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# Detailed cost estimation for landscape architecture: an indicator of final construction costs in the DFW Metropolitan area

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# DETAILED COST ESTIMATION FOR LANDSCAPE ARCHITECTURE: AN INDICATOR OF FINAL CONSTRUCTION COSTS IN THE DFW METROPOLITAN AREA

by

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Abstract

DETAILED COST ESTIMATION FOR LANDSCAPE ARCHITECTURE:

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IN THE DFW METROPOLITAN AREA

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This thesis uses quantitative research methods to study detailed cost estimating to determine how accurately this estimating procedure helps landscape architects forecast construction costs in the Dallas – Fort Worth Metroplex. Specifically, this study seeks to determine the benefits for landscape architects in providing detailed cost estimates to their clients as a deliverable during the design process. Considering how accurate forecasts of construction costs could be used to meet clients' budget expectations more effectively, this is an important field of study for landscape architecture. By evaluating the construction documents costs for each of the study's landscapes, the research determines whether construction costs are in fact accurately forecasted by the cost estimation process.

This research analyzes the responses from members of the construction development team. The teams are made up of project owners, landscape architects, and prime contractors who may have knowledge of detailed cost estimates. The research determines if these team members were more satisfied with the outcome of the project than clients who did not receive such estimates. Additionally, this research analyzed the construction cost estimation process and construction documents to understand how landscape architecture practitioners benefit from the implementation of detailed cost

estimations into their design processes. Detailed cost estimates directly influences design, making the predictive process all the more important for landscape architects to accurately forecast construction costs.

This research focuses primarily on the detailed cost estimating process as it was one of the several estimating methods used in determining the actual construction cost for the projects being studied. This research investigated the importance of detailed cost estimating by implementing an online survey strategy. Structured with trade specific question sets for project owners, landscape architects, and prime general contractors, the survey sought to collect data from individuals familiar with landscape construction work, as well as cost estimation.

The principals and themes of this data addresses factors such as compliance with local government construction guidelines and building ordinances. Additional data collected from landscape construction specifications, landscape construction design notes, construction details, subcontractor notes and other factors related to estimating landscape construction costs were catalogued into a basic inventory which further organized these data into respective themes.

In summary, the collection, inventory and analysis of the data from the study defined a process that contributes to understanding how detailed cost estimating verifies whether the cost of a project is indeed the actual construction cost. The analysis of these findings aided in determining detailed cost estimation is considered an accurate and valuable construction cost forecast tool by landscape architects. Comparisons and findings, in addition to the survey results, also suggested that adapting detailed cost estimating into the design process assists landscape architects deliver projects that accurately matches the construction budget expectations of the owner.

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# Chapter 1

## Research Objectives

### 1.1 Introduction

The objective of this study is to understand how accurately the detailed cost estimating process helps landscape architects forecast construction costs. Because it is not always part of their design process, landscape architects often fail to realize the full potential of detailed cost estimation. Due to a lack of experience in the local/regional construction market, and the relatively large amount of time required to assemble an accurate detailed cost estimate, the majority of landscape architects are choosing not to offer this service to their clients (Dell'losa, 2003.) This means that landscape architects are undeserving their clients in two major ways:

- They are relying on other, potentially unreliable, sources for detailed cost estimates;
- They are missing an opportunity to help their client better meet construction budgets.

These have detrimental effects on the accuracy of detailed cost estimate. It is worthwhile for landscape architects to expend the resources necessary for providing detailed cost estimating, as a billable service, directly to the client. If landscape architects were to implement the detailed cost estimate as a typical part of their design process, perhaps the full potential of this valuable service could be realized. Only then could the client be assured they are receiving an accurate forecast of true construction costs.

Collecting information provided by landscape architects via descriptive observation of construction documents, and answers from an online survey, this research studies the effectiveness of detailed cost estimation as a construction cost tool for landscape architects. What this means is that this study seeks to determine the benefits

for landscape architects in providing detailed cost estimates to their clients, as a deliverable during the design process, by employing a descriptive observation strategy and an online survey to obtain these data.

