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Evaluation of Utility Relocation Costs and Best Management Practices

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Evaluation of Utility Relocation Costs and
Best Management Practices

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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 concerns for the district engineers responsible for the projects. Through meetings with SCDOT personnel and utility company 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 by a panel on multiple criteria to generate a list of "poor", "good", and "excellent" estimates. The "excellent" estimates provided insight into the development of a standard estimate form and the deficiencies noted in all of the estimates were addressed in the standard form. The standardized cost estimate form should be simple, easy to use, and flexible for use on all types of utility relocation projects. An Excel spreadsheet was developed with line items for material, labor, and overhead costs. It is recommended that all utility companies on all utility relocation cost estimates submitted to the SCDOT use this format. This report presents five separate standardized estimate forms for power, communication, gas, water, and sanitary sewer utilities. This report also makes recommendations for improvements to the SCDOT's cost management database while utilizing cost management best practices. The main suggestion to improve the overall cost management process is to transition to a professional project management software such as Primavera P6 that can work seamlessly with the standardized estimate

forms presented in this report, manage planned versus actual costs, search and sort data by any field, and generate useful cost and schedule reports.

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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 company has prior rights and SCDOT is responsible for reimbursing the utility company. 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 the 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 performed. 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.

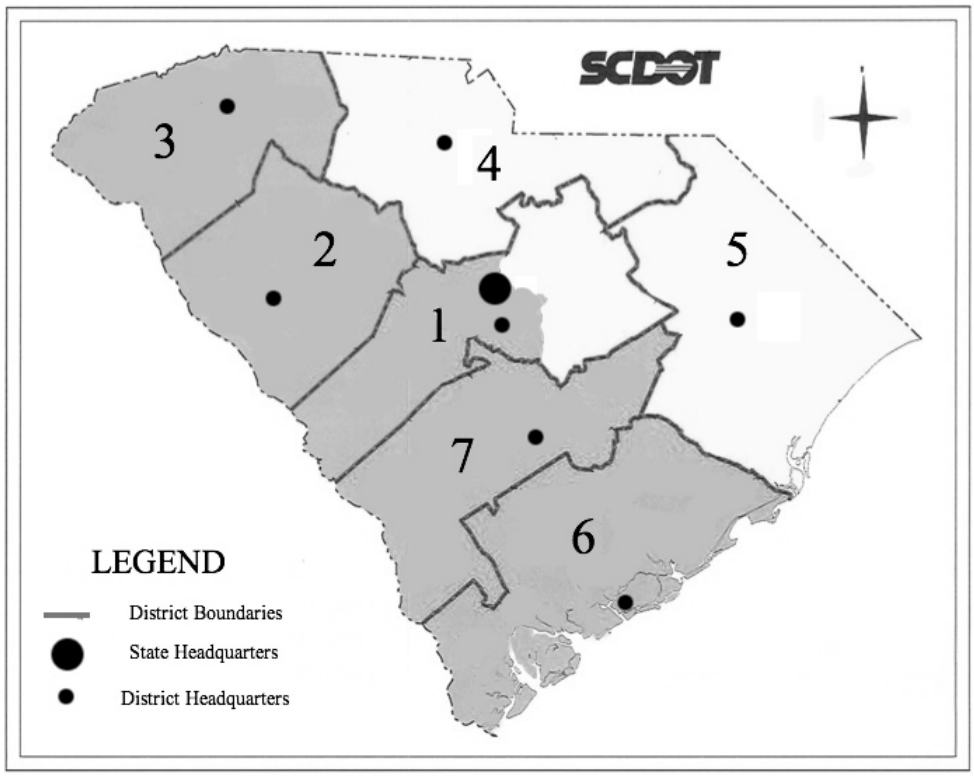

Figure 1.1: SCDOT District Map
(Source: SCDOT)

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 performed within its area. When the SCDOT decides to widen or redo 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 forwarded 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 office where the relocation planning begins. The SCDOT utility relocation plans are typically submitted to the utility company when the project design is about 60% complete, about six months to a year before the project is let to contract. The SCDOT then requests that the utility company 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 in Columbia where they are reviewed and approved by 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 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 track the reasons behind the change order requests and to determine if those requests are valid. Most change orders are 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 orders must be documented but this documentation is not often sent to headquarters and remains with the project documents located at the district. The accounting and construction departments at HQ must then approve the change order request. After headquarters approves the change order, it goes back to the lead district engineer. The lead district engineer then notifies the utility company of the approval and the next invoice usually contains the additional costs. The

reasons for the change orders are not usually included in the cost management database that is managed at HQ.

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 a 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.

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 closed 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 were 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. This report focuses primarily on the creation and utilization of a standardized estimate procedure and its benefit to the SCDOT's cost management practices.

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 two major areas: 1) developing a utility cost reimbursement system; and 2) reviewing the current SCDOT database for tracking and managing utility relocation costs. It is anticipated that this information will assist in the creation of an estimate form and database for obtaining and maintaining utility relocation cost information. The literature review should also provide information on best practices associated with utility relocation cost estimates in South Carolina.

Many of the documents referenced in this report were identified using online databases, while others were available through the Clemson University Library. The Transportation Research Information Services (TRIS Online) database provided many of the references. TRIS Online is the world's largest and most comprehensive source for documents relating to the transportation industry. Other databases used were the ASCE Research Library, the Transportation Research Board (TRB), and the Clemson University Library Database of Theses and Dissertations, a compilation of thesis and dissertations from universities across the United States. While no prior research has specifically addressed the problems at hand in South Carolina, the information discussed in this report can be used concurrently to determine a solution tailored to the SCDOT.

Cost Estimating and Database Management Techniques

The Texas Transportation Institute 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 cost estimating 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 of the problem. It is necessary to rely on additional guidelines, specifications, and provisions to handle situations not covered by those rules. In Texas many different versions of special specifications and provisions exist throughout 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 appears 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 defines 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 authored 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 named 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-FHWA 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 distributed survey. Currently, 59 percent of the responding states indicated they outsourced some of their project oversight and management, while 79 percent said they anticipated outsourcing work in the future. Florida reported that 75 percent of their utility work is 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).

Site Visits and Surveying Methods

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 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, as well as the lead engineers or managers may be good candidates for interviews or site visits.

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.

CHAPTER THREE

STANDARDIZING COST ESTIMATING

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. One possible reason for so many change orders associated with utility relocation projects is that the initial cost estimates seem to lack many basic line item details for each project. If the estimate form is standardized while allowing flexibility, it is believed that the number of change orders and the impact of these cost overruns can be significantly reduced. Change orders are inevitable in any type of construction project, but reducing the number per project will ultimately save money. In order to facilitate the reduction of change order requests, a standardized cost estimating form submitted to the SCDOT from utilities is needed.

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 very difficult to compare information between utilities or even between projects. The quality and quantity of information submitted in the estimate varies from utility to utility and sometimes from project to project, depending on the utility representative responsible for creating the estimate. To analyze the estimates submitted

to SCDOT, a research panel of three graduate students 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 by the panel 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 the panel of "Poor", "Good" or "Excellent." These rankings are for preliminary comparisons only and are not intended to provide an objective estimate rating system. Good estimates were well laid out and included the recommended detail as determined in the Utility agreement. However, two "good" estimates may look completely different and may not be easily compared. Some of the estimates submitted included very little detail and are considered for this report to be "poor" estimates. "Excellent" estimates included all of the required detail but were even more detailed and well organized and often included 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 company were not very consistent. Santee Cooper Electric & Gas (SCE&G), for example, rated well on some of their estimates, but also scored a "poor" on about half of them.

To offer an adequate picture of the level of detail contained in many of the estimates submitted to SCDOT, two recently completed project estimates are included. Figure 3.1 is an actual utility relocation estimate submitted by Farmers Telephone Cooperative (Project #12682). This estimate was rated as "poor" by the research team. There is little to no detail 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 and there was no reason identified for the omission of these items in this estimate.

Included with each estimate should be a definition sheet explaining exactly what each abbreviation stands for. In the Farmer's estimate 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.

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 Partial Estimate
(Source: SCDOT Project #12682)

Another project estimate is Duke Energy (Project #12635) shown in Figure 3.2. 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. Indirect and labor costs are addressed, but there is no overhead cost line item.

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
(Source: SCDOT Project #12635)

Figure 3.2 is only the summary page of the estimate because it includes pages and pages of line items that seem to have little to no organization or categorization. Anyone unfamiliar to the Duke Energy estimates would have a difficult and rather time-consuming search for a specific line item. Discussions with SCDOT district engineers revealed that they have become accustomed to the Duke format and that with some additional categorization and simplification it could be the basis for an acceptable standardized estimate format.

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 and on the estimates that did report it, the overhead cost ranged from 2% to 44% of the total project cost. Understandably, not every utility company will charge the same amount for overhead, but such a broad range is uncommon. The estimate form proposed in this research has 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. This should allow the SCDOT to easily view and compare overhead costs.

Proposed Estimate Forms

The Clemson University research team, with the input from the SCDOT and South Carolina utility providers, has developed a standardized estimate form specifically for utility relocation projects. The purpose of these estimate forms are to provide a detailed, 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. A Microsoft Excel© spreadsheet has been developed for each

major utility sector- Power, Communication, Water, Sanitary Sewer, and Gas. These sheets are designed to make it easier for the SCDOT to read and understand the estimate while being straightforward and simple to use. 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 form is simple and does not require any complex formulas, but still contains all the necessary information to help the SCDOT make informed decisions about the projects costs. The complete standardized estimate forms for each utility sector (power, gas, water, etc.) are available in Appendix B.

Proposed Estimate Format

To determine an estimate format, it was determined from the literature, the analysis of the best estimates, as well as from interviews with SCDOT representatives that a number of important column headings should be included. Table 3.2 lists the typical column headings in the proposed estimate forms. Although the line-item categories for each utility sector may vary, the column headings remain the same.

Table 3.2: Proposed Standard Estimate Form Headings

Item	Unit of Measure	I/R	Part #	I/R Qty	Labor Unit Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total

It is anticipated that the standard estimate form will be made available to every utility company submitting estimates to the SCDOT in a Microsoft Excel spreadsheet. This form could 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.

To illustrate how the estimate form can be used by a utility in creating a utility relocation estimate, an example is presented. In this case, a fictitious project requiring the relocation of telephone poles is used as an example. A telephone pole is the unit of measure by quantity, so "each" is the correct unit of measure. Table 3.3 illustrates how the cost form can be used in a project.

