EVALUATION OF UTILITY RELOCATION COSTS AND BEST MANAGEMENT PRACTICES

FINAL REPORT

SCDOT Research Project 684

Lansford C. Bell
Stefanie G. Brandenburg
Jennifer H. Ogle
Mike Reinke

Department of Civil Engineering
Clemson University

May 21, 2014

Technical Report Documentation Page

1. Report No. FHWA-SC-14-01	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle EVALUATION OF UTILITY RELOCATION COSTS AND BEST MANAGEMENT PRACTICES		5. Report Date 5/21/2014 6. Performing Organization Code
7. Author(s) Bell, L., Brandenburg, S., Ogle, J., and Reinke, M.		8. Performing Organization Report No.
9. Performing Organization Name and Address Glenn Department of Civil Engineering Clemson University 110 Lowry Hall Clemson, SC 29634		10. Work Unit No. (TRAIS) 11. Contract or Grant No. SPR No. 684
12. Sponsoring Agency Name and Address South Carolina Department of Transportation Office of Materials and Research 1406 Shop Road Columbia, SC 29201		13. Type of Report and Period Covered Final Report 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

In recent years, the SCDOT has experienced a significant variation in estimated costs for the relocation of utilities on many projects. This has led to cost overruns and caused headaches for the district engineers responsible for the projects. Through meetings with SCDOT personnel and utility provider representatives it was determined that a standardized cost estimate form combined with improved change order management and cost management strategies was needed. Recently submitted estimates were analyzed and rated on multiple criteria to generate a list of "poor", "good", and "excellent" estimates. The "excellent" estimates provided insight into the development of the standard estimate form and the deficiencies noted in all of the estimates were addressed in the standard. The standardized cost estimate form should be simple, easy to use, and flexible for use on all types of utility relocation projects. It is recommended that this format be used by all utility companies on all utility relocation cost estimates submitted to the SCDOT. This report presents the standardized estimate format and makes recommendations for improvements to the SCDOT's cost management database while utilizing cost management best practices. Further recommendations involve incorporating a utility relocation program within the safety office to encourage active participation of utility owners in resolution of severe safety problems, as well as standardizing CAD plan mark-up procedures for early project development to aid in obtaining more accurate estimates. Finally, a pilot unit cost database was developed from Progress Energy and Black River estimates and provides the basis for entry of historical cost data for checking the validity of cost estimates.

17. Key Words	18. Distribution Statement
Utility Relocation, Invoice	No restrictions.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. Of Pages	22. Price
Unclassified	Unclassified	96	

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

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

Problem Statement

In the past, the SCDOT has experienced variations in estimated costs compared to invoices for the relocation of utilities on projects for which the utility provider has prior rights and SCDOT is responsible for reimbursing the utility provider. On reimbursable utility relocation projects, utility companies and State DOTs are required by law to enter into agreements describing the scope of work and responsibilities for financing and accomplishing the work. Cost estimates identify the items of work to be performed, broken down by the estimated costs of direct labor and surcharges, overhead and indirect construction charges, materials and supplies, handling charges, transportation, equipment, contingencies, right-of-way, preliminary engineering, construction engineering, salvage credits, betterment credits, accrued depreciation credits, etc., and are an essential part of these agreements. The estimates for these items of work should include sufficient detail to provide SCDOT with a reasonable basis for cost analysis and budgeting, as well as verifying the reasonableness of invoices.

Background & General Practices

Roadside utilities are not owned or directly controlled by the State or the Department of Transportation. Because of this, legislation has been used to develop policies that govern how utilities may use public rights-of-way, and how public funds can be used to relocate those utilities. Two sections of highway law in Title 23 of the United States Code, 23 U.S.C 109(I) and 23 U.S.C. 123 went into effect in January 2007 and address the accommodation of utilities on Federal right-of-way and the reimbursement for the relocation of these utilities respectively. Title 23 states, "When a State shall pay for the cost of relocation of utility facilities necessitated by the construction of a project on any Federal-aid system, Federal funds may be used to reimburse the State for such cost in the same proportion as Federal funds are expended on the project."

Part 645 of title 23 Code of Federal Regulations (23 CFR 645) requires that each state reimburse utility companies for the relocation of utilities "which are to be retained, relocated, or adjusted within the right-of-way of active projects under development or construction when Federal-aid or direct Federal highway funds are either being or have been used on the involved highway facility." Most of the utility relocations throughout South Carolina involve the relocation of power, telephone, gas, water, and sewer utilities.

One of the first steps in a utility relocation project is the establishment of right-of-way (ROW) drawings on a district map. Right-of-way acquisition is a major hurdle in any project as it determines on whose property the work will be done. There are usually two different SCDOT offices in South Carolina that are involved at this point in the project, the district in which the work is being done and the SCDOT headquarters in Columbia. South Carolina has seven different district offices- Columbia (Headquarters – District 1), Greenwood (District 2), Greenville (District 3), Chester (District 4), Florence (District 5), Charleston (District 6), and Orangeburg (District 7). Figure 1.1 shows the locations of the SCDOT districts.

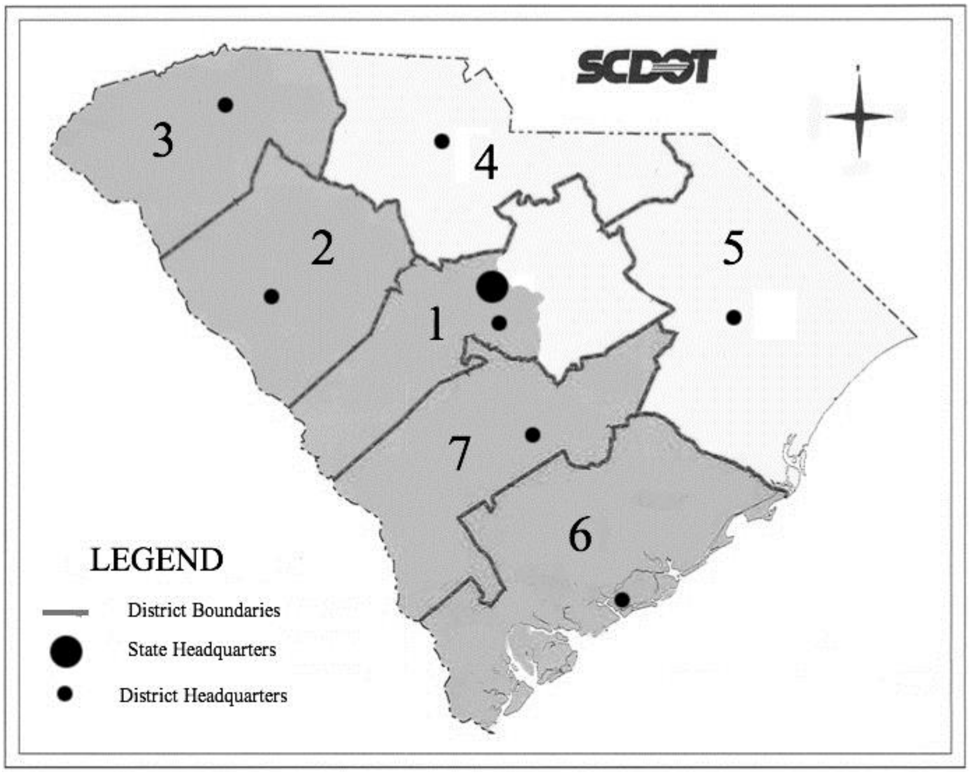


Figure 1.1: SCDOT District Map
(Source: SCDOT)

Although representatives from each of the district offices meet in Columbia to problem solve and find better ways to do business with the utilities, each individual district is responsible for the work being done within its area. When the SCDOT decides to widen or improve a roadway, a utility information meeting is held to discuss how the roadside utilities will be accommodated. If it is necessary to relocate any utilities, the SCDOT has a utility relocation meeting to discuss right-of-way issues and design. At this stage, it is necessary for the SCDOT and the utility provider to enter into an agreement determining the scope and fiscal responsibility of the project. In the preliminary construction meetings, the SCDOT determines the best location for the relocated utility. These plans are then sent to the lead district engineer for approval. After the district engineer has confirmed that the plans are suitable for construction, they are sent to the local utility provider's office where the relocation planning begins. The SCDOT utility relocation plans are typically submitted to the utility provider when the project design is about 60% complete, which is usually six months to a year before the project is let. The SCDOT then requests that the utility provider approve and return the plans for relocated utilities two months before any funds are allocated. It is at this time that initial cost estimates from the utility companies are submitted to the SCDOT headquarters where they are reviewed and approved by both the accounting and the construction departments.

After cost estimates are reviewed and approved by the SCDOT, the utility can then be relocated. During construction, the SCDOT reimburses costs incurred by each utility provider for the relocation of existing utilities in one of two ways, either unit cost or lump sum. Change orders are submitted by the utility provider to the lead district engineer for the SCDOT. It is the responsibility of the district engineer to analyze the change order requests and to determine if those requests are valid. Most change orders involve requests for additional funding and must be approved by the lead district engineer and then sent to the SCDOT headquarters (HQ) in Columbia. All change order requests must be adequately documented but the supporting documentation is not often submitted to headquarters with the request and remains with the project documents located at the district. The change order request must also be approved by the accounting and construction departments at HQ. After the change order is approved, it is returned to the lead district engineer who then notifies the utility provider of the approval. Usually, the subsequent invoice from the utility provider includes the additional costs requested in the change order. The cost information associated with change orders and the reasons for the change requests are not usually included in the SCDOT cost management database for utility relocations. The limitations and inefficiencies of the existing SCDOT utility relocation cost management database will be discussed further in Chapter 4 of this report.

During a meeting with SCDOT district engineers in June of 2010, many grievances were aired about the difficulties encountered on utility relocation projects where it appeared as if the utility companies received preferential treatment by other State representatives. Some examples and concerns expressed at the June meeting causing repeated frustrations are:

- Many utilities, SCE&G being a prime example, tend to give as little information as possible in estimate submittals, but just enough information to get an approval.
- The SCDOT is graded on the timely completion of projects, but often the utility relocation work is finished behind schedule, thus delaying the scheduled start and completion dates of SCDOT construction.
- The SCDOT had to pull a $2,000,000 project one day before the project let date because a single utility claimed they did not have the funds to move. SCDOT pulled all encroachment permits from the utilities to try and gain an upper-hand. Eight hours later the utility companies, with politician aid from the State House, had the permits back in place.
- There are numerous instances of utility companies claiming they cannot do the relocation work for a variety of reasons, and all the SCDOT engineers can do is tell their bosses "sorry." There is little the SCDOT can do to make these relocations happen.
- One participant noted, "It is like dog fighting with a dog that has no teeth."
- Due to the utility provider workload, the SCDOT is, more often than not, at the mercy of the utilities schedule.

- There are also a number of frivolous claims arising from utility contracts. For example, utilities have charged meals at very expensive restaurants on project invoices to the SCDOT.

Since January 2008, twenty-one relocation projects throughout the state of South Carolina have overrun initial cost estimates by over $287,000. That represents 40% of the relocation projects that have been completed since the beginning of 2008. Only 10 projects, or 20%, of the closed projects since January 2008 have been on budget. This suggests that the cost estimating procedures utilized by utility providers in South Carolina may not be sufficient to minimize change orders and cost overruns. It is recommended that a standardized estimating process be implemented by the SCDOT to reduce cost overruns and improve the efficiency of the utility relocation process.

Research Methodology & Objectives

Research was conducted to examine the utility relocation cost estimating process and develop a more uniform, standardized procedure for the state of South Carolina. It is important to track and manage costs throughout the project life cycle, from estimate to final invoice. The key to effectively managing these costs is the database where estimates can be linked to invoices and causes of change orders/ cost overruns can be identified. Reviewing literature from departments of transportation throughout the United States suggests that improving cost estimates and cost comparisons between utility providers is related to the standardization of the initial cost estimates.

Standardizing Cost Estimating and Historical Unit Cost Data

The Clemson University research team met with the SCDOT steering committee as well as with other SCDOT district representatives. Initial meetings provided direction to the research team and facilitated the communication with district offices on the existing utility reimbursement procedures. An analysis of many completed relocation projects indicated a need to communicate with utility providers on their invoicing procedures and their willingness to utilize a more standardized cost estimate. From these meetings it was determined that one way to control costs across all utility relocation projects is to make the cost estimating process more standardized from the beginning of each project. Once the cost estimates are formatted to provide the SCDOT with adequate, detailed information, the information could be effectively managed through a project cost database.

The SCDOT must relocate various utilities in the course of its highway projects such as power lines/poles, gas lines, sewer and waste drainage, water, cable, telephone, fiber optics, etc. Each utility provider appears to have its own method and format for cost estimates, making comparisons between each utility very difficult. This makes it very difficult to adequately track costs and identify causes of cost overruns. A standardized form for submitting estimates could be of significant value to the SCDOT.

Database Management Practices

Currently, SCDOT utilizes a cost management database to track and manage the costs associated with utility relocations. The database is used to track costs and information throughout a project's life. The database's main function is to track invoices from the utilities to facilitate reimbursements for the work that has been completed. Having accurate cost information including such details as invoice amounts, reasons for change order requests/approvals, and the dates associated with invoices and payments will assist the SCDOT in efficiently managing its fiscal resources.

Since 2005, SCDOT has gone through several programs to manage utility relocation costs starting with a simple Excel spreadsheet which did not allow for the complexity of utility estimating and invoicing to be properly recorded, to an Access database which became plagued by too many linked tables and open ended fields that allowed users too much freedom in data entry, to the current system Entire Connection which can handle the complexity, but is not user friendly. Given these prior and current issues, the research team sought out flexible, robust, and user friendly options for utility relocation data management and presented these findings in Chapter 4.

Initially, the project team had expected to be able to use the information provided in the existing databases and estimates to develop a historical unit cost database, but the lack of a consistent coding among utility companies coupled with the limited level of detail in the estimates made this an almost impossible task. One of the biggest problems is identifying the type of item in the estimates from the codes provided by the utility companies in lieu of an item description. SCDOT was able to obtain the code book for Progress Energy and Black River which allowed the project team to use data from several estimates to develop a sample unit cost database that could be expanded in the future, or copied for use with other utility providers. This effort is also described in Chapter 4. Unfortunately, the lack of a common coding system limits the usefulness of the database across utility companies. However, if adopted, the standardized cost estimate/invoice format would allow generation of a more comprehensive unit cost database for the future.

SCDOT Utility Pole Safety Assessment

Subsequent to the unit cost database, estimate standardization, and management system this report also looks at unique opportunities for funding utility relocation work through safety programs. South Carolina has more than three times the fatal utility pole crashes per million licensed driver population than the nation (14.73 vs.4.43 respectively). Approximately 10% of the fatal run-off-road fixed object crashes in South Carolina involve utility poles. Between the years of 2004 and 2006, there were 7,759 crashes of all severity levels reported involving utility poles. States, such as Georgia and Pennsylvania, have developed safety programs to proactively remove and relocate utility poles to reduce the negative safety impacts of having utilities in the highway right-of-way. The research team has identified several high-crash corridors and conducted a cost-benefit analysis for utility relocation projects (Alluri and Ogle, 2011). The safety component of this research is described in more detail in Chapter 5 of this report.

CHAPTER TWO

LITERATURE REVIEW

Introduction

A preliminary review of the literature was conducted in the early stages of the research. This review focused on finding information related to the three project objective areas: 1) developing a utility cost reimbursement system; 2) reviewing the current SCDOT database for tracking and managing utility relocation costs; and 3) analyzing the major positive safety impacts of utility relocations. It is anticipated that this information will assist in the creation and management of a database for obtaining and maintaining utility relocation cost information. The literature review also provided information on best practices associated with utility relocation cost estimates for South Carolina.

Cost Estimating and Database Management Techniques

The Texas Transportation Institute (TTI) at Texas A&M University has conducted several investigations for the Texas Department of Transportation (TxDOT) relating to utility relocation costs (Quiroga 2007). The first of the TTI reports reviewed was titled "A Specification Framework for Communication Utilities and Estimation of Utility Adjustment Costs" (Quiroga 2007). The report, among other things, summarizes a methodology to develop utility adjustment cost estimates during the early stages of the project development process and a procedure for estimating the uncertainty and likelihood of exceeding those estimates. Quiroga lays out a proposed specification relating to the adjusting, removing, and relocating of pole assemblies. The specification breaks down different work activities into separate line items, making it easier to assemble an accurate cost estimate. There are proposed specifications ranging from open-trench conduit structures to abandoning structures. The framework is very generic and is therefore not limited to public or private utility installations that occupy state right-of-way. The authors highlight several reasons for improving the capability to forecast utility adjustment costs, including the construction costs that are frequently underestimated. The new requirement is for states to provide adequate project financial integrity, delivery, and oversight. Utility adjustment costs are among the most difficult costs to estimate and carry a high potential for risk and change. However, the Virginia Department of Transportation (VDOT) and TxDOT have recently implemented two new estimation tools (Quiroga 2007). The TxDOT uses a program called ProtoCost, which assumes the utility adjustment as a percentage function of highway project size, location, roadway type, and project type. This program is in the early stages of development, but looks to be very promising. More useful information relating to utility cost estimation techniques is found throughout Quiroga's report (Quiroga 2007).

Another report by Cesar Quiroga titled "A Unit Cost and Construction Specification Framework for Utility Installation" focuses on the lack of a standardized and comprehensive set of specifications for contractor use (Quiroga 2006). The Texas utility accommodation rules have minimums in accordance with the accommodation, location, installment, adjustment, and maintenance of utility facilities along state right-of-ways. The lack of specifications is only part the problem. It is necessary to rely on additional guidelines, specs, and provisions to handle situations not covered by those rules. In Texas many different versions of special specifications and provisions exist around the state. Quiroga proposes a standardized methodology and procedure to help determine actual costs involved in a utility relocation. The lack of standardization translates into difficulties in verifying the validity of the cost data submitted for reimbursement and how to adequately prepare for audits. The report summarizes the work completed to develop a prototype framework of construction specifications corresponding to unit cost work items and how to implement them.

According to a 2009 Federal Highway Administration report, it seems to be a common theme in many other states that cost data provided in the final bill are typically different from those included in the original cost estimate. The applicability of the unit cost approach for utility relocation work opposed to other forms of estimating and reimbursement is also discussed in Quiroga's report. Some degree of unit cost within an estimate is not only unavoidable, but also usually desirable because it lays out specific line items to be addressed during reimbursement. Quiroga writes about several different forms of cost estimation and gives sample sources of different indexes from which to gain information. While Quiroga's report focuses primarily on water and sanitary sewer specifications, the methodologies can be applied to all areas of utility relocation.

Another report by Quiroga and the Texas Transportation Institute is titled "A Construction Specification Framework for Utility Installation" (Quiroga 2006). This report focuses on the specific issue of the lack of a standardized set of specifications for utility installations. This lack of standardization translates into difficulties dealing with verification of the validity of the cost data submitted for reimbursement and adequate preparation for audits. Quiroga proposes the development of a prototype framework of construction specification requirements ranging from utility installations to utility relocation. He states that to make accurate cost comparisons between estimates and projects, it is necessary to develop and implement a construction specification that provides a clear differentiation between bid items and subsidiary items as well as adequate information about materials, procedures, and performance requirements. Developing a clear and consistent set of specs has the ability to reduce uncertainty and risk in the bidding process, which in the long run can result in monetary savings for all parties involved (Quiroga 2006).

The Oregon Department of Transportation (ODOT) and the Alabama Department of Transportation (ALDOT) have developed detailed billing report forms that are distributed to utility contractors. The Oregon and Alabama DOTs provide actual billing reports with instructions for using the forms to each of the utility contractors (ALDOT 2004 & ODOT 2008). The billing report forms are used primarily for utility relocation work, which is similar to the SCDOTs proposed project and is influential in developing a solution for the SCDOT. The billing form indicated that all reimbursable utility relocation work must have prior ODOT authorization before work is started. The ODOT indicated the sheet was not mandatory at the time of bid collections, but was required at the time of final invoice. The ODOT is working towards making the itemized unit cost list mandatory when the bid is initially submitted. The sheet is similar to many other bid forms, including column headers with the activity, unit, quantity, unit cost, and the total cost. It also includes additional requirements such as written explanations of costs if the total bill exceeds 10% of the original cost estimate. The ODOT has developed other provisions within their billing reports that allow for invoice investigations, billing audits, progress or partial payments, and documentation requirements for payment. This billing report format from both Alabama and Oregon appears to be a suitable way to track the utility companies' costs, and a similar method of cost tracking may be a viable solution in South Carolina.

Researchers at The University of Texas at Austin have also conducted research in the area of highway right-of-way. Jared Heiner wrote a report titled "The Cost of Right of Way Acquisition: Methods and Models for Estimation" (Heiner 2005). Transportation infrastructure and other projects often require the acquisition of property, or right-of-way (ROW). The costs associated with the acquisition of these properties, such as damages, court fees, utility relocations, and other related items are often very difficult to anticipate. Heiner writes, "Accurate estimation procedures are needed to facilitate budgeting coupled with a timely completion of the project." This report includes a description of literature regarding appraisal processes and the influence of federal law on acquisition practices. It also provides hedonic price models for estimation of costs associated with obtaining property use data in the state of Texas. Results indicate that damages depend heavily on parking, access, and location, while the size of the taking is not as important as the value of the improvements. The utility costs were found to be highly variable. Utility relocations observed in this report had extreme costs repercussions, and may have even exceeded property acquisition costs. An example of a current cost estimate for utility relocations required in the expansion of Interstate 10 in Houston, TX, exceeded $200 million. This number represents a unit cost of $10 million per mile over a 20-mile stretch. This estimate from utility relocations alone was 30% of the right-of-way budget. The author develops a formula amounting to different regressions for estimating the total cost for Texas corridors (Heiner 2005). These techniques may be investigated further for possible use by the SCDOT.

Indiana developed a separate group within the DOT called the Utility Relocation Task Force (Indiana DOT 2004). This group released a report titled "Accountability, Communication, Coordination, and Cooperation" after a group of officials in Indiana met to discuss issues regarding the location, coordination, and relocation of utility facilities. They identified the major problem areas and offered recommendations to improve the current process. A typical highway improvement project involves for key stages: planning, design, right-of-way procurement, and construction. The report addresses 11 distinct, yet related issues, and suggests that significant improvements can result only if changes are made in every single interrelated issue. The issues identified in the report are as follows:

- Issue 1: Make each party accountable for matters within its control. The role of each party in the design and construction phase should be clearly defined and held responsible for their actions.

- Issue 2: Obtain reliable information on underground utilities. The utility providers need to keep accurate and updated plans of where the underground utilities are located. The identification of these utilities prior to construction will save valuable time and resources.
- Issue 3: Facilitate coordination among all entities. Communication opportunities are vital to the success of utility relocation projects and need to be taken advantage of.
- Issue 4: Use design to minimize utility relocation. Designers need to be aware that taking the extra time and money to modify a relocation design may in the end save construction time and resources.
- Issue 5: Obtain sufficient right-of-way for relocation. State DOTs need to determine a way to obtain enough right-of-way for construction while keeping public as happy as possible.
- Issue 6: ROW acquisition should be streamlined. A possible solution is for the state DOT and the utility provider to have a joint venture in ROW acquisition.
- Issue 7: Highway improvement contracts should include utility relocation work plans. All contracts should also be standardized to ease communication and speed up work processes.
- Issue 8: Expedite utility relocation work with ROW preparation. ROW should be determined earlier so things such as demolition, clearing, and grading can begin taking place earlier. A clear written plan would help to expedite the process.
- Issue 9: Determine the role the DOT should take in managing the public right-of-way along state highway corridors. The DOT should work together with utilities to develop guidelines regarding which utility facilities should go in which part of the right-of-way and why. A database management system could be of use in this situation.
- Issue 10: Improve the utility relocation coordination process during construction. Mandatory pre-bid meetings and weekly construction meetings for clearing up any discrepancies the contractor may have are recommended.
- Issue 11: Develop a written plan for dealing with conflicts when unexpected utility facilities are encountered during construction.

These steps can help with many issues regarding the location, coordination, and relocation of utility facilities. It is important to note that the INDOT report authors insist that significant improvements to the overall system are only possible if all eleven issues are addressed in a coordinated manner.

There are also some potential alternative solutions to the problems that South Carolina has had with its utility relocation process. Outsourcing SCDOT utility relocation work is a possible alternative. "Outsourcing Utility Coordination" is a report taken from the results of a survey and opinions from transportation professionals expressed at the 2006 AASHTO-FWHA Subcommittee for Right-of-Way and Utilities Conference in Baltimore to define the current and projected use of utility coordination consultants (Lindley 2006). Twenty-eight US states and provinces (including Puerto Rico) responded to the survey. Currently, 59 percent of the responding states indicated they outsourced some of their work, while 79 percent said they anticipated outsourcing work in the future. Florida reported that 75 percent of their utility work is already outsourced. It is interesting that 14 of 18 state DOTs rated the consultant services as "very good" or "good." The other 4 states said their services were "excellent" or they did not have enough data to rate them as of yet (Lindley 2006). There are two main reasons that states are and possibly should be turning to consultants. One involves rapidly expanding DOT budgets, which require a much larger workforce. Another reason, possibly not as significant to South Carolina, is the capping of the number of DOT employees which is causing a need for workers outside the DOT. The statistics show that there is no drop off in quality when using a consultant, mainly because many of the DOTs have set qualifications, which include previous direct utility coordination experience and at least one PE in the firm. Many state DOTs have 10 to 30 approved consultants on their "approved consultants list." The bottom line is that almost 80% of the states rated their consulting services as good or very good, which in SCDOTs case could mean cheaper relocation projects, less SCDOT manpower, and no sacrifice of quality (Lindley 2006).

The General Accounting Office (GAO) of the United States conducted a survey relating to the extent of delays on highway and bridge projects due to utility relocations (GAO 1999). These delays usually result in monetary damages that are undocumented. In the GAO report "Impacts of Utility Relocations on Highway and Bridge Projects," states indicated a number of projects delayed due to a utility relocation. In one state every project reported delays while three states indicated no impacts. Ten of the states indicated that the delays had a great impact on the costs and/or construction schedules of these projects. Forty-four states compensated contractors for utility relocation delays by either schedule extensions or by increased costs. Some contractors said that they assume full financial responsibility for utility relocation delays. A few states use alternative methods to "encourage" utility relocations are completed on time such as monetary incentives, monetary penalties, and the court system. South Carolina reported that only 11-20 percent of the federal-aid projects involved utility construction delays, a relatively small number compared to other southeastern states such as Georgia and Virginia that reported over 30 percent. Most states only responded to the percentage of delays of which they were aware. Most states are unaware of the true impact of utility relocations since many of them are delaying projects but the delays are not reported as specific to the utilities. The report also summarizes some of the reasons for the delays as reported by the state DOTs. One of the most prevalent reasons is the short time frame for the planning and design of the projects and relocations. Table 2.1 identifies the most prevalent reasons for delays in relocating utilities.

Table 2.1: States' Responses Identifying Reasons for Delays in Relocating Utilities
(Source: GAO 1999)

Reason	Number of States
Utility lacked resources	34
Short time frame for state to plan and design project	33
Utilities gave low priority to relocation	28
Increased workload on utility relocation crews because highway/bridge construction had increased	28
Delays in starting utility relocation work: some utilities would not start until construction contract was advertised or let	28
Phasing of construction and utility relocation work out of sequence	26
Inaccurate locating and marking of existing utility facilities	23
Delays in obtaining rights-of-way for utilities	23
Shortages of labor and equipment for utility contractor	19
Project design changes required changes to utility relocation designs	19
Utilities were slow in responding to contractors' requests to locate and mark underground utilities	16
Inadequate coordination or sequencing among utilities using common poles/ducts	13

The states also provided information indentifying technologies used in locating and identifying utilities during the design process to facilitate utility relocations. Computer-aided design, vacuum extraction, GPS, and subsurface utility engineering were among the common technologies utilized.

Information from Site Visits and Interviews with Other States

To identify states that may have developed policies or procedures of interest to SCDOT, the Federal Highway Administration Excellence in Utility Relocation and Accommodation Awards from 2009 was consulted. The goal of the award program is to showcase exemplary projects, programs, initiatives, and practices that successfully integrate the consideration of utilities in the planning, design, construction, and maintenance of transportation facilities. The awards are described in brief to follow:

- The Project Development Category Winner was the Maryland Route 97 and Randolph Road intersection in Montgomery County, Maryland. The Maryland State Highway Administration implemented Accelerated Construction Technology Transfer methodologies to address numerous coordination challenges. The project team used value engineering and quality improvement techniques to successfully move utility relocations off the projects schedule's critical path. This approach resulted in dramatic reductions in cost, schedule, and impacts to the traveling public and surrounding communities (FHWA 2009).
- The Project Development Category Honorable Mention 2009 went to the Route 17 and Essex Street Interchange Reconstruction in Bergen County, New Jersey. Through an extensive project development process involving collaboration with 14 utility companies, $10 million of utility relocations were accommodated as part of a $40 million project. With the aid of innovative methods the construction schedule was reduced from 32 to 16 months.
- Other project development honorable mentions were awarded as well as winners in categories such as construction management and innovation. Other DOTs receiving awards were the Minnesota DOT, the Georgia DOT, the Florida DOT, and the Texas DOT (FHWA 2009).

These states were considered as good candidates for phone interviews or site visits. From these interviews, a few key components of successful utility relocation programs were identified. These included: 1) use of online web applications for relaying utility coordination information and documentation; 2) use of prepared plans and mark-up programs to ensure a full understanding of project scope among DOTs and utility companies; and 3) use of proactive safety program funding to relocate utilities for safety improvements rather than for facility expansion or other construction program. The following sections provide summaries of information obtained through site visits and telephone interviews with these DOTs.

Utility Coordination Web Sites

Both the Florida and Texas Departments of Transportation received FHWA utility accommodation awards for communication efforts surrounding online information delivery processes. The Florida DOT has developed a Utility Coordination Web Site that spans both design and construction and provides information related to utility conflicts and relocation time-lines for all current construction projects. The web site is accessed by DOT employees, contractors and utility companies, and each can see how any changes they will impose will impact the project schedule and the schedules of other parties associated with the project. This web site has streamlined information delivery, and has been successful at making project partners accountable for their actions in a very transparent mechanism.

While the web site used by Texas DOT was not a permanent site for all projects, it was proven very successful on a large 23 mile Interstate reconstruction project involving 33 utility owners over four separate utility corridors. For this project, Texas DOT used an outsourced utility and inspection coordination team to maximize available crews and minimize costs. The team set up a project-specific web site for sharing project documentation and mark-ups. The site fostered communication among stakeholders and helped in the successful coordination of utility work. The tracking elements found on the site are now being used as a model for other large utility projects in the state.

A quick web search indicated that other utility accommodation award winning states such as Minnesota and Georgia are also using utility coordination web sites to transfer information and maintain project timelines. This mechanism may help SCDOT overcome utility project overruns related to overlapping schedules, as the different partners would be able to see work progress in real time and plan accordingly.

Utility Plan Sheet Mark-up Guides and Programs

In response to problems with utility cost and timeline overruns, Minnesota's Department of Transportation (Mn/DOT) has recently undertaken a redesign of their utility relocation process to define the scope of work and budget estimate for utility relocation very early in the design process. They have developed a very detailed utility manual (Available at http://www.dot.state.mn.us/utility/utilityowners.html) which covers roles and responsibilities of DOT employees as well as utility providers, and describes a 15 step process to ensure timely relocation of utilities within the originally estimated budget. The crux of the utility relocation bidding/invoicing process revolves around early and detailed project plan sheet development. Since the utilities are usually the first to engage on the project site, *Mn/DOT designers obtain detailed inventories of utilities in the field and populate the initial plans at very early stages*. This allows the utility companies to accurately estimate items that will need to be moved, temporarily located, and left in place. The first few steps in the process document this review process:

- Step 1: Utility Identification for Construction Projects – at this stage, Mn/DOT requests information from the utility hotline, conducts field investigation, conducts SUE investigation (if necessary), and puts all utility information onto the plans. During this process, Mn/DOT engineers assess whether the utility will be removed, remain in place, or relocated.
- Step 2: Utility Contact for Coordination – this step involves the preparation/processing of easement questionnaires sent to utility owners before a Utility Information Meeting. These questionnaires are designed to provide information on the location of each utility. Prior to the utility information meeting a plan sheet is given to each utility owner by the project manager which includes: layouts, profiles, retaining wall/bridge locations, preliminary utility tabulations, topography, construction plans, preliminary drainage, preliminary cross sections with estimated right-of-way and existing utility facilities, and staging information.
- Step 3: Utility Information Meeting- this meeting is held when construction plans are 20 to 45 percent complete and is designed to provide an opportunity for "Mn/DOT

and utility owners to learn as much as possible from each other about how the project may affect utility facilities."

- Step 4: Review of Information from Utility Owners- the information submitted by utility owners is used in the design of the projects. "Showing utility facilities on the plans early and correctly is critical to good design and successful utility coordination."
- Step 5: Utility Design Meeting- "The Utility Design Meeting brings together all involved parties to focus on finding solutions to place facilities within a project while maintaining good, economic design." This meeting usually takes place when design is between 60 and 75 percent complete.

In conjunction with the initial project surveys and development of preliminary design plans (~20%), Mn/DOT locates all utilities in the project area and includes them in the initial design plans (see Step 1 above). Similar to the subsurface utility engineering plans developed by SCDOT (Figure 2.1), Mn/DOT has developed CAD standards for above ground and subsurface utilities that are added to the design plans and submitted along with the initial site survey to the utility companies for review. The standard procedures involve the use of a CAD template with color designations following a red, green, brown system. Red indicates existing utility items that are to be removed, green marks existing items that are to remain in place and in service, and brown marks the location of proposed facilities. Given the high level of detail obtained in the early phases of the project, Mn/DOT designers initially code the utilities as they view them, and then the utility companies review for errors.

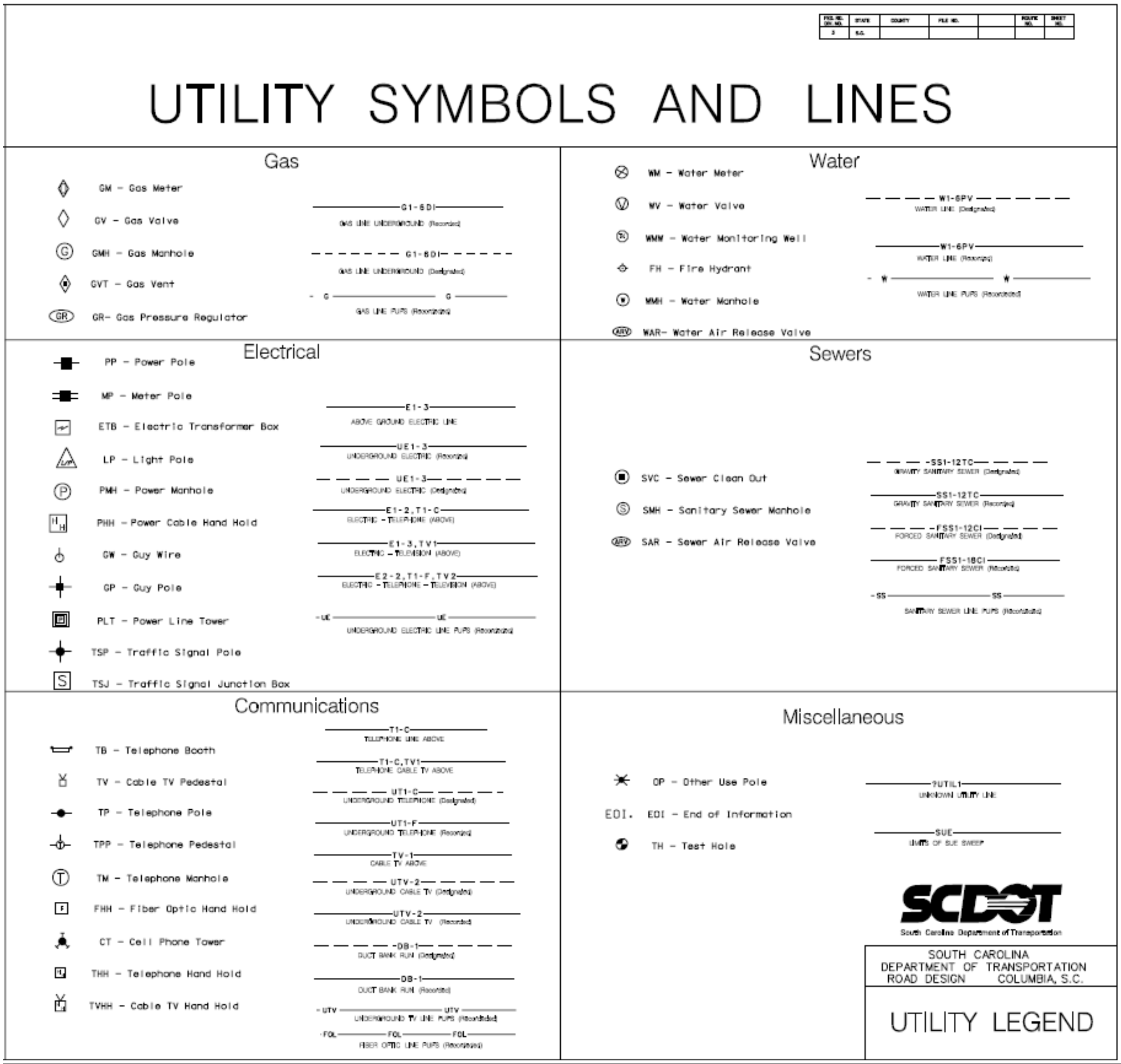


Figure 2.1 SCDOT SUE CADD Items

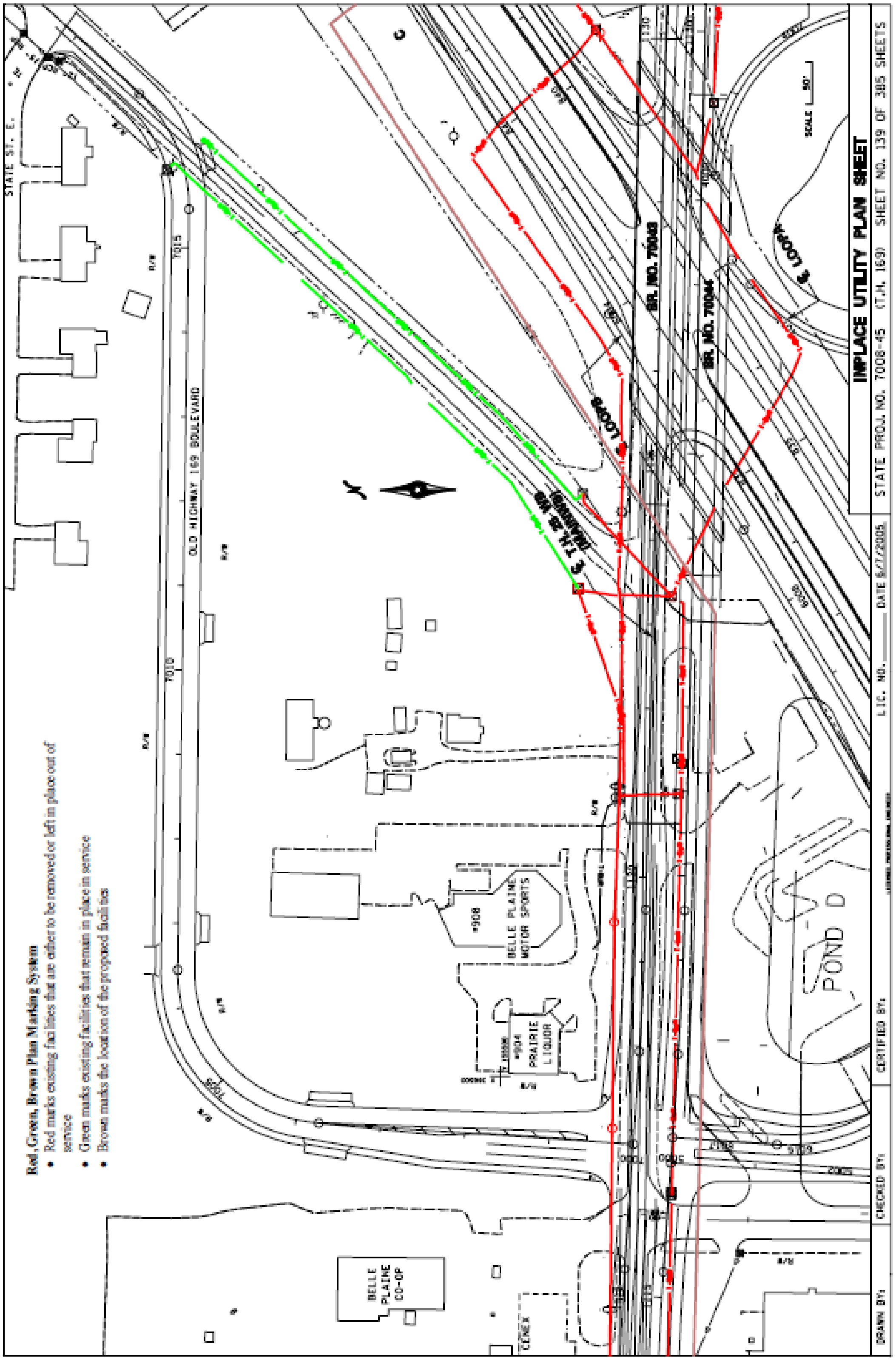


Figure 2.2 Mn/DOT Red, Green, Brown Plan Marking System Example

Based on the Red, Green, Brown plan sheet mark-up, the designers also compile a listing of all the utility elements in the project indicated by red and brown colors that may involve some expense to remove and reinstall, remove and replace, or install new. Given this level of detail being provided by Mn/DOT to the utility company, the estimates received from the utilities are expected to be much more accurate and can be easily tracked by Mn/DOT employees. Of course, the utilities are responsible for checking over the plans and marking up any changes that may be necessary. Also, because each item is tracked to a specific station location, Mn/DOT employees can easily monitor the progress in the field and track charges by date and location of work. In the interview with Mn/DOT, it was indicated that the plan sheet development and review is the cornerstone of a successful and efficient utility relocation program.

GDOT uses a similar plan preparation process and review process. A sample of the CAD standards for power utilities are provided in Figure 2.3. As you will see, GDOT uses a black and white rendition of the plan details in place of the red, green, brown scheme that Mn/DOT uses. This allows plans to be read as easily in B/W or in color. A double system using color and symbols would work just as easily. According to Figure 2.1, it is unclear how removals vs. new installs are indicated in SCDOT plans. From the estimates obtained from the utility office, it did not appear that SCDOT provided completed plans to utilities – rather the utilities drew or sketched changes on road design plans provided by SCDOT. A lack of consistent detail was noted, and could result in less efficient estimating and future cost overruns. SCDOT is encouraged to adopt these plan processes for incorporation in to standard operating processes.

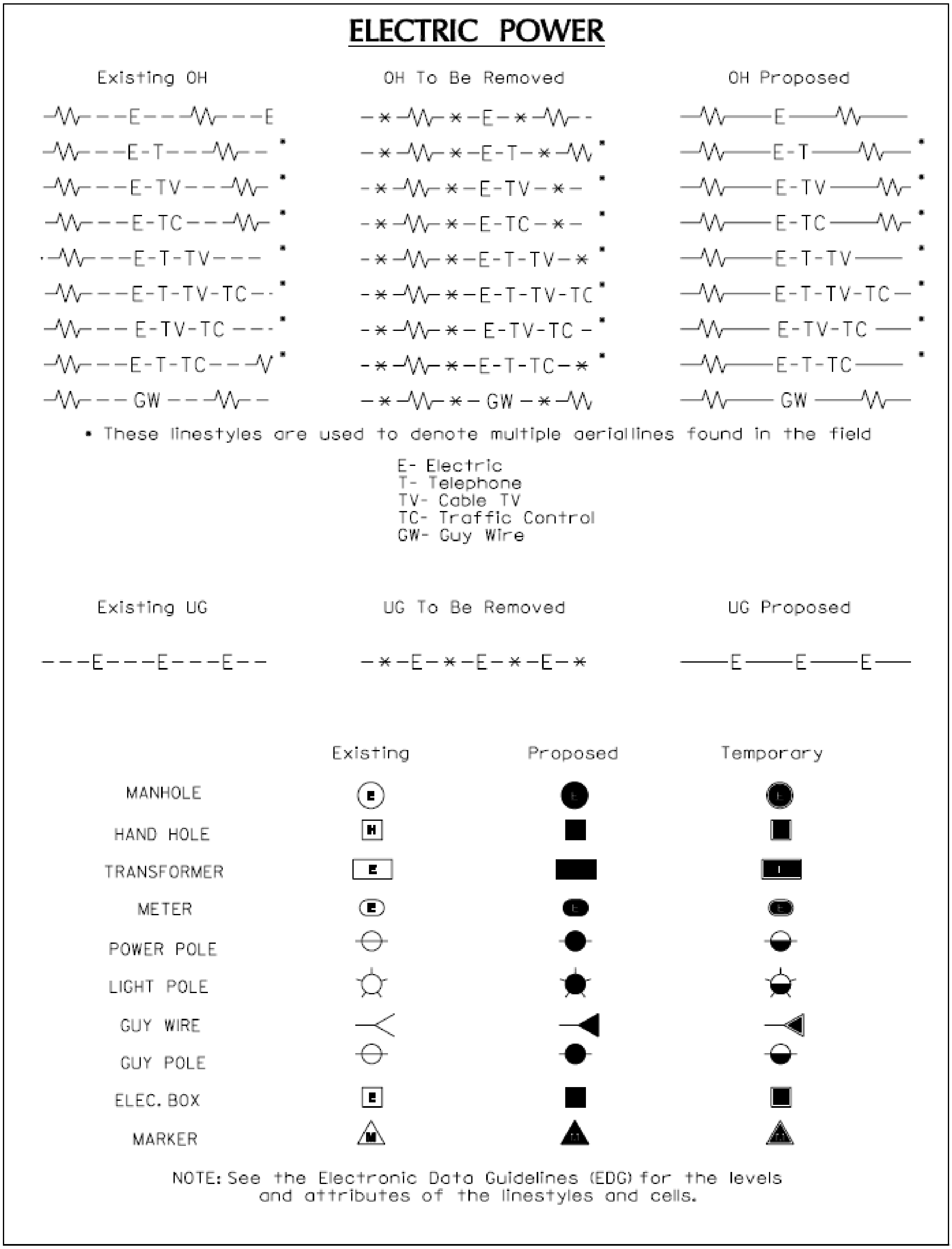


Figure 2.3 GDOT Plan Marking System for Utilities

Proactive Utility Relocation Safety Programs

The Utility Safety Task Group, part of the Transportation Research Board and the National Research Council, reviewed and reestablished the importance of the utility pole safety problem (NRC 2004). In the NRC report titled "Utilities and Roadside Safety" many solutions, strategies, and initiatives were presented to help address the issue of utility pole safety. The latest data indicated that there were 1,103 fatalities and more than 60,000 injuries related to vehicles crashing into utility poles (NRC 2004). The utility companies own these poles, but they are usually located on public right-of-ways. The pole then becomes a joint utility with responsibility lying on both the utility provider and the state DOT to take appropriate measures to reduce the hazard associated with these roadside fixed objects. The first objective is to increase the probability of keeping vehicles on the road. Other objectives include removing poles or changing their position, installing safety devices, and warning motorists about the obstacles. The report also mentions that state DOTs and local highway associations have two major reasons to be concerned about utility pole collisions: improved safety for motorists and the threat of litigation due to allegations of negligence. In the end, the implementation of roadside safety programs only leads to positive results for organizations that take the initiative.

The Georgia Department of Transportation (GDOT) shared similar thoughts on the matter of roadside utility safety. In 2000, Georgene Geary presented the efforts of the GDOT and Georgia Utility Coordinating Council (GUCC) Clear Roadside Committee (CRC) at the 2000 Transportation Research Board Meeting (TRB 2001). Georgia was one of eight states chosen to portray the best in roadside safety efforts in the United States. In 1998, Georgia received an award from FHWA for the Best Overall Operational Improvement in Safety. The purpose of the presentation was to relay the experiences and success of the Clear Roadside Program. The program was greatly needed because there were over 3 million utility poles in Georgia and an average of 50 deaths and 3400 injuries every year relating to these poles prior to the establishment of the committee.

Due to the staggering number of utility pole related crashes, the CRC set out to identify the top 100 sites based on total number of crashes as well as total number of injuries and fatalities and develop a program to mitigate these crashes. Most of the sites were on curbed sections of roadways in metropolitan areas with the top 10 occurring in Fulton County – the heart of metro Atlanta. The CRC adopted a policy stating that a 12' clear zone is desirable, but a minimum of 6' is required when speeds are below 35 mph, and 8' is required when speeds are > 35 mph and <= 45 mph.

The CRC program was based on a give-and-take premise. The utilities agreed to voluntarily move a certain number of poles each year to a safer location, and in turn GDOT would allow variances to a previously strict policy of not allowing pole attachments to any pole deemed within the clear zone. The number of poles to be moved is estimated as the number of existing poles that need to be mitigated over a 30-year period. The intent is to clear the more crash susceptible areas first while still having a plan to clear all state routes within 30 years. The Georgia Power program committed to relocate 179 poles per year. One of the first sites to achieve relocation was North Avenue in Atlanta. Prior to relocation in 1992, a 3-mile stretch experienced an average of 6 crashes per year. In the five years after relocation, an average of less than two crashes was observed.

In 1997, there were still 43 fatal crashes in Georgia related to utility poles. Each of these accidents was reviewed in detail. The majority of the accidents involved alcohol, lack of seatbelt, male drivers, 35-45 mph roads, and metro areas. In 1997, they also noticed a large number of cross-over crashes where vehicles were hitting poles on the opposite side of the roadway. GDOT determined that the more restrictive clear zone policy was good, but they may need to do more. There are many other methods in addition to pole relocation to reduce accidents such as designing projects to meet clear roadside design guidelines, reviewing accidents to avoid future occurrences, and increasing awareness of poles placed in the apex of curves. Many site-specific safety considerations such as curves, T-intersections, lane drops or deceleration lanes, intersecting streets, kinks in alignment, and driveways/alleys were taken into account. In order to reduce or eliminate the number of injuries or fatalities associated with utility poles, a cost effective method of avoiding the accidents altogether is important.

While the CRC program did have some level of success, the difficult financial times of the past decade had significant impacts on the ability of the utility companies to voluntarily absorb the expense of relocating utilities. In 2009, GDOT revised their Utility Accommodation Policy and Standards Manual, and incorporated a new policy by which the GDOT would cost-share (50/50) the expense of relocating troublesome utilities with the highest rate sections being selected first. Several mitigation strategies are acceptable given the context of the site including: increasing pole spacing, combining pole usage with multiple utilities, burying electric and telecommunications, changing pole position, using breakaway poles, or using guardrail or crash cushions. GDOT is currently tracking the results of the new program with before and after crash studies. Past reductions in utility pole crashes in Georgia associated with these programs have exceeded 70%. As a proactive program, utility relocation for safety is an effective program to reduce costs associated with crashes at the DOT and should be considered by SCDOT for future implementation.

CHAPTER THREE

STANDARDIZING COST ESTIMATING AND HISTORICAL UNIT COST DATA

Introduction

Standardizing the cost estimating process and providing an improved cost management database should improve the overall cost effectiveness of utility relocation projects across the State. The number of change orders from utility providers on relocation projects has been growing over the past several years. These change order requests usually involve requests for additional funds and are not easy to track using SCDOT's current cost database. This chapter discusses the standardization of cost estimates to reduce the occurrence of change orders, and takes a look at the potential for a historical unit cost database. Chapter 4 will discuss the necessary components of a cost database that will allow sufficient tracking of cost data including change orders.

One possible reason for the number of change orders associated with utility relocation projects is that the initial cost estimates for each project seem to lack many basic line item details. The lack of detail for the estimate starts with the lack of standard plan elements to identify utility components that must be removed or relocated. If the design plans and quantity estimates are standardized, then it is easy to standardize the estimate form. To be effective, the estimate form should still provide flexibility for utilities to include their own codes but maintain the summary information in standard format. If the plan documents and estimate form are standardized, it is believed that the number of change orders and the cost impact of those change orders can be significantly reduced.

The SCDOT works with many different utility providers on a regular basis. Each utility has its own specific estimating process and submits very different estimates making it difficult to compare information between providers or even between projects completed by the same provider. The quality and quantity of information submitted in the estimate varies from provider to provider and sometimes from project to project, depending on the utility representative responsible for creating the estimate.

Review of Prior SCDOT Utility Estimates

The data available to the Clemson researchers associated with the utility estimates was varied and difficult to analyze using the SCDOT utility cost management database. To effectively analyze the estimates submitted to SCDOT, the research team took a sample of 47 recently submitted project estimates and rated each based on the submittal clarity and line item detail. The estimates were also analyzed to identify which included overhead cost as a separate line item. Submittal clarity was based on the estimate's readability, understandability, and layout. Each estimate was given a subjective rating by a three person panel of "Poor", "Good" or "Excellent." From each person's rankings a total ranking for each estimate was developed. These rankings are developed for preliminary estimate comparisons only and are not intended to provide an objective estimate rating system. "Good" estimates are well laid out and include the recommended detail as defined in the Utility agreement. Two "good" estimates, however, may look completely different and may not be easily compared. Some of the estimates included very little detail and were considered for this report to be "poor" estimates. "Excellent" estimates include all of the required Utility Agreement detail and then some. They were also well organized and often include overhead as a separate line item. As the estimates were analyzed it was determined that only 24 (52%) estimates provided the overhead costs as a separate line item. Table 3.1 summarizes the utility estimate comparisons. The full table is located in Appendix A.

Table 3.1: Utility Estimate Comparisons

Estimate Form Rating	Number of Estimates	% of Total
Poor	17	36%
Good	16	34%
Excellent	11	23%
Not Rated	3	6%

Over one third of the projects sampled were rated "poor" on the quality of the estimates. Less than one quarter of the estimates could be considered "excellent." This means that only one out of four estimates submitted to the SCDOT will contain the detail needed to effectively manage and track utility relocation costs. Even different estimates from the same utility provider were not consistent. Santee Cooper Electric & Gas (SCE&G), for example, scored "Good" on some of their estimates, but also scored "Poor" on about half of them.

To get an adequate picture of the level of detail contained in many of the estimates submitted to SCDOT, an analysis of two recently completed project estimates are included in this report. Figure 3.1 is an actual estimate for a utility relocation submitted by Farmers Telephone Cooperative (Project #12682). This estimate was rated as "poor" by the research team. There is little to no detail included in this estimate. The estimate includes several abbreviations for which there are no definitions. Different utility companies use different abbreviations for the same items making it very difficult to determine the item's definition and compare it to other utility estimates. There are also no labor costs, no overhead, and no indirect cost line items in this estimate. These costs are usually included in cost estimates, but there was no reason identified for the omission of these items in this estimate.

COST ESTIMATE FOR THE ALICE DRIVE ROAD MOVE WHERE WE ARE ON PRIVATE RIGHT-OF-WAY:
BROAD ST. TO WESMARK BLVD. (STATES SHARE)

SIZE	FTG	COST		EXT COST
BFC 900-24D	719’	42.50/FT	=	30,557
BFC 600-24D	400’	32.70/FT	=	13,080
BFC 400-24D	896’	24.07/FT	=	21,567
BFC 100-24D	400’	7.66/FT	=	3,064
2 4” CONDUIT	2415’	30.00/FT	=	72,450
	TOTAL			$ 140,718

THIS COST INCLUDES RETIREMENT AND CONTINGENCY FUNDS.

THIS ESTIMATE WAS REVISED 9/30/2008 BY
WILL WILES WITH NEW COPPER PRICES

WE WILL ABANDON THE FOLLOWING ITEMS, WHICH ARE ON THE PRIVATE EASEMENTS:

2415’ BJF 600-24
2415’ UF 600-24
896’ BFC 300-24
2415’ BJF 25-24
2415’ (1) 4” CONDUIT
896’ (2) (4”) CONDUITS

BELOW IS THE ESTIMATE WHERE FTC IS ON HIGHWAY RIGHT OF WAY ACROSS BROAD STREET AND WILL REPLACE THE CABLE AT OUR EXPENSE. (FTC SHARE)

SIZE	FTG	COST		EXT COST
BFC 400-24D	2093’	24.07/FT	=	50,379
BFC 300-24D	347’	18.00/FT	=	6,246
BFC 200-24D	1752’	12.50/FT	=	21,900
BFC 100-24D	823’	7.66/FT	=	6,304
2 2” CONDUIT	2922’	12.78/FT	=	37,343
	TOTAL			$ 122,172

Figure 3.1: Farmers Telephone Cooperative Estimate
(SCDOT Project #12682)

It is recommend that each estimate include a list of definitions or item codes that adequately explain all of the items used in the estimate. In the Farmer’s estimate, for example, there is a line item that reads “BFC 900-24D.” While this may be a common term for Farmer’s Telephone, it may not have meaning for SCDOT.

Another project estimate that was analyzed was Duke Energy (Project #12635). The Duke Energy estimate is better than the Farmers Telephone estimate and was rated as “Good”, but it still contains areas for improvement. The Duke estimate includes a summary table, which outlines the major summed costs for the project (Figure 3.2). Indirect and labor costs are addressed, but there is no overhead cost line item. In addition to the summary table, the Duke estimate includes multiple pages of line-items that are not adequately organized in any consistent format. This provides for difficult and time-consuming searches for specific line items. Discussions with SCDOT district engineers revealed that they have become familiar with the Duke format and that with some additional categorization and simplification it could be the basis for an acceptable standardized estimate format.

I/R	Qty	CU	CU Description	Material Cost	Salvage Value	Labor Install	Labor Remove
R	21	1761	DOUBLE TOP TIE 336 AAC	$-	$-	$-	$60.89
R	51	1780	HAND TIE	$-	$-	$-	$49.38
R	4	2103	I/O LC RISER 1P 25KV ARR-10 KV	$-	$-	$-	$277.63
R	3	2106	I/O LC RISER 3P 25KV ARR-1P KV	$-	$-	$-	$316.22
R	3	3330	2/O AL SVC RISER IP 600V	$-	$-	$-	$116.25
R	3	3340	4/O AL SVC RISER IP 600V	$-	$-	$-	$116.25
R	50	3850	ATTACH PRI TO ENERGIZED POLE	$-	$-	$-	$578.57
R	7	3870	INST 15 TO 50 KV KVA IP TX	$-	$-	$-	$377.30
Totals:				$64,017.95	$-	$214,525.37	$12,369.31
Indirect Costs:						$190,927.57	$11,008.69
Total Labor:						$405,452.94	$23,378.00
Total Install Cost:				$469,470.89			
Total Removal Cost:				$23,378.00			
Total Custom Costs:				$840.00		Total Install Man Hours:	4,976.48
Total Salvage Value:				$-		Total Remove Man Hours:	239.09
Total Project Cost:				**$493,688.89**			

Figure 3.2: Duke Energy Partial Estimate (SCDOT Project #12635)

The overhead cost line item is also an area of concern for SCDOT. Many of the estimates did not specify a line item for overhead. When the estimate did include a specific line item for overhead, the overhead cost ranged from 2% to 44% of the total project cost. Overhead costs do vary by utility providers but such a broad range is not common. The estimate format proposed in this research includes a specific line item for overhead costs as well as an overhead percentage line item to allow for easy entry into a cost management database.

Proposed Estimate Format

The Clemson University research team, with the input from the SCDOT, South Carolina utility providers, and MnDOT and VDOT utility relocation enhancement teams, identified a standardized estimate format specifically for utility relocation projects. The purpose of standardization is to provide an easy to use format so that utility providers can submit an estimate with all of the information that SCDOT needs to efficiently review, track, and manage costs using their cost management database. While the format is designed to make it easier for the SCDOT to read and understand the estimate, it also provides utility owners with a straightforward, simple method for submitting estimates. In the past, utility companies have resisted policies initiated by SCDOT because of perceived governmental influence and resistance to bureaucratic "red tape." It is anticipated, however, that the proposed estimate form will receive little opposition. Several utility representatives were contacted and questioned about the proposed format and it was not rejected. The format is simple, does not require any complex formulas, and provides flexible data entry while containing all the necessary information.

The estimate format was adopted predominantly from recent MnDOT utility form revisions and feedback from MnDOT staff, but also from the literature, the analysis of the best estimates, as well as from interviews with SCDOT representatives which provided a number of important column headings that should be included. Table 3.2 lists the column headings for the detailed cost estimate sheet in the proposed estimate format. Although the line-item categories for each utility sector may vary, the column headings remain the same.

Table 3.2: Proposed Standard Estimate Itemized Cost Detail Form Headings

Plan Sheet #	
Route # or Name	
SCDOT Standard Item Category	
SCDOT Standard Item Type	
Utility Item Code	
Item Description	
Unit of Measure	
Quantity	
Install, Remove , or Leave As-Is (I/R/A)	
Station and Offset	**Start to End**
	Left/Right and Distance from Centerline
On/Off Right of Way	**On**
	Off
Responsible Utility Company	
Labor Unit Cost	
Material Unit Cost	
Total Labor Cost	
Total Material Cost	
Salvage Value	
Betterment Value	
Total Cost	
SCDOT Cost	

It is anticipated that the standard estimate form will be made available to every utility provider submitting estimates to the SCDOT in a Microsoft Excel spreadsheet. This form could also be made available on the SCDOT website and submitted electronically. The electronic availability and submission process should also make database entry of the data obtained from each estimate form less time-consuming for the SCDOT. The line items identified in each utility sector are general and allow for some flexibility for each of the utility providers in how line items are specified.

States that have invested more time and energy upfront to identify and include utility locations in the plan sheet development process have seen benefits of more comprehensive and correct estimates and fewer change order requests to deal with items/quantities missed during the estimation process. Given the current level of detail for plans submitted by utility companies, SCDOT is strongly encouraged to adopt the plan mark-up procedures outlined by MNDOT in the Literature Review Chapter. Every item in the estimate is associated with a specific item/location in the plan sheets, as the plan sheets become the basis for the estimate. Adopting a common plan mark-up standard will aid in this transition. The estimate is developed sheet by sheet, and item by item providing specific locations for each of the items (such as the station/offset for utility poles, or the start and end stations and offsets for lengths of cable). Figure 3.3 depicts stationing and offsets for items in place in the field by utility ownership. Given this level of detail, it is apparent how provision of this information to the utility company would aid in obtaining a more comprehensive and correct initial estimate.

POWER							
STATION TO STATION	OFFSET	ITEM IN PLACE	REMARKS			OWNERSHIP	REMARKS
			RELOCATE	ADJUST	LEAVE AS IS		
MAINEB (MAIN ST. WB)							①
1112+21	12' LT	POWER POLE	X			XCEL ENERGY	①
1114+62	14' LT	POWER POLE	X			XCEL ENERGY	①
1114+82	15' LT	POWER POLE	X			XCEL ENERGY	①
1117+01	26' LT	POWER POLE	X			XCEL ENERGY	①
1118+95 TO 1119+48	87' LT TO 42' LT	P-BUR			X	XCEL ENERGY	
1119+46	37' LT	POWER POLE	X			XCEL ENERGY	①
1120+94	39' LT	POWER POLE	X			XCEL ENERGY	①
1120+94 TO 1120+96	39' LT TO 54' RT	OH POWER	X			XCEL ENERGY	
1121+09	37' LT	ANCHOR	X			XCEL ENERGY	
1124+32	39' LT	POWER POLE	X			XCEL ENERGY	
1124+61	40' LT	ANCHOR	X			XCEL ENERGY	
1131+79	57' LT	ANCHOR	X			MN VALLEY ELEC COOP	
169BLVD							
7015+99	12' LT	POWER POLE	X			XCEL ENERGY	
169SB							
839+19	309' LT	ANCHOR	X			XCEL ENERGY	
839+42	332' LT	ANCHOR	X			XCEL ENERGY	
839+48	315' LT	POWER POLE	X			XCEL ENERGY	
840+25	75' LT	POWER POLE	X			XCEL ENERGY	
840+45	74' LT	ANCHOR	X			XCEL ENERGY	
169NB							
839+91	63' RT	ANCHOR	X			MN VALLEY ELEC COOP	
840+32	62' RT	POWER POLE	X			MN VALLEY ELEC COOP	

Figure 3.3 Example of Plan Mark-up Data Provided by MnDOT to Utility Companies (Source: MNDOT)

A route number or name is provided for each item along with a standard SCDOT item type. SCDOT item types are generalized items based on the CADD standard drawing elements (i.e., GM – Gas Meter, PP – Power Pole, or E 1-3 – Above Ground Electric Line). Several other CADD standards have been adopted by other state departments of transportation, such as the one identified in the literature review from GDOT. SCDOT should review the level of detail desired in the unit cost database before settling on the final CADD standard items, as this will be the basis for summarizing historical unit cost data. For instance, all power pole items for a particular station could be grouped together to determine range of costs for power pole assemblies. However, the station specific codes and item descriptions will still allow the DOT to determine the cost, size, etc. of a specific pole. It would be nice to identify a standard set of specific codes for common items to which the utilities could map their individual codes - thus allowing a statewide historical cost data structure to be developed at the unit level.

One of the changes that MnDOT indicated that they would have made in their process revision is the maintenance of the detailed costs by station for both the initial estimate as well as in subsequent invoices. While MNDOT requires pole assemblies to be identified by station on the plans and in initial material tables, they did not carry this level of detail through to the final estimate and invoices, rather they grouped similar items into categories such as: copper cable/service wire, fiber/equipment, poles, conduit/inner-duct, vaults/cabinets, etc. This is the one thing they wished they had done differently in hindsight. If the estimating is initially done at the station level, this should be maintained in the excel worksheet to provide a sufficient level of detail for the development of the unit cost database. Given the current format of the estimates and invoice templates (see Appendix B), MNDOT will only be able to estimate percentages of project costs by large grouping areas vs. at the level of the pole assembly or type of cable. Thus, MNDOT recommended the addition of a specified itemized data entry sheet with tiered data entry including a category and an item specified. The implication for the estimate form is the inclusion of a station specific itemized cost estimate worksheet page. The data on this page will allow the project costs to be summarized by category, but maintains the costs down to the individual component level (pole or line) for cost comparison on these items. A revised set of forms proposed for use by SCDOT, which incorporate the station level detail, are provided in Appendix C as well as on DVD.

The ‘Utility Item Code’ can make it easy to find certain objects within a spreadsheet. If a pole’s part number is 0055, the user can simply search that part number in the spreadsheet to find all of the data associated with that type of pole. While common codes across all utilities would make it easier to define a historical unit cost database, having ranges of estimates for poles and other appurtances across all utilities will likely be the next best option. Thus, the CADD standard codes will be the summarizing factor in the historical unit cost database. To date, most departments of transportation have not adopted the specificity of costing down to a specific utility pole or arm, but rather at the assembly level. Thus, the estimate for a pole at station 101+43.56 will include the pole as well as cross members, supports, etc.

It was found that many estimates did not identify a unit of measure and on many estimates “each” will be the most common. Identifying the unit of measure should make controlling costs easier, especially with underground utilities. Install/Remove or Retire/Leave As-Is, abbreviated “I/R/A”, is the next column heading that was missing from most estimates. To relocate a telephone pole, the utility provider must first take out, or retire, the existing pole and install the new one in the designated place. Identifying the installed item (I) and the retired item (R) will make it easier to track the labor and material costs for the poles that are installed versus retired. If a utility is removing and installing the same pole it must still be listed as two different line items which will have the same ‘Utility Item Code’ and likely different labor costs associated with removal and installation.

If the pole were not to be relocated, but rather retired altogether, a salvage value may be associated with the retired material which would reduce the cost to the SCDOT. In addition, installing a pole with a betterment will likely increase the cost of materials, but the betterment may not be incurred by SCDOT – thus the inclusion of a column to specify betterment costs. Finally, the estimate details all utilities in the affected area regardless of whether they will be relocated or removed. Thus, leaving the item as-is provides the third option for the existing field item. This option may not have associated costs, but could incur labor to temporarily disable the device until service is restored.

The Labor Unit Cost column should show the labor costs for installing or retiring a single item. For example, it should include the cost of installing one pole as opposed to installing all five poles in the relocation. The unit labor cost column is designed to track labor costs from one utility estimate to another. If Utility A is charging $100 per pole retirement and Utility B is charging $300 per pole retirement, it would be easily recognized within the standardized estimate form.

The Material Unit Cost column is designed for a similar purpose. This column should contain the material costs for an individual pole. Similar to the Labor Unit Cost column, the Material Unit Cost makes variations in cost for the same line item easily recognizable. In the past, many utilities have not included unit cost quantities in their submitted estimates to the SCDOT.

The Total Labor Cost and Total Material Cost columns do not require any action from the submitting utility because they are automatically calculated using pre-set formulas. For the Labor Cost total, the Install/Retire Quantity is multiplied by the Labor Unit Cost. To calculate the Material Cost, the Install/Retire Quantity is multiplied by the Material Unit Cost to determine the total value of the materials used for that line item.

The Salvage Value is the value to the utility from retired parts not being reused in that specific relocation project. These are items that may have use (value) to another project. These amounts should be entered as a negative value because they are not costs but benefits to the utility. Similarly, the Betterment column will show reduced cost to the DOT for betterments between retired items and installed items. While the betterment will be included in the unit cost, this column allows the betterment portion of the cost to be entered as a negative value since it will not likely be paid by the DOT. The Total is the sum of the Labor Cost and the Material Cost minus that of the Salvage Value and Betterments. The Total Cost will also be calculated automatically. The estimate and invoice spreadsheets will do much of the calculations, which is one of the benefits associated with using them.

Estimate Format Subsections

As found in Appendix C, the estimate form has 4 subsections with more detailed categories underneath depicting pre-construction costs, construction costs, post-construction costs, and a project summary with overhead and total costs and benefits to the utility as well as to the DOT. Even though a variety of different utilities will be using the estimate format, the layout remains constant, which makes analysis of different estimates from different utilities much less troublesome.

The four subsections were based predominantly upon the MNDOT estimate form which can be found online at http://www.dot.state.mn.us/utility/utilityowners.html and is also provided by worksheet in Appendix B. These sections allow the DOT to understand costs required by phase and to approve small agreements for upfront pre-construction work as needed.

The pre-construction section will include the following line items:

- Right of way and easements,
- Surveying,
- Legal fees,
- Engineering,
- Administration costs,
- Potholing, and
- Mobilization.

Unlike the construction section that requires major detail for each and every pole or section of line to be removed and relocated, this section is more just a summary by labor hours for each of these items. In some DOTs, these costs are placed on a separate agreement to keep longer-term out of pocket costs for the utility to a minimum, as these items should be done well in advance of the actual utility construction work. By providing a separate pre-construction agreement for the utility, the DOT is signaling that this is an important project that they expect to fund and will result in the most effective planning and execution of an overall project.

Mobilization is typically referred to as the contractor's activation and assembly of manpower and physical resources on the construction site where work is to be performed. Mobilization is a necessary part of every construction project, although many utility relocation estimates in the past have not included this in their estimates submitted to SCDOT. Engineering includes design-engineering-review costs incurred during the project. Many contracts will be engineered to accommodate difficult relocation projects, and these costs should be listed under this category. In addition to the categories proposed, SCDOT may want to add additional categories such as equipment rentals, traffic control, as well as many others. The true value of the standardized estimate will be noted in the development of the unit cost database. For all items that the DOT would like to have a unit cost, there should be specificity in the coding used in the estimate.

The last part of the estimate is the summary. It should provide a detailed summary of all of the totals from each of the phases (pre-construction, construction, and post-construction), as well as by utility item categories (utility poles vs lines, etc.). These totals are automatically summed to an Estimate Summary Sheet and an Estimate Detail Sheet

The standardized estimate form should provide a mutually beneficial service to SCDOT and utility providers. For many utility companies that work regularly with the SCDOT, the estimate form will only require minor adjustments to their estimate process. Other utilities that do not work with the DOT often or are new to the utility relocation process will find that the estimate spreadsheets are easy to use and provide a straightforward method for creating a cost estimate. The research team expects an immediate impact for the SCDOT in that estimates from different utilities will be similar, straightforward, easy to understand, and easy to find line item cost data. This should make entering and tracking cost data in SCDOT databases a much more simple process.

CHAPTER FOUR

DATABASE MANAGEMENT PRACTICES

SCDOT Database Programs

Currently, SCDOT utilizes a cost management database to track and manage the costs associated with utility relocations. The database is used to track costs and information throughout a project's life. The database's main function is to track invoices from the utilities to facilitate reimbursements for the work that has been completed. Having accurate cost information including such details as invoice amounts, reasons for change order requests/approvals, and the dates associated with invoices and payments will assist the SCDOT in efficiently managing its fiscal resources.

An effective database must be one that is user-friendly. It should reduce the complexity of the cost data system by controlling how data is entered and allow data entry to occur in one central location. An effective database should also provide key reports and facilitate the automation of reports and communication between entities or other cost management systems.

In the last five years, the SCDOT has seen a tremendous change in how utility relocations costs are tracked. Until 2005, a written spreadsheet was used. This spreadsheet collected information such as:

- Agreement Number
- File Number
- Name of Utility
- Agreement Date
- Date Received
- Agreement Amount
- Invoice Date
- Amount of Invoice
- Date to Accounting
- Date Paid

While the information itself was useful, this system obviously had its flaws. There was limited space within which data could be entered and only one user could access the spreadsheet at a time. Information could only be entered manually and required little formatting or consistency in the way in which data was entered. There is only one field for Amount of Invoice and Date paid, but during the course of a single project there could be as many as five different invoices and payments. Once data was entered, it was difficult to read and made tracking costs across multiple projects extremely time consuming.

After 2005, the SCDOT began to transition away from paper spreadsheets and created a Microsoft Access© database system. While Access is a user-friendly program, it does require careful planning and design to create a database that will function as anticipated. The SCDOT system, however, seems to have been plagued with too many linked files and a difficult data entry process. Unless data entry forms are designed to require certain formatting and input codes, there will be too much variation and data entry errors when multiple users are responsible for entering the data. From interviews with SCDOT personnel, it is apparent that the design of the Access system was not adequate for all the cost management functions that it was required to perform. It did, however, simplify the data entry process and was very effective at tracking invoices and payment amounts. Reports could be generated that would list the total cost of the project as well as document the latest invoice date and amount paid on that invoice. There was also a comments section that could be used to describe change orders or other miscellaneous information. An SCDOT construction engineer described his feelings of the SCDOT database system as:

> "The only thing we use the Access database for is to finish up older projects. We don't add any new projects to it. The Entire Connection program is a little more difficult to manipulate, but it gives the RCE's and District personnel instant access to the information, as it is a live program. They can see when a Utility Agreement is approved and track when payments are made to the utility companies. I like the Entire Connection program better because it gives the District's instant access and keeps them from having to call [the lead utility relocation engineer] or myself to find out when something has been approved or paid. Also, when [an engineer] opens up the program to the project he or she is working on, all of the information is already loaded, so [they] don't have to enter or re-enter the information such as file numbers, project number, charge codes, let dates etc." (SCDOT Interview).

From the screenshot of the SCDOT Access Database in Figure 4.1, it is evident that a considerable amount of information had to be entered for each project.

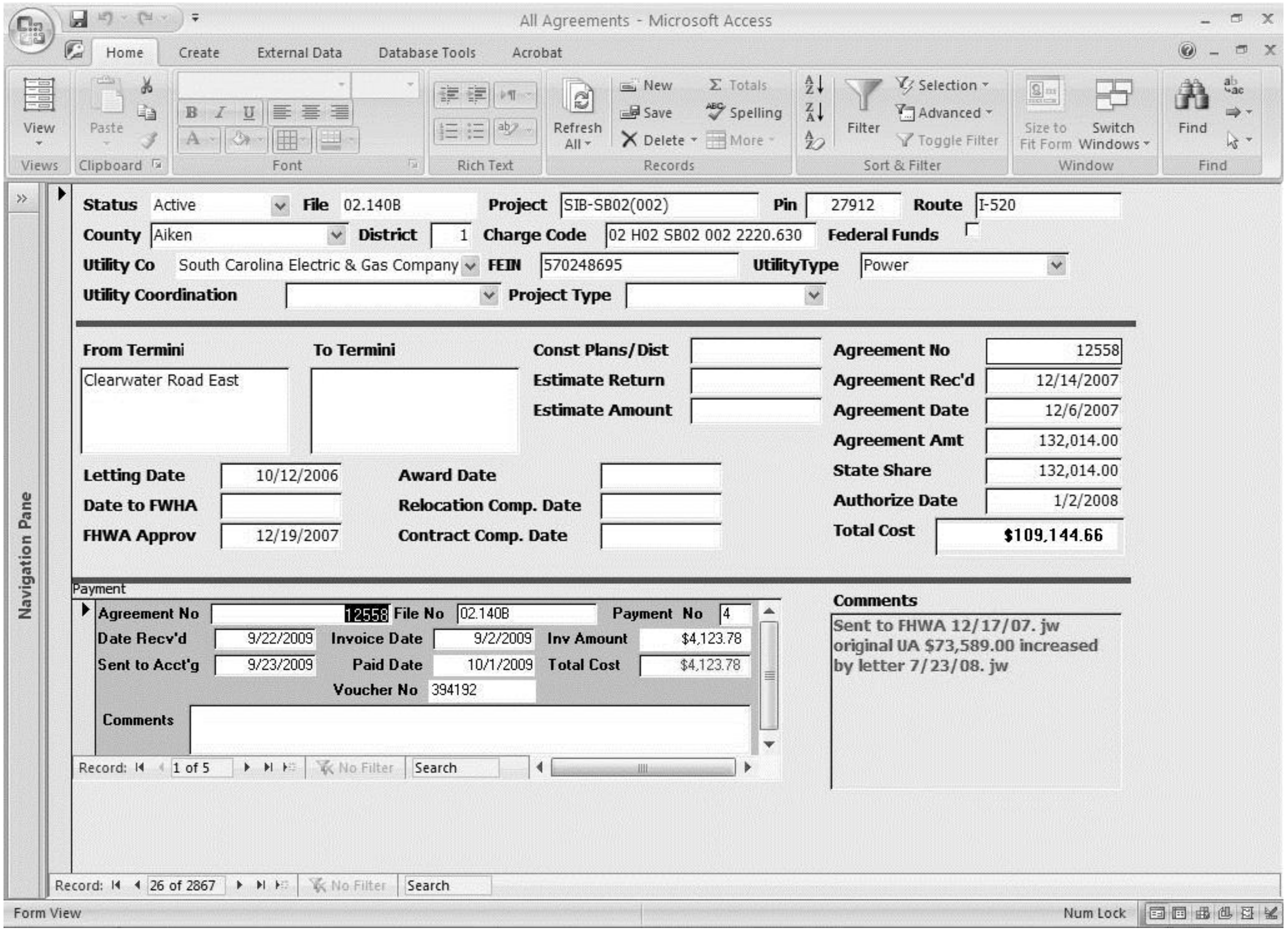


Figure 4.1: SCDOT Microsoft Access Database
(Source: SCDOT)

It is also evident in Figure 4.1 that although information can be entered easily into each cell on the form, there does not appear to be a lot of standardization or formatting required. There is also not a lot of detail regarding the initial estimates for the project as related to change orders and invoiced costs. The comments section in Figure 4.1 shows that the original utility agreement was for $73,589, but the Agreement Amt section just above the comments displays an amount of $132,014. Also, the Estimate Amount cell is empty. This suggests that every time there was an approved change order, the user was able to change the agreement amount cell rather than enter an estimate amount and then enter the additional funds into a separate cell as the funds were approved. The only evidence of the original estimate is in the Comments section on the lower right hand corner of the database entry form. As indicated, for a cost tracking system to be effective, the database must control complexity and be designed to require consistent data entry. The SCDOT Access database is not adequately designed to control how information is entered. The SCDOT database also does not include an effective report generating function. For example, there is no way in the SCDOT database to generate a report that compares the initial project estimate to the final invoice cost. Change orders are only included as comments and therefore cannot be tracked.

Due to the limitations of the Access database, SCDOT has developed a system called Entire Connection. Entire Connection allows users to access the data across the network at the same time, one of the key elements of a good database system. This creates real-time data entry and up-to-date information for all users at any given time. Entire Connection has been used by the Texas A&M Department of Finance for some time with success (TAMU, 2010). Although it is effective database software, it is not as user-friendly. A screenshot of the Entire Connection program for SCDOT utility agreement number 12667 is shown in Figure 4.2.

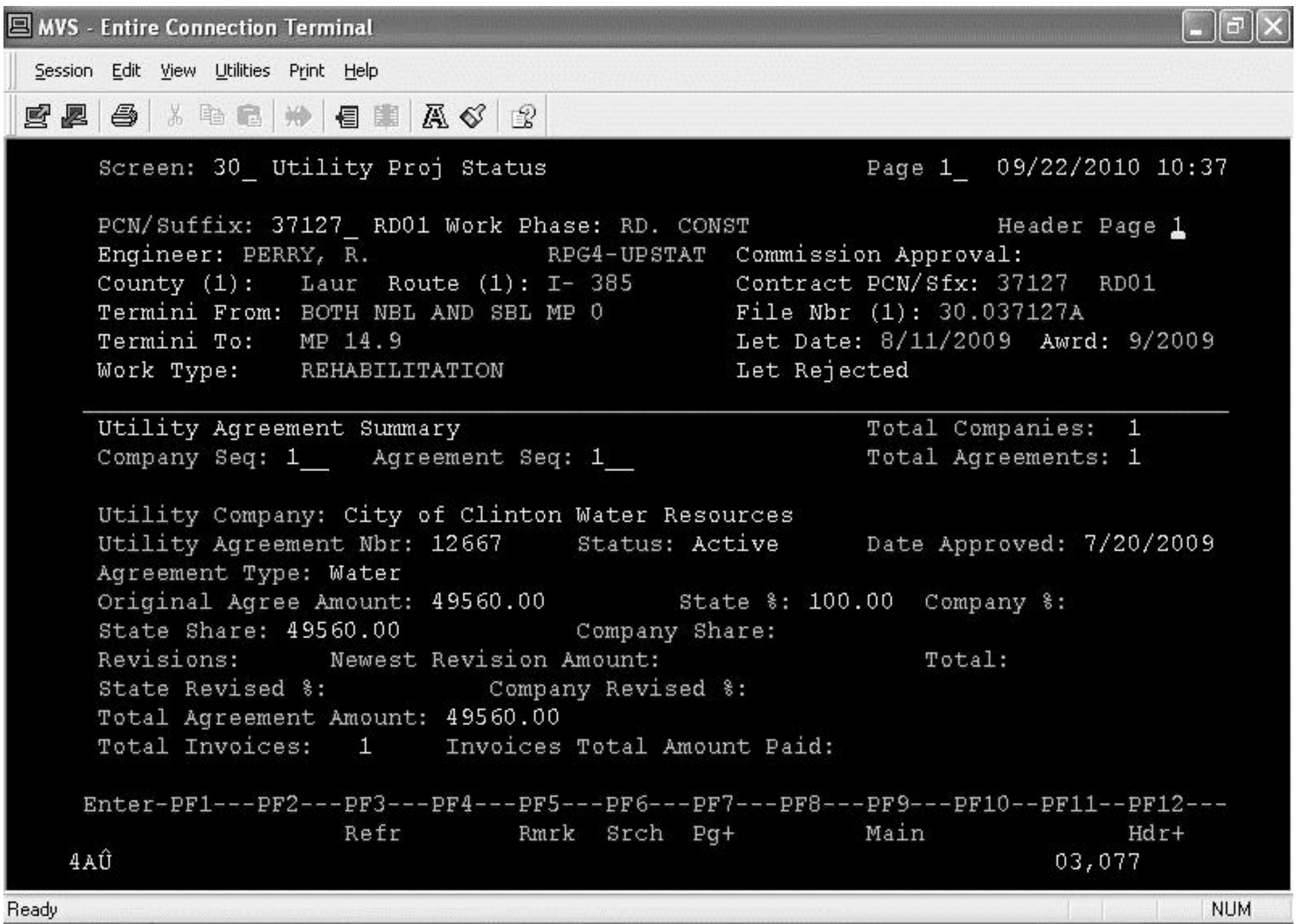


Figure 4.2: SCDOT Entire Connection Screenshot
(Source: SCDOT)

This screenshot is one of many screens associated with project agreement number 12667; the others include more detailed information about the project. As is evident from this figure, the program is not nearly as easy to read or as simple to find information. This project has an Agreement Amount of $49,560.00 and only 1 invoice has been submitted. In contrast to the Access database, there appear to be specified coding and formats within each data field. It is the appearance and the ease of data entry that are the primary deficiencies with this program. While the Entire Connection program may be more functional than Access, it is difficult to read and is similar in form to the old MS-DOS based programs of the early 1990s.

The SCDOT is aware of the limitations of their current software programs and database designs and is currently planning to acquire or develop a new system in the near future. There are many database management programs available “off the shelf” that could address the SCDOT’s needs for tracking and controlling project costs, cost control, user-friendliness, comparing costs from one utility to another, and the ability to compare initial estimates to final invoice costs. One advantage of “off the shelf” programs is that they, typically, are compatible with other Microsoft programs such as Excel and could therefore be used in conjunction with the Standardized Cost Estimate forms proposed in this research.

Recommendations for Cost Management Database Software

A cost management database program, by definition, should be able to organize, store, retrieve and manage information that is entered by the program’s users. There are many programs available on the market today, but selecting the right program that can do all of the tasks listed above is critical to its effectiveness. Some of the database management software programs that would be of use to the SCDOT are programs such as Windows Primasoft and Oracle, which has recently acquired the well-known Primavera family of software.

Primasoft is a Windows-based database management system that could be of benefit to the SCDOT. It allows the user to create many different kinds of files to organize a wide variety of data. One of the Primasoft packages is called Project Cost Organizer Pro that is specifically designed for project cost tracking (Primasoft, 2010). Some of the features of Organizer Pro that would be beneficial to the SCDOT are:

- Fast and easy data entry
- Print and display project cost summary reports
- Manage planned and actual costs
- Import data from text, excel, and other file types
- Search and sort data by any field

Another program for consideration is Oracle’s Primavera P6 Professional Project Management software (Oracle, 2010). Primavera P6 is a project management software package marketed by Oracle that manages and controls project-related activities. Resources representing labor, materials and equipment are used to track time and costs for a given project. Delayed project activities and costs are updated automatically and can be viewed by calling reports or graphs. Having both options of text and graphical reports can be helpful in understanding the data being reviewed. Figure 4.3 shows a few sample reports that can be generated using the P6 Reporting Database on the Primavera platform.

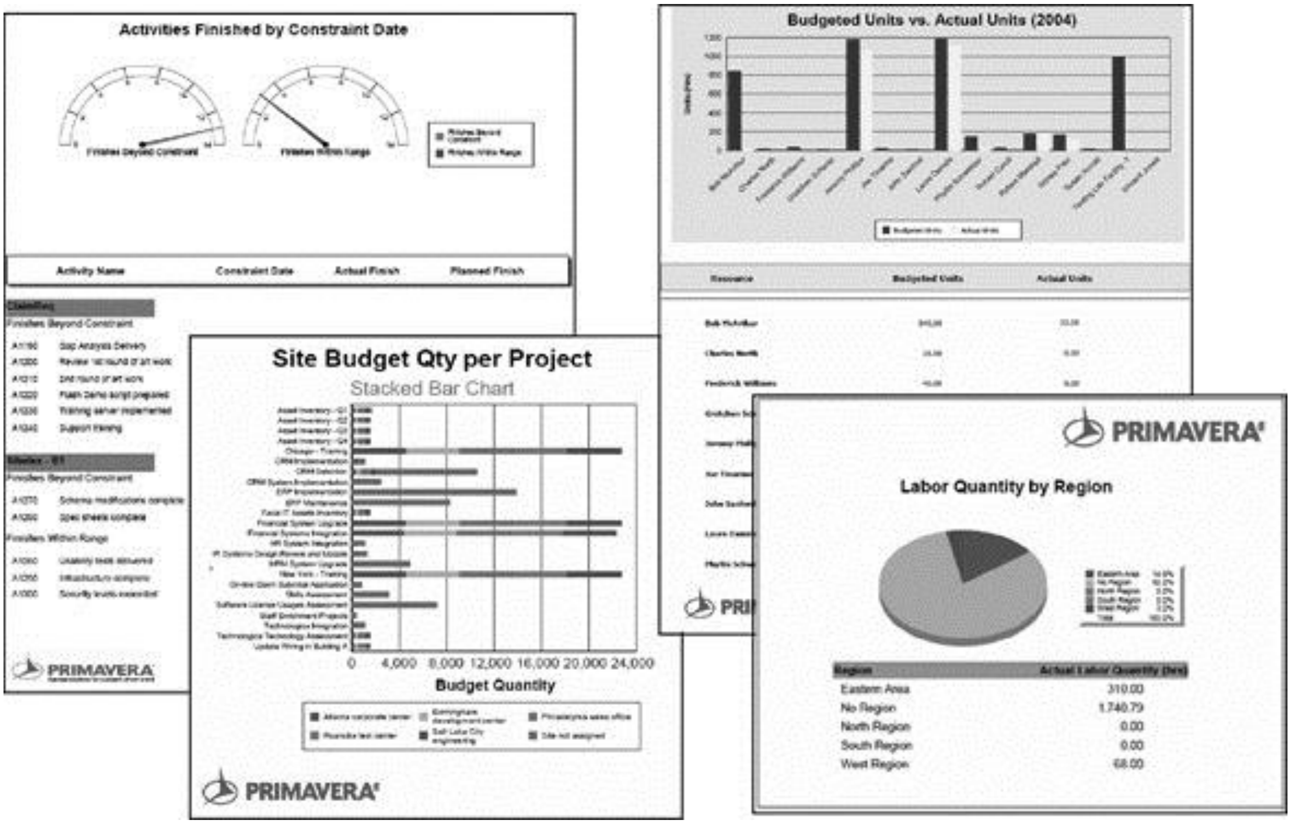


Figure 4.3: Sample Primavera Cost and Schedule Report
(Source: Foregetrack, 2010)

Primavera P6 is designed for use on large, complex construction projects but could be adapted, with the assistance of Primavera experts, for use on all SCDOT construction projects to plan, schedule, manage resources, and track costs across ALL types of projects. Some of the potential benefits of Primavera to SCDOT are:

- Enhanced processes and methods
- Improved project team collaboration
- Measurement of progress toward objectives
- Ensure projects align with a determined strategy
- Complete more projects successfully and with the intended payback

It is the reporting database that would be of most value to SCDOT. It is designed to provide "a central repository for all portfolio and project data. Its open architecture allows users to create operational reports and business intelligence analysis using any third-party reporting tools." (ForgeTrack, 2010). This would allow SCDOT to maintain a portfolio of information submitted by each utility provider regarding part numbers, cost codes, etc.

Oracle also has a line of Project Portfolio Management (PPM) software specifically designed for use by the public sector. The Primavera Enterprise PPM for the Public Sector is described as a solution that "allows government agencies to propose, plan, and control investments that present the greatest value to both the agencies and the public they serve. With Primavera enterprise project portfolio management solutions, national and local governments can effectively manage time, costs, resources, contracts, and changes to all types of projects or programs—including management of IT investments, grants, military systems, capital facility projects, maintenance and improvement programs, and more." (Oracle, 2010)

The Primavera software would require extensive training for all SCDOT personnel involved in the management of projects and it would represent a significant cost investment as well. It's benefits, however, if SCDOT is planning to redesign its cost management software, may be worth the expense and it is recommended that SCDOT further investigate the potential applications, costs, and benefits of the Primavera PPM software. If it is deemed that this software is not a practical investment for the SCDOT at this time, it does represent the cost and data management goals that SCDOT may want to establish for their own cost management database.

Using the Standardized Estimate Forms and the Database

The standardized estimate and invoice format, originally developed for Mn/DoT and adapted for SCDOT, proposed in this research provides a reasonable basis for the development of a cost management database. The format is simple, easy to read and could very easily become the method by which information is automatically and systematically entered into a database. Many database programs can input data from a spreadsheet (Access, FrontPage, Oracle), especially if the forms have predefined codes and limitations to the way in which the information is entered. It is anticipated that the forms proposed in this research could quickly and easily be entered into a database. Every heading, line item, unit of measure, etc. could be simply transferred to the database. This would allow consistent data entry and provide SCDOT with a method to generate reports, view information, and track costs more effectively.

Database Management and Unit Costs

The SCDOT has made leaps and bounds since the pen and paper databases of the not so distant past. Currently, the SCDOT uses a database program called Entire Connection that is relatively comprehensive, but there is room for improvement. The SCDOT currently has plans to move to a new database software package, and the points listed in this chapter should help to make an informed decision on a worthwhile program to choose. The important factors to remember when selecting a software package is to ensure that data is fast and easy to enter, can generate useful cost reports, can import data from other programs (i.e. Excel), and can search data within the database using keywords. Ultimately, SCDOT should be able to assess utility estimates for reasonableness and appropriate costs based on historical cost data much like the processes used in the roadway construction bidding process. The current databases do not maintain enough detail to support this level of information.

Initially, the project team had expected to be able to use the information provided in the existing databases and/or estimates and invoices to develop a historical unit cost database, but the lack of a consistent coding among utility companies coupled with the limited level of detail in the estimates made this an almost impossible task. One of the biggest problems is identifying the type of item in the estimates from the codes provided by the utility companies in lieu of an item description. SCDOT was able to obtain the code book for Progress Energy and Black River which allowed the project team to use data from several estimates to develop a sample unit cost database that could be expanded in the future, or copied for use with other utility providers. Unfortunately, the lack of a common coding system limits the usefulness of the database across utility companies. However, if adopted, the standardized cost estimate/invoice format would allow generation of a more comprehensive unit cost database for the future.

The sample unit cost database is made up of 3 tables, 10 crosstab queries, and one summary query. The three tables include:

1. Agreement Info – This table contains basic information on the utility agreement including the file number, agreement number, district, utility company name, county, city, agreement date, invoice date, type of work to be performed, route id, alternate route id, beginning milepoint and ending milepoint, the SCDOT share percentage, the original cost estimate, a general description of the project, and if applicable, a revision number and revised cost.
2. Material Code Descriptions – This table contains information from the Progress Energy code tables, so it is specific to the energy utilities and cannot necessarily be used to categorize items from other energy utilities because each utility maintains their own code tables. Further, the Progress Energy tables included both an old identifier number and a new identifier number. In some cases there were items that had one or the other but not both, indicating that there were new items or discontinued items within the company. The fields in the table include an automatically generated ID number, a utility section category (i.e., brackets, poles, conduit, etc), a subsection providing additional detail about the type of bracket or pole, a new id, a text description of the item, and the unit of measure for quantities. Some items have specific costs for installation and removal, so there is a column to indicate removal only, and finally a column to indicate the old id number.
3. Unit Cost Data from Invoices – The final table was generated by entering line items directly from invoices for which we had the Progress Energy codes. Black River also uses the same codes, so data were included for 2 Progress Energy estimates and 2 Black River estimates from Sumter and Darlington. For each line item, a new record is entered with the following information: file number, agreement number, quantity, item identifier, action (install or remove), material, material unit cost, labor, labor unit cost, and total cost.

Based on these three tables, ten different cross-tab queries were developed to define unit costs by item and by file number. These included average material costs, average labor costs, count of items by file number, file number average material costs, file number maximum material costs, file number minimum material costs, maximum labor costs, minimum labor costs, maximum material costs, and minimum material costs. All of these queries were ultimately combined into a summary query, a portion of which is shown on the first page of Appendix D. For each item that had at least one cost record from any one of the four files is provided in the summary sheet. Unfortunately, the sample database was limited to the four estimates for which the research team had item codes, but it is a start and provides a basis for entering other estimates should SCDOT obtain additional coding elements. The file structures are fully represented in the remaining figures in Appendix D.

To reiterate, the research team expects an immediate impact for the SCDOT should it adopt the plan mark-up, quantity estimate, and standardized invoicing components as proposed. The research team believes that standardized estimates from different utilities will be similar, straightforward, easy to understand, and easy to find line item cost data. This should make entering and tracking cost data in SCDOT databases a much more simple process.

CHAPTER FIVE

SCDOT UTILITY POLE SAFETY ASSESSMENT

As reported in Chapter 2, GDOT has been successful in developing win-win proactive utility relocation programs for safety improvements involving utility companies. These programs – either voluntary with provisions for leniency in permitting, or with 50/50 cost-sharing using safety funds – have produced significant reductions in crashes of all severity levels. These reductions in crashes can result in realized savings in tort liability cases where the DOT and utility can be jointly responsible if the utility is within the DOT right-of-way or if the required clear zone requirements are found to be insufficient. As such, a joint program to address the most hazardous utility pole locations will not only involve the utility companies in sharing/carrying the cost of the relocation, but it will also provide the DOT with the desired result – a roadside with sufficient clear space and fewer utility pole crashes.

In general, the concept of relocating utility poles to increase safety is derived from research conducted by Zegeer in the mid-1980s. Below you will find the often cited table of expected percent reduction for relocation of poles further from the roadside. It is observed that utility pole crashes decrease as the distance between the poles and the roadway increases i.e. as suffiient clear zone is provided. Significant improvements can be observed when the poles at least 10 feet from the roadway. As the pole distance from edge of traveled way is increased beyond 10 feet, there is slow increase in safety rate. Table 5.1 shows the expected percent reduction in crashes as utility poles are relocated away from the roadway for ADT = 10,000 and pole density = 40 poles/mile (Zegeer, 1984 a/b). Thus, associated crash reductions and expected benefits can be calculated based on existing clear zone and proposed clear zone distances. As with all clear zone projects, it is essential to note whether there are other roadside hazards in need of removal – else you may relocate one hazard to find that another is right next to it.

Table 5.1 Percent reduction in crashes for moving utility poles

Expected Percent Reduction in Pole Crashes									
Pole Line Before Removal (Ft)	Pole Line After Removal (Ft)								
	6	8	10	12	15	17	20	25	30
2	50	58	64	68	72	74	77	80	82
3	35	46	53	58	64	67	70	74	77
4	22	35	44	50	57	60	65	69	73
5	11	26	36	43	51	55	59	65	69
6	–	17	28	36	45	49	54	61	65
7	–	8	20	29	39	44	50	57	62
8	–	–	13	23	33	39	45	53	58
10	–	–	–	11	23	29	37	45	52
11	–	–	–	5	18	25	33	42	49
12	–	–	–	–	14	20	29	39	46
13	–	–	–	–	9	16	25	35	43
14	–	–	–	–	4	12	21	32	40
15	–	–	–	–	–	8	17	29	37

Therefore, this research builds on a recent SCDOT research project, "Support for the Elimination of Roadside Hazards: Evaluating Roadside Collision Data and Clear Zone Requirements", to identify the magnitude of the utility crash problem in South Carolina and determine the potential cost benefit of relocating utilities at problem sites. A multi-task approach was taken to achieve the following tasks:

- Define the magnitude of the utility pole crash problem in South Carolina and analyze trends associated with pole crashes
- Analyze a convenience sample from prior research project to evaluate clear zone sufficiency and assess existing roadside characteristics associated with pole crashes
- Define the range of potential Benefit/Cost ratios for implementing utility pole relocation and other countermeasures
- Establish a priority ranking method for utility pole crashes based on existing data and identify hazardous sites and road segments in South Carolina

Each of these tasks will be discussed briefly in the following sections.

Magnitude of the Utility Pole Crash Problem in South Carolina

For this research, three years (2004 to 2006) of South Carolina crash data with GPS coordinates received from South Carolina Department of Transportation were analyzed to determine descriptive statistics associated with utility pole crashes. Additional data associated with crash sites was requested from the SCDOT Roadway Inventory Management System to include traffic volumes, functional classification, speed limit, number of lanes, etc.

The research team was interested in only those crashes which involve utility poles. This is achieved by running various queries using Microsoft Access, a database management system. The database for all 3 years consisted of 333,051 crashes in total. To extract the utility pole related crashes from this database, researchers queried FHE: First Harmful Event, MHE: Most Harmful Event, and SOE: Sequence of Events for utility poles (code value of 61). SOE and MHE extraction from the location database produced the most number of crashes, 7217. FHE extraction of the same location database resulted in only 5413 crashes. These results were consolidated by removing duplicates to obtain 7759 crashes. 6734 out of 7759 were single vehicle crashes and 1025 involved two or more vehicles. Subsequently querying the vehicle units database, researchers found 8954 units involved in utility pole related crashes. Occupant information was only available for 2004, in that year 2482 pole related crashes involved 2746 drivers. The crashes were plotted in a geographic information system and concentrations near metropolitan areas are clearly noted in Figure 5.1. Further, the kernel density of crashes is shown in Figure 5.2.

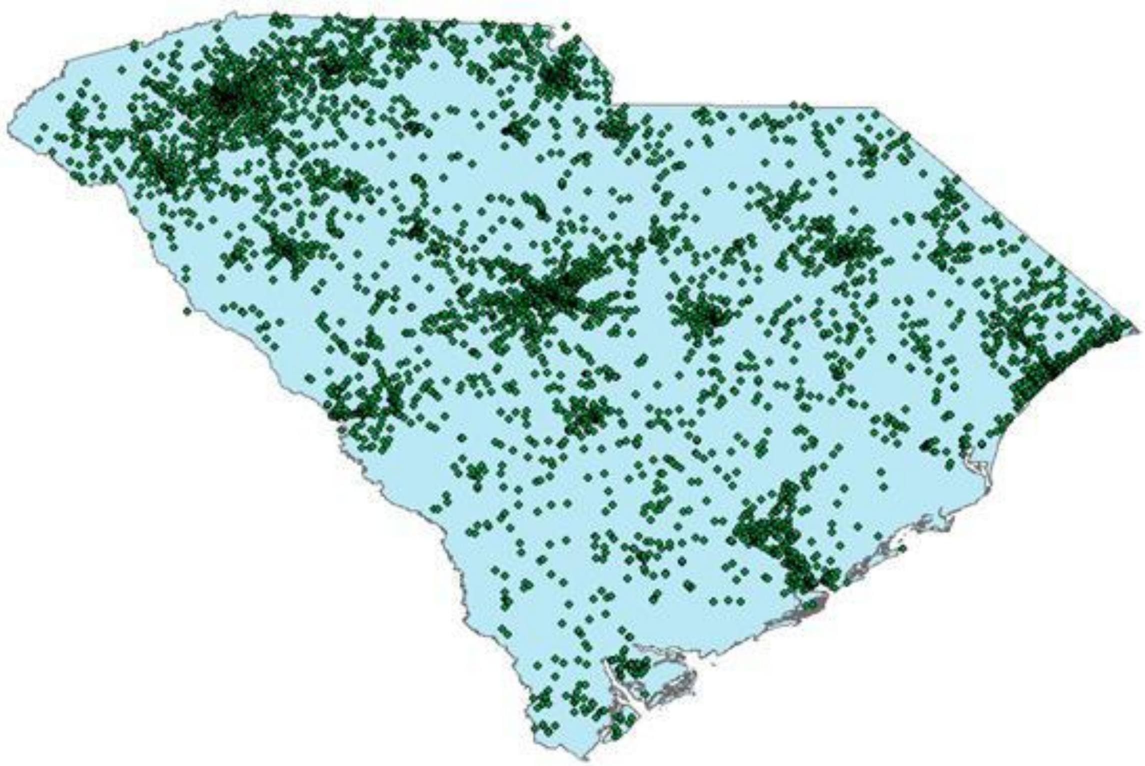


Figure 5.1 Locations of utility pole crashes in South Carolina

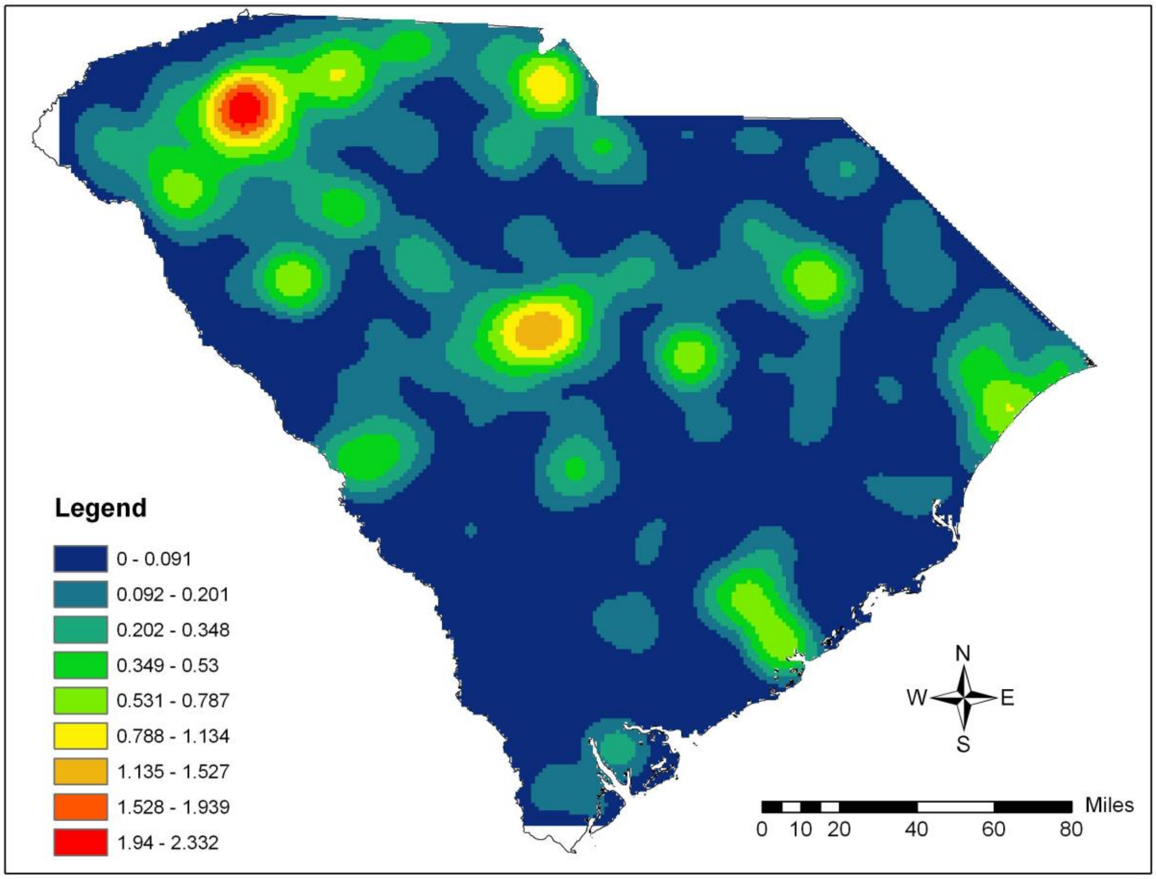


Figure 5.2 Density of utility pole crashes in South Carolina

Table 5.2 shows the roadway functional classification of pole crashes. As expected few (3.17%) crashes occurred on interstate roads. This is concurrent with the abundance of poles on the roadside of primary, secondary and county roads. Also the lack of pole, and thus pole related crashes on interstates supports the claim that more ample clear zones effectively reduce run-off-road fixed object crashes.

As seen from the Table 5.3 males have a significant share (60%) of pole-related crashes, more than double that of females. They also make up only 51% of South Carolinas registered drivers. Thus it can be safely concluded that males are at a higher risk of being involved in utility pole crashes.

It can be seen from the Table 5.4 that young drivers (35 year old and younger) lead the statistics for utility pole related crashes. They contribute to about 55% of the total crashes. But the worst offenders are the drivers within the age range of 15 to 24 years; they make up about 34% of the total utility pole related crashes, but contribute only to 7% of the SC registered drivers. The younger age groups are also at a higher risk of being injured or killed in a utility pole crash. It can also be seen that the risk of crashes, injuries, and fatalities decrease as drivers get older and likely more conservative.

Table 5.2 Utility Pole Crashes by Functional Class

RCT	FUNCTIONAL CLASS	Total	% CRASHES
1	INTERSTATE	246	3.17
2	US PRIMARY	1494	19.26
3	SC PRIMARY	1475	19.01
4	SECONDARY	3429	44.19
5	COUNTY	1115	14.37
	TOTAL	**7759**	**100**

Table 5.3 Utility Pole Crashes by Gender

DRIVER GENDER	TOTAL	%	SC Registered Drivers
FEMALE	2555	28.53	48.6
MALE	5388	60.17	51.4
UNKNOWN	1011	11.29	0
TOTAL	**8954**	**100**	100

Table 5.4 Utility Pole Crashes by Age and Severity Level

Age Group	Total	Not Injured	Possible	Non-incapacitating	Incapacitating	Fatal
0-14 years	20	11	5	3	1	0
15-24 years	1596	983	326	199	81	7
25-34 years	910	569	185	100	46	10
35-44 years	643	410	130	63	27	13
45-54 years	556	344	120	59	24	9
55-64 years	339	207	73	41	13	5
65-74 years	131	78	27	17	8	1
75+ years	75	47	14	11	2	1
Unknown	505	379	76	37	11	2
Total	4775	3028	956	530	213	48

Table 5.5 Utility Pole Crashes by Probable Cause

RANKING	PRC	PROBABLE CAUSE	TOTAL	% CRASHES
1	3	Driving Too Fast for Conditions	2680	37.47
2	16	Under the Influence	995	12.82
3	2	Distracted/Inattention	490	6.32
4	6	Ran Off Road	477	6.15
5	29	Unknown	358	4.61
6	12	Made an Improper Turn	276	3.56
7	7	Fatigued/Asleep	265	3.42
8	10	Medical Related	261	3.36
9	5	Failed to Yield Right of Way	255	3.29

The crash database maintains the probable cause of the traffic collision in the expert opinion of the responding officer. Speed of the vehicle is a major cause for most of the crashes. Table 5.5 shows about 35% of the pole related crashes were caused by the driver driving too fast for conditions and another 29% exceeding speed the limit. Driving under the influence of an illegal drug is also a major cause for accidents. These cases account for about 13% of the pole-related crashes. A distracted driver can also lose control of the vehicle, run off the road and find himself in a crash, such incidences accounted for around 13%. The top 4 causes total over 60% of utility pole crashes.

Overall, the trends shown above mirror those found nationally. Utility pole crashes are found more often in metro areas on lower functional class roadways involving predominantly young male drivers, speeding, and DUI.

Evaluation of Clear Zone Sufficiency

Information on exiting clear zone relative to utility pole location was obtained by using the Clemson University mobile transportation laboratory van. This instrumented vehicle is capable of simultaneously collecting video and laser measurements of the roadside topography and associate those with the GPS derived location of van. The video-log is collected by recording the roadside with two cameras situated in front and back of the vehicle. The roadway features, cross slope and distances to roadside obstacles are measured by the rotary laser attached to the rear of the vehicle which rotates 360 degrees and takes 400 measurements within one revolution at a rate of 20,000 samples per second (See Figure 5.3). To compile and analyses this raw data a Matlab based GUI software was written and used to plot the laser measured data.

Figure 5.3 360 degree rotating laser in action

The software is designed to calculate the clear zones for a particular site using manual inputs of speed and volume data. For this particular measurement (Figure 5.4), there are 3 slope segments. Starting at the edge of the travel lane, the segments are numbered from left to right. Segment 1 has a slope of -5.6H:1V with a horizontal distance of 0.89 feet. Segment 2 has a slope of 0.23H:1V and so on. The three columns in the top left corner of Figure 5.4 represent the segment number, horizontal slope component of the side slope in *H:1V, and horizontal distance of the segment. The program also automatically checks for traversable and recoverable slope status and either includes or excludes sections from the total clear zone and clear zone runout area. Thus actual clear zone is only 2.57 feet. For the combination of ADT and posted speed the required clear zone is 16-18 feet. Hence the site does not satisfy the minimum clear zone required for safe operation. However, this site was noted as a section with curb and gutter, so typical AASTHTO clear zone requirements are reduced significantly although several states have suggested that they probably should not be. Similarly 28 sites were analyzed for the clear zone adequacy.

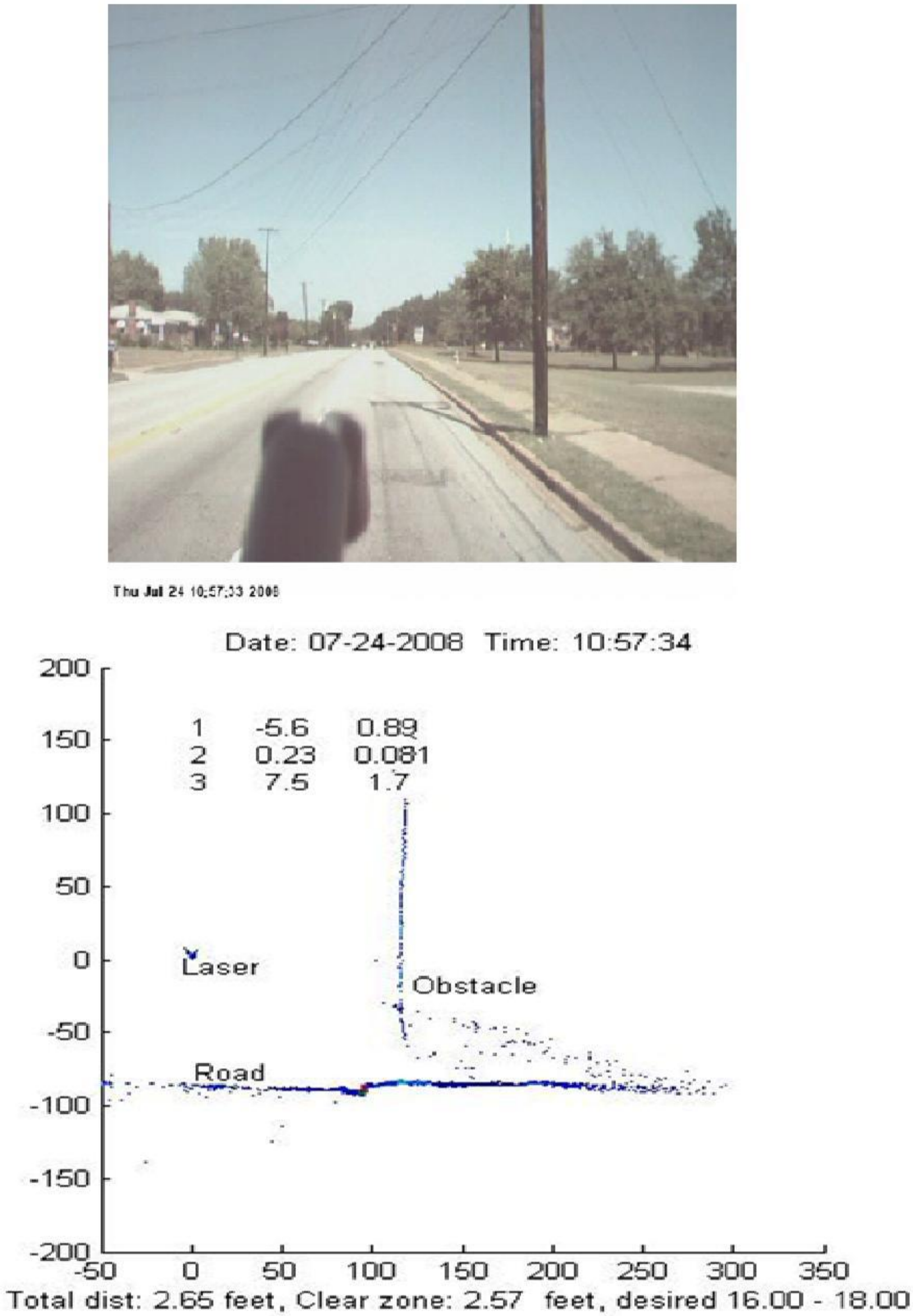


Figure 5.4 Roadside features and laser measurement

Table 5.6 shows the clear zone distance observed at the utility pole crash sites. 24 out of 28 sites analyzed did not meet minimum clear zone requirements. About 87% of pole related crashes occurred at sites with deficient clear zones.

Table 5.6 Clear Zone Sufficiency for Utility Pole Crash Sites

Clear Zone Situation	Total Sites	Related Crashes	% Crashes
Clear Zone Met	4	17	12.59
Clear Zone Not Met	24	118	87.41
Total	**28**	**135**	**100**

Table 5.7 shows the sites were curbs were observed. Curbs are generally recognized as having no significant containment or redirection capability, AASHTO Roadside Design Guide recommends that clear zone should be based on traffic volumes and speeds, both with and without a curb. There are still contradictory passages in various AASHTO documents; the Technical Committee on Roadside Safety has initiated a short-term project to identify all such inconsistencies and to recommend appropriate language corrections. The 2002 AASHTO Roadside Design Guide says, “When obstructions exist behind curbs, a minimum horizontal clearance of 0.5m (1.5ft) should be provided beyond the face of curbs to the obstructions. This offset may be considered the minimum allowable horizontal clearance (or operational offset), but it should not be construed as an acceptable clear zone distance. Since curbs do not have a significant redirectional capability, obstructions behind the curb should be located at or beyond the minimum clear-zone distances." Table 5.7 shows that sites with curbs on the roadside do not have minimum clear zone distances.

Table 5.7 Clear Zone Sufficiency for Sites with Curbing

Clear Zone Situation	Total Sites	No Curb	Curb
Clear Zone Met	4	4	0
Clear Zone Not Met	24	13	11

Potential Benefit/Cost Ratios for Implementing Utility Relocation

Benefit/cost analysis was performed for the sites with similar characteristics within the available convenience sample. The data available for these 28 sites was analyzed and the sites were grouped according to SCDOT functional classification. Such type of grouping will allow us to correlate benefits observed for these crashes to existing conditions on current SCDOT roadways. Furthermore, to gauge the range of benefit/cost ratio expected from implementing suggested alternative, these groups were scouted for sites with extreme and mild conditions. Thus, benefit/cost analysis of such groups provides realistic interpretation of the expected benefits. Roadside Safety Analysis Program (RSAP) was used for this analysis. The following three types of alternatives were analyzed:

Existing condition - Status quo

1. Relocate the pole to desired clear zone distance
2. Clearing roadside by providing underground utilities (Uniform clear zone free of hazardous objects)

RSAP incorporates a stochastic solution method using the Monte Carlo simulation technique. Vehicle encroachments are simulated one at a time to determine if a crash would occur and the resulting severity, and to calculate the associated crash costs. RSAP calculates the benefit/cost ratio by analyzing changes in annual crash rates for each alternative. A distinct difference is observed for the results of the extreme vs mild condition sites. For urban minor arterial extreme condition, a high benefit/cost ratio of 3.92 was observed for relocating the poles to provide minimum required clear zone, also underground utilities can provide a benefit/cost ratio of 1.18.

The benefit ratios for relocating the poles over providing underground utilities are significantly higher; this major difference in ratios can be attributed to the installation cost of the two alternatives. The cost for relocating poles ($75k-100k/mile) is almost five times cheaper than providing underground utilities ($528k/mile). The benefit/cost ratios for urban minor arterial mild condition were respectable. The difference in benefit/cost ratios of extreme and mild conditions indicate that most bang of the buck can be obtained by treating the worst pole crash sites.

Establishing a Priority Ranking System

For this analysis 7,759 pole related crashes from the SCDOT crash database were used as input parameters for kernel density, crash rate, county/route frequency and crash severity analysis in ArcGIS. The purpose of conducting all the above mentioned ranking methods is to acknowledge the fact that each ranking method has its own biases, and thus, if a site ranks poorly within multiple methods it is more likely to be a truly deviant site.

The minimum cumulative rank possible was 4 while the minimum rank obtained was also 4. For illustrative purposes all the results have been displayed on maps of South Carolina. The utility pole crashes plotted in Figures 5.6 through 5.9.were ranked as a 7 or greater on the cumulative ranking scale. Figure 5.2 shows the kernel density analysis performed on pole related crashes in South Carolina. It can be clearly seen that major hubs of pole crashes are in Greenville, Richland, Horry, Lexington, Anderson, Charleston and York. This is consistent with the population distribution of South Carolina. The descriptive statistics obtained for the SCDOT crash database validate this result. Figure 5.5 shows the counties in South Carolina leading in pole crashes. The top ten counties make up almost 60% of total pole crashes in South Carolina.

Linear patterns of pole crashes are observed on roads in and around major cities like Greenville, Anderson, Charleston, Columbia and Myrtle Beach. Figures 5.6 through 5.9 show the pole crashes by spatial location in South Carolina. It can be observed that various road sections in South Carolina can be identified as high risk pole crash sites. US 276 and US 123 in Greenville, US 76 in Anderson, etc.

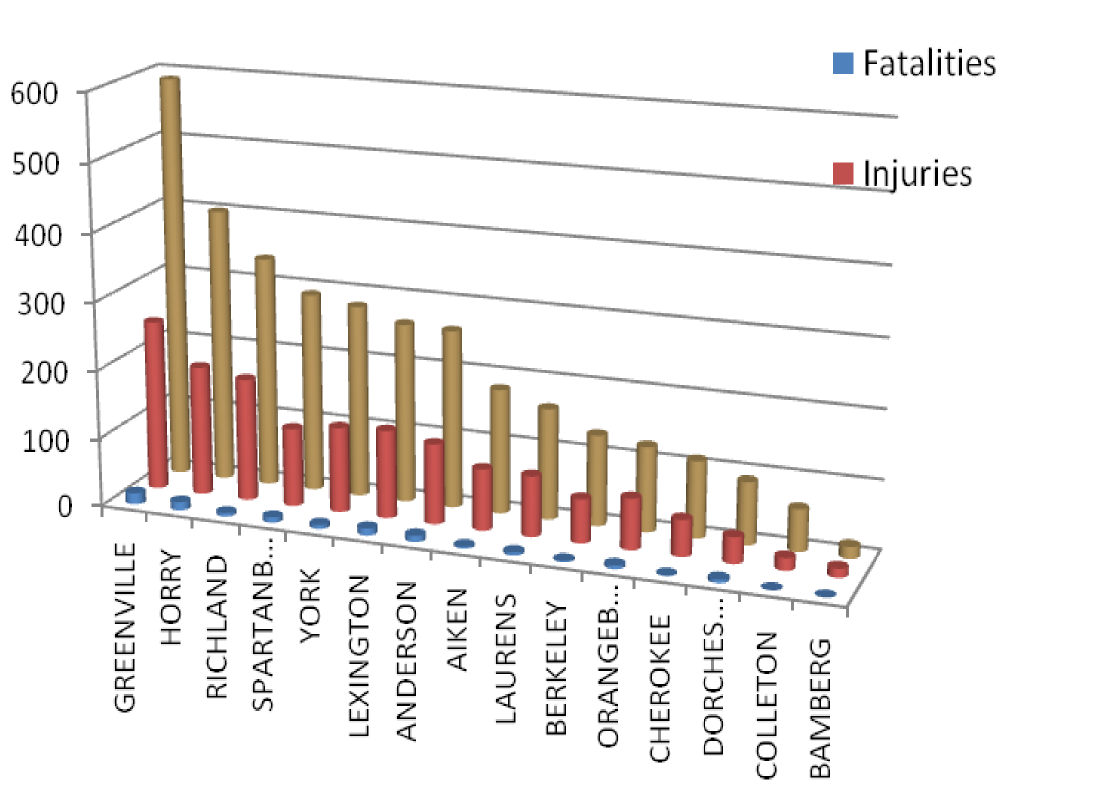


Figure 5.5 Top Ten Counties based on Fatalities, Injuries, and Total Utility Pole Crashes

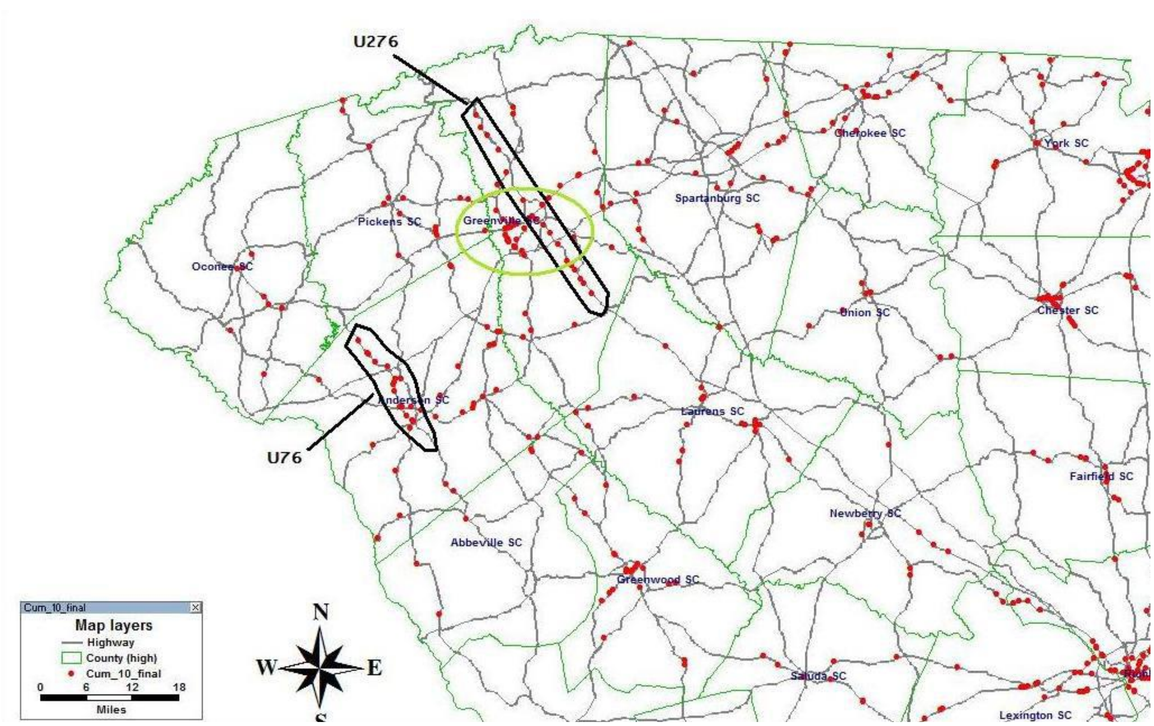


Figure 5.6 Priority Sites in the Upstate (U276 Greenville, U76 Anderson)

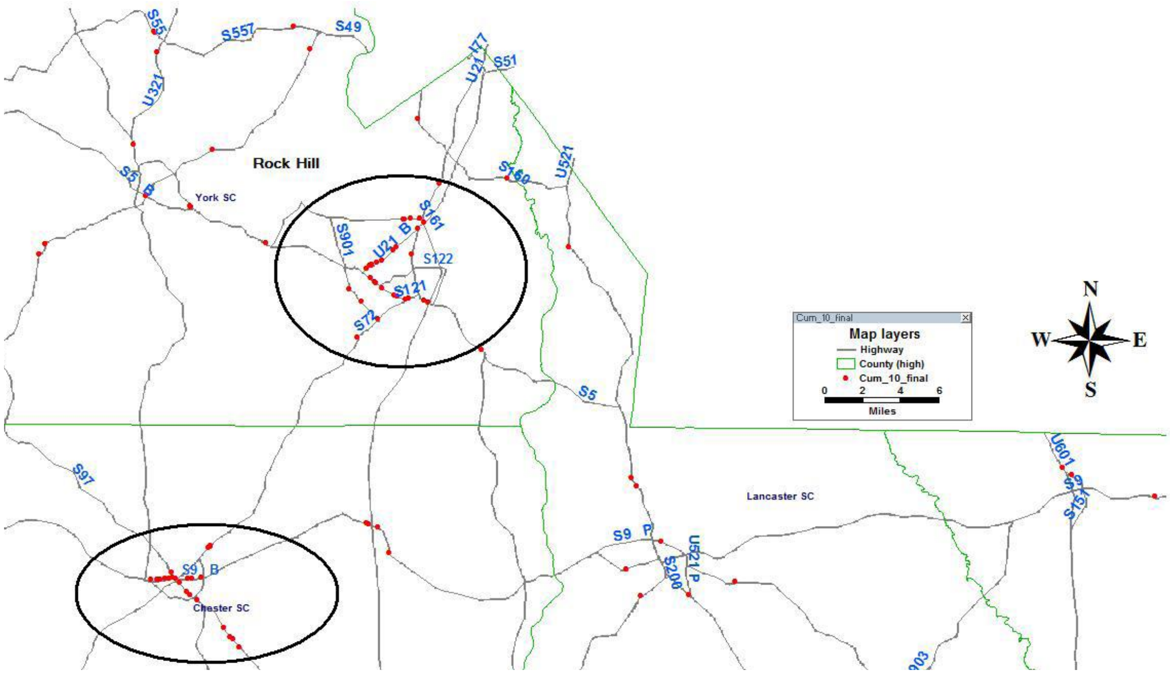


Figure 5.7 Priority Sites on S322 and U21B in York County

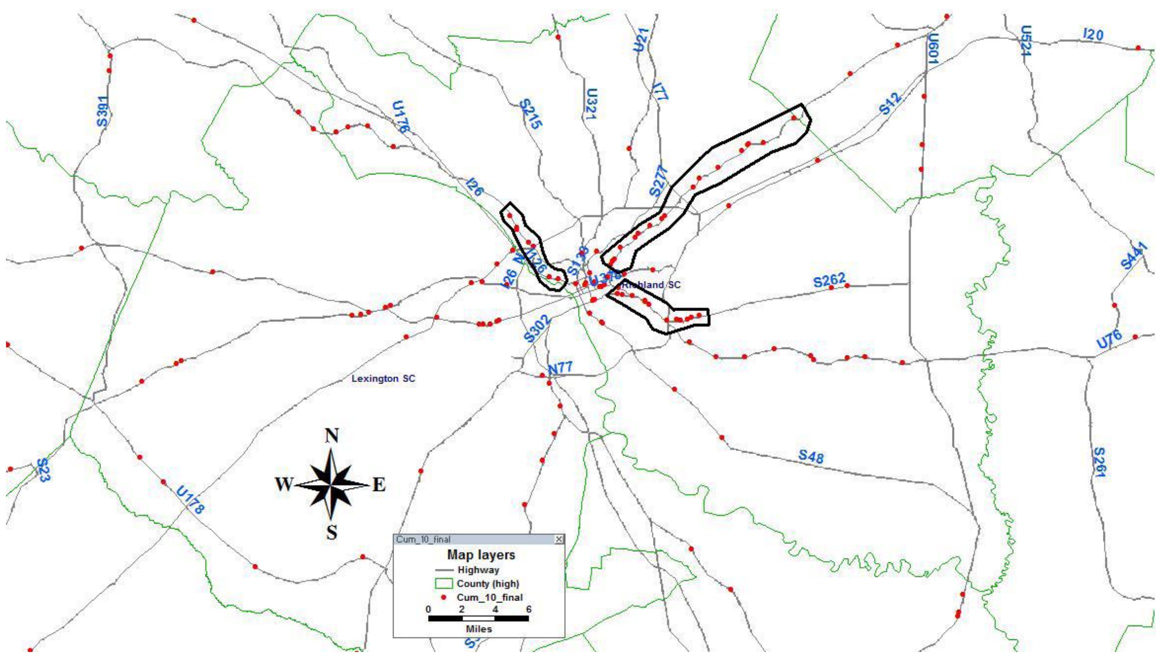


Figure 5.8 Priority Sites on U76, S262 and U1 in Richland and Lexington

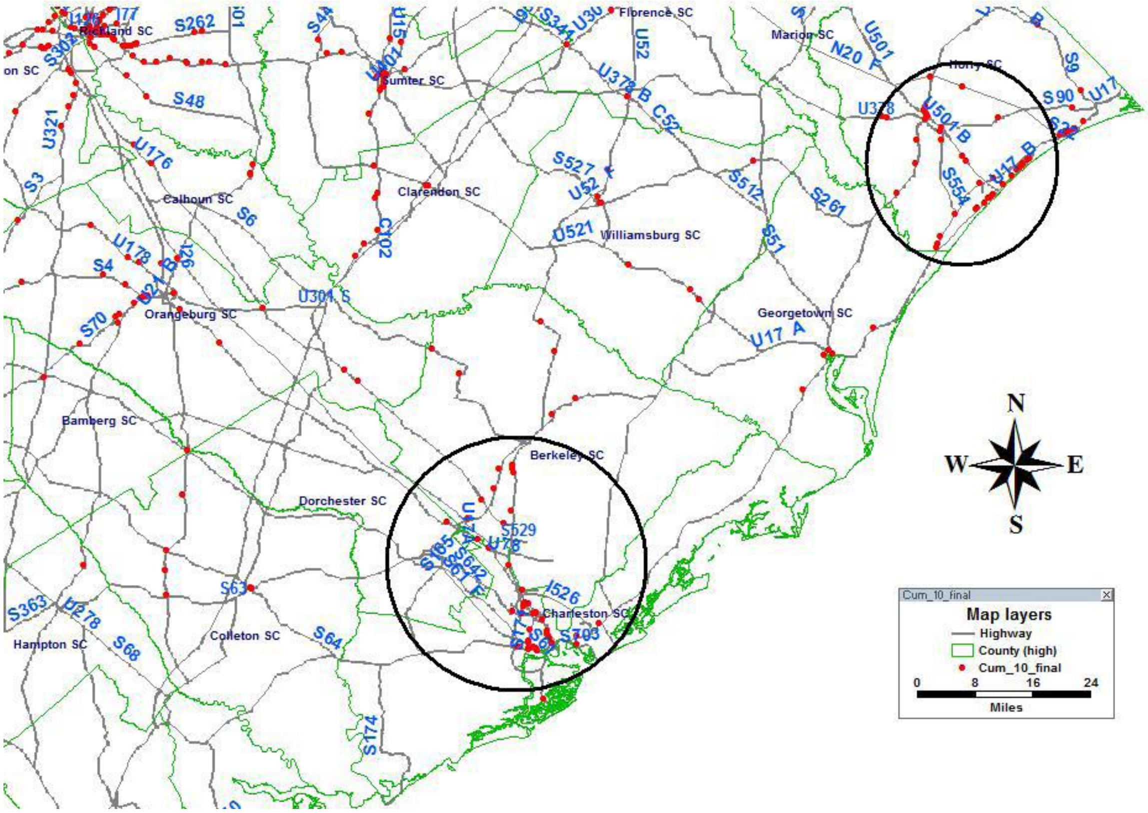


Figure 5.9 Priority Sites on I26 and S61 in Charleston County

CHAPTER SIX

RECOMMENDATIONS FOR FUTURE RESEARCH

This research report could not address all of the concepts and ideas related to utility relocation cost reimbursement. Many of these future research ideas were identified in meetings with the SCDOT, and this chapter will address some of the areas for potential future research. Some areas that could be subjects of future research consideration are state legislation regulating the relationship and balance of power between South Carolina utility providers and SCDOT, outsourcing SCDOT utility relocation work, and the certification of utility estimates to limit the number of cost overruns.

State Legislation

Research is needed into potential state legislation that could give the SCDOT more leverage in negotiating contracts for the reimbursements of utility relocation costs. Many states have imposed regulations on how utilities are reimbursed for relocation projects and these could provide information into the structuring of legislation for South Carolina. The state of Colorado has recently passed legislation concerning major utility relocation projects. The Transportation Expansion Project (T-REX) was $1.87 billion venture along Denver's Interstates 25 and 225 that added 19 miles of light-rail and improved 17 miles of highway. The success of the project was defined by shared partnered goals, timely legislation to allow the use of "master" agreements, and extensive underground utility identification efforts that created the basis for the T-REX utility team to correctly coordinate utility relocations. Before construction began, the T-REX utility team held a meeting to inform utility companies of the project and establish a utility taskforce. The utility taskforce consisted of representatives from the Colorado Department of Transportation, the Regional Transportation District and utility companies that met monthly until construction began. The task force's goal was to foster partnering, share information and ideas, and give the utility companies input into the new T-REX projects processes and procedures. A major accomplishment of the utility task force was obtaining input from utility companies on proposed legislation. Senate Bill 203 passed in spring 2000 requiring a "master" relocation agreement, or Project Specific Utility Relocation Agreement for each utility provider on design-build projects. The legislation required a new level of cooperation and coordination among the CDOT, utility companies and contractors, reducing costly utility delays (FHWA 2006).

The development of legislation that encouraged cooperation, coordination, and communication between SCDOT personnel and the utility providers would be of significant benefit to the SCDOT in terms of reduced frustrations, improved project costs due to reductions in changes associated with poor coordination/planning, and improved relationships with the utilities.

Outsourcing Utility Relocation Work

Outsourcing SCDOT utility relocation work is another possible area of future research. "Outsourcing Utility Coordination" is a report that was touched on in the Literature Review chapter of this report. Currently, 59 percent of the responding states in "Outsourcing Utility Coordination" indicated they outsourced some of their work, while 79 percent said they anticipated outsourcing work in the future. Florida reported that 75 percent of their utility work is outsourced. Fourteen of the eighteen states that used outsourced services rated the consultant services as "very good" or "good." The statistics show that there is no drop off in quality when using a consultant, mainly because many of the DOTs have set qualifications, which include previous direct utility coordination experience and at least one PE in the firm (Lindley 2006). The fact is that almost 80% of the states rated their consulting services as good or very good, which in SCDOTs case could mean cheaper relocation projects, less SCDOT manpower, and no sacrifice of quality.

Another utility relocation project where outsourcing was used was Kate Freeway Reconstruction in Harris Country, Texas. This project involved the reconstruction of 23 miles of interstate with 33 different utility companies. The use of outsourced utility inspectors and coordination teams enabled the Texas Department of Transportation to better utilize their resources on other, more important activities. This project's processes and tracking tools were so successful in Texas that they are now used as models for other large-scale projects in the state (FHWA 2009).

An investigation into the feasibility and potential benefit to SCDOT of utilizing consultants in the management of utility relocation work could be of value to the department.

Certification of Estimates

When engineering drawings are submitted to an owner there is always a PE stamp on the drawing certifying that the drawing is correct and backed by the education, experience, and expertise of the engineer whose name is on the stamp. This sort of certification gives a significant amount of credibility to the drawings. This type of process could be applied to the estimates submitted to SCDOT for utility relocations. When a contractor, or a utility provider, submits an estimate to the SCDOT they could be required to "certify" that estimate amount so that it is a determined amount. This certified estimate would be considered the Agreement Amount and would require detailed provisions for the submission and approval of any change order. Insisting on a certified estimate would require utility companies to provide more thorough cost estimates and could reduce the number of change order requests. If the SCDOT had a process for guaranteeing and certifying the initial estimates submitted by the utility companies, they would have more certainty in predicting final project costs. This may require an act of legislation as well, but if approved could save the state hundreds of thousands of dollars in unnecessary change order costs.

There are many areas of future research that would be beneficial to the SCDOT in the field of utility relocations. This report has only highlighted a few whose importance was highlighted during the research.

CHAPTER SEVEN

SUMMARY AND CONCLUSION

In the past the SCDOT has experienced higher final invoice costs compared to that of the preliminary estimate cost. The plan development process, cost estimates, and the databases used to manage these costs should contain enough information to assist the SCDOT in making decisions concerning cost analysis, budgeting, and most importantly, deciding if the estimates are reasonable. The estimating practices suggested in this report with the aid of the proposed standardized estimate forms should encourage standardization and ultimately save money for the SCDOT. Change orders should be reduced because it is anticipated that utility providers will submit more thorough estimates with less omissions due to the layout of the standardized estimate form. The cost estimate forms should also prove to be beneficial in tracking costs from one utility to another and making these estimates easier to understand due to their spatial relation within the plan sheets.

Meetings with district coordinators from the SCDOT also gave the research team a better understanding of how they use their database management systems. The database system that is currently in use is primarily for the tracking of invoices and payments to the utility companies. The database also contains information such as project start date, initial cost, and information regarding the location of the project. There are positives and negatives to the systems that have been used in the past, but a new software platform such as Primavera could provide much more automated and coordinated cost management processes. A more functional database system should be able to compare cost data from utilities, alert the user if a project is behind schedule or over budget, and generate useful reports in both text and graphical styles.

The creation of the standardized estimate forms provided for the SCDOT should prove to be beneficial in reducing overruns by the utility companies. The selection of a new, more user-friendly, and powerful database management system accompanying the estimate forms should further organize the cost and labor data submitted to the SCDOT. The implementation of the estimate forms should provide immediate results to both the SCDOT and the utility companies when used alongside the information in this report.

In addition to standardizing the estimates/invoices and implementing a more sophisticated database tracking system, the research identified a number of additional procedures that SCDOT could adopt to gain additional efficiencies in project development, oversight, and management. As mentioned in the site visit and interview section, there are a number of practices identified from prior FHWA Utility Accommodation Award Winners that have proven to be effective in numerous states including:1) use of online web applications for relaying utility coordination information and documentation; 2) use of prepared plans and mark-up programs to ensure a full understanding of project scope among DOTs and utility companies; and 3) use of proactive safety program funding to relocate utilities for safety improvements rather than for facility expansion or other construction program.

REFERENCES

Aboleda, Carlos A. et al. (2004). "Evaluation, Analysis, and Enhancement of INDOT's Utility Accommodation Policy." Report to the Indiana Department of Transportation. FHWA/IN/JTRP-2004/22. October 2004.

Alabama Department of Transportation (2004). "Non-Reimburseable Agreement for Relocation of Utility Facilities on Public Right-of-Way/Work to be Done by State Contractor." Distributed to Utility Companies. July 23, 2004.

Alluri, Priyankaa & Jennifer Ogle (2011). SCDOT Utility Relocation Safety Report.

"Entire Connection." (2010) Texas A&M University Division of Finance, Accessed November 4, 2010. http://finance.tamu.edu/fmo/ts/docs/connection.asp.

Federal Highway Administration (2006). "2006 Excellence in Utility Relocation and Accommodation Awards Winners.", Accessed May 10, 2010: http://www.fhwa.dot.gov/utilities/2006awards.cfm.

Federal Highway Administration (2009). "2009 Excellence in Utility Relocation and Accommodation Awards Winners.", Accessed May 8, 2009: http://www.fhwa.dot.gov/utilities/2009awards.cfm.

Federal Highway Administration (2009). "Utilities Program.", Accessed October 10, 2009: http://www.fhwa.dot.gov/programadmin/utility.cfm.

Forgetrack Limited (2010). Software Page Accessed September 11, 2010: http://www.forgetrack.co.uk/software/software.php.

General Accounting Office (1999). "Transportation Infrastructure/Impacts of Utility Relocations on Highway and Bridge Projects." GAO/RCED-99-131. June 1999.

Heiner, Jared and Kara Kockelman (2005). "Costs OF Right-of-Way Acquisition: Methods and Models for Estimating." ASCE Journal of Transportation Engineering. Vol 131, No. 3, March 1, 2005

Indiana Department of Transportation. "Accountability, Communication, Coordination, and Cooperation." Report of the Utility Relocation Task Force. July 1, 2004.

Transportation Research Board (2001). Utility Safety: Mobilized for Action and State, City, and Utility Initiatives in Roadside Safety. E-Circular, E-C030, January 9-13, 2000. Accessed October 25, 2010: http://onlinepubs.trb.org/onlinepubs/circulars/ec030/ec030.pdf

Kanasas Department of Transportation (2007). “KDOT Utility Accommodation Policy. Distributed to the Bureau of Construction and Maintenance.

Lindly, Jay K (2006). “Outsourcing Utility Coordination/Who, Where, and Why?” Transportation Research Record 2025.

National Research Council (2004). “Utilities and Roadside Safety,” Transportation Research Board, Committee on Utilities.

O’Connor, James T. (2008). “Findings on Determining Durations of Right-of-Way Acquisition and Utility Adjustment on Highway Projects.” Report to the Texas Department of Transportation. FHWA/TX-09/5-4617-01-1. July 2008.

“Oracle’s Primavera P6 Reporting Database” (2010) ForeTrack Ltd website. Accessed November 4, 2010. www.forgetrack.co.uk/software/software.php#reporting.

Oregon Department of Transportation (2008) “Procedures for Utility Relocation/Reimbursement for Federally Funded Local Public Agency Projects.” Distributed to Oregon Local Public Agencies.

“Primavera P6 Professional Project Management”(2010) Oracle product website. Accessed November 4, 2010. www.oracle.com/us/products/applications/042374.htm.

“Primavera Enterprise PPM for the Public Sector” (2010) Oracle product website. Accessed November 30, 2010. www.oracle.com/us/products/public-sector/043458.htm.

“Project Cost Tracking Organizer Pro” (2010) Project Cost Tracking Software for Windows. Accessed November 4, 2010. www.primasoft.com/pro_software/project_cost_tracking_software_pro.htm

Quiroga, Cesar et al. (2006) “Construction Specification Framework for Utility Installations.” Sponsored by the Utilities Committee.

Quiroga, Cesar et al. (2006). “A Unit Cost and Construction Specification for Utility Installations,” Report to the Texas Department of Transportation. FHWA/TX-07/0-4998-1. October 2006.

Quiroga, Cesar et al. (2007). “Specification Framework for Communication Utilities and Estimation of Utility Adjustment Costs.” Report to the Texas Department of Transportation. FHWA/TX-08/0-4998-3. October 2007.

Texas Transportation Institute (1999). “Safer Roadsides Through Better Utility Pole Placement, Protection, and Construction.”

Zegeer, Charles V., and Michael J. Cynecki. Selection of Cost-E_ective Countermeasures for Utility Pole Accidents: Users Manual, Federal Highway Administration, Report No. FHWAIP, July 1984.

Zegeer, Charles V., and Martin R. Parker, Jr. "E_ect of Tra_c and Roadway Features on Utility Pole Accidents." Transportation Research Record 970, Transportation Research Board. 1984. pp. 65-76.

APPENDIX A

UTILITY ESTIMATE COMPARISON

Agreement Number	Utility	Agreed Cost	Adjusted Cost	Overhead Cost	Overhead Cost % of Total	Estimate Submittal Clarity
12627	Aiken Elec.	$2,482.12	Not Listed	$528.68	21%	Good
12649	Aiken Elec.	$4,510.29	Not Listed	Not Listed	Not Listed	Good
12660	Aiken Elec.	$13,852.55	Not Listed	$2,759.92	20%	Good
12652	AT&T	$13,144.38	$11,177.31	Not Listed	Not Listed	Poor
12598	Beaufort-Jasper Water & Sewer Authority	Cancelled –Design change				N/A
12678	Berkeley Electric Cooperative Inc	$1,826,510.01	Not Listed	$754,972.00	41%	Excellent
12688	Black River Elec.	$29,086.27	Not Listed	Very Vague	Not Listed	Excellent
12684	Black River Elec.	$138,242.82	Not Listed	Very Vague	Not Listed	Excellent
12668	Carolina Gas Transmission	$28,916.15	Not Listed	$2,991.15	10%	Excellent
12689	Central Electric Power Cooperative Inc	$126,740.05	Not Listed	$2,500.00	2%	Good
12667	City of Clinton	$49,560.00	Not Listed	Check	Not Listed	Excellent
12605	Coastal Electric Cooperative Inc.	$2,838.27	Not Listed	$762.40	27%	Good
12635	Duke Energy	$493,698.89	Not Listed	Not Listed	Not Listed	Good
12656	Duke Energy	$66,667.59	Not Listed	$1,590.82	2%	Excellent
12682	Farmers Tele	$140,718.00	Not Listed	Not Listed	Not Listed	Poor
12672	Horry Electric Cooperative Inc.	$130,020.59	Not Listed	$9,165.36	7%	Excellent
12673	Horry Electric Cooperative Inc.	$83,179.27	Not Listed	$6,620.11	8%	Excellent
12633	Horry Electric Cooperative Inc.	$37,595.66	Not Listed	$2,988.28	8%	Excellent
12628	Laurens W&S	$37,300.00	Not Listed	Not Listed	Not Listed	Poor
12653	Laurens Elec.	$3,420.32	Not Listed	$1,518.67	44%	Good
12693	Marlboro Electric Cooperative Inc.	$60,603.19	Not Listed	Not Listed	Not Listed	Good
12695	Mid Carolina	$177,700.00	Not Listed	Ver Vague	Not Listed	Poor
12676	The City of North Myrtle Beach	$53,000.00	Not Listed	Not Listed	Not Listed	Poor (Drawings only)
12687	Newberry Elec.	$13,183.88	Not Listed	$1,680.00	13%	Good
12375	Newberry Elec.	$36,619.34	$62,654.42	Not Listed	Not Listed	Not Listed
12640	Palmetto Electric Cooperative Inc.	$504,469.27	Not Listed	$75,769.10	15%	Good
12639	Palmetto Electric Cooperative Inc.	$526,834.01	Not Listed	$204,451.00	39%	Good
12685	Progress Energy	$770,847.97	Not Listed	$116,200.42	15%	Poor
12669	Progress Energy Carolina Inc.	$23,642.53	Not Listed	$5,648.02	24%	Excellent
12644	Progress Energy Carolina Inc.	$3,968.00	None	Not Listed	Not Listed	Poor (Drawings only)
12490	Progress Energy Carolina Inc.	$99,190.31	$369,202.73	Not Listed	Not Listed	Poor
12585	SCE&G	$299,315.00	$433,133.00	Not Listed	Not Listed	Not Listed
12654	SCE&G	$75,904.00	Not Listed	$12,306.00	16%	Excellent
12661	SCE&G	$12,689.00	Not Listed	$2,559.00	20%	Poor
12662	SCE&G	$40,521.00	Not Listed	$9,531.00	24%	Poor
12663	SCE&G	$13,090.00	Not Listed	$4,198.00	32%	Poor
12595	SCE&G	$289,623.00	$321,810.63	Not Listed	Not Listed	Poor
Agreement Number	**Utility**	**Agreed Cost**	**Adjusted Cost**	**Overhead Cost**	**Overhead Cost % of**	**Estimate Submittal**

					Total	Clarity
12677	SCE&G	$464,818.00	Not Listed	$74,465.00	16%	Good
12642	SCE&G	$131,989.00	Not Listed	$16,197.00	12%	Good
12604	SCE&G	$119,068.00	$148,637.00	Not Listed	Not Listed	Poor
12648	SCE&G	$48,537.00	Not Listed	Not Listed	Not Listed	Good
12686	SCE&G	$30,146.00	Not Listed	$2,365.59	8%	Good
12675	Summerville Commissioners of Public Works	$346,708.82	Not Listed	Not Listed	Not Listed	Poor (Drawings only)
12681	Time Warner Cable	$314,800.00	Not Listed	Not Listed	Not Listed	Poor (Drawings only)
12683	Time Warner	$75,412.00	Not Listed	Not Listed	Not Listed	Poor
12692	Tri City Elec.	$32,338.37	Not Listed	Not Listed	Not Listed	Poor
12680	Verizon Business/MCI	$5,544.00	Not Listed	Not Listed	Not Listed	Good

APPENDIX B

MNDOT UTILITY ESTIMATE WORKSHEET PAGES

Estimate Summary Sheet

Please provide the information requested in each section. Some cells are free-flow, in which you will have to manually enter data. Other cells contain drop down lists, from which you can select the best answer. If you have any questions or comments about the fields, or about any information in this template, please contact the Utilities Unit.

Preparer Name and Date:

Enter the name of the person who is preparing the Estimate Summary Sheet, and the date it is completed.

Worksheet Heading:

Enter all information within the worksheet heading for your information to be considered.

a. MnDOT State Project #
b. MnDOT Utility Agreement #
c. Utility Owner
d. Utility Project #

Location:

Enter the location of the work you will complete under the MnDOT Utility Agreement.

a. MnDOT District (drop down)
b. County (drop down)
c. City / Township
d. State/US/Interstate Highway (drop down)
e. Stationing (optional)
f. Reference Point
g. Township, Range, Section
h. Project Limits (location of the overall construction project)

Type of Work:

Enter the type of work you will complete under the MnDOT Utility Agreement.

a. Type of Facility
b. Transmission / Distribution
c. New or Replacement Service
d. Installation Type
e. Betterment
f. Change of Service
g. Change of Service Type
h. Season of Work
i. Rural / Urban
j. Written Description

Description of Work:

Enter a description of the work you will complete under the MnDOT Utility Agreement. There is no limi to the text field and the size can be adjusted to accommodate the full length of the narrative description.

a. Narrative Description of Work
b. Schedule Constraints
c. Staging / Phasing Requirements
d. Special Soil Conditions
e. Total Estimated Cost ($) (auto-populated)

Preparer's Signature and Date:

The preparer of this Estimate Summary Sheet must sign and date the document prior to submitting it. The signed documents will be accepted in the following formats: Emailed in PDF or dropped off / mailed in hardcopy - electronic signatures are accepted in lieu of wet signatures. In addition to the signed copy, the electronic excel version of the Estimate Summary Sheet must be submitted via email to the Utilities Unit for the estimate to be accepted.

Estimate Detail Sheet

Please provide the information requested in each section. Some cells are free-flow, in which you will have to manually enter data. Other cells contain drop down lists, from which you can select the best answer. If you have any questions or comments about the fields, or about any information in this template, please contact the Utilities Unit.

Preparer Name and Date:

These cells will be auto-populated from the information provided on the "Estimate Summary Sheet".

Worksheet Heading:

The worksheet heading information will auto-populate from the information provided on the "Estimate Summary Sheet" worksheet.

a. MnDOT State Project #
b. MnDOT Utility Agreement #
c. Utility Owner
d. Utility Project #
e. Narrative Description of Work

Pre-Construction Phase:

Under the "Description of Work" column, choose the appropriate work item from the drop down lists provided. Select the best answer that applies to the work you will complete under the MnDOT Utility Agreement.
Once you have selected the appropriate work, enter the estimated amount for each line item: Labor, Material, Equipment, Subcontractors. Totals and subtotals for each line item and column will be autc calculated.

Drop down options:

a. Right of Way & Easements
b. Surveying
c. Legal Fees
d. Engineering
e. Administration Costs
f. Potholing
g. Materials Storage and Loading

Construction Phase:

Under the "Description of Work" column, choose the appropriate work item from the drop down lists provided. Select the best answer that applies to the work you will complete under the MnDOT Utility Agreement.
Once you have selected the appropriate work, enter the estimated amount for each line item: Labor, Material, Equipment, Subcontractors. Totals and subtotals for each line item and column will be auto-calculated.

Drop down options:

a. Copper Cable / Service Wire
b. Fiber / Equipment
c. Poles
d. Conduit / Inner-duct
e. Vaults / Cabinets
f. Load Coils / Repeaters
g. Terminals / Pedestals
h. Natural Gas Pipeline
i. Petroleum Pipeline
j. Miscellanious Materials - Itemized
k. Surface Restoration - Itemized
l. Salvage Value
m. Watermain
n. Sanitary Sewer - itemized
m. Miscellaneous Labor Charges (testing, pipe removal, x-ray, etc.) - Itemized

Post Construction Phase:

Under the "Description of Work" column, choose the appropriate work item from the drop down lists provided. Select the best answer that applies to the work you will complete under the MnDOT Utility Agreement.
Once you have selected the appropriate work, enter the estimated amount for each line item: Labor, Material, Equipment, Subcontractors. Totals and subtotals for each line item and column will be auto-calculated.

Drop down options:

a. Survey
b. As-Built and Engineering

Project Phase Subtotals:

The project phase subtotals will auto-calculate from the information provided in the Pre-construction, Construction and Post Construction phase subtotal fields.

Preparer's Signature and Date:

The preparer of this Estimate Detail Sheet must sign and date the document prior to submitting. The signed documents will be accepted in the following formats: Emailed in PDF or dropped off / mailed in hardcopy - electronic signatures are accepted in lieu of wet signatures. In addition to the signed copy, the electronic excel version of the Estimate Detail Sheet must be submitted via email to the Utilities Unit for the estimate to be accepted.

ESTIMATE SUMMARY SHEET

Estimate Prepared By: **Preparer's Name** **Date :** ____________

MnDOT SP#	State Project Number
MnDOT Utility Agreement #	Agreement Number
Utility Owner	Utility
Utility Project #	Utility Project #

Location

(Choose from drop down lists where available)

MnDOT District		Stationing (optional)	
County		Reference Point	
City / Township		Township, Range, Section	
State / US / Interstate Highway		Project Limits	

Type of Work

(Choose from drop down lists)

Type of Facility		Change of Service	
Transmission / Distribution		Change of Service Type	
New or Replacement Service		Season of Work	
Installation Type		Rural / Urban	
Betterment		Written Description (e.g. 100ft N of 140th St & Cedar (77) in Apple Valley)	

Description of the Work

Narrative Description of Work	Enter a complete narrative description of the work
Schedule Constraints	Provide any schedule constraints that have been accounted for in the estimate
Staging / Phasing Requireme	Provide any staging/phasing requirements that have been accounted for in the estimate
Special Soil Conditions	Provide any special soil conditions that have been accounted for in the estimate
Total Estimated Cost ($)	$ -

ESTIMATE DETAIL SHEET

Estimate Prepared By: Preparer's Name   **Date :** 1/0/1900

MnDOT SP # State Project Number

MnDOT Agreement # Agreement Number

Utility Owner Utility

Utility Project # Utility Project #

Narrative Description of Work: Enter a complete narrative description of the work

Pre-Construction Phase

Description of Work (Choose from drop down lists)	Totals				
	Labor	Material	Equipment	Subcontractors	Total
	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -
Subtotal	$ -	$ -	$ -	$ -	$ -

Construction Phase

Description of Work (Choose from drop down lists)	Totals				
	Labor	Material	Equipment	Subcontractors	Total
	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -
Subtotal	$ -	$ -	$ -	$ -	$ -

Post Construction Phase

Description of Work (Choose from drop down lists)	Totals				
	Labor	Material	Equipment	Subcontractors	Total
	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -
Subtotal	$ -	$ -	$ -	$ -	$ -

Project Phase Subtotals

Pre-Construction Phase	$ -
Construction Phase	$ -
Post Construction Phase	$ -

Project Total $ -

Preparer's Signature

Date

Labor Calculations

The purpose of this sheet is to establish the built up cost of labor required to perform the utility relocation work.

Cost per Hour

Overhead Calculations	
10%	Rate

Labor Category	Labor Direct	Indirect	Subtotal	Fringes	Subtotal	Overhead	Total
Sample Laborer	$ 12.12	27%	$ 15.39	$ 6.08	$ 21.47	$ 2.15	$ 23.62
Sample Pipelayer	$ 12.45	27%	$ 15.81	$ 6.08	$ 21.89	$ 2.19	$ 24.08
Sample Operator 1	$ 21.25	27%	$ 26.99	$ 11.67	$ 38.66	$ 3.87	$ 42.52
Sample engineer	$ 42.00	27%	$ 53.34	$ 11.67	$ 65.01	$ 6.50	$ 71.51

Labor Indirect

The purpose of this sheet is to establish the built up cost of indirect labor costs associated with the performance of the utility relocation work.

Labor Indirect Costs

Sample Operator		Sample Operator		Sample Operator		Sample Operator	
Workers Compensation	18%	Workers Compensation	18%	Workers Compensation	18%	Workers Compensation	18%
State	7%	State	7%	State	7%	State	7%
FICA	2%	FICA	2%	FICA	2%	FICA	2%
Federal Tax	7%	Federal Tax	7%	Federal Tax	7%	Federal Tax	7%
Total Indirects	34%	Total Indirects	34%	Total Indirects	34%	Total Indirects	34%

Sample Operator		Sample Operator		Sample Operator		Sample Operator	
Workers Compensation	18%	Workers Compensation	18%	Workers Compensation	18%	Workers Compensation	18%
State	7%	State	7%	State	7%	State	7%
FICA	2%	FICA	2%	FICA	2%	FICA	2%
Federal Tax	7%	Federal Tax	7%	Federal Tax	7%	Federal Tax	7%
Total Indirects	34%	Total Indirects	34%	Total Indirects	34%	Total Indirects	34%

Equipment Rate Calculations

The purpose of this sheet is to tabulate the rental and operating costs of the equipment required to perform the utility relocation work. All equipment should be priced in accordance to MnDOT Technical Memorandum No. 09-17-TS-04, dated December 4,

Description	Monthly Rate	Divisor	Hourly Rent	Equipment Operating Expense	Total Rate Per Hour
690 John Deere excavator	$ 11,500.00	176	$ 65.34	$ 21.76	$ 87.10

APPENDIX C

PROPOSED SCDOT UTILITY ESTIMATE WORKSHEET PAGES

SCDOT Utility Estimate Submittal Forms

Instructions

Estimate Summary Sheet

Please provide the information requested in each section. Some cells are free-flow, in which you will have to manually enter data. Other cells contain drop down lists, from which you can select the best answer. If you have any questions or comments about the fields, or about any information in this template, please contact the Utilities Unit.

Preparer Name and Date:

Enter the name of the person who is preparing the Estimate Summary Sheet, and the date it is

Worksheet Heading:

Enter all information within the worksheet heading for your information to be considered.

a. SCDOT File #
b. SCDOT Utility Agreement #
c. Utility Owner
d. Utility Project #

Location:

Enter the location of the work you will complete under the SCDOT Utility Agreement.

a. SCDOT District (drop down)
b. County (drop down)
c. City / Township
d. State/US/Interstate Highway
e. Stationing (optional)
f. Reference Point
g. Township, Range, Section
h. Project Limits (location of the overall construction project)

Type of Work:

Enter the type of work you will complete under the SCDOT Utility Agreement using drop down menus.

a. Type of Facility
b. Transmission / Distribution
c. New or Replacement Service
d. Installation Type
e. Betterment
f. Change of Service
g. Change of Service Type
h. Season of Work
i. Rural / Urban
j. Written Description

Description of Work:

Enter a description of the work you will complete under the SCDOT Utility Agreement. There is no limit to the text field and the size can be adjusted to accommodate the full length of the narrative description.

a. Narrative Description of Work
b. Schedule Constraints
c. Staging / Phasing Requirements
d. Special Soil Conditions
e. Total Estimated Cost ($) (auto-populated)

Preparer's Signature and Date:

The preparer of this Estimate Summary Sheet must sign and date the document prior to submitting it. The signed documents will be accepted in the following formats: Emailed in PDF or dropped off / mailed in hardcopy - electronic signatures are accepted in lieu of wet signatures. ***In addition to the signed copy, the electronic excel version of the Estimate Summary Sheet must be submitted via email to the Utilities Unit for the estimate to be accepted.***

Estimate Detail Sheet

Please provide the information requested in each section. Some cells are free-flow, in which you will have to manually enter data. Other cells contain drop down lists, from which you can select the best answer. If you have any questions or comments about the fields, or about any information in this template, please contact the Utilities Unit.

Preparer Name and Date:

These cells will be auto-populated from the information provided on the "Estimate Summary Sheet".

Worksheet Heading:

The worksheet heading information will auto-populate from the information provided on the "Estimate Summary Sheet" worksheet.

a. SCDOT File #
b. SCDOT Utility Agreement #
c. Utility Owner
d. Utility Project #
e. Narrative Description of Work

Pre-Construction Phase:

Under the "Description of Work" column, choose the appropriate work item from the drop down lists provided. Select the best answer that applies to the work you will complete under the SCDOT Utility Agreement.
Once you have selected the appropriate work, enter the estimated amount for each line item: Labor, Material, Equipment, Subcontractors. Totals and subtotals for each line item and column will be auto-calculated.

Drop down options:

a. Right of Way & Easements
b. Surveying
c. Legal Fees
d. Engineering
e. Administration Costs
f. Potholing
g. Mobilization

Construction Phase:

Under the "Description of Work" column, choose the appropriate work item from the drop down lists provided. Select the best answer that applies to the work you will complete under the SCDOT Utility Agreement.
Once you have selected the appropriate work, enter the estimated amount for each line item: Labor, Material, Equipment, Subcontractors. Totals and subtotals for each line item and column will be auto-calculated.

Drop down options:

a. Copper Cable / Service Wire
b. Fiber / Equipment
c. Poles
d. Conduit / Inner-duct
e. Vaults / Cabinets
f. Load Coils / Repeaters
g. Terminals / Pedestals
h. Natural Gas Pipeline
i. Petroleum Pipeline
j. Miscellanious Materials - Itemized
k. Surface Restoration - Itemized
l. Watermain
m. Sanitary Sewer - itemized
n. Traffic Control
o. Miscellaneous Labor Charges (testing, pipe removal, x-ray, etc.) - Itemized

Post Construction Phase:

Under the "Description of Work" column, choose the appropriate work item from the drop down lists provided. Select the best answer that applies to the work you will complete under the SCDOT Utility Agreement. Once you have selected the appropriate work, enter the estimated amount for each line item: Labor, Material, Equipment, Subcontractors. Totals and subtotals for each line item and column will be auto-calculated.

Drop down options:

a. Survey
b. As-Built and Engineering

Project Phase Subtotals:

The project phase subtotals will auto-calculate from the information provided in the Pre-construction, Construction and Post Construction phase subtotal fields.

Preparer's Signature and Date:

The preparer of this Estimate Detail Sheet must sign and date the document prior to submitting. The signed documents will be accepted in the following formats: Emailed in PDF or dropped off / mailed in hardcopy - electronic signatures are accepted in lieu of wet signatures. ***In addition to the signed copy, the electronic excel version of the Estimate Detail Sheet must be submitted via email to the Utilities Unit for the estimate to be accepted.***

ESTIMATE SUMMARY SHEET

Estimate Prepared By: **John Doe** **Date :** **1/1/2014**

SCDOT File #	State Project Number
SCDOT Utility Agreement #	Agreement Number
Utility Owner	Utility
Utility Project #	Utility Project #

Location

(Choose from drop down lists where available)

SCDOT District		Stationing (optional)	
County		Reference Point	
City / Township		Township, Range, Section	
State / US / Interstate Highway		Project Limits	

Type of Work

(Choose from drop down lists)

Type of Facility		Change of Service	
Transmission / Distribution		Change of Service Type	
New or Replacement Service		Season of Work	
Installation Type		Rural / Urban	
Betterment		Written Description (e.g. 100ft N of Huger & Gervais in Columbia)	

Description of the Work

Narrative Description of Work	Enter a complete narrative description of the work
Schedule Constraints	Provide any schedule constraints that have been accounted for in the estimate
Staging / Phasing Requirements	Provide any staging/phasing requirements that have been accounted for in the estimate
Special Soil Conditions	Provide any special soil conditions that have been accounted for in the estimate
Total Estimated Cost ($)	$ 684.64

Definitions of Estimating / Pricing Components

Materials	Direct reimbursement for cost of materials, including sales tax and freight to jobsite. Materials from stock must be supported by an invoice for replacement stock. All materials should be itemized within the inidividual utility owner cost estimates. A fair market value or inventory cost should be used to determine the cost of these
Equipment	All equipment should be priced in accordance to SCDOT Technical Memorandum No. xxxx
Labor, Direct	Direct labor wage paid on the employee check.
Labor, Fringes	The hourly rate for the vacation, medical, dental, disability, vision and vacation time for the employee.
Labor, Indirect	Payroll tax, workmen's compensation.
Overhead	Includes all general and administrative duties and facilities for same. The overhead rate will equal the annual audited rate on file with MnDOT. All overhead charges should be included per individual utility agreements.
Betterment	Any upgrade of a utility facility (e.g. increase in capacity) that is not attributable to the project construction that the utility owner elects to perform for its sole benefit. This upgrade does not include a technological improvement if its cost is equal or less than the cost of a "like-for-like" replacement or relocation. Using new materials in order to comply with current standards is not considered a betterment. If betterments are included in the utility scope of work, two estimates will be required. An estimate will be required for both the "In-Kind" replacement of the facility and the "Upgrading" of the facility.
Salvage Value	The credit deducted by the utility from the cost of the project for the amount received from the sale of utility property that has been removed, or the amount at which the recovered material is charged to the utility's accounts if retained for reuse.
Rural / Urban	Rural conditions typically consist of two and four lane roads with paved or gravel shoulders where ditch sections are typically used to handle street drainage. Urban conditions have curb and gutter for drainage.

ESTIMATE DETAIL SHEET

Estimate Prepared By: **John Doe** **Date :** **1/1/2014**

SCDOT File # State Project Number

SCDOT Agreement # Agreement Number

Utility Owner Utility

Utility Project # Utility Project #

Narrative Description of Work Enter a complete narrative description of the work

Pre-Construction Phase

Description of Work (Choose from drop down lists)	Totals						
	Labor	Material	Equipment	Salvage Value	Betterment	Total	SCDOT Total
Surveying	$ 300.00	$ -	$ -	$ -	$ -	$ 300.00	$ 270.00
	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Subtotal	*$ 300.00*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 300.00*	*$ 270.00*

Construction Phase

Description of Work (Choose from drop down lists)	Totals						
	Labor	Material	Equipment	Salvage Value	Betterment	Total	SCDOT Total
a. Copper Cable / Service Wire	$ 22.80	$ 12.00		$ -	$ -	$ 34.80	$ 31.32
c. Poles	$ 317.88	$ 235.30	$ 300.00	$ 96.42	$ 100.00	$ 356.76	$ 321.08
	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Subtotal	*$ 340.68*	*$ 247.30*	*$ 300.00*	*$ 96.42*	*$ 100.00*	*$ 391.56*	***$ 352.40***

Post Construction Phase

Description of Work (Choose from drop down lists)	Totals						
	Labor	Material	Equipment	Salvage Value	Betterment	Total	SCDOT Total
	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Subtotal	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*

Project Phase Subtotals

Pre-Construction Phase	$ 270.00	
Construction Phase	$ 352.40	
Post Construction Phase	$ -	
Overhead	$ 62.24	10%
Project Total	***$ 684.64***	

Preparer's Signature

Date

Labor Calculations

The purpose of this sheet is to establish the built up cost of labor required to perform the utility relocation work.

Cost per Hour

Overhead Calculations

10% Rate

Labor Category	Labor Direct	Indirect	Subtotal	Fringes	Subtotal	Overhead	Total
Sample Laborer	$ 12.12	27%	$ 15.39	$ 6.08	$ 21.47	$ 2.15	$ 23.62
Sample Pipelayer	$ 12.45	27%	$ 15.81	$ 6.08	$ 21.89	$ 2.19	$ 24.08
Sample Operator 1	$ 21.25	27%	$ 26.99	$ 11.67	$ 38.66	$ 3.87	$ 42.52
Sample engineer	$ 42.00	27%	$ 53.34	$ 11.67	$ 65.01	$ 6.50	$ 71.51

Labor Indirect

The purpose of this sheet is to establish the built up cost of indirect labor costs associated with the performance of the utility relocation work.