To determine if construction costs were in fact accurately predicted by the cost estimation process, this research evaluated responses provided by this study's participants. Additionally, the responses between this study's participants who received detailed cost estimates prior to the project are compared to the responses of those who did not receive these estimates. The conclusion of this study describes the implications of detailed cost estimating for landscape architects, should they decide to incorporate it into their design process.

Currently, not all landscape architects take full advantage of the detailed cost estimation process, let alone express any interest in providing this important service to their clients at all, this according to Mr. Dell'isola, a certified project engineer and construction value estimator (Dell'isola, 2003.) According to Demkin, those landscape architects that attempt to use cost estimates, often have no professional resources in-house, and therefore rely on third party entities in order to provide this valuable service (Demkin, 2002.) The findings of this study contribute an understanding of how detailed cost estimating is used during the design process as an accurate construction cost forecasting tool for landscape practitioners.

It is worth restating that project owners expect their design and construction team to manage project costs in an accurate and dynamic manner, while not compromising excellence in design (Christensen.) During the construction procurement process, the architect or landscape architect helps the owner with hiring a qualified contractor onto the construction team (AIA, 2008.) The makeup of construction teams vary from project to project, but typically include owners, landscape architects, and prime general contractors.

These professionals are important to this study, as they possess field experience and general familiarity with the detailed cost estimation process. Furthermore, these individuals were asked to participate in this research because they contribute to the design development of projects considered in this study. These individuals have used detailed cost estimates in the past, and are in a position to offer insight on the effectiveness of such estimates as an accurate construction cost forecasting tool. In addition, landscape architects use the authority granted them via their State of Texas issued professional seals, along with their contact information, onto the construction documents. This is important because once stamped, the plans become by law, legal documents and are available for viewing for scrutiny by the general public (Hopper, 2007).

Request for proposals (RFP) on the projects within this study asked specifically for cost estimates, such as Guaranteed Maximum Pricing estimates (GMP). GMP is a sum established in an agreement between owner and contractor as the maximum compensation amount to be paid for performing specified work on the basis of the cost of labor and materials plus overhead expenses and profit (AIA Handbook, 2008.) Once a final price for construction is agreed upon, only price increases approved by the owner through change orders, are allowed. This is important because an inaccurate price used by the owner and the financier could have detrimental effect on the project management team's ability to successfully complete construction.

The projects in this study relied on different divisions of construction trades, including structural, electrical, HVAC, and civil. These different professions have to work together as a team in order to successfully build the project in a timely and profitable manner. This study focused on Division 2 of the MASTERSPEC American Institute of Architecture (AIA) Master Systems list (1999) which contains the AIA standards on

specifications and covers landscape construction (AIA Handbook, 2002, page 294.) The research also relied on information from the construction document packages specific to each project. Items such as landscape specifications, design notes, construction details, subcontractor notes, and other documents related to estimating landscape construction costs were considered in this study as this data is typically found in most construction documents. Additionally the research analyzed, whenever possible, quantitative data by collecting and cataloging the cost estimates submitted to construction teams by qualified contractors.

A large part of data collection for this study employed a mixed approach, including an online survey alongside a descriptive observation strategy (Nugrahenny, 2012, page 137), to capture data from construction documents. Descriptive research design is described as a scientific method which involves observing and describing the behavior of a subject without influencing it in any way. The data found in the construction documents weren't able to be edited or influenced in anyway by the researcher, these data sources could not be observed in any other way except via the descriptive observation method, ensuring the integrity of the information. The findings created from the methods mentioned determined that the actual building costs for construction were accurately predicted by the detailed cost estimation process.

## 1.2 Research Questions

The major research questions raised in this thesis were:

1. Does the cost estimating process accurately forecast construction costs?
2. Is there a benefit to landscape architects in providing detailed cost estimating services to their client?

3. Are the apparent benefits of the detailed cost estimating process, as established in the literature review, actually realized by the landscape practitioners involved in this study?

## 1.3 Definition of Terms

Addenda: It is the review of the bidding documents during the bidding period by prime bidders, sub-bidders, and material suppliers which often reveals items that must be clarified, corrected, or explