way (ROWs) to utility companies to save public resources and serve the public interest. As both highway and utility needs for additional space increase, competition for that available space results. Departments of transportation (DOTs) manage that competition through internal, state, and federal regulations, policies, and procedures.

Many states believe that they give utilities adequate consideration in their highway designs. Even so, utilities remain a leading cause of delays to highway projects. Such projects are often designed with little or no consideration of utilities. As a result, utilities are routinely relocated, frequently at great expense and often unnecessarily. With the ever-increasing cost and time required to relocate utilities, another option is to leave utilities in place and design the roadway to avoid utility conflicts. This approach can result in roadway design changes that significantly increase the cost and lengthen the schedule for completion of the project. To avoid these problems and reach a balance of all needs it is desirable to have early coordination between utilities and designers, best information on utility location, and a sound decision-making process.

This study explores current practices in use by transportation agencies for consideration of utilities during the project development process, including where in the process the utility impacts are assessed and relocation decisions are made; what policies, regulations, manuals, and guidelines are used; and how design decisions are influenced by utilities. The study includes both below-ground and above-ground utilities.

Information gathered for this study included:

- How and when the decision is made to either relocate utilities or design around them.
- Practices for gathering underground and above-ground utility information.
- How designers evaluate and incorporate utility information into the project development process.
- Barriers to the use of utility information in the project development process.

Information was acquired through a literature review, survey, and interviews. The survey (see Appendix B) was distributed in 2009 to the DOTs of the 50 states, Puerto Rico, District of Columbia, and 9 Canadian provinces. The Canadian survey results are presented separately from the U.S. results, although the results are quite similar, with the exception that the Canadians consider the costs of the ratepayer with more weight than their U.S. counterparts.

The literature review established background information on the range of practices that are now being pursued with respect to utility mapping and design consideration. Resources used included the Transportation Research Information Service (TRIS), Internet and web searches, and resources of professional associations. Particular attention was paid to the following references suggested in the project scope:

- *Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data* (2003) (*1*).
- *Avoiding Utility Relocations* (2002) (*2*).
- *A Policy on Geometric Design of Highways and Streets* 5th ed. (2004) (*3*).
- FHWA Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects (current edition).
- SHRP 2 R-01 and R-15 studies.
- Domestic scans (FHWA) and international scan.
- AASHTO "Right of Way and Utilities Guidelines and Best Practices" (*4*).

More than 2,000 documents were reviewed for applicability. After a content review this list was narrowed to 77 (see Bibliography). Although there are a significant number of documents, there is little unique information on this issue contained within these 77 documents; most is a repackaging of information from previous documents. The best and most up-to-date information came from interviews conducted with three DOTs and architecture/engineering design consultants. Representatives from the DOTs included state-wide and district utility units, and design, construction, and planning personnel.

Future chapters discuss utility issues in highway design (chapter two), the range of practices (chapter three), three case studies (chapter four), best practices (chapter five), research in progress (chapter six), and research needs (chapter seven). Chapter eight provides the conclusions. There are five appendices, two on-line only.

CHAPTER TWO

UTILITY ISSUES IN HIGHWAY DESIGN

The literature review identified those issues potentially affecting a design accommodation versus utility relocation. Some issues may be duplicated in part with other related ones and many issues were duplicated in more than one document. In these cases, the most recent and comprehensive documents are cited as the primary source in this study, although the reference list in the Bibliography is more comprehensive.

Many issues with utilities are related to the coordination process. These issues were recently documented in the SHRP 2 project (R-15) *Integrating the Priorities of Transportation Agencies and Utility Companies* (*5*). These issues are highly interrelated to the decision on whether to relocate a utility or consider a design change to accommodate it in place. Duplication of information has been kept to a minimum.

Decisions regarding "relocation versus design-to accommodate" can be based on cost, time, policy and statutes, project awareness, knowledge and training, available space, project design elements, accurate utility location knowledge, type of utility, past cooperation, personal preference of the project manager and designer, and singular project-specific details. These issues are interrelated and, as such, it is often difficult to anticipate the cause and effect of potential solutions to utility issues.

The R-15 study identified the following design issues pertaining to relocation decisions for utilities (excerpted):

- *Coordination Process Variations and Involvement Insufficiencies.* As the DOT design development process is focused on solving a transportation need and the coordination process is flexible (weakly structured), transportation design typically proceeds with little or no input from the utilities. Transportation designers have an incentive to design projects quickly, and constraints such as utilities can take additional time. The general understanding is that utilities can and will be relocated if there is a conflict. Designing to avoid utility conflicts remains the exception rather than the rule. There is substantial variability in the timing and format of a DOT's first contact with utilities, although contact around 30% design appears to be average. In many cases, there is no meeting between the utility engineer and the DOT design engineer. The quality and timing of the required communication is apparently variable, largely depending on the initiative of the individual designer and/or utility coordinator.
- *Base Information on New Locations for Utilities.* One challenge to DOT–utility coordination is the base knowledge needed by the parties and the lack of availability of that information. Utilities are just one item in the ground that DOTs need to deal with and preferably design around. Locations for utilities to be moved may be identified; however, other unknown objects, ground conditions, and geotechnical conditions in the new location can preclude them. The lack of good base data magnifies other problems.
- *Limited Technical Knowledge.* Utilities occupying a public ROW have increased in number and type. The technical complexity of utility systems has also increased; however, DOT design engineers and DOT construction contractors have little or no formal training in the technical aspect of utility systems. There is a general shortage of experienced designers, and the shortage of engineers in the United States continues to increase. Additionally, utility relocation engineers employed by utility companies have little formal training in transportation system design and construction.
- *Variability in Transportation Funding.* Owing to inadequate funding for a given transportation project, DOTs and utilities have encountered situations where a project is shelved after utilities provide plans. This stop/start project funding situation creates coordination issues when the time between utility relocation plan submittal, review, and approval and the authorization for the utility to go to work to relocate utilities may be several years. Understandably, utility owners do not want to be caught having invested time, effort, and financial resources in planning for or executing relocations that turn out to be unnecessary. DOTs are coordinating earlier than ever with utilities, sharing plans 5 to 10 years in advance in some cases, but project funding can be more uncertain at this early stage. To address this issue, some DOTs have made substantial efforts to increase the predictability of their transportation program, so that UCs and municipalities can plan projects that are included in the Transportation Improvement Program, the 4- to 6-year program of budgeted projects. Funding situations can still change and projects can be re-prioritized. Interviews revealed that sometimes "the utility owner (still) does not trust DOT, and is not sure that DOT will really build the project." This can cause delays as the UC

waits until a later point in the process to initiate its portion of the work.

- *Inability of DOT to Purchase ROW in Advance for Utility Relocations.* Many DOTs cannot purchase the ROW in advance for utility relocations. Not knowing whether the ROW is available can influence design decisions.
- *Difficulty Getting "Design Ticket" Locates from One-Call Centers and Locators.* DOTs and utilities are affected by the limited level of service that One-Call centers and locators can provide, particularly during the design phase. Reliance of utility owners on their One-Call systems has not worked well for design purposes because the system was designed for safety during construction. Indeed, in a majority of states, state legislation or practices preclude permitting or mandating what utility owners do to prevent utility ratepayers from having to supplement the design costs that may be covered by other stakeholders.
- *Inaccurate or Incomplete Field Markings, Risks with Multiple Locators, and Process Inefficiencies.* In states that allow utility owners to mark for design, utilities have generally protected themselves from liability by seeking statutory language that absolves them of responsibility for the accuracy or completeness of the marks. This statutory protection reduces the incentive of utilities to produce accurate or timely location information. DOTs rarely recover redesign or contractor delay claims from utilities for wrong design markings. This issue is compounded because designers have little or no information about the accuracy and completeness of the marks placed by the One-Call systems and place their faith in it when there is no other source of information.
- *Availability of Subsurface Utility Engineering (SUE) and State-Specific Cost-Benefit Information.* A number of states are conducting research and implementing programs to promote SUE. SUE is an engineering process for accurately identifying the quality of subsurface utility information needed for highway plans and for acquiring and managing that level of information during the development of a highway project. In states where SUE is not standard or a SUE program does not exist, it may still be used in exceptional circumstances. However, even with significant documented savings from a variety of independent sources and research organizations, some states still resist the practice of SUE.
- *Quality and Effectiveness of SUE Services.* Many DOT engineers consider SUE mapping services to be expensive and therefore do not include it in the budget. SUE providers have proliferated and this has led to concerns in some cases, including: (1) SUE providers not using adequate imaging equipment, (2) procurement of the wrong amount of imaging to cut costs or meet other goals and limits, (3) inadequate level of skill or experience interpreting visual output, and (4) poor scopes of work.
- *Overly Small Mapping Limits in Early Characterization.* In an attempt to minimize initial project cost, mapping limits are frequently set unrealistically small. As this is discovered during the project development process, extra costs and time are incurred. Previous designs can be irrelevant or inefficient if more space is available, but if addressed early the extra costs of extending the topo and utility survey limits can be minimized.

Another document that has significant applicability to this study is the FHWA's 2002 *Avoiding Utility Relocations* (*2*). Its major premise is that "unplanned and unnecessary utility relocations must be avoided." It identified the following six applicable utility issues with their related problems:

1. Property interest—Because a majority of utilities within the ROW are under permit or franchise agreements, the state or municipality has the power to force relocation with the cost of that relocation borne by the utility. In such cases, the agency, although cognizant of the relocation impacts and costs, is not as concerned with avoidance strategies as they would be if they were reimbursing the utility. Just obtaining required easements on private property is a time-consuming and costly issue for the utility.
2. Quality of records—Unless utilities are designated through the One-Call design system (only available in about 12 states) or through a SUE firm. Records that are frequently inaccurate, incomplete, and many times unavailable are the source for location information. This makes it difficult to make accurate decisions.
3. Readability of plans sent to utilities—Many times utilities are asked by the DOT to place their utility information on a set of highway plan sheets. These plan sheets may be difficult for the utility owners to interpret, owing to a lack of trained personnel in highway plan reading, inadequate or confusing topographic references, plan scale, clutter, or detail contrast.
4. Reliance on institutional memory—There is a significant generational change in both the utility companies and the DOTs as agencies become "right-sized, downsized, or capsized." There are few mid-level people who would be the heirs to valuable planning and design practices.
5. Technology to locate utilities—There is no one piece of equipment capable of detecting all types of utilities in a given location. Even many SUE firms do not employ all the possible tools owing to DOT budget concerns, lack of trained personnel, and logistical issues. Technology is advancing, but so is the cost of equipment and the training required to use and interpret it. There is a broad range of assumptions by highway designers on technology capabilities.
6. Abandoned facilities—Abandoned facilities usually have no available records. However, they may still contain product and, as such, can create expensive and dangerous construction conditions. Abandoned facilities, existing in close proximity to active ones are easily mistaken for the active ones, and vice-versa. Abandoned facilities are best identified in the design stage so that

ample time to investigate ownership and contents is available. However, without a comprehensive surface geophysical investigation, abandoned facilities are not usually found until construction has begun.

Other issues pulled from DOT and consultant interviews and other source documents that were not specifically included in the previous documents are:

- Historical sequencing of solutions to problems—A solution to one problem may create new problems, which are then fixed, and so on. A series of "patches" to the problem are devised, rather than an entire new operating system. The end result is policies and procedures from which a patch to the problem may no longer work (W.D. Pickering, So-Deep, Inc., personal communication).
- DOTs are unwilling to allow any changes in their existing utility relocation policies that might open up a change to legislation for fear that the utility lobbyists will be able to parlay that concession into a larger one that will be unsatisfactory to the DOT (W.D. Pickering, So-Deep, Inc., personal communication).
- Overlapping permit agencies—When state highways run through municipalities, the DOT sometimes cedes control of utility installation permits and records to the municipality, and such permits and records may not be in a standardized format (S.M. Wolfe, Cobb, Fendley & Associates, personal communication).
- No comprehensive "Alternate Design" catalogue with associated costs—Although the FHWA did publish a generic *Avoiding Utility Relocations* manual (*2*), it is used in less than 50% of the states according to the survey and it contains no cost information for comparison purposes (Question 27).
- It is well understood that utility issues will arise on some projects. A prevailing attitude is that there is little that can be done to prevent them and there are procedures in place to address them when they happen (K.S. Nichols, CH2M Hill, personal communication).
- Existing procedures are satisfactory for a majority of projects—Because a majority of projects handle utility issues well enough with existing procedures and policies, and it is difficult to know beforehand which projects may have significant utility issues, it becomes difficult to justify to management a solution that is inherently systemic in nature and may not show value for all projects. For instance, a recent Pennsylvania DOT (PennDOT)/Penn State University Study found that "All of the projects showed a strong relationship between SUE benefit-cost ratio and buried utility complexity level at the project site. The analysis clearly showed that there is no relationship between SUE benefit-cost ratio and project cost and also no relationship between buried utility complexity level and project cost" (*6*).
- DOTs have a tendency to believe research findings or practices to be invalid for their state if they originate from organizations outside of their jurisdiction. This may partially explain why published "best practices" are seemingly not put into practice quickly or in some cases at all, and may explain why issues still remain even after their extensive and long-term identification of them (J.J. Lew, Purdue University, personal communication).
- Competing technical specifications—States have different manuals and specifications for different divisions or departments. At issue is the lack of a common system to arrange the task and activities that the manuals describe. This issue is compounded by the lack of a common labeling system among manuals. There are differing chains of command for these activities, and the "who's in charge of what, and when" is sometimes vague or in conflict (R. Kerchner, Gannett Fleming, Inc., personal communication).
- Ease of finger pointing—Because utilities are a joint issue between the DOTs and the individual utilities, it is always easy to blame the other entity for the problems (*7*).
- Consistency of procedures and philosophies across departments—The survey included responses from different departments within the DOT. For every question there was a difference in responses among the DOTs, ranging from 4% disagreement of the answers to as high as 45% (Question 5). Certainly, there is a diversity of attitudes, opinions, training, or priorities with each DOT depending on job function, resulting in a wide variety of information or practices. This argues for a lack of training issue, or perhaps a larger organizational issue.

CHAPTER THREE

RANGE OF PRACTICES

This study identifies that each DOT has a unique range of practices for dealing with utility issues as they relate to highway design.

This chapter reviews in detail five specific practices: (1) consideration of utilities during design, (2) philosophies regarding design versus relocation, (3) knowledge of designers in utility issues, (4) procedures and practices for decision making, and (5) utility mapping (both overhead and underground). Most of the issues identified in this chapter fall within these broad categories.

CONSIDERATION OF UTILITIES DURING DESIGN

Utilities can be moved or the project can be designed in such as way as to keep all existing utilities in place. These are essentially the two possible endpoints. DOT historical philosophies, knowledge of designers in utility issues, interface of utility staff with designers, specific procedures and practices related to this decision process, and project-specific design and available space elements influence the "relocation versus design-to accommodate" decision.

DOT organization is quite diverse, subject to change, and was not a focus of this study. Most of the DOTs have persons knowledgeable in utility accommodation rules and policies who are responsible for coordinating any relocations with utility companies. In most states, the role is that of a manager of the utility coordination process. These persons may not necessarily have training or experience in highway design or utility design. The interplay between these persons responsible for utility relocation coordination and the highway design staff varies from state to state and is in some respects related to how the DOT is organized.

Just over 50% of the DOTs have placed their utility units within the DOT's design section. Another 43% are placed in the right-of-way section. In some states, the right-of-way section is contained within the design section, making these statistics difficult to interpret (Question 10). It does appear as if there are two main ways in which the utility personnel are used for a project. They are either assigned to be part of the project design team (65% of the states) or they serve as a resource for the project design team (30% of the states) (Question 11).

DOTs expressed the desire to get utilities involved in the process as early as possible. The nature of that involvement is diverse, but mostly is limited to determining what is there and where it is, rather than should it be considered important or costly enough to be a design issue. Twenty percent of DOTs get their utility personnel involved in the project planning stage (Question 12). In a majority of cases it is primarily an identification of the utilities that may exist within the project limits. In some cases it includes a preliminary utility cost estimate, where the costs of moving utilities out of the way of the highway project are estimated. Philosophies on what to consider differ; the preliminary utility cost estimate can be either a worst-case scenario, a best-case scenario, or a most-likely case scenario. Ten percent of DOTs start getting utility information at the topo survey stage, whereas 52% wait until the early design stage of a project. The remaining 18% wait until later in design, or sometimes until just before construction (Question 12). Almost 90% of DOTs consider the impacts of utilities on aerial versus underground utilities at the same time (Question 17).

The 2004 AASHTO "Right of Way and Utilities Guidelines and Best Practices" states that:

> Major utility companies should be identified early in the project development phase. The impact of the proposed project on existing utility facilities should be evaluated. The cost to mitigate conflicts with these utilities should be evaluated when alternative designs are considered. If there are major conflicts, the utility owner should be contacted and encouraged to develop and evaluate alternative design proposals (*4*).

Although fewer than 30% of DOTs reported that they use this guidance document, anecdotal evidence suggests that this document is incorporated into their policies and procedures (Question 27).

The SHRP 2 R-15 study discovered that:

> The DOT design development process is focused on solving a transportation need. Partly because of the weak structure of the coordination process, the transportation design proceeds for the most part without input from the utilities. The transportation project is designed with the belief that utilities can and will be relocated if there is a conflict. Designing to avoid utility conflicts is the exception rather than the rule (*5*).

In some instances, ROW, terrain, or other considerations necessary to accomplish the surface transportation project may be unchangeable and, therefore, no consideration of a change of design versus relocation can take place. For instance, a project may involve large expanses of deep cuts. Given the high cost of ROW relative to the cost of utility easements it is the rare project that would show a combined cost benefit (ratepayer/taxpayer) to buy additional ROW to relocate a utility.

Philosophies Regarding Design Versus Relocation

Thirty-three percent of DOTs believe that it is solely the responsibility of the utility owners to know where utilities are located within their ROW (Question 6). The remaining DOTs believe there is joint responsibility. These philosophies affect the way DOTs portray utilities on design plans. For instance, those believing they have no responsibility do not pay to get utilities depicted on their plans (e.g., through hiring a SUE) and are therefore at the mercy of the utility owners for both the timing and quality of information.

Sixty percent of DOTs consider their project costs as more important than the relocation costs to the utility ratepayers (Question 7). This is understandable given that the DOT budget is derived from taxpayer money. This reality drives considerations such as the timing and generation of utility cost estimates for relocation, designing project elements to avoid utility relocations, timing of involvement of utility companies in the design process, and training of designers in utility issues. Only 25% of DOTs consider the costs to ratepayer and taxpayer as equal in importance (Question 7).

Seventy-three percent of the DOTs noted they do not consider cost or time factors as part of the relocation/design decision (Question 23). This is somewhat in conflict with survey answers that indicated a decision to design around specific utility types in a majority of cases (such as cell towers, transmission gas, transmission electric, substations, environmental vaults, and petroleum pipelines), whereas other utility types are less apt to be considered for a highway design change to accommodate them (distribution gas, water lines, aerial distribution facilities, sewer systems). Cost and time appear to be the common factors with these utility types.

The cost factor is bolstered because if the utility has no compensable right to be in the ROW, the decision to relocate the utility versus design around it increases by a factor of about 33% for buried facilities (Question 24). Only for aerial distribution facilities does this not appear to be a factor in the decision.

It is interesting that given the propensity to relocate a utility versus design around it, the survey respondents generally considered the following design elements as a valid reason for a design change versus utility relocation: drainage design (84%), structure design (73%), cuts and fills (70%), ROW procurement (65%), lighting design (54%), signage (51%), signalization (49%), and placement of the travel lanes (43%). This survey question was one in which there was a significant diversity of opinion within individual DOTs on whether it was valid to consider a relocation for a particular type of utility versus design other elements around it (Questions 5 and 24).

Knowledge of Designers in Utility Issues

Despite the extensive network of underground utilities and pipelines across the United States, there is very little formal education and training specifically aimed at design, operation, and maintenance of these assets (*8*). This lack of training is exacerbated by the growing scope of required knowledge and the need for individuals with a broad knowledge base in utilities, their risks, and project design and construction practices (*9*). Limited efforts have been made to introduce pipeline-related courses and utility asset management instruction into engineering curricula; however, this introduction is difficult because of the pressure of other growing education and training needs for each branch of engineering. The vast majority of individuals that assume the job duties dealing with utilities receive no formal training at all.

The FHWA recognized this and developed and sponsored the National Highway Utility Conference, which was held annually from 1991 through 2000. This conference brought together DOT personnel, utility company personnel, and consultants for information exchange and training. However, very few highway design personnel, if any, attended. It was at these conferences that ideas such as subsurface utility engineering, outsourcing of utility coordination, outsourcing of utility relocation design, and other ideas taken for granted today were first introduced on a national stage. Utility owner designers shared current information on costs and relocation design constraints with attendees, and case studies on projects that were successful as far as avoiding unnecessary utility relocations.

The AASHTO Subcommittee on Right-of-Way and Utilities has made an effort to fill the void created when the National Highway Utility Conference folded. This annual AASHTO meeting is primarily attended by DOT ROW or Utility Section personnel and consultants. Consultant designers do attend, and it has allowed an exchange of knowledge for consultant designers, who are familiar with aspects of highway design, with DOT utility personnel.

In 2000, the National Highway Institute developed the Highway/Utility Issues Course. It is a two-day course designed to bring DOT utility personnel together with other utility personnel to develop an awareness of each other's issues. This course held by the DOTs is infrequently requested (J. Lindly, University of Alabama, personal communication).

Utility organizations do develop and conduct specific utility design courses for their constituents. The Electric Power Research Institute (www.EPRI.com), Gas Technology Institute (www.gastechnology.org), American Water Works Association (www.awwa.org), and others hold courses, webinars, and sessions at conferences relating to the design of specific utilities. DOT designers could take advantage of these educational opportunities and courses; however, there is no documentation that they do.

Sixty percent of DOTs surveyed reported that their designers were not trained in utility issues (Question 13); 16% were not sure. For those that did have training, 60% said that it was limited to issues regarding getting utilities relocated. Only 2% had training in utility relocation costs, providing little incentive for designers to look at design alternatives (Question 14).

The R-15 study said this about knowledge of designers in utility issues:

> Several state DOTs and UCs claimed that many designers are not sufficiently knowledgeable of the utility relocation process (and technical issues) and suggested that training programs be held in order to educate them. High turnover rates at DOTs have led to inexperienced people doing design. Utility networks can be very complex. There is a feeling in the utility industry that if DOT designers understood the complexity of some utility systems, a greater effort would be made to avoid utility relocation during highway design. Advancements in technology are also being made, providing new information that could be utilized in the design and relocation process. Training must be done in order to get designers and UCs to utilize this information correctly. This practice should be employed before the design phase. When designers have a comprehensive understanding of the utility system and the relocation process, consideration of utilities during the design process will increase the potential for cost savings with innovative designs that avoid utility relocations. The development of a consistent procedure to follow and better coordination with the UC can increase timely relocations and reduce utility delay claims, and gain the confidence of the people you are working with (*5*).

Procedures and Practices for Decision Making

All state accommodation policies reviewed require the utility to relocate its facilities if they conflict with the transportation facility. A few state policies request designers to attempt to minimize relocations. Eighty-five percent of DOTs do not have any policies or guidance documents that affect a decision to relocate or to design around a utility conflict, other than for above-ground, clear zone safety issues (Question 8). The logical assumption from this statistic is that the decision to design around a utility or relocate the utility is derived from other factors. Approval for that decision is either through a normal chain of command process or a formal approval process of some type in 64% of the DOTs (Question 22). This implies that even though there is no formal decision policy, the decision is dependent on more senior management, but must first originate with the designer.

Several state DOTs have begun to include a work category of "design analysis and conflict resolution" in their consultant contracts. The level of activity varies from identifying potential conflicts at the 60% design stage for the selection of test holes to actually recommending changes to the highway design to accommodate select utilities.

Current practice in most states is to return the project plans back to the utility owners and make them responsible for determining their own conflicts. In this manner, project owners do not pay for the conflict identification. This is another ratepayer–project owner issue where the public pays for the inefficiencies created by multiple plan sets reviewed by multiple individuals that will need to be collated. A single entity identifying all conflicts (the utility owners can verify and serve as a quality assurance role) is better. A single, trained, competent individual can perform this function more efficiently than a mix of many utility owners on their own timetables with limited resources. The amount of time to get familiarized with the project is more efficient for one person than ten (*5*).

Several state DOTs have developed a "Conflict Analysis" spreadsheet that assists decisions on design versus relocation by relating estimated costs of relocation to conflicts. This practice is the focus of an ongoing SHRP 2 research project, R-15B, Identification of Utility Conflicts and Solutions.

Fewer than 50% of DOTs rely on the FHWA's *Avoiding Utility Relocations* (*2*) as a guidance document and fewer than 30% use AASHTO's "Best Practices for Right of Way and Utility Issues" (Question 27).

UTILITY MAPPING

Perhaps the single most important step in dealing with utility issues is the knowledge of what and where utilities are present. If you do not know if something exists, or where it exists, the decision of whether to consider it during design is nonexistent. Utilities can be overhead (aerial) or underground, and many times are both, as in the case of electrical or telecommunications systems. Underground and aerial facilities are discussed separately in this chapter, but there are some common issues that may affect decisions on relocating versus design.

Transportation projects and utilities share the same space. When anything within that space changes, it can produce actual or perceived physical conflicts that need to be resolved. The first step of resolving conflicts is the knowledge of the "who, what, where, why, and when" of the space occupation. Cost, time, and safety are important factors that influence the technology and procedures used to answer these questions. Responsibility for determining this knowledge is clear for anything that is visible, and there are clear standards for accuracy and precision of depicted items, including visible utility structures. The transportation project providers invariably produce a topographic survey and take responsibility for that cost and time.

Interpretations of, and responsibility for, the who, what, why, where, and when are fairly simplistic when an object is visible. This is not the case for objects in nonvisible space. Challenges in documenting and understanding accuracy for indirectly measured or inferred utilities are part of the problem and are perpetuated by "accuracy" language that is misunderstood in state One-Call statutes. Responsibility for locating and characterizing the nonvisible (i.e., buried utility) items occupying space varies widely and is not well delineated in practice. Different parties may be responsible for utility depictions for differing phases of the project (e.g., planning, design, and construction). These are some of the reasons that problems relating to utilities occur on transportation projects (*8*).

The project limits for utility mapping can be a factor. Frequently, in an attempt to minimize initial project cost, project limits are set unrealistically small early in the project development process. This may not address subsequent space requirements for anticipated but not yet determined new ROWs, utility easements outside of the ROWs, or unanticipated design changes during the project. The additional costs of extending the survey limits a small amount are minimal when done in conjunction with the initial survey mobilization (*5*).

In addition to utilities themselves, the character of the existing space within the project limits must be identified. By character we mean the space occupied by the existing utilities and ground conditions that may affect the relocation of existing utilities (such as bedrock, large boulders, depth to water table, debris and rubble from past use, and unstable ground). It is not only the utility "lines" that create potential issues. The space required for thrust blocks, vaults, pole anchors, and so forth can be a factor.

The ways in which DOTs get utility information portrayed on their planning and design documents are diverse. They include research, analysis, and interpretation of utility records by DOT personnel or their consultants; submission of base plans to utility owners for them to draw on their facility locations; requesting utilities to mark their facilities in the field for subsequent survey; hiring a contract locator to mark utilities in the field; allowing department survey forces to make best guesses in the field based on visual observations; or hiring a subsurface utility engineering firm. In many cases, more than one way is used, usually at different phases of the project and in varying degrees of thoroughness.

Sixty-four percent of DOTs reported that they have no formal mechanism to decide which particular method they will use to get utilities depicted on plans (Question 16). Several states and consultants indicated that it is the decision of the individual project manager. This statistic is confusing when combined with another one, that being that 67% of the states noted that consultant-designed projects must follow the same procedures for getting utility information on plans as the department (Question 18). This may indicate that although there is no formal mechanism for choice there is a set procedure.

Overhead Utilities

No documentation was found for a coordination process for relocation efforts involving multiple utilities occupying the same aerial structures. Electrical distribution poles may also serve various other utilities such as telephone and cable. Poles cannot be relocated until all utilities have been relocated. Utilities are typically placed on a first come, first served basis. This process generally works, although a utility submitting a plan after another may conflict with the first utility plan and thereby cause inefficiencies.

Coordination and design decision involving overhead utilities follow the same procedures as those for underground ones. Eighty-nine percent of the DOTs consider the impacts of aerial facilities at the same time as they do the underground facilities (Question 17). Variances in responses for relocation decisions involving overhead versus underground facilities were within 4% (Question 5).

Underground Utilities

Underground utilities are the biggest challenges. They cannot be seen, good records are not kept of them, there are many of them, technology does not exist to image all of them, and there are no standard practices for identifying them that are in common and prevailing use. A recent SHRP 2 study, R-01, *Encouraging Innovation in Locating and Characterizing Utilities* (*8*), is a current and comprehensive document that details many of the issues necessary in identifying and accurately portraying existing underground utilities on highway design plans. Much of the same literature resulted from this research and similar but slightly different surveys have been performed. Much of the information contained within this section is duplicated in more detail in R-01. It is a good companion document to this study to more fully understand the range of underground utility mapping issues.

Utility Records

In 60% of the DOTs, department personnel obtain and use utility records (Question 15). In the R-01 survey, a slight majority of individuals responding to the survey believed utility records were sufficient for highway design purposes. Accurate and comprehensive records are a solution and a good first step. However, existing records of underground site conditions are often incorrect, incomplete, or otherwise inadequate because:

- They were not accurate in the first place—design drawings are often not "as-built," or installations were "field run" and no record was ever made of actual locations.

- On old sites there have often been several utility owners, architects/engineers, and contractors installing facilities and burying objects for decades. The records are seldom put in a single file and are often lost—there is almost never a composite map.
- References are frequently lost—the records might show something 28 ft from a building that is no longer there, or from the edge of a two-lane road that is now four lanes or part of a parking lot.
- Lines, pipes, and tanks are abandoned, but do not get taken off the drawings.

Even so-called as-builts frequently lack the detail and accuracy needed for design purposes in a utility-congested environment. Furthermore, references on depth are rarely referenced to a recognized elevation datum. The amount of cover over a utility can change without obvious visual indications owing to interim construction activity, erosion, etc., creating errors on records where "depth of cover" is the sole reference to vertical position (*10*).

The problem has only grown worse over time. The increasing use of geographic information system (GIS) systems for utility recordkeeping, coupled with the easy integration of data from computer-aided design (CAD) systems, has led to a proliferation of utility data. Sometimes original data have been scrapped once it became digital. Digitizing mistakes are common, as are misinterpretations of the original record data. GIS and CAD data can have the misperception of perfection. It is important to know the pedigree of the data so that good judgments can be made on its validity. Without ground-truthing or other verification means, it is impossible to know the accuracy or completeness of these utility location and characterization data. This area is one focus of a new SHRP 2 study R-01A.

In addition to using records, DOTs implement other measures for obtaining, refining, or validating utility information. For instance, in 55% of the states, DOTs will provide to the utility companies a set of design plans on which to draw utilities (Question 15). The reasons for this may be related to cost, time, or accuracy. If accuracy related, the inference here is that utility owners can better interpret their own records, have better records than they are willing to give the DOTs, have better information in their institutional memory than their records, or be willing to augment record information with their own field locating. There was no information found for this study that determined the effectiveness of this practice.

Utility records analysis and interpretation can be quite complex. To correlate these records to the highway plans, it is important that those plans be understandable and readable by the personnel using them. Several utility companies have partnered with either state DOTs or consultants for developing and arranging Highway Plans Reading Courses. No literature was found indicating availability of a utility records interpretation course. It is unlikely that senior personnel, who may have the most experience with both these issues, are the ones that end up interpreting and translating this information onto plans.

One-Call Markings

Each state has a unique One-Call statute that requires utility owners to place utility markings on the ground surface for safety purposes during construction. As of 2004, only 13 states specifically allowed utility locates ("design ticket") and field marking for design purposes (*11*). It is illegal for utilities to provide this service in some states with the rationale of a ratepayer versus taxpayer issue, whereas in other states there is no mention of it one way or the other. As such, reliance on utility owners to provide utility markings for design purposes through their One-Call systems has not been effective because (1) the service is unavailable, (2) the service is not mandatory, and (3) the system was designed for safety during construction rather than for design. States that have a design ticket typically waive the requirements for accuracy or completeness of the marks. No entity is responsible for looking for abandoned or unknown utilities or other underground obstacles or for assessing how many cables go from one vault to another. The process is inefficient and the ability to assess completeness is limited. In spite of this, approximately 30% of DOTs send out survey crews to survey utility owner's One-Call marks either at time of design or at time of construction (Question 15).

SUE

SUE was developed in the early 1980s to address many of the issues regarding uncertainty in the utility mapping process. It has steadily evolved over the years to the point where today it is viewed and endorsed by the civil engineering community as a branch of engineering practice, rather than a "boutique" and unusual service. It includes many tasks associated with the risk management of utilities.

Today, SUE includes the mapping of underground utilities in accordance with ASCE 38-02 (Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data); the inspection and mapping of gravity utilities utilizing closed-circuit television systems, sondes, and insertion devices; aerial pole mapping and documentation of structures and utilities on poles; vault detailing; profile development; all aspects of utility coordination including conflict analysis and resolution; utility relocation cost estimates; utility relocation design; corridor planning; construction observation and certified record drawing development during utility installation; GIS database population; three-dimensional imaging and visualization; and general utility consulting (J. Harter, Cardno-TBE, personal communication).

ASCE 38-02 is a national engineering consensus standard (in accordance with American National Standards Institute rules) that outlines a procedure for obtaining utility information and classifying that information as to its Utility Quality Level. The 2004 AASHTO "Right of Way and Utilities Guidelines and Best Practices" (*4*) states that "All state transportation departments should comply with the requirements in this standard guideline." However, fewer than 50% of DOTs use this document for guidance; almost the same number use their state's One-Call ticket (Question 27).

Nineteen percent of DOTs regularly use SUE mapping on a majority of their projects, whereas another 54% use it on select projects (Question 15). Its low percentage of use can be ascribed to several factors: belief that the One-Call system is adequate for many projects; a philosophy that utilities should pay for location information; a history of inadequate SUE providers locally; and the perception that there is not a positive cost–benefit ratio (R. Memory, North Carolina DOT, personal communication).

Cost–Benefits of SUE

Throughout the 1980s and 1990s, cost–benefit data on SUE mapping versus traditional utility depictions on plans were generated by two individual states (Virginia and Maryland) that had to justify their SUE contract expenditures to the U.S.DOT. The Virginia DOT (VDOT) found a $7.00 benefit for every $1.00 spent, plus a time savings for the project development through construction process of 20%. The Maryland State Highway Administration documented an $18.00 benefit for every $1.00 spent. Although well documented and publicized, these data were doubted by many state DOTs, as reported to the FHWA. In response, the FHWA commissioned an independent study that was published in 2000. This study was conducted by Purdue University and titled *Cost Savings on Highway Projects Utilizing Subsurface Utility Engineering* (*12*). It looked at a total of 71 projects evenly distributed across 4 states. The projects selected for study all had a minimum mapping utility quality level of Quality Level B (QLB); some also had QLA data. The study found that the minimum savings in gathering utility data on average was $4.62 for every $1.00 spent. The study reviewed the savings derived from having more accurate utility data than traditional Quality Level D (QLD)/Quality Level C (QLC) data (*12*).

In 2005, the University of Toronto published a study titled "Subsurface Utility Engineering in Ontario: Challenges and Opportunities" (*13*). This report outlines the results of a 12-month study commissioned by the Ontario Sewer and Watermain Contractors Association to investigate the practice of utilizing SUE on large infrastructure projects in Ontario. The report includes detailed documentation of nine successful case studies of SUE implementation in Ontario. These case studies were generally characterized by having a value greater than $500,000, being located in urban settings, and having a large number of buried infrastructure systems. The research team documented the qualitative costs and benefits of conducting SUE in these cases. For these particular cases, the average Return-On-Investment (ROI) for SUE was approximately $3.41 for each $1 spent. ROI figures varied considerably across the case studies and ranged from as low as $1.98 to as high as $6.59. All figures indicate a positive ROI.

In 2008, Penn State University published a report commissioned by the Pennsylvania DOT (PennDOT). The study undertook an in-depth analysis of ten PennDOT projects that had a minimum mapping utility quality level of QLB; some also had QLA data. It found that there was a cost savings of $22.21 for every $1.00 spent in gathering utility data. The study reviewed the savings derived from having more accurate utility data than traditional QLD/QLC data. All of the projects showed a strong relationship between the cost–benefit ratio and the complexity of the buried utilities on the project. The analysis clearly showed that there is no relationship between SUE/benefit–cost ratio and project cost, and no relationship between buried utility complexity and project cost. The study concluded that Utility Quality Levels QLB and QLA be used based on the complexity of the buried utilities on the project. The study further developed a decision matrix to assist the DOT in determining the potential complexity of the buried utilities. The decision matrix places a low threshold on the concept of complexity (*6*).

Given the results of these studies, it is not clear why there is still so much resistance to state DOTs using the concepts of SUE for project mapping. One aspect identified in the R-15 study was that SUE is still viewed by many as an expensive version of the One-Call system, with the addition of a vacuum truck, because it started out primarily as a craft service that marked nongravity utilities with pipe and cable locators and exposed them with vacuum excavation. However, the reality is that there is the opportunity to do a better job finding and marking utilities through SUE than through One-Call (see Appendix A).

The R-15 study also had this to say:

> Many DOT engineers consider SUE services to be expensive and SUE services are not included in the budget. A few offer services via a program budget allocation, to encourage usage of SUE as needed. When DOTs procure SUE services, they want it to be worth it. SUE providers have proliferated and to a certain extent, and now SUE is treated like a commodity instead of a professional service. This has led to some problems in some cases, including:
>
> - SUE provider not using adequate imaging equipment.
> - Procurement of the wrong amount of imaging in order to cut costs or meet other goals and limits.
> - Inadequate level of skill or experience interpreting visual output.

CHAPTER FOUR

CASE STUDIES

This study reviewed the general practices of three state DOTs regarding utilities.

PENNSYLVANIA DEPARTMENT OF TRANSPORTATION

PennDOT publishes a 12-year plan that gives intent of potential upcoming transportation projects. When a project is selected for the planning process to begin, the PennDOT district office assigns a project manager, who will be responsible for that project from that point on until construction is completed. The project manager assembles a project team that includes at least one representative from the following district or central sections: Maintenance, Traffic, Construction, Utilities, ROW, Environmental, Bridge (if necessary), and Design. If it is anticipated to be a consultant-designed project, the consultant will also select a project manager to work with the department's project manager. The FHWA will also have a representative on the team for federal-aid projects.

This project team meets at the project location at the environmental and engineering stage (before design begins). The utility team member uses this field visit, in conjunction with a call to the One-Call center for a design ticket, to develop a preliminary utility cost estimate. In Pennsylvania, the One-Call Design Ticket is a notification to utility owners of a future project and a request for records. It is not a request for field markings by the utility owners. The utility team member creates a QLD/QLC map (using topo received at the 0%–5% design stage).

At the 30% design stage there is a second field visit by the project team with plans in hand. At the 30% plan stage, design is sufficiently advanced so that large-scale design elements are shown in a "proposed" location. During this visit, the utility team member provides advice about relocation costs, time issues, and other utility issues to the team for their consideration. It is at this point that the decision to upgrade, if desired, the utility quality level to QLB is made. Note that the DOT is currently undergoing a major revision to its utility procedures that will in the future use the decision matrix developed by Penn State University for decisions on utility quality levels, and advance this decision to earlier in the design stage.

After this field visit is made and after upgrading to QLB mapping is complete (if QLB is requested), the utility team member returns sends this mapping to the utility owners for corrections, additions, and comments, or for information on already planned utility improvements not yet constructed. Information other than location is also requested, such as size, encasement status, material, and so on. The first face-to-face meeting with all utility owners is held 30 days after this first submission of plans to the utility owners. At this meeting, suggestions from utility owners regarding relocations are heard. The preliminary utility cost estimate is revised with input from the utility owners.

Throughout the rest of design, the utility team member coordinates with the rest of the design team and the utility owners to offer input on design versus relocation options. At the 60% design stage, the utility team member begins the process of reviewing those utilities that may be able to stay in place, but that may need only a minor adjustment, depending on their location as determined through QLA data. After receipt of these data, the normal process of utility coordination continues.

Pennsylvania has several unique statutes or findings that affect how PennDOT considers utilities. The first is a ruling that a contractor on PennDOT jobs is allowed to perform their own test holes at PennDOT expense if the contractor has reason to believe the utility information as shown on the plans is in error. This has led PennDOT to be much more proactive in controlling those potential contractor costs by requesting QLA data in the design stage of a project. The second is a rather new One-Call statute revision that requires all projects in the state to use SUE (ASCE 38-02) or justify why not if the project construction cost is estimated to exceed $400,000. This statute was the driving force behind the Penn State University study and resulting SUE Decision Matrix.

Every two years, each state-maintained roadway is video-logged. PennDOT personnel use this video of the road to see the above-ground utilities, what is hanging on the poles, and so on. This tool is used by the utility team member during the planning and design stages of the project as a visualization benefit.

PennDOT believes that it has developed a great rapport with the utility owners through these procedures. It also participates in quarterly statewide meetings between major utilities and the Turnpike Commission, and holds Utility

Coordination classes for utility owners and consultants. The DOT performs vertical adjustments for the smaller utilities in the state at state cost (labor costs only, not materials).

PennDOT's new civil engineers rotate through the utility and other units for training. They have developed an instructional DVD, and hold a regular Design Manual Class for new and existing designers that includes utility procedures and practices.

PennDOT is undergoing a major revision to its utility program. This revision includes a complete modernization of its utility manual, and coordination of this manual to other departmental documents for consistency. Its scope of work for its SUE consultants has been updated to better reflect the requirements found in ASCE 38-02 and new technology. Finally, there are revisions underway to its computer-aided design and drafting deliverables requirements to reflect ASCE 38-02 and to develop standardization between its SUE consultants.

VIRGINIA DEPARTMENT OF TRANSPORTATION

VDOT works from a six-year plan. It uses a Concurrent Engineering Process, where representatives from Location & Design, Environmental, Right of Way, Utility, and Construction groups begin the project development process. VDOT selects a project manager who is responsible for the project from planning through construction and it is this individual who is responsible for pulling together the representatives from the various groups. Before survey of the project starts, this group uses aerial photographs (flown statewide every two years) or more recently Google Earth to get an initial sense of the utility involvement on a project. A past attempt to use a statewide GIS system was discontinued because the GIS data were not being regularly updated.

VDOT has the longest-running SUE program in the nation, and it uses QLB and QLA mapping extensively on its projects. The timing and manner of its QLB mapping is unique. VDOT uses survey consultants at the 0% design stage to develop its topo. The survey consultants are required to have a SUE provider as a team member, and QLB data are obtained concurrently with the topo so that this high-quality and comprehensive data are available for the very start of the design process.

The first meeting with utility owners is held just after topo development, and the QLB data are already available for the benefit of both the designers and utilities. A preliminary utility cost estimate is developed on a "worst-case" scenario for this meeting. These data are fed into a Project Cost Estimating System. State and utility costs are differentiated later; however, VDOT considers the ratepayer and taxpayer costs as equally important in their decisions to relocate or design around a utility. In the case of municipal water and sewer cost estimates, the agency uses historical project averages; however, in the case of all other utilities, VDOT or its consultant designer uses a line item method for the cost estimates, and adds a 10% betterment cost based on historical averages. This utility cost estimate is revised and updated quarterly throughout the life of the project design.

In addition to the initial utility meeting, VDOT has a minimum of three additional meetings throughout the project cycle, held at the 50%, 90%, and 100% design stages.

A utility coordinator is assigned to the project before the 30% stage. It is the responsibility of this coordinator to be familiar with the utility locations and issues, and bring design versus relocation issues to the attention of the designers. Having the quarterly updates on the expected utility relocation costs available as design progresses is of great assistance in getting attention paid to utility relocation alternatives.

VDOT has put into place several other procedures that assist in getting attention for "relocation versus design-to accommodate" decisions. One of these is a federal pilot program, in place since 2000, where VDOT pays the utilities for the costs of their engineering and design regardless of prior rights (see Appendix C). In support of this program, VDOT has hired outside consultants to assist them in designing utility relocations if the utilities choose not to use their own designers or cannot meet the project time frames. These outside consultants are also versed in highway design and, as such, are tasked with making recommendations on design changes if it appears to be more advantageous than relocation. If the utility owner uses its own designers and does not meet the time frames, the design cost paid by VDOT is prorated and reduced. VDOT estimates that this procedure increased its ability to hit target dates by 15%, and decreased the project timelines by 5% to 10%. On specific projects, their time savings are estimated to be in excess of one year.

At the 50% design stage, the utility coordinator and design engineer pick locations for QLA data, based on potential design conflicts. As these data are added to the plans and as relocation design progresses, additional QLA data may be requested.

In the 1990s, VDOT found that utility owners were delaying projects when they could not obtain utility easements in the project time frames. VDOT changed its policy and now is able to negotiate the easements of the utility owner as long as the utility owner already has a prior right. The utility still pays for the easement, but the negotiation is at state labor cost and the timing is controlled because the state has better power of eminent domain than the utility owner.

VDOT provides Microstation licenses for its utility companies and design consultants. In this manner, VDOT gets all design data in the same format. VDOT estimates that this results in a 2- to 3-month decrease in project timelines.

VDOT has not developed a formal tracking of utility relocation costs versus design change decisions or cost savings.

However, it does track claims, and has found that 95% of all utility claims come from drainage issues.

VDOT has begun a new trial program in its Northern Virginia District. It is installing radio frequency identification markers that can be programmed with precise global positioning system coordinates and data about the utility. It is installing these markers every 25 ft or at bends on nonmetallic (and every 50 ft on metallic), relocated, or newly installed utilities. Their precise locations are indicated in the CAD file and on the plans. A hand-held reader at the ground surface will then give detailed information about the utility to the contractor.

GEORGIA DEPARTMENT OF TRANSPORTATION

The Georgia DOT (GDOT) conducts its planning for the Statewide Transportation Improvement Program on a 3-year cycle. The Construction Work Program is set up for 6 years and includes any long-range projects (beyond 6 years). The Chief Engineer selects a Project Manager for each project. The Project Manager then coordinates with all the different offices involved including the Statewide Utilities Program, which is comprised of the State Utilities Office (SUO) and seven district utilities offices (DUO). The SUO, headed by the State Utilities Engineer under the Operations Division, is responsible for producing the policies and procedures. The DUO, headed by the District Utilities Engineer under the Field Services Division, is responsible for implementing the policies and procedures. The Statewide Utilities Program is not part of the Right-of-Way, Design, or Construction offices. GDOT believes this separation from other design-related offices, coupled with its formal Plan Development Process, is an advantage to making utility decisions without partisan interference. Also, GDOT is one of two state DOTs (SCDOT is the other) that have a State Subsurface Utilities Engineer (SSUE) position within the SUO.

The Plan Development Process covers the preconstruction phase of a design project and begins with the Concept Phase of the project (0%–10% design stage). The objective of this stage is to develop a Concept Report that describes a recommended project "footprint," including logical termini. An Initial Concept team meeting is held to identify the core team and specialty team members including the SUO and DUO. The outcome of the Initial Concept meeting is a better understanding of the project scope, identification of what information is available and what is needed, and the next steps to be accomplished in the concept development. A draft Concept Report is created.

The Project Manager then schedules a Concept team meeting to present the proposed concept and alternatives, draft a Concept Report, and allow for discussion by the attendees. Included is an analysis of the benefit-to-cost ratio for the project. The DUO assists the Project Manager by furnishing a preliminary utility cost estimate for the proposed project. The DUO is responsible for reviewing the planned project with utility owners and requires them to submit a preliminary utility cost estimate, based on worst-case conditions, within three weeks. This cost estimate includes the names of all the utility companies, both public and private, having facilities along or crossing the project and the type of facility present, whether or not there are any major utility facilities that may be affected by the planned project and, if known at this time, whether or not any of the utilities plan to install any new equipment or upgrades to their facilities within the life of the project.

It is also desirable to know as early as possible if SUE is to be used on the project. GDOT's SUE program includes both the overhead and subsurface utilities. In 2008, GDOT's SUE (overhead and underground) program was used to map more than 2 million ft of utilities, 5,200 utility poles, and 300 test holes. Because of the success and growth of this federally funded program (80%), GDOT has been given direction by its senior management to include SUE on all urbanized projects and other projects on a case-by-case basis. All SUE services are to be performed by a prequalified SUE consultant.

If overhead/SUE has not already been included in the project's scope, then the District Utilities Engineer and/or Project Manager can request SUE services based on the criteria listed in GDOT's SUE Utility Impact Rating Form. The SSUE reviews the request and determines whether or not the project is a good candidate for SUE. The SSUE also determines the level(s) of SUE to be performed on the project. QLD is typically performed during the Concept Phase.

After the Project Manager receives all of the information needed, an alignment is recommended and the Concept Report is completed and sent to the appropriate entities for approval. The Preliminary Design Phase of the project (10%–60% design stage) begins with the approval of the Concept Report. If SUE is not being performed, the DUO sends out first submission plans to the utility owners as early as possible after mapping is completed and utility sheets are created. The utility owners provide their existing utility facilities information to the DUO in either electronic format or by means of hard copy markups. If SUE is being performed, it takes the place of first submission to the utility owners. Depending on the complexity of the project, QLC/QLB is typically performed during this phase (10%–30% design stage). The SSUE reviews and approves the SUE deliverables. The approved SUE information is provided to the Project Manager/Designer and the DUO.

The existing utility information is incorporated into the Utility Plans regardless of whether or not SUE was performed on the project. However, if SUE was performed on the project, the DUO sends the Utility Plans to the utility owners to review the SUE information.

As soon as preliminary drainage, erosion control, staging, structures, and construction limits are available, a Utility

Impact Analysis (UIA) may be performed by the SUE consultant (30%–60% design stage). The SUE consultant reviews all potential existing utility conflicts with the proposed design and makes recommended resolutions (utility relocation or adjustment to the proposed design), determines if QLA test holes are needed, determines a utility impact with "ball-park" cost (as designed), and provides a benefit of resolution. Both overhead and underground conflicts are considered at the same time. These items are incorporated into a conflict matrix spreadsheet, which is reviewed and approved by the SSUE. The approved SUE UIA information is provided to the Project Manager/Designer and the DUO.

The Preliminary Design Phase ends with a Preliminary Field Plan Review (PFPR). The Final Design Phase of project development (60%–100%) begins with the approval of the environmental document and distribution of the PFPR report. The second submission to the utility owners to provide markups for their proposed utility facilities/relocation plans occurs as soon as possible following approval of the PFPR report (70% stage). GDOT's District 3 is piloting a project to require utilities to provide their preliminary design at the 60% plan development stage to allow for earlier coordination with preconstruction offices and time to resolve remaining conflicts during the preconstruction phase, not during the construction phase.

Also at this time, the SSUE, the Project Manager/Designer, the DUO, and the utility owners meet to discuss the UIA findings and determine which QLA test holes to perform. The QLA deliverables are reviewed and approved by the SSUE before incorporation into the project's design. If the Project Manager/Designer adjusts the proposed design, then a second UIA may be done to determine if other utility conflicts become present. Consequently, additional QLA test holes may need to be done. This process is iterative as needed.

The Final Design Phase ends with a Final Field Plan Review, which is typically held a minimum of 16 weeks before letting, and the Construction Phase of the project begins. Although QLA test holes are ideally done during the preconstruction phase, they may also be done during the construction phase of the project.

GDOT's efforts to minimize project delays resulting from utility issues and provide more accurate utility information to enhance sound decision making have resulted in an award winning utility program.

In the spring of 2006, after a year of development, GDOT's Statewide Utilities Program rolled out GDOT's Utility Redline Software, which is an innovative enhancement to Bentley Redline's computer application that greatly facilitates the transmitting of utility plan markups in an electronic format for GDOT construction projects and is provided to GDOT's utility industry at no cost. This application makes use of the electronic Computer Assisted Design and Drafting files, and FTP (File Transfer Protocol) to communicate highway project status to affected utility owners in GDOT's electronic format. The GDOT Redline has user-friendly menus that allow its users to draw the utility information to GDOT's Electronic Data Guidelines. The benefits of this new software are:

- Saves both GDOT and utility owner's printing costs,
- Increases construction plan quality,
- Facilitates project utility coordination efforts,
- Speeds up project plan development, and
- Aids utility companies and GDOT in the implementation of GIS applications.

This software has been a significant asset in GDOT's ongoing mission to minimize delays to project delivery schedules. In recognition of this accomplishment, GDOT received the 2009 FHWA Excellence in Utility Accommodation and Relocation Award for Innovation and is the first state DOT in the nation to provide such a helpful and innovative tool.

Additionally, GDOT's SUO developed a training program, Avoiding Utility Project Impacts, to provide useful tools to help designers and project managers avoid many utility-related problems, thereby reducing project delays by identifying and resolving utility conflicts early in the design process. The program incorporates state-of-the-art methods and technologies and encourages creative solutions when handling utility relocation and accommodation issues. The trainees learn how to:

- Avoid unnecessary utility relocations,
- Effectively apply SUE on GDOT projects,
- Develop and make use of a UIA/Conflict Matrix, and
- Apply utility conflict avoidance methods on an actual GDOT project.

GDOT received the 2007 FHWA Utility Outstanding Achievement Award for Exceptional Accomplishment in the category of Utility Leadership for this training.

CHAPTER FIVE

BEST PRACTICES

In this chapter, best practices are limited to those that have application, even if minor, to the “relocation versus design-to accommodate” decision process. They do not include the large range of other utility best practices relating to other issues such as relocation construction and basic coordination. Best practices were culled from the literature and interviews.

- Train project managers and other design team personnel on utility issues. Training may be more comprehensive for project manager (PennDOT, GDOT).
- Train consultants and utility owner personnel in utility coordination processes and issues. Turnover in the work force may place inexperienced personnel in utility decision-making positions without the proper knowledge (PennDOT).
- Consider paying utility relocation design costs regardless of prior rights to maintain coordination between available space and project timing (VDOT).
- Consider task-order contracts with expert consultants versed in utility and highway design as an additional resource for design alternative suggestions (VDOT).
- Develop an early utility cost estimate based on worst-case assumptions and continually revise it as design progresses (VDOT, SHRP 2 R-15).
- Use technology tools such as Google Earth, roadway video logging, and GIS systems to get early visualization of utilities in the planning stages of projects (PennDOT).
- Place a utility expert on the project design team as early as possible and keep them involved and informed as design develops (GDOT, PennDOT, VDOT).
- Develop a standardized format for identifying and resolving utility conflicts and continually revise it as design progresses (GDOT).
- Develop a mechanism to capture any changes to the existing utility facilities performed by utility owners or contractors on the project as design develops. Update the utility mapping on the design plans as the utility data changes (SHRP 2 R-01).
- Develop or utilize a GIS system to store, manage, and recall utility information gathered during plan development and during utility relocations and new installations during construction (SHRP 2 R-01).
- Install or require utilities to install radio frequency identification markers on nonmetallic utilities during utility relocations or new installations (SHRP 2 R-01).
- Develop a catalogue or database of historical utility relocation costs to generate the best possible cost estimate. Update this database on a regular basis, but not to exceed annually (AASHTO Scan, VDOT).
- Develop visualization aids for utility pole and structure relocation costs (AASHTO Scan).
- Develop catalogues and visualization techniques to assist designers in alternate design possibilities (AASHTO Scan).
- Develop a rigorous pre-qualification for SUE consultants that addresses their technical qualifications. The SHRP 2 R-01 study and FHWA SUE web page are valuable resources in this effort (SHRP 2 R-01, PennDOT, GDOT, VDOT).
- Develop a screening tool to assist and formalize the process of selecting the appropriate Utility Quality Levels for utility mapping. This might be an iterated process that is re-evaluated as additional detail is added to the design plans (PennDOT).
- Build on cost–benefit studies already performed to evaluate the cost-effectiveness of SUE (SHRP 2 R-01, SHRP 2 R-15, PennDOT).
- On projects where it is known in advance that utilities are a significant time or cost factor, get QLB mapping as early as possible, preferably at time of topo development. Consider the underground utilities as a topo feature that is underground (VDOT).
- Have frequent joint meetings with utility owners as design progresses to get their input on relocation issues and to make certain they coordinate their relocation designs with the available space (AASHTO Best Practices Guide, SHRP 2 R-15).
- Provide training in highway plan reading to utility owners (VDOT, GDOT).
- Ensure that all guidance documents do not conflict with each other and that they use the same standard terminology as it relates to utilities (PennDOT).
- Use or consider establishing utility corridors for utilities crossing major highways or located longitudinally along highway ROWs (AASHTO Scan).
- Acquire sufficient ROW for utility purposes (VDOT).

CHAPTER SIX

RESEARCH IN PROGRESS

There are several ongoing research efforts in areas that will assist in decision making for utility relocation versus design to accommodate. Three of these projects have peripheral involvement, in that they are looking into better ways to map existing utilities and to keep utility data current on projects: SHRP 2 R-01 (A), (B), and (C). Additional information on these projects can be found on the TRB website. There are two SHRP 2 projects that have direct application to the issues discussed in this report.

Scoped but not yet funded SHRP 2 R-15 (A), Model Curricula and Training Programs for Utility Relocation, seeks to develop a training program and model curricula to equip agency, consultant, and utility professionals responsible for coordinating and/or designing utility relocation work on transportation projects with a better understanding of the technical challenges faced by all involved parties. It is expected that the model training curricula and training materials would, at a minimum, include the following modules:

- Legal—familiarity with federal and state laws and regulations, permitting, and occupancy rights, etc.
- Coordination—understanding the roles and responsibilities of all parties involved in utility relocation work on transportation projects.
- Planning—emphasizing the importance of early identification of utility impacts and development of mutual resolution strategies.
- Design—understanding the basic principles of highway and utility design work, including how to interpret highway and utility plans, identify utility impacts, and develop mutual resolution strategies.
- Construction—understanding how project sequencing and construction methods affect contractor and utilities activities.
- Utility cost estimating and invoicing—understanding the necessity for and methods of developing accurate cost estimates for utility relocation work on transportation projects, and understanding the eligibility and invoicing requirements for reimbursement.

SHRP 2 R-15 (B), Identification of Utility Conflicts and Solutions, seeks to provide a tool and methodology for identifying and resolving utility conflicts that public agency and utility professionals can use to improve the project development process. The plan is to work with a minimum of two state DOTs that already have UCM processes in place and conduct work sessions to verify the usability of the draft UCM and the process for its use. The work sessions could determine gaps and opportunities for improvement of the draft UCM. Attendees of these work sessions shall include a cross section of DOT functional staff having varying levels of project development and utility coordination experience. Attendees at these work sessions could also include utility representatives, design consultants, and the FHWA. Additionally, staff from other DOTs and transportation agencies could be notified of the work sessions and encouraged to attend where practical. The end goal is to develop training materials including a procedural manual and other training aids for use in a pilot training program intended for DOTs that do not currently have a UCM process in place.

CHAPTER SEVEN

RESEARCH NEEDS

The following research needs were derived from the literature, consultant interviews, TRB working committees, state DOT personnel, and the consultant's experience. They were limited to those activities that may have a direct result on the decisions to relocate a utility versus design to accommodate that utility in place.

- Addressing Utilities on Design-Build Projects. There is a wide range of practice for utilities on design-build projects. Identifying the variances, pros and cons, and case studies may provide guidance for DOTs on future design-build projects.
- Standards for Utility "As-Builting" During Installation. Utilities are inspected during construction by a number of individuals, with a variety of drawing accuracy and precision. There are no consistent standards for creating a certified record drawing of a utility installation. Identifying the variances, costs, and ROI will assist DOTs and other organizations in creating standards for as-builting. This may be covered in part in SHRP 2 R-01 (A).
- Developing Effective Utility Relocation Cost Databases. Several states have a system for obtaining and maintaining utility relocation costs and updating them periodically. A study of effective methods to do this, the costs to do this, and a look at the necessary updating frequencies will assist DOTs that do not have such a system in developing one.
- Integrating Utility Relocation Cost Databases with Three-Dimensional Modeling of Utility Conflicts. The ability to create and query databases in GIS systems will allow for integration of cost-relocation databases with conflict analysis.
- Analysis of Condition Assessment with Relocation Decisions. A decision to relocate or design to accommodate a particular utility may be significantly affected by a utility's condition, if that condition is known. A decision tool on how to assess condition, the frequency of inspection points if exposure is the best method, and the cost–benefits of such a tool will assist DOTs in their decisions.
- Evaluating Performance of Utilities When Relocation Is to a Geotechnically or Seismically Suspect Area. Available relocation of a utility may be to a potentially unsuitable location for soils or geotechnical performance. Identification of this as a factor and quantifying its short- and long-term implications for a utility may influence the decision to relocate it in the first place. Developing existing cost data and a decision tool will assist DOTs and utility owners.
- Factoring in the Cost of Protective Measures When Utilities Are Not Relocated Away from Construction Areas. Not all relocation costs are directly related to materials and the costs of the construction relocation. There may also be costs associated with protecting utilities that are left in place and are in the footprint of construction. A catalogue of protective measures and their costs may assist DOTs in their relocation decisions.

CHAPTER EIGHT

CONCLUSIONS

State departments of transportation (DOTs) handle utility issues in diverse ways; there are few common threads. Even federal guidance documents from FHWA and AASHTO are routinely used by fewer than 60% of the states. On the other hand, virtually all state DOTs follow their in-state utility accommodation policies, which reference some of these other documents. Most of these policies are general in nature and pertain mostly to cost-reimbursement issues.

There is a real need to better evaluate and weigh the costs of relocating a utility versus accommodating it in place through design considerations for the benefit of the citizen who is both the ratepayer and the taxpayer. This is understandable given the budget considerations of the DOTs and the historical perspective that highways are primarily for vehicular transportation and utility occupancy is a privilege.

The lack of available and pertinent literature on the topic indicates that not much attention has been paid to the issue. These attitudes are slowly changing as the impacts of relocating utilities are beginning to be measured more accurately and comprehensively, such as road-user costs for lane closures. The increasing costs for utility materials, construction labor, and engineering are also a factor that DOTs can no longer ignore, along with time concerns owing to the lack of trained and experienced professional and technical staff from the utilities.

Recently, there has been a significant effort from several DOTs to address utility issues with new technologies, philosophies, and procedures. There is also an increased national emphasis on utility issues that has resulted in significant research efforts. Translating this research into practice remains a challenge.

An entire branch of civil engineering practice, subsurface utility engineering (SUE), has evolved to address the very issues raised in this study. The unintentional but very real misperception that SUE is just an expensive version of One-Call has hampered DOTs over the years. There is some justification for this perception in the lack of qualifications and performance in the early SUE industry. Now that mainstream engineering firms, municipalities, private project owners, and others are embracing the concepts of utility risk management and performing SUE services this perception could change as services improve and noncapable providers are selected less often by DOTs.

The concepts of altering a highway design to accommodate existing utilities are not as well represented in the literature or in past studies as might be imagined, given the pervasiveness of utility issues and highway design. Several research projects with bearing on the problem are underway or planned for the near future. Five of these projects dealing with the broad topics of utility data storage and retrieval, utility locating and mapping technologies, and utility coordination and conflict identification, are currently underway under the auspices of the SHRP 2 program.

Other research needs include:

- Addressing utilities on design-build projects,
- Adapting standards for utility “as-building” during installation,
- Developing effective utility relocation cost databases,
- Integrating utility relocation cost databases with three-dimensional modeling of utility conflicts,
- Analyzing condition assessment with relocation decisions,
- Evaluating performance of utilities when relocation is to a geotechnically or seismically suspect area, and
- Factoring in the cost of protective measures when utilities are not relocated away from construction areas.

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APPENDIX A

Subsurface Utility Engineering versus One-Call

A subsurface utility engineering mapping effort addresses many issues that directly affect the quality and comprehensiveness of utility mapping that One-Call responses are not equipped to address. The One-Call system is only a messaging service, routing a request from a designer or excavator to a utility owner. In turn, that utility owner sends out a person to mark the utilities within the project limits described on the request. As such, if there are ten different utility owners within a project limit, there may be ten persons in the field marking those individual utilities. Sometimes utility owners contract these marking services to other firms; sometimes more than one utility owner in an area contracts with the same utility marking firm, although this practice once common is becoming more rare. Not a single One-Call statute in the country requires abandoned utilities to be marked, although this is more of a construction issue than a design one.

Regardless of whether utility owners should mark during design, here are some arguments as to why they cannot do a job as well as a single entity responsible to mark all utilities on a project.

The very nature of a single entity (say for instance a subsurface utility engineer) marking all utilities within the project limits fosters an environment where utilities can be marked on the ground surface with greater reliability than during One-Call operations. For convenience sake, we will call the marking of utilities by a subsurface utility engineer as “designating” and by a utility owner or One-Call locator as “locating.” Consider these typical comparisons:

Designator: Possesses all utility owner records
Locator: Possesses only those records for the utility owner for which he/she is under contract.

Designator: Finds and marks all utilities
Locator: Only marks some utilities—does not have advantage of seeing all parts of the puzzle. For instance, abandoned utilities, unknown utilities, multiple nonencased wires, etc., cause identification confusion.

Designator: Has realistic time constraint for finding and marking utilities
Locator: Is under severe time constraints for getting utilities marked.

Designator: Has many pieces of equipment on-site or readily available
Locator: Has limited equipment available.

Designator: Maps large area, allowing better familiarization with utilities at site
Locator: Usually only responsible for a very small area at any given time, making it difficult to see the large picture.

Designator: Because of large area to be marked and no time constraints, traffic control can be set up, allowing time and security for decision and precision. Usually has at minimum a two-person crew
Locator: Usually no time for traffic control. Runs between vehicles when safe. Usually a one-person operation; almost never is there more than one person on-site.

Designator: Opens and inspects all available utility structures and addresses each utility wire and conduit source to source
Locator: Typically is not allowed to open any utility structure, therefore not getting the best possible data on number of cables or conduits or having ability for direct signal application.

Designator: Can place transmitter over utilities in traffic
Locator: Cannot use equipment effectively in traffic owing to one-person limitation.

An additional and significant problem exists when utility owners mark their utilities. Someone has to transfer that data from the ground to the Computer Assisted Design and Drafting file. This process begins with the surveyor. However, when the surveyor has no control over the process of the field marks, he does not know when to go survey the marks. He does not know if all the marks have been made in the field. He may need to make multiple trips to the same spot to survey additional marks. Forty percent (40%) of DOTs report that they use their survey forces, and/or their outside design consultants do, in this manner. This results in inefficiencies and potential quality issues. These issues become moot when the entities making the marks and the surveyor of the marks are the same responsible party.

APPENDIX B

Survey

NCHRP PROJECT 20-05, Synthesis Topic 40-04:
Utility Location & Highway Design

QUESTIONNAIRE FOR STATE DOTS

Background

This survey is designed to gather data on how states approach integrating utility issues into their highway design process. Highway projects may be designed with little or no consideration of existing utilities, resulting in routine utility relocations late in the project development process. The other end of the spectrum of practice is to leave utilities in place, map them accurately very early in the project development process, and design the roadway to avoid most or all utility conflicts.