Labor Indirect Costs

Sample Operator	
Workers Compensation	18%
State	7%
FICA	2%
Federal Tax	7%
Total Indirects	34%

Sample Operator	
Workers Compensation	18%
State	7%
FICA	2%
Federal Tax	7%
Total Indirects	34%

Sample Operator	
Workers Compensation	18%
State	7%
FICA	2%
Federal Tax	7%
Total Indirects	34%

Sample Operator	
Workers Compensation	18%
State	7%
FICA	2%
Federal Tax	7%
Total Indirects	34%

Sample Operator	
Workers Compensation	18%
State	7%
FICA	2%
Federal Tax	7%
Total Indirects	34%

Sample Operator	
Workers Compensation	18%
State	7%
FICA	2%
Federal Tax	7%
Total Indirects	34%

Sample Operator	
Workers Compensation	18%
State	7%
FICA	2%
Federal Tax	7%
Total Indirects	34%

Sample Operator	
Workers Compensation	18%
State	7%
FICA	2%
Federal Tax	7%
Total Indirects	34%

Equipment Rate Calculations

The purpose of this sheet is to tabulate the rental and operating costs of the equipment required to perform the utility relocation work.

Description	Monthly Rate	Divisor	Hourly Rent	Equipment Operating Expense	Total Rate Per Hour
Example: 690 John Deere excavator	$ 11,500.00	176	$ 65.34	$ 21.76	$ 87.10

Construction Itemized Cost Data Worksheet

Plan Sheet #	Route # or Name	SCDOT Standard Item Category	SCDOT Standard Item Type	Utility Item Code	Item Description	Unit of Measure (lf, sf, cf, cy, sy, ea)	Install, Remove , or Leave As-Is (I/R/A)	Station Start	Station End	Offset L or R	Offset Dist from Centerline (ft)	Quantity	On/Off ROW	Labor Unit Cost	Material Unit Cost	Total Labor Cost (auto calc)	Total Material Cost (auto calc)	Equipment Cost	Salvage Value	Betterment Value	Total Cost (auto calc)	SCDOT % Cost =	90%
1	US-77	c. Poles	Elec Power Pole	35C5A	Dist Pole Wood 35 FT Class 5	ea	R	1112+21		L	12	1	On	108.78	0	108.78	0	100	96.42	0	12.36	11.124	
1	US-77	c. Poles	Elec Power Pole	40C5A	Dist Pole Wood 40 FT Class 5	ea	I	1112+21		L	18	1	On	209.1	235.3	209.1	235.3	200	0	100	344.4	309.96	
1	US-77	a. Copper Cable / Se	Elec Above Ground Line	BC6	WIRE OH PRI #6 BARE CU HARD DRAWN SOLID	lf	I	1112+21	1113+10	L	18 to 24	120	On	0.19	0.1	22.8	12	50	0	0	34.8	31.32	

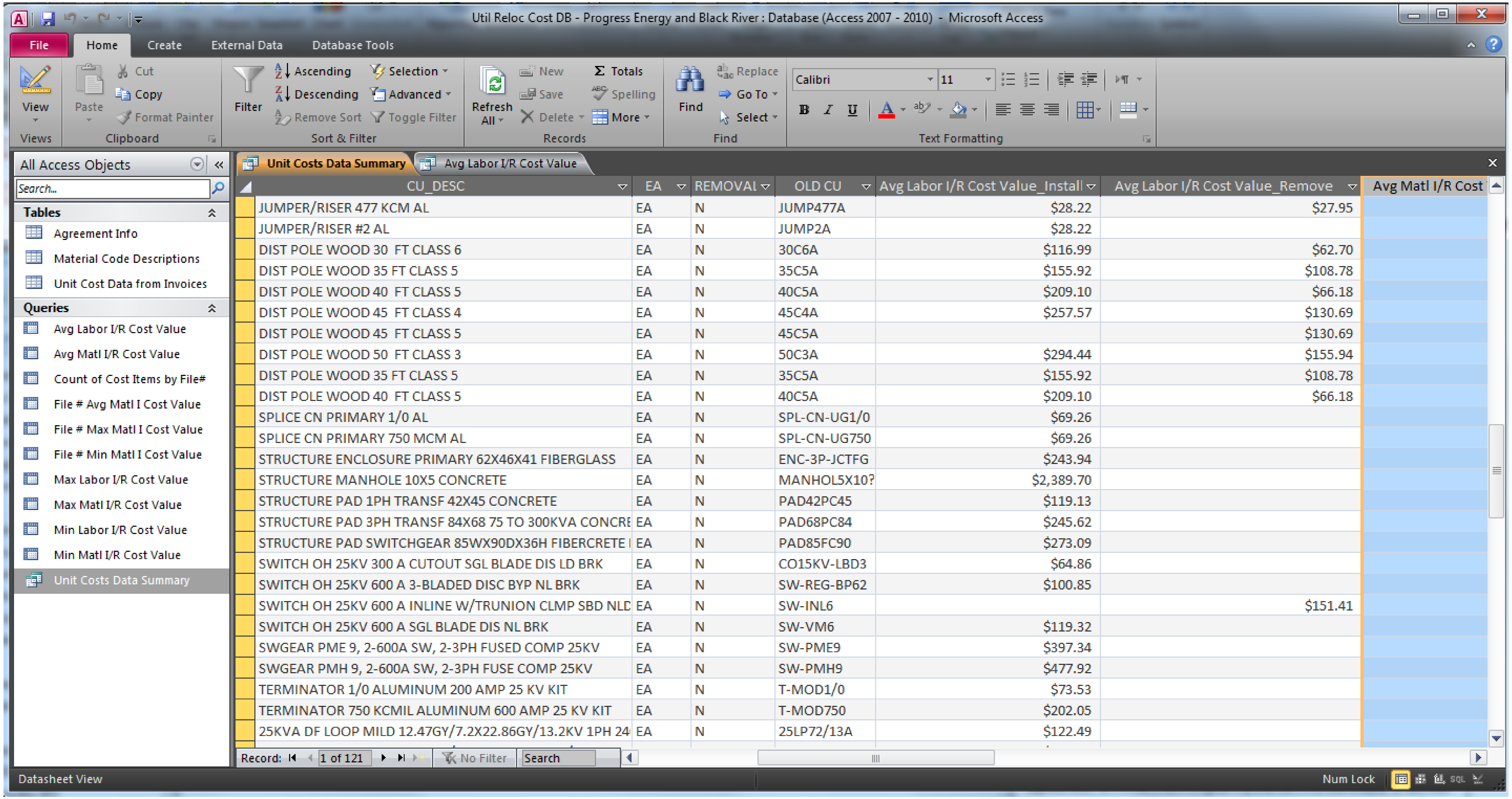
Construction Itemized Cost Data Worksheet (automatically populates using Pivot Table Function)

Row Labels	Sum of Total Labor Cost (auto calc)	Sum of Total Material Cost (auto calc)	Sum of Equipment Cost	Sum of Salvage Value	Sum of Betterment Value	Sum of Total Cost (auto calc)	Sum of SCDOT % Cost =
a. Copper Cable / Service Wir	22.8	12	50	0	0	34.8	31.32
c. Poles	317.88	235.3	300	96.42	100	356.76	321.084
Grand Total	**340.68**	**247.3**	**350**	**96.42**	**100**	**391.56**	**352.404**

APPENDIX D

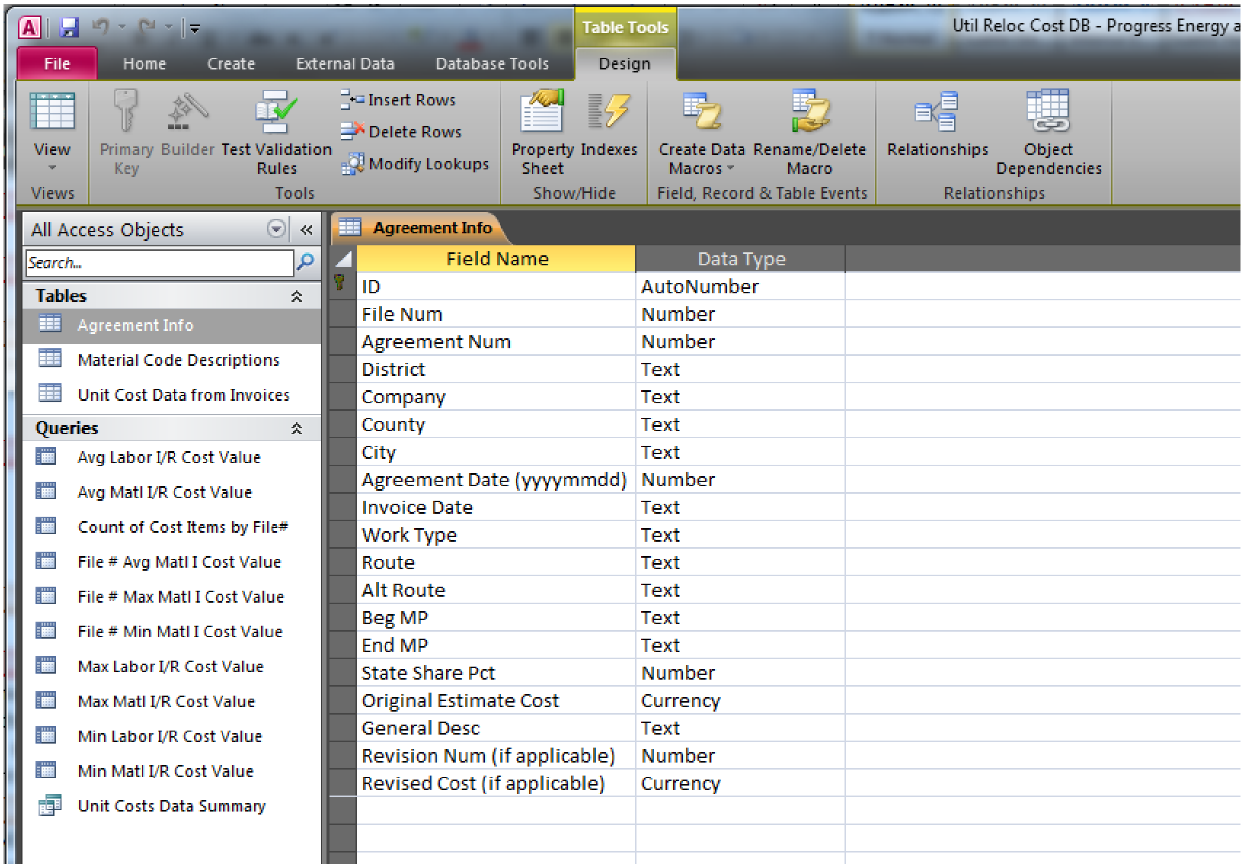
SAMPLE UNIT COST DATABASE FROM PROGRESS ENERGY ITEM CODES

Unit Cost Data Summary

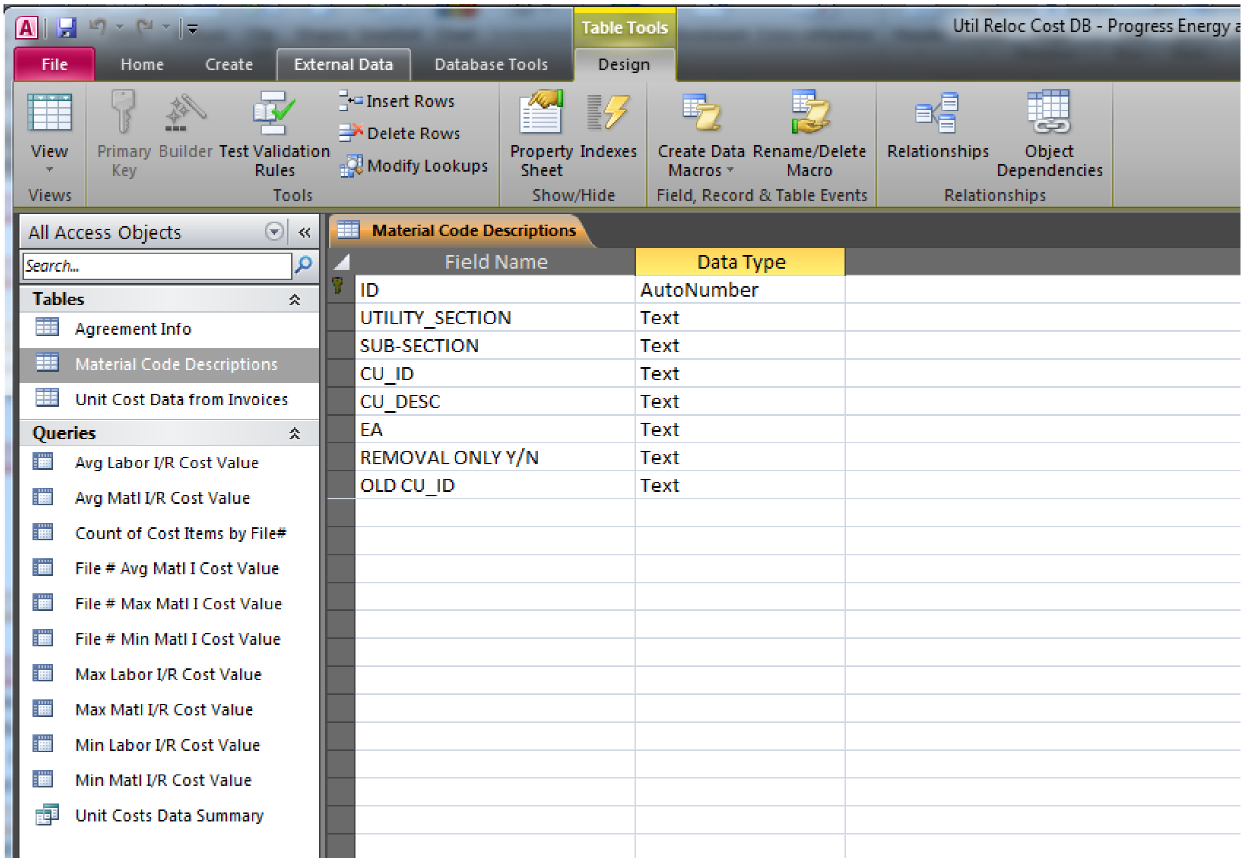


CU_DESC	EA	REMOVAL	OLD CU	Avg Labor I/R Cost Value_Install	Avg Labor I/R Cost Value_Remove	Avg Matl I/R Cost
JUMPER/RISER 477 KCM AL	EA	N	JUMP477A	$28.22	$27.95	
JUMPER/RISER #2 AL	EA	N	JUMP2A	$28.22		
DIST POLE WOOD 30 FT CLASS 6	EA	N	30C6A	$116.99	$62.70	
DIST POLE WOOD 35 FT CLASS 5	EA	N	35C5A	$155.92	$108.78	
DIST POLE WOOD 40 FT CLASS 5	EA	N	40C5A	$209.10	$66.18	
DIST POLE WOOD 45 FT CLASS 4	EA	N	45C4A	$257.57	$130.69	
DIST POLE WOOD 45 FT CLASS 5	EA	N	45C5A		$130.69	
DIST POLE WOOD 50 FT CLASS 3	EA	N	50C3A	$294.44	$155.94	
DIST POLE WOOD 35 FT CLASS 5	EA	N	35C5A	$155.92	$108.78	
DIST POLE WOOD 40 FT CLASS 5	EA	N	40C5A	$209.10	$66.18	
SPLICE CN PRIMARY 1/0 AL	EA	N	SPL-CN-UG1/0	$69.26		
SPLICE CN PRIMARY 750 MCM AL	EA	N	SPL-CN-UG750	$69.26		
STRUCTURE ENCLOSURE PRIMARY 62X46X41 FIBERGLASS	EA	N	ENC-3P-JCTFG	$243.94		
STRUCTURE MANHOLE 10X5 CONCRETE	EA	N	MANHOL5X10?	$2,389.70		
STRUCTURE PAD 1PH TRANSF 42X45 CONCRETE	EA	N	PAD42PC45	$119.13		
STRUCTURE PAD 3PH TRANSF 84X68 75 TO 300KVA CONCRE	EA	N	PAD68PC84	$245.62		
STRUCTURE PAD SWITCHGEAR 85WX90DX36H FIBERCRETE I	EA	N	PAD85FC90	$273.09		
SWITCH OH 25KV 300 A CUTOUT SGL BLADE DIS LD BRK	EA	N	CO15KV-LBD3	$64.86		
SWITCH OH 25KV 600 A 3-BLADED DISC BYP NL BRK	EA	N	SW-REG-BP62	$100.85		
SWITCH OH 25KV 600 A INLINE W/TRUNION CLMP SBD NLD	EA	N	SW-INL6		$151.41	
SWITCH OH 25KV 600 A SGL BLADE DIS NL BRK	EA	N	SW-VM6	$119.32		
SWGEAR PME 9, 2-600A SW, 2-3PH FUSED COMP 25KV	EA	N	SW-PME9	$397.34		
SWGEAR PMH 9, 2-600A SW, 2-3PH FUSE COMP 25KV	EA	N	SW-PMH9	$477.92		
TERMINATOR 1/0 ALUMINUM 200 AMP 25 KV KIT	EA	N	T-MOD1/0	$73.53		
TERMINATOR 750 KCMIL ALUMINUM 600 AMP 25 KV KIT	EA	N	T-MOD750	$202.05		
25KVA DF LOOP MILD 12.47GY/7.2X22.86GY/13.2KV 1PH 24	EA	N	25LP72/13A	$122.49		

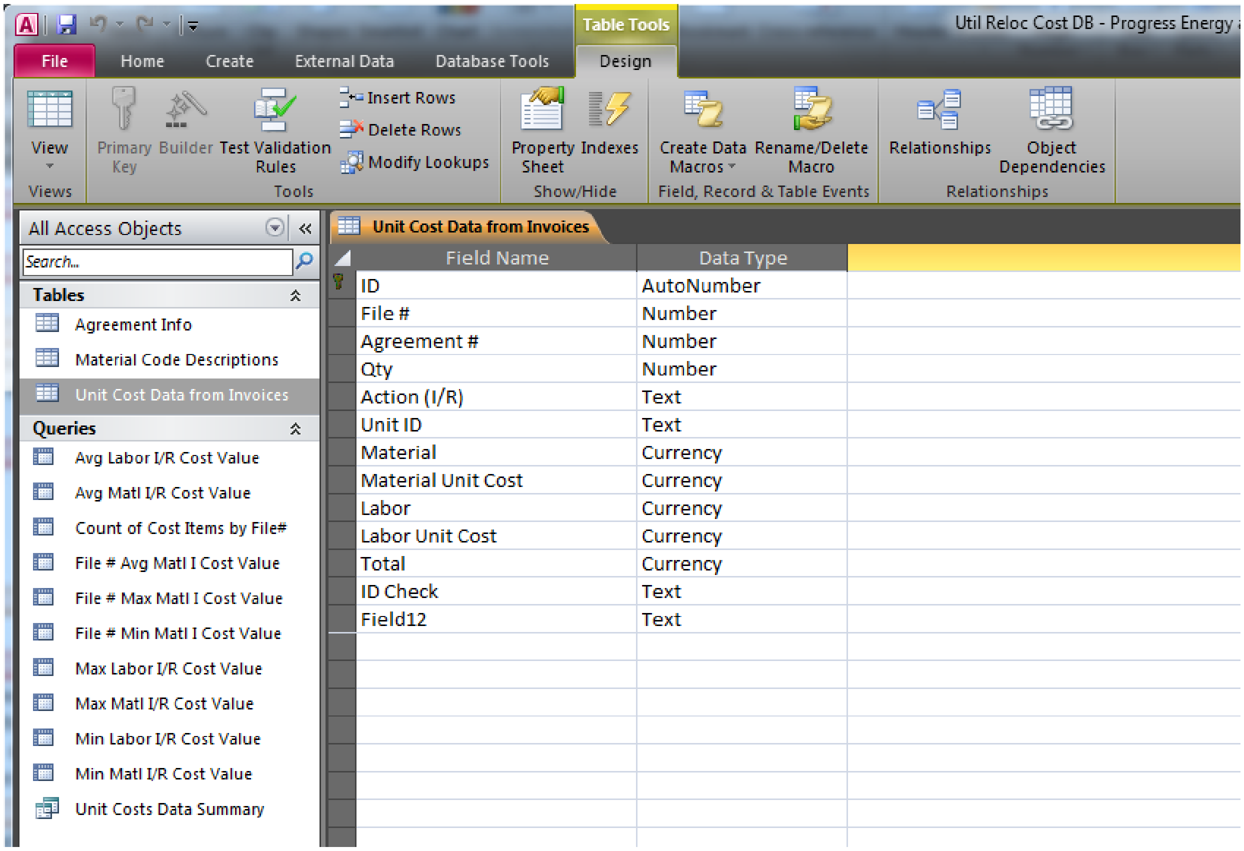
Agreement Information Table Fields



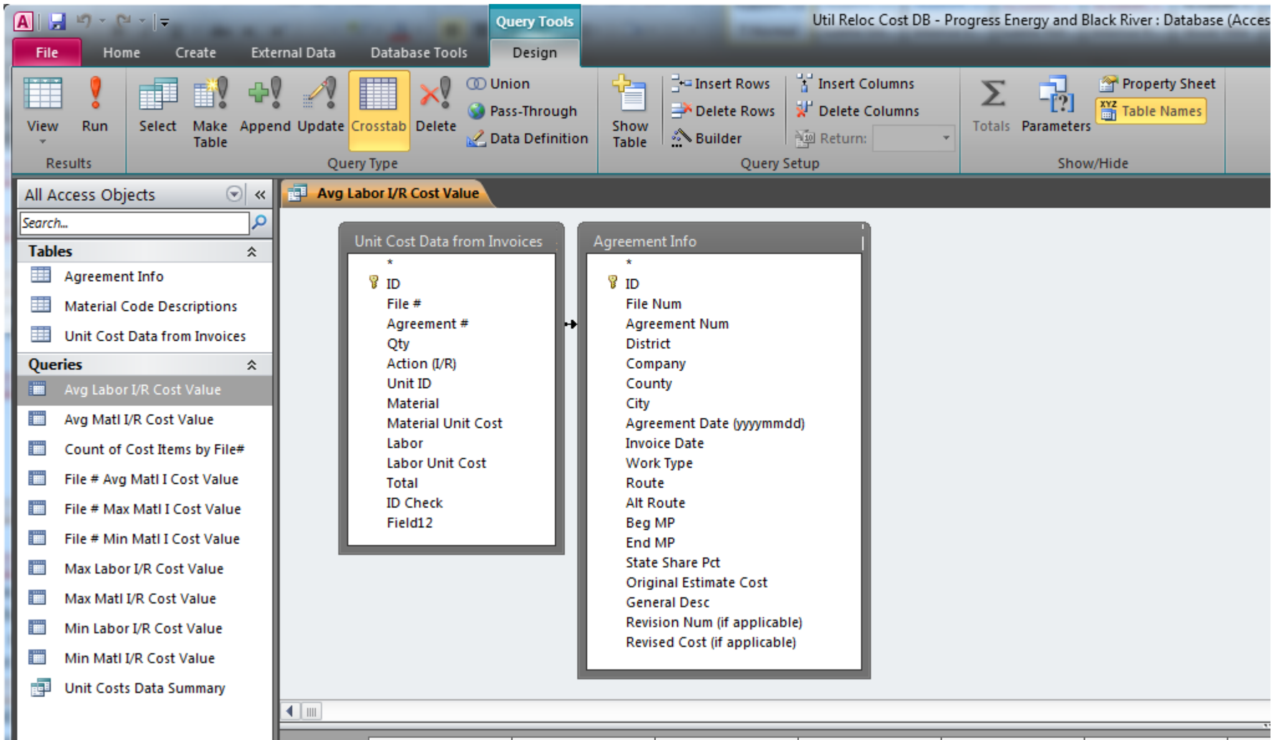
Material Code Description Fields – (Codes Provided by Progress Energy)



Unit Cost Data from Invoices Fields (Progress Energy or Black River Only)



Average Labor Install/Removal Cost Value Query



Field:	Unit ID	Action (I/R)	Labor Unit Cost	Total Of ID: ID	Action (I/R)	Agreement Date (yyyy
Table:	Unit Cost Data from I	Unit Cost Data from I	Unit Cost Data from I	Unit Cost Data from I	Unit Cost Data from I	Agreement Info
Total:	Group By	Group By	Avg	Count	Where	Where
Crosstab:	Row Heading	Column Heading	Value	Row Heading		
Sort:						
Criteria:					"install"	>20081231
or:					"remove"	