Table 3.3: Retire and Installation on Same Item

Poles	Unit of Measure	I / R	Part #	I/R Qty	Labor Unit Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
CCA Pole 40 ft. Class 5	each	*R*	0055	5	$100.00	$-	$500.00	$-	$-	$500.00
CCA Pole 40 ft. Class 5	each	*I*	0055	5	$110.00	$-	$550.00	$-	$-	$550.00

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/Retire is the next column heading, abbreviated "I/R." To relocate a telephone pole, the utility company 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 retiring and installing the same pole it must still be listed as two different line items. In the example shown in Table 3.3 the utility is, in fact, removing an existing pole and moving it to a new location. This can be seen because the pole has the same description and part number. Because there is no added material cost associated with this pole, it is easy to see that the same pole is simply being retired and then installed, basically relocated. This is also evident in the slightly higher labor costs associated with the installation of the pole versus retirement. The part number can make it easy to find certain objects within a spreadsheet. If a pole's part number is 0055, as in Table 3.3, the user can simply search that part number in the spreadsheet to find all of the data associated with that type of pole.

The Installation Quantity or Retire Quantity is the next important column heading. If a utility is doing a simple relocation with no betterments, the installation and retirement quantities should be the same. If, in fact, there are betterments included in the relocation agreement and the utility is adding more poles or upgrading the quality of the poles, it is easy to identify using this column. The current estimates submitted to SCDOT often do not identify or clarify if betterments are included in the estimate.

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 with a 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 next two columns do not require any action from the submitting utility 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. The Total is the sum of the Labor Cost and the Material Cost minus that of the Salvage Value. The Total will also be calculated automatically by Microsoft Excel. These Excel spreadsheets will do much of the calculations in an estimate, which is one of the benefits associated with using them.

Estimate Format Subsections

Each estimate form has either 3 or 4 subsections with more detailed categories underneath, depending upon the utility sector. Every project estimate form contains a

General section and an Appurtenances section, and different subsections such as Lines for Power and Communications utilities and Pipes in Gas, Water, and Sewer utility estimate forms. Even though there are different sections for different types of utility providers, the layout remains constant, which makes analysis of different estimates from different utilities much less troublesome.

General Subsection

The General subsection contains Mobilization, Overhead, Preparation, Rentals, and Traffic Control. Table 3.4 shows a sample General subsection.

Table 3.4: General Subsection

	Unit of Measure	I/R	Part #	Install / Retire Qty	Labor Unit Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
General										
Mobilization										
Overhead	each									
Preparation	each									
Rentals	each									
Traffic Control	each									
Other	each									
Total										

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. Every utility should also have some type of home office overhead that will need to be listed in the Overhead category. Overhead is typically a percentage of the total project cost. Overhead costs have been of specific concern to the SCDOT and many estimates have not included it as a separate line item. The Overhead category in the Standard Estimate form will allow SCDOT to track overhead percentages and develop a database file that should assist in determining what acceptable overhead rates should be on specific relocation projects.

Preparation includes design-engineering costs incurred during the project. Many contracts will be engineered to accommodate difficult relocation projects, and these costs should be listed under this category. While many larger utility companies own most of their equipment, smaller utilities may need to rent equipment to complete a specific relocation and these should be entered in the Rentals category. Traffic control is very important from a safety standpoint in utility relocations as every project takes place right next to sometimes very dangerous roads. Additional funds may need to be allocated to traffic control, in which case the cost should be addressed under this category. At the end of every subsection there is an "Other" category as well. Line items that do not fit under any other categories in this section should be listed in the "Other" category.

Lines Subsection

The Power and Communications Utilities estimate form contains a subsection for Lines. The Lines section should include items ranging from conduit lines and conduit structures. Table 3.5 shows the Lines subsection with example line items from a fictitious project.

Table 3.5: Example Lines Subsection for Power Utilities

Lines	Unit of Measure	I / R	Part #	I/R Qty	Labor Unit Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
Above Ground Conduit Structures										
Cond I/O ACSR Bare	l.f.	*I*	0570	600	$5.56	$4.55	$107.94	$132.00		$239.94
Cond 2 ASCR Bare	l.f.	*R*	0560	600	$9.95		$60.32		$(27.86)	$32.46
Open-Trench Conduit Structures										
Open-Trench Pipe and Conduit Structure Encasement	l.f.									
Pole Transformers	each									
Trenchless Pipes, Conduit Structures, and Box Culverts	each									
Other	each									
Top Tie 2 ACSR	each	I	1746	9	$0.39	$0.72	$23.14	$12.51		$35.65
Top Tie I/O ACSR	each	I	1750	1	$0.77	$0.69	$1.30	$1.44		$2.74
Hand Tie	each	I	1780	1	$0.77	$2.38	$1.30	$0.42		$1.72
Top Tie 2 ACSR	each	R	1746	12	$0.39		$30.86		$(5.68)	$25.18
Side Tie 2 ACSR	each	R	1748	2	$0.39		$5.14		$(0.25)	$4.89
Top Tie I/O ACSR	each	R	1750	1	$1.54		$0.65		$(0.10)	$0.55
Total										
										$343.13

The sample estimate in Table 3.5 shows that in this instance there is a heavy amount of conduit and tie replacements. Since there is no specific place for ties it should go under the "Other" category. In this instance, there were no transformers or underground conduit being addressed.

Earthwork and Pipes Subsections

In many other types of utility relocation projects there is underground work that requires special consideration. Earthwork and Pipes are major subsections that have specific categories associated with them. Concrete or asphalt removal, excavation, and trench protection are a couple of the major categories in the earthwork section. It is important when estimating this section that all units remain constant from utility to utility. The most common units of measure are linear feet, square feet, and cubic feet as determined from a study of past submittals to the SCDOT. Table 3.6 illustrates how a sample Earthwork section may look.

Table 3.6: Earthwork Subsection for Underground Utilities Example

	Unit of Measure	I/R	Part #	I/R Qty	Labor Unit Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
Earth Work										
Concrete & Asphalt Removal										
Asphalt Removal	*s.f.*	R	A122	100	$2.00	$-	$200.00	$-	$-	$200.00
Asphalt Paving	*s.f.*	I	A123	100	$3.50	$3.00	$350.00	$300.00	$-	$650.00
Curb, Gutter, etc.										
Curb Removal	*l.f.*	R	C130	5	$10.00	$-	$50.00	$-	$-	$50.00
Curb Installation	*l.f.*	I	C131	5	$15.00	$5.00	$75.00	$25.00	$-	$100.00
Excavation and Backfill for Structures										
Excavation	*c.f.*	R	E144	75	$3.50	$-	$262.50	$-	$-	$262.00
Backfill	*c.f.*	I	B144	65	$2.75	$-	$178.75	$-	$-	$178.75
Trench Excavation Protection										
Other	*each*									
Total										
										$1,441.25

Pipes are also used primarily in underground utility relocation. Line items such as pipe encasements and water or gas pipes are the most common. The Pipe subsections for water and gas utilities are very similar and are shown in Tables 3.7 and 3.8, respectively.

Table 3.7: Pipes Subsection for Water Utilities

	Unit of Measure	I/R	Part #	I/R Qty	Labor Unit Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
Pipes										
Open-Trench Water Pipe										
(insert line items here)	*l.f.*									
Trenchless Pipes and Box Culverts										
	l.f.									
Open-Trench Pipe Encasement										
	l.f.									
Adjusting & Relocating Water Pipes										
	each									
Other										
Total										

Table 3.8: Pipes Subsection for Gas Utilities

	Unit of Measure	I/R	Part #	I/R Qty	Labor Unit Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
Pipes										
Trenchless Pipes and Box Culverts										
Open-Trench Pipe Encasement	*l.f.*									
Adjusting & Relocating Gas Pipes	*l.f.*									
Other	*each*									
Total										

Appurtenances Subsection

The last subsection is Appurtenances and is included in all of the different utility estimate forms. This section includes all of the accessories involved in a utility relocation. Each utility's appurtenances section will look different, but commonly contains information not provided in any of the other subsections. An example appurtenances section from a power utility estimate is shown in Table 3.9.

Table 3.9: Appurtenances Subsection for Power Utilities

	Unit of Measure	I/R	Part #	I/R Qty	Labor Unit Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
Appurtenances										
Adjusting Manholes and Inlets										
(insert line items here)	each									
Bolts and Fasteners										
	each									
Cable Vaults										
	each									
Fuses and Accessories										
	each									
Ground Boxes/Rods										
	each									
Guy Wires/Anchors										
	l.f.									
Manholes and Inlets										
	each									
Poles										
	each									
Other										
Total										

Summary Section

The last part of the estimate is the summary. It should provide a detailed summary of all of the totals from each of the subsections, General, Earthwork (if

included), Line/Pipes, and Appurtenances. These totals are automatically summed to a Total Project Cost box at the bottom of the summary. The total installation and retirement labor costs are also calculated on the summary page. The Install and Retire Labor Hours are the only cells that need to be entered manually by the utility, all others are automatically inserted using Excel coding from the subsections above. Excel then automatically calculates a Total Project Cost. Table 3.10 shows a sample summary page for a power utility with a total project cost of $50,000.

Table 3.10: Summary Sample for a Power Utility

Summary					
Indirect Costs (5%)	$2,500.00			General	$5,000.00
Total Install Cost	$11,000.00	Total Install Labor Hours	315	Lines	$11,000.00
Total Retire Cost	$13,000.00	Total Retire Labor Hours	350	Appurtenances	$34,000.00
Total Salvage Value	$5,000.00				
		TOTAL PROJECT COST	$50,000.00		

These standardized estimate forms should provide a mutually beneficial service to SCDOT and utility providers. For many utility companies that work regularly with the SCDOT, the estimate forms 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.

Initially, line items will be manually entered into the spreadsheets and will need to be entered into the SCDOT database by hand. It is anticipated that as information is collected and the process is standardized, a Uniform Specification Code List can be developed that will contain preset codes for all line items related to utility relocation work. These codes could then be imbedded into the spreadsheet and used by the utilities as their estimates were developed. This type of coding will require a well-designed database and a cost management process that can enter, track, and manage all of this information.

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 basic hand written spreadsheet was utilized. 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 constrained 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 on 10/27/2010).

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.

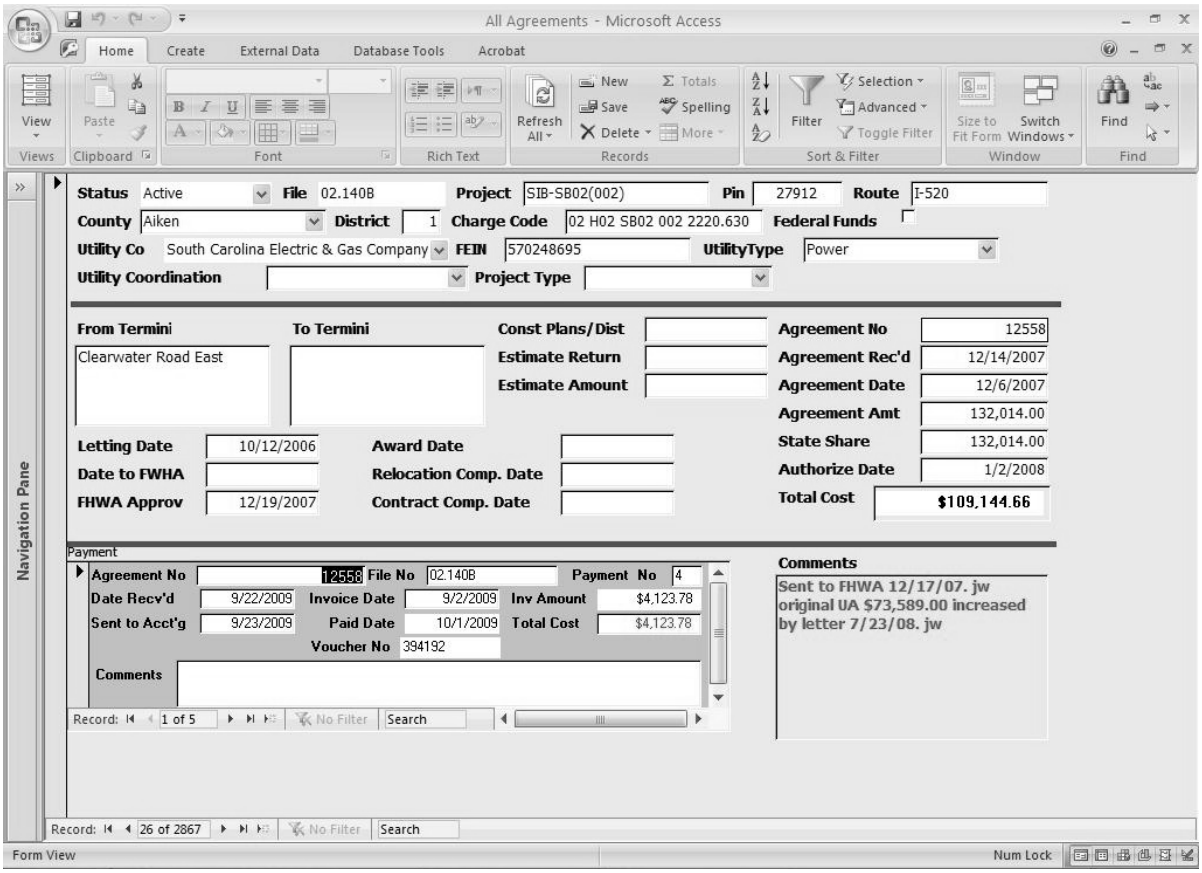

Figure 4.1: SCDOT Microsoft Access Database
(Source: SCDOT)

It is also evident from Figure 4.1 that although information can be entered easily into each cell on the form, there does not appear to be adequate standardization or formatting. 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 computers to communicate with other computers on the same network, 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 an effective database system, it appears to have user-friendly limitations. A screenshot of the Entire Connection program for SCDOT utility agreement number 12667 is shown in Figure 4.2.

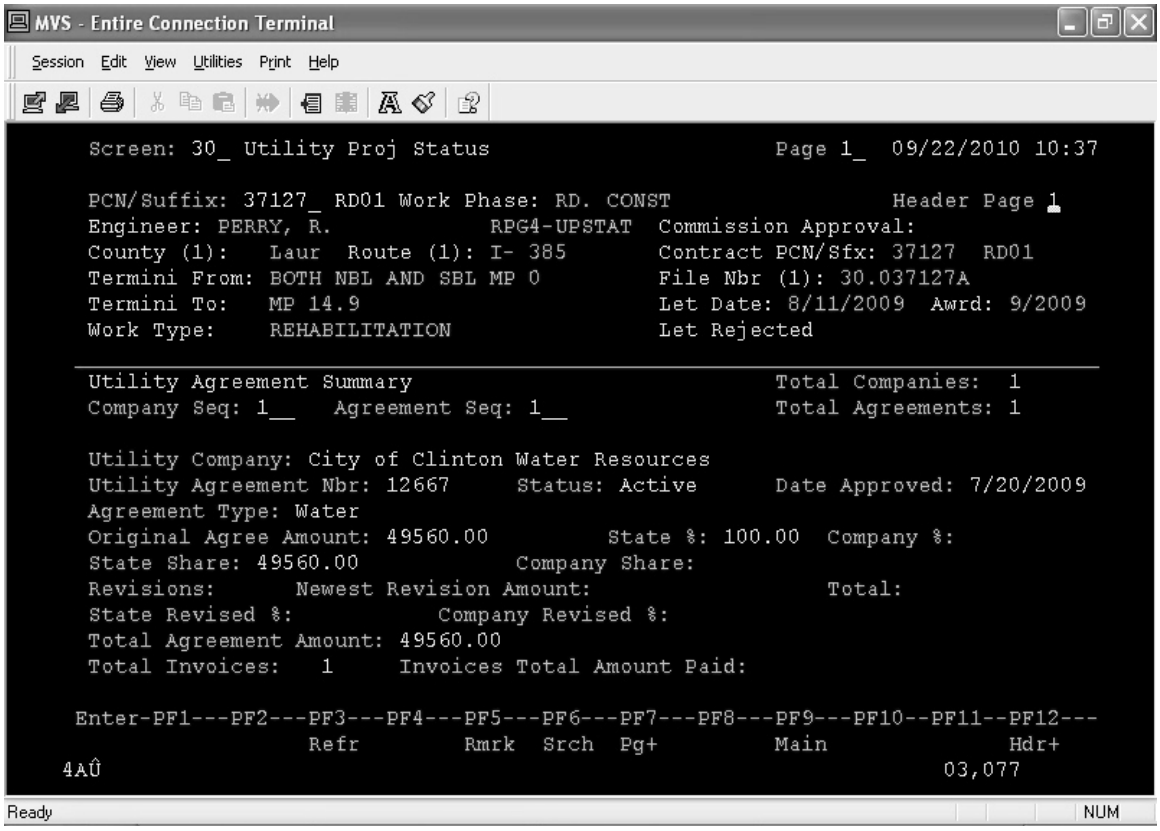

Figure 4.2: SCDOT Entire Connection Screenshot
(Source: SCDOT)

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 appears 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.

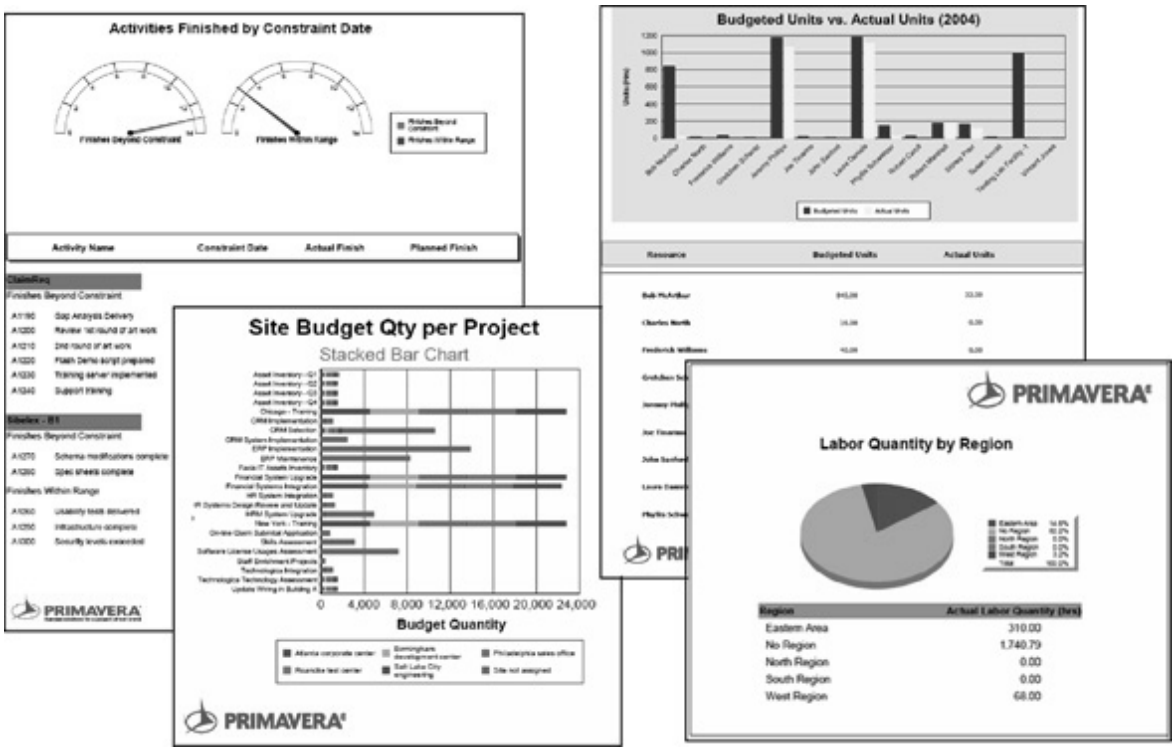

Figure 4.3: Sample Primavera Cost and Schedule Report
(Source: Foregetrack, 2010)

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 features of the 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).

The "lookup table" capability of Primavera is another important attribute. A lookup table would be beneficial in comparing cost data on similar line items from one utility to another. A common equipment coding scheme throughout all South Carolina utilities would be ideal, and eliminate the need for such a lookup table, but development of such a coding system would very likely require mandated, legislative or otherwise, cooperation from the utilities. The lookup table capability of Primavera is one of the many primary justifications to the implementation of a program such as this.

This software would require extensive training for all SCDOT personnel involved in the management of construction projects as well as a significant cost investment, but may be worth the time and funds in the long run. The Primavera P6 Professional Project Management package would cost $2,500/per application user, but may prove to be cost and time beneficial as utility relocation projects continue to grow in number and size throughout the state. Oracle is also known for their variety of training methods on their products. Some of the different training formats include instructor led training, live virtual class, self-study CD-ROM, and private events. Private event training sessions may be the most beneficial to the SCDOT because they can customize team-training programs based on the specific needs of the SCDOT. The private training events can also have a set schedule and location dictated by the SCDOT. Another training option is the

Live Virtual Training offered by Oracle. The online sessions are more cost effective and offer a three day (eight hours per day) class for $1,800. A positive aspect about this type of software is the ability to get program training on the SCDOT's schedule and budget (Primavera P6 Professional Project Management).

This software may not be a practical investment for the SCDOT at this time, but represents the cost and data management goals that the SCDOT may want to establish for their cost management database. Currently, many different programs are being used throughout the SCDOT to handle different tasks such as scheduling, resource management, and funds allocation. A software program such as Primavera P6 would allow the SCDOT to do away with many of the other programs currently used because of the multitude of tasks that the Primavera program can handle. Journalist David Salway, who has over two decades of information technology experience, writes:

> "The most useful features of Primavera include the ability to jumpstart projects and facilitate communications throughout the organization. Companies can start using the Primavera project management tool on a small level, and then implement advanced features to leverage the full power of the application. Companies can familiarize themselves with Primavera by exploiting its scheduling features, like activity and deadline tracking. Then, the company can bring its business to the next level by leveraging Primavera's more advanced tool capabilities to manage documentation, communication, contracts and to implement process standardization and automation." (Salway 2010)

Using the Standardized Estimate Forms with a Database

The standardized Estimate Forms proposed in this research provide a reasonable basis for the development of a cost management database. The forms are 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 an Excel spreadsheet (Access, FrontPage, Oracle) and other programs can be adapted to accept such information. If the database (and Excel forms) provides limitations and codes to the way in which the information is entered, it is anticipated that as Estimate Forms are submitted to the SCDOT, they 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 Conclusion

The SCDOT has made vast improvements 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 effective, but there is room for improvement. Microsoft Access may still be a suitable solution, but will require extensive effort from SCDOT data processing personnel or an external consultant to develop a truly usable utility management database that will compare to a software package such as Primavera. The SCDOT currently has plans to move to a new database software package, and the points listed in this chapter should help the agency 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.

CHAPTER FIVE

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. 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 many times the utility relocation work done by the utilities companies are finishing behind schedule, thus delaying the scheduled completion date of SCDOT construction.
- The SCDOT had to cancel a $2,000,000 project one day before the project let date because a single utility claimed they did not have the funds to relocate. The SCDOT cancelled all encroachment permits of 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.
- Instances of utility companies claiming they cannot do the relocation work for many reasons and all SCDOT engineers can tell their bosses is "sorry." There is little the SCDOT can do in these situations.
- "It is like dog fighting with a dog that has no teeth."
- Due to the utility company workload, the SCDOT is, more often times than not, at the mercy of the utilities schedule.
- Utility's have charged meals at very expensive restaurants to project invoices to the SCDOT.

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 also 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 company 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 and project oversight and management, 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 that responded 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. The Society of Cost Estimating and Analysis (SCEA) currently offers certification classes in estimating procedures. A certification or qualification such as this should be required for those responsible for submitting estimates to the SCDOT. Insisting on these certifications 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 SIX

SUMMARY & CONCLUSION

In the past the SCDOT has experienced higher final invoice costs compared to that of the preliminary estimate cost. The 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 for the user.

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. These estimate forms should prove to be useful to both the SCDOT and the utility providers. The research team expects an immediate impact for the SCDOT due to the estimate forms standard format. This should make entering and tracking cost data in SCDOT databases a much more simple process.

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 a program such as Primavera P6 should provide positive results to the SCDOT when used alongside the information in this report.

This research report could not address all of the concepts and ideas related to utility relocation cost reimbursement, but future research in the areas of state legislation, outsourcing, and estimate certification should ultimately help the SCDOT obtain their goal of lowering final project costs.

APPENDICES

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 Total	Estimate Submittal 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

STANDARDIZED PRE-CONSTRUCTION ESTIMATE FORMS

Power Utility Form

Pre-Construction Estimate Form for Power Utilities										
	Unit of Measure	I/R	Part #	Install / Retire Qty	Labor Unit Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
General										
Mobilization										
	each									
Overhead										
	each									
Preparation										
	each									
Rentals										
	each									
Traffic Control										
	each									
Other										
Total										

	Unit of Measure	I/R	Part #	Install / Retire Qty	Labor Unit Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
Lines										
Above Ground Conduit Structures										
(insert line items here)	l.f.									
Open-Trench Conduit Structures										
	l.f.									
Open-Trench Pipe and Conduit Structure Encasement										
	each									
Pole Transformers										
	each									
Trenchless Pipes, Conduit Structures, and Box Culverts										
	each									
Other										
Total										

	Unit of Measure	I/R	Part #	Install / Retire Qty	Labor Unit Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
Appurtenances										
Adjusting Manholes and Inlets										
(insert line items here)	each									
Bolts and Fasteners										
	each									
Cable Vaults										
	each									
Fuses and Accessories										
	each									
Ground Boxes/Rods										
	each									
Guy Wires/Anchors										
	l.f.									
Manholes and Inlets										
	each									
Poles										
	each									
Other										
Total										

Summary										
Indirect Costs (__%)								***General***		
Total Install Cost				**Total Install Man Hours**				***Lines***		
Total Retire Cost				**Total Retire Labor Hours**				***Appurtenances***		
Total Salvage Value										
						TOTAL PROJECT COST				

Communication Utility Form

Pre-Construction Estimate Form for Communication Utilities										
	Unit of Measure	I/R	Part #	Install / Retire Qty	Unit Labor Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
General										
Mobilization										
(insert line items here)	each									
Overhead										
	each									
Preparation										
	each									
Rentals										
	each									
Traffic Control										
	each									
Other										
Total										

	Unit of Measure	I/R	Part #	Install / Retire Qty	Unit Labor Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
Lines										
Above Ground Conduit Structures										
(insert line items here)	each									
Communication Cables										
	each									
Open-Trench Conduit Structures										
	each									
Open-Trench Pipe and Conduit Structure Encasement										
	each									
Pole Load Coils/Repeaters										
	each									
Trenchless Pipes, Conduit Structures, and Box Culverts										
	each									
Other										
Total										

	Unit of Measure	I/R	Part #	Install / Retire Qty	Unit Labor Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
Appurtenances										
Adjusting Manholes and Inlets										
(insert line items here)	each									
Bolts and Fasteners										
	each									
Cable Vaults										
	each									
Communication Buildings and Cabinets										
	each									
Fuses and Accessories										
	each									
Ground Boxes/Rods										
	each									
Guy Wires/Anchors										
	l.f.									
Manholes and Inlets										
	each									
Poles										
	each									
Other										
Total										

Summary										
Indirect Costs (__%)								***General***		
Total Install Cost				**Total Install Man Hours**				***Lines***		
Total Retire Cost				**Total Retire Labor Hours**				***Appurtenances***		
Total Salvage Value										
						TOTAL PROJECT COST				

Water Utility Form

Pre-Construction Estimate Form for Water Utilities										
	Unit of Measure	I/R	Part #	Install / Retire Qty	Unit Labor Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
General										
Mobilization										
(insert line items here)	*each*									
Overhead										
	each									
Preparation										
	each									
Rentals										
	each									
Traffic Control										
	each									
Other										
Total										

	Unit of Measure	I/R	Part #	Install / Retire Qty	Unit Labor Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
Earth Work										
Concrete & Asphalt Removal										
(insert line items here)	*s.f.*									
Curb, Gutter, etc.										
	l.f.									
Excavation and Backfill for Structures										
	c.f.									
Trench Excavation Protection										
	each									
Other										
Total										

	Unit of Measure	I/R	Part #	Install / Retire Qty	Unit Labor Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
Pipes										
Open-Trench Water Pipe										
(insert line items here)	*l.f.*									
Trenchless Pipes and Box Culverts										
	l.f.									
Open-Trench Pipe Encasement										
	l.f.									
Adjusting & Relocating Water Pipes										
	each									
Other										
Total										

	Unit of Measure	I/R	Part #	Install / Retire Qty	Unit Labor Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
Appurtenances										
Adjusting or Relocating Pipe Appurtenances										
(insert line items here)	*each*									
Manholes and Inlets										
	each									
Water Appurtenances										
	each									
Other										
Total										

Summary										
Indirect Costs (__%)								***General***		
Total Install Cost				**Total Install Man Hours**				***Earth Work***		
Total Retire Cost				**Total Retire Man Hours**				***Pipes***		
Total Salvage Value								***Appurtenances***		
						TOTAL PROJECT COST				

Sanitary Sewer Utility Form

Pre-Construction Estimate Form for Sanitary Sewer Utilities										
	Unit of Measure	I/R	Part #	Install / Retire Qty	Unit Labor Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
General										
Mobilization										
(insert line items here)	*each*									
Overhead										
	each									
Preparation										
	each									
Rentals										
	each									
Traffic Control										
	each									
Other										
Total										

	Unit of Measure	I/R	Part #	Install / Retire Qty	Unit Labor Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
Earth Work										
Concrete & Asphalt Removal										
(insert line items here)	*s.f.*									
Curb, Gutter, etc.										
	l.f.									
Excavation and Backfill for Structures										
	c.f.									
Trench Excavation Protection										
	each									
Other										
Total										

	Unit of Measure	I/R	Part #	Install / Retire Qty	Unit Labor Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
Pipes										
Open-Trench Gravity Sanitary Sewer Pipe										
(insert line items here)	*l.f.*									
Open-Trench Pressure Sanitary Sewer Pipe										
	l.f.									
Trenchless Pipes and Box Culverts										
	l.f.									
Open-Trench Pipe Encasement										
	each									
Other										
Total										

	Unit of Measure	I/R	Part #	Install / Retire Qty	Unit Labor Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
Appurtenances										
Sanitary Sewer Appurtenances										
	each									
Manholes and Inlets										
	each									
Other										
Total										

Summary										
Indirect Costs (__%)								***General***		
Total Install Cost				**Total Install Man Hours**				***Earth Work***		
Total Retire Cost				**Total Retire Man Hours**				***Pipes***		
Total Salvage Value								***Appurtenances***		
						TOTAL PROJECT COST				

Gas Utility Form

Pre-Construction Estimate Form for Gas Utilities										
	Unit of Measure	I/R	Part #	Install / Retire Qty	Unit Labor Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
General										
Mobilization										
(insert line items here)	*each*									
Overhead										
	each									
Preparation										
	each									
Rentals										
	each									
Traffic Control										
	each									
Other										
Total										

	Unit of Measure	I/R	Part #	Install / Retire Qty	Unit Labor Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
Earth Work										
Concrete & Asphalt Removal										
(insert line items here)	*s.f.*									
Curb, Gutter, etc.										
	l.f.									
Excavation and Backfill for Structures										
	c.f.									
Trench Excavation Protection										
	each									
Other										
Total										

	Unit of Measure	I/R	Part #	Install / Retire Qty	Unit Labor Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
Pipes										
Trenchless Pipes and Box Culverts										
	l.f.									
Open-Trench Pipe Encasement										
	l.f.									
Adjusting & Relocating Gas Pipes										
	each									
Other										
Total										

	Unit of Measure	I/R	Part #	Install / Retire Qty	Unit Labor Cost	Material Unit Cost	Labor Cost	Material Cost	Salvage Value	Total
Appurtenances										
Adjusting or Relocating Pipe Appurtenances										
(insert line items here)	*each*									
Manholes and Inlets										
	each									
Other										
Total										

Summary

Indirect Costs (__%)			***General***
Total Install Cost	**Total Install Man Hours**		***Earth Work***
Total Retire Cost	**Total Retire Man Hours**		***Pipes***
Total Salvage Value			***Appurtenances***
		TOTAL PROJECT COST	

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