It is important to receive feedback from all applicable departments within your DOT; however, we only want to receive one survey back per DOT. Therefore, please print out as many copies of the survey as necessary for your internal distribution and collate the results into one survey for submission through the web. We realize there may be answers to some questions for which there is not consensus within the DOT. Please use your judgment to choose the “best” answer(s) for final submission. However, non-consensus is also an important fact to know for the study, so Question #5 is designed to answer this. The first five questions do not need to be routed to or answered by anyone other than the person responsible to submit the final survey.

The due date for this survey is February 21, 2009.

Please provide the following information for your agency. Your agency will be identified in the report as a survey respondent if the completed questionnaire is returned or submitted.

1) Agency Name

____

2) Agency Address

____

3) Person(s) and Title(s) of Respondent(s)

____

4) Please give us a contact phone number and e-mail address for the primary respondent to this survey

____

____

____

5) This question is to be filled out only by the person responsible to collate answers. We realize that there may be some diversity of opinion on some of the answers to the questions depending upon who is taking the survey. You may have been forced to make your best judgment about the correct answer, based upon your knowledge and the general consensus of the survey takers. Please indicate below which questions, if any, had different answers from different persons within your organization by checking the appropriate box for each listed question number.

	Survey takers completely agree on their answers	Survey takers are mostly in agreement on their answers	Survey takers disagree somewhat on their answers	Survey takers are in complete disagreement on their answers
Question # 6	❍	❍	❍	❍
Question # 7	❍	❍	❍	❍
Question # 8	❍	❍	❍	❍
Question # 9	❍	❍	❍	❍
Question # 10	❍	❍	❍	❍
Question # 11	❍	❍	❍	❍
Question # 12	❍	❍	❍	❍
Question # 13	❍	❍	❍	❍
Question # 14	❍	❍	❍	❍
Question # 15	❍	❍	❍	❍
Question # 16	❍	❍	❍	❍
Question # 17	❍	❍	❍	❍
Question # 18	❍	❍	❍	❍
Question # 19	❍	❍	❍	❍
Question # 20	❍	❍	❍	❍
Question # 21	❍	❍	❍	❍
Question # 22	❍	❍	❍	❍
Question # 23	❍	❍	❍	❍
Question # 24	❍	❍	❍	❍
Question # 25	❍	❍	❍	❍
Question # 26	❍	❍	❍	❍
Question # 27	❍	❍	❍	❍
Question # 28	❍	❍	❍	❍
Question # 29	❍	❍	❍	❍
Question # 30	❍	❍	❍	❍
Question # 31	❍	❍	❍	❍
Question # 32	❍	❍	❍	❍

6) Which statement best describes your DOT's philosophy on utilities?

❍ The utility company is responsible to know where they are located in my right of way
❍ The DOT is responsible to know where all utilities are located in the right of way
❍ The DOT and the utility companies are equally responsible to know where the utilities are within the right of way.
❍ Other (please specify)

If you selected other, please specify:

---

7) Is your DOT philosophy to weigh the cost to both the utility ratepayer and the taxpayer when considering whether to design around or move utilities? (Mark all answers that apply.)

❑ We take into consideration the cost effect of relocation on the utility ratepayer
❑ We only consider the cost to the taxpayer for our design decisions
❑ We weigh the costs to the taxpayer and rate payer equally for our design decisions
❑ We consider the costs to the rate payer, but view the costs to the taxpayer as more important to us.

8) Are there any state statutes or policies that affect your decision to relocate utilities versus design around utility conflicts? If "yes," please give a brief description in the "Other" section.

❍ Yes
❍ No
❍ Not sure
❍ Other (please specify)

If you selected other, please specify:

---

9) Are there any DOT policies or guidance documents that negatively affect your ability to consider whether to relocate utilities or design around them? If "yes," please give a brief description in the "Other" section.

❍ Yes
❍ No
❍ Not sure
❍ Other (please specify)

If you selected other, please specify:

---

10) Where does your "Utility Section" fit within the overall DOT organization? (Mark all answers that apply.)

❑ a. Design Section
❑ b. Right of Way Section
❑ c. Maintenance/Operations Section
❑ d. Survey Section
❑ e. It is different at the State versus District/Region Level
❑ Other (please specify)

If you selected other, please specify:

---

11) Is a member of the "Utility Section" designated to be part of the project design team?

❍ Yes
❍ No
❍ Not sure

12) If "Yes," at what point in the project development process do they have the first opportunity to get involved?

❍ i. Planning stage
❍ ii. Topo survey stage
❍ iii. Early design
❍ iv. Mid-design
❍ v. Late design
❍ vi. Post-design/pre-construction
❍ vii. Construction
❍ Other (please specify)

If you selected other, please specify:

____

13) Do you have designers on most projects that are trained in utility issues?

❍ Yes
❍ No
❍ Not sure

14) If "Yes," do they have training in the following areas? (Mark all answers that apply.)

❑ Utility relocation costs
❑ Time necessary for utility companies to design and relocate
❑ Utility design constraints (e.g., manhole maximum depths, distances between structures, distances from other utilities, etc.)
❑ Utility right-of-way and minimum clearance issues
❑ Utility accommodation policies/rules
❑ Other (please specify)

If you selected other, please specify:

____

15) How do you get utility information on design plans?

	All the time	Most of the time	About half of the time	Some of the time	Rarely	Never
Department personnel obtain and use utility records	❑	❑	❑	❑	❑	❑
Utility companies get set of design plans and draw utilities on it	❑	❑	❑	❑	❑	❑
Department personnel survey "construction one-call marks"	❑	❑	❑	❑	❑	❑
Consultant surveys "construction one-call marks"	❑	❑	❑	❑	❑	❑
Department personnel survey "design one-call marks"	❑	❑	❑	❑	❑	❑
Consultant surveys "design one-call marks"	❑	❑	❑	❑	❑	❑
Hire subsurface utility engineering firm	❑	❑	❑	❑	❑	❑
Not sure	❑	❑	❑	❑	❑	❑

16) Do you have a formal mechanism to decide on which of the above methods you will use for a specific project?

❍ Yes
❍ No
❍ Not sure

17) Do you consider the impacts of overhead utilities at a different time in the project development process than you do the underground utilities?

❍ Yes
❍ No
❍ Not sure

18) Do consultant-designed projects follow the same procedures for obtaining utility information that the department does?

❍ They must follow the same procedures
❍ They have flexibility to obtain utility information any way they choose
❍ They suggest a scope and then must receive permission from the Department for that scope

19) Does your Contract Management policy enforce Errors & Omissions for utility data depicted on plans by consultants?

❑ We are aggressive in this enforcement
❑ We don't hold our consultants responsible for missing or incorrect utility information
❑ We place the final burden for utility information being correct on the utility owners
❑ Only if we hire a SUE firm to collect the data
❑ We find it too difficult to enforce Errors & Omissions for utility mapping unless there is a catastrophy
❑ Other (please specify)

If you selected other, please specify:

---

20) Which of the following elements are routinely considered as a valid reason for a design change as a result of a utility conflict? (Mark all answers that apply.)

❑ Placement of the travel lanes
❑ Right of way procurement
❑ Cuts & fills
❑ Structures—such as retaining walls, footers, etc.
❑ Drainage
❑ Signage
❑ Lighting
❑ Traffic signalization
❑ Overhead signs
❑ Other (please specify)

If you selected other, please specify:

---

21) If such a design change is suggested, who does the suggesting? (Mark all answers that apply.)

❑ Utility section personnel
❑ Task element designer
❑ Consultant

❑ Utility owner
❑ Other (please specify)

If you selected other, please specify:

____

22) Is there a formal approval process required to make a design change in order to accommodate a utility?

❍ Yes
❍ No
❍ Not sure
❍ Normal "Chain of Command" process

23) If "Yes," is there a threshold for this approval based on cost, time, or other factors?

❍ Yes
❍ No
❍ Not sure

24) Would you consider a design change in order to accommodate the following utilities (in their own easements) in conflict with the highway design?

	Always	Most of the Time	Some of the Time	Only in unusual circumstances	Never
Transmission Gas Pipeline	❍	❍	❍	❍	❍
Distribution natural gas	❍	❍	❍	❍	❍
Water lines	❍	❍	❍	❍	❍
Aerial transmission power lines	❍	❍	❍	❍	❍
Aerial distribution power lines	❍	❍	❍	❍	❍
Aerial communication lines	❍	❍	❍	❍	❍
Buried transmission electric facilities	❍	❍	❍	❍	❍
Encased distribution electric lines	❍	❍	❍	❍	❍
Direct-buried distribution electric lines	❍	❍	❍	❍	❍
Encased communication facilities	❍	❍	❍	❍	❍
Direct-buried communication facilities	❍	❍	❍	❍	❍
Substations	❍	❍	❍	❍	❍
Buried environmentally controlled vaults	❍	❍	❍	❍	❍
Gravity sanitary systems	❍	❍	❍	❍	❍
Pressure sanitary systems	❍	❍	❍	❍	❍
Storm drainage	❍	❍	❍	❍	❍
Large commercial services	❍	❍	❍	❍	❍
Residential services	❍	❍	❍	❍	❍
Steam	❍	❍	❍	❍	❍
Petroleum pipelines	❍	❍	❍	❍	❍

25) Would you consider a design change in order to accommodate the following utilities (in the right of way by permit) in conflict with the highway design?

	Always	Most of the Time	Some of the Time	Only in unusual circumstances	Never
Transmission gas pipeline	❑	❑	❑	❑	❑
Distribution natural gas	❑	❑	❑	❑	❑
Water lines	❑	❑	❑	❑	❑
Aerial transmission power lines	❑	❑	❑	❑	❑
Aerial distribution power lines	❑	❑	❑	❑	❑
Aerial communication lines	❑	❑	❑	❑	❑
Buried transmission electric facilities	❑	❑	❑	❑	❑
Encased distribution electric lines	❑	❑	❑	❑	❑
Direct-buried distribution electric lines	❑	❑	❑	❑	❑
Encased communication lines	❑	❑	❑	❑	❑
Direct-buried communication lines	❑	❑	❑	❑	❑
Substations	❑	❑	❑	❑	❑
Buried environmentally controlled vaults	❑	❑	❑	❑	❑
Gravity sanitary systems	❑	❑	❑	❑	❑
Pressure sanitary systems	❑	❑	❑	❑	❑
Storm drainage	❑	❑	❑	❑	❑
Large commercial services	❑	❑	❑	❑	❑
Residential services	❑	❑	❑	❑	❑
Steam	❑	❑	❑	❑	❑
Petroleum pipelines	❑	❑	❑	❑	❑

26) When do you or the utility owner excavate test holes on existing utilities to determine vertical conflicts?

	Never	Rarely	Sometimes	Most of the time	Almost always
0–10% design	❑	❑	❑	❑	❑
10–30% design	❑	❑	❑	❑	❑
30–70% design	❑	❑	❑	❑	❑
70–90% design	❑	❑	❑	❑	❑
90–100% design	❑	❑	❑	❑	❑
During construction	❑	❑	❑	❑	❑

27) We routinely use the following guidance documents for design as it relates to utilities. (Mark all answers that apply.)

❑ FHWA—“Avoiding Utility Relocations”
❑ CI/ASCE 38-02—“Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data”
❑ AASHTO—“A Policy on Geometric Design of Highways and Streets”
❑ FHWA—“Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects”
❑ AASHTO Strategic Plan Strategy 4-4: “Right of Way and Utilities Guidelines and Best Practices”
❑ State One-Call Statute “Design Ticket”
❑ AASHTO—“A Policy on the Accommodation of Utilities Within Freeway Right-of-Way”
❑ AASHTO—“A Guide for Accommodating Utilities Within Highway Right-of-Way”

- ❑ FHWA—"Program Guide: Utility Relocation and Accommodation on Federal-Aid Highway Projects"
- ❑ State Utility Accommodation Rules
- ❑ Other (please specify)

If you selected other, please specify:

____

28) We outsource the following functions

	Never	Rarely	Sometimes, on select projects	A majority of the time	Almost always
Depicting aerial utilities on plans	❑	❑	❑	❑	❑
Depicting subsurface utilities on plans	❑	❑	❑	❑	❑
Utility conflict identification	❑	❑	❑	❑	❑
Utility conflict resolution	❑	❑	❑	❑	❑
Utility relocation cost estimates	❑	❑	❑	❑	❑
Review of plans & estimates	❑	❑	❑	❑	❑
Drafting of special provisions	❑	❑	❑	❑	❑
Utility relocation design	❑	❑	❑	❑	❑
Utility construction inspection	❑	❑	❑	❑	❑

29) We estimate that we (the DOT) spend approximately the following amounts per year

	Less than $250,000	$250,000–$500,000	$500,000–$1M	$1M–$3M	$3M–$7M	>$7M
Getting subsurface utility information depicted on design plans in-house	❍	❍	❍	❍	❍	❍
Getting subsurface utility information depicted on design plans by consultant designers	❍	❍	❍	❍	❍	❍
For a "formal" SUE utility mapping program	❍	❍	❍	❍	❍	❍
Educating our designers on utility issues	❍	❍	❍	❍	❍	❍
On utility relocations that are state cost responsibility	❍	❍	❍	❍	❍	❍
On utility coordination functions	❍	❍	❍	❍	❍	❍
On utility change orders during construction	❍	❍	❍	❍	❍	❍
On utility claims during or post-construction	❍	❍	❍	❍	❍	❍

30) Do you have any case studies that evaluate the costs of designing a project around existing utilities versus relocating them?

- ❍ Yes
- ❍ No
- ❍ Not sure

31) Do you have a database that includes project information on utility relocation costs?

- ❍ Yes
- ❍ No
- ❍ Not sure

32) If "Yes," does this database include both costs to the utility and costs to the state?

- ❍ Yes
- ❍ No
- ❍ Not sure

33) Do you have additional information not covered in this questionnaire that is pertinent to the issue of whether it is better to design around utilities or have them relocate?

- ❍ Yes
- ❍ No
- ❍ Not sure
- ❍ Other (please specify)

If you selected other, please specify:

---

34) Do you have additional information that could benefit other DOTs on your DOT's process to decide whether to design around a utility or relocate it?

- ❍ Yes
- ❍ No
- ❍ Not sure
- ❍ Other (please specify)

If you selected other, please specify:

APPENDIX C

VDOT Utility Reimbursable Preliminary Engineering Pilot Program

COMMONWEALTH of VIRGINIA

DEPARTMENT OF TRANSPORTATION
1401 EAST BROAD STREET
RICHMOND, 23219-2000

CHARLES D. NOTTINGHAM
COMMISSIONER

STUART A. WAYMACK
DIRECTOR, RIGHT OF WAY AND UTILITIES

June 30, 2000

MEMORANDUM

TO: Mr. J. G. Browder, Jr.

FROM: S. A. Waymack

SUBJECT: Utility Company Preliminary Engineering Cost

In June 1999, the General Accounting Office (GAO) developed a report to Congressional Requesters on "Impact of Utility Relocations on Highway and Bridge Projects". All 50 states and the District of Columbia responded to a questionnaire from GAO regarding this matter. States' responses identified the number one reason for delays in relocating utilities as a lack of utility company resources.

At the AASHTO/FHWA Conference, in Savanna, Georgia, we were requested to initiate a pilot program whereby 100% of preliminary engineering cost would be billable to the project, regardless of the project prorate. We have discussed this change with our District Utility Engineers and the consensus of opinion is that this change will result in our obtaining easement information and adjustment plans and estimates in a more timely manner.

This in to request administrative concurrence in proceeding with this pilot project. The utility relocation construction cost will continue to be administered in accordance with current procedures.

Cc: J.D. Austin
M.W. Reynolds

Approved

Mr. J.G. Browder, Jr.

7-5-00

Date

COMMONWEALTH *of* VIRGINIA

Office of the Attorney General
Richmond 23219

Mark L. Earley
Attorney General

900 East Main Street
Richmond, Virginia 23219
804 - 786 - 2071
804 - 371 - 8946 TDD

August 7, 2000

RECEIVED
AUG 9 2000
R/W & U DIVISION

J. David Austin
VDOT – Right of Way & Utilities
1401 East Broad Street
Richmond, Virginia 23219

Re: Preliminary Engineering Costs Related to Utility Relocation

Dear Mr. Austin:

I have reviewed your question about the proposed FHWA pilot program where 100% of the preliminary engineering costs associated with utility relocation will be billable to the road project. As I understand the current situation, these costs may be 100% utility company responsibility, prorated between VDOT and utility, or 100% VDOT. The anticipated benefit of this pilot program is to hasten utility relocation and realize a cost savings over the life of the project by reducing utility delay claims and utility disruptions.

While the various statutes provide that VDOT pay for some utility relocation costs, preliminary engineering is neither proscribed nor required specifically. These statutes speak of "costs properly attributable to such relocation." I believe this ambiguity in the statutory language gives VDOT the flexibility of cooperating with the federal pilot program should it be deemed appropriate.

If there are further questions on this issue, please let me know.

Very truly yours,

James F. Hayes
Senior Assistant Attorney General

5:26:444

cc: Richard L. Walton, Jr.
James G. Browder, Jr.

COMMONWEALTH of VIRGINIA

DEPARTMENT OF TRANSPORTATION
1401 EAST BROAD STREET
RICHMOND, 23219-2000

CHARLES D. NOTTINGHAM
COMMISSIONER

STUART A. WAYMACK
DIRECTOR, RIGHT OF WAY AND UTILITIES

August 15, 2000

MEMORANDUM

TO: District Utility Engineers

FROM: J. David Austin

SUBJECT: Preliminary Engineering Costs Related to Utility Relocations

In accordance with discussions at our meeting with various utility companies on July 12, 2000, it is satisfactory to proceed with bearing 100% of the preliminary engineering costs for utility relocations.

Attached are copies of a letter of approval from Mr. J. G. Browder and a letter of concurrence from Mr. James F. Hayes, Senior Assistant Attorney General.

We will need to insure that procedures outlined in Section 7.5 of the utility manual are followed. Consultant fees for engineering services greater that $10,000 will need to be approved by this office. We will also need to closely review the proposed work to insure that we are not bearing the engineering expense for expanding or enlarging the utility facilities. If you have any concerns please let us know.

Please notify each utility in writing of this change to establish an effective begin date.

cc: J. G. Browder
S. A. Waymack
District Administrators
District Right of Way Managers

VDOT UTILITY REIMBURSABLE PRELIMINARY ENGINEERING PILOT PROGRAM

All costs incurred for preliminary engineering on VDOT roadway improvement projects shall be 100% reimbursable by VDOT regardless of the construction prorate.

This policy is effective September 1, 2000 for all VDOT projects initiated from this date forward, and will remain in effect until notified otherwise by the State Utilities Engineer's office. A project is considered initiated with the holding of a utility field inspection or by a project specific preliminary engineering authorization letter to the utility company.

No-plan projects shall **not** be included in this policy.

Preliminary engineering for Cable television facilities are reimbursable under this pilot program.

Approvals for use of consultant engineering companies by a utility shall be in accordance with the latest edition of Volume II of the Right of Way and Utilities manual. This includes gaining approval for the use of a particular consultant firm by a utility company from the State Utilities Engineer's office. A written request to utilize consultant engineers shall be sent to the District Utilities Engineer for each individual project by the utility company. Approvals for engineering services on each project shall be the responsibility of the District Utilities Engineer for services less than $10,000.00 and by the State Utilities Engineer's office for those services with amount's totaling $10,000.00 and greater.

There shall be a disincentive clause in the approvals granted for reimbursement stating: (If failure to provide the requested information [easements, plans and estimates] in the timeframe stipulated as mandated by the VDOT project schedule and the District Utilities Engineer is not met, reimbursement for preliminary engineering in excess of the project prorate shall be forfeited.)

Upon authorization of a plan and estimate or issuance of a permit for work at utility expense by VDOT, the period of reimbursable preliminary engineering activity is concluded for that particular project. Should VDOT revisions require additional engineering efforts, these will be handled case specific.

The final invoices for reimbursable engineering services shall be submitted to VDOT within 90 days of authorization of the plan and estimate for each project or reimbursement is forfeited.

VIRGINIA Preliminary Engineering Cost Reimbursement

WHAT:
Reimburse utilities for 100% of the preliminary engineering cost incurred on a VDOT roadway improvement project.

WHEN APPROVED:
September 1, 2000

WHEN STARTED:
Same date

END DATE:
To be determined

Progress Summary:
In 2002 we authorized reimbursement on 50+ projects. This is a slight increase from the 2001 authorizations. To date we have noticed a small but steady increase in the timely response and receipt of the plan and estimates from the utilities and their consultants. The VDOT roadway project workload has been reduced in the last two years so a good response is not available at this time. However the utilities view this as a very important step by VDOT in helping them meet the engineering demands for their relocations. The utilities have down sized their engineering staffs in the last few years so when our workload does return we should see great benefits from this program.

Because of a reduced workload, Virginia is unable to determine a monetary savings as a direct result of this pilot program. Utility claims, which were mounting in the millions annually, have clearly been reduced; but much of the reduction can be traced to fewer projects. However, there is no question that the program is looked upon favorably by the utility industry as they are also reducing forces. Overall, the FHWA pilot program for payment of these costs has resulted in a faster turn-around in reducing utility conflicts, which is aiding in our ability to meet the advertisement schedules advertisement of projects.

GREG FYI

Right-of-Way and Utilities Pilot Project Fact Sheet
May 2004

Pilot Name: VDOT Utility Reimbursable Preliminary Engineering Program

State: Virginia

State Contact: Gregory Wroniewicz, PE (804) 786-2931

FHWA Contact: Barbara Middleton (804) 775-3341

Pilot Purpose: see attached

When Approved: July 2000

When Started: September 2000

End Date: open

Summary of Pilot Approach, Implementation, and Current Status: see attached

Results to Date: mixed

Evaluation of Results to Date (including savings, costs, benefits, downsides):
VDOT has had a down turn in roadway construction for the last 3 years. The pilot program worked in this reduced project era and should work even better as our roadway construction resumes in the future.
We have noticed an increase in the utilities using outside sources to develop their plans and estimates. These have been getting to VDOT in a timelier manner.

Lessons Learned:
The process can speed up the plan and estimate submittal from the utilities.

Would you recommend this technique to others? yes

Please describe any issues that might affect use of the technique in other states.

Abbreviations used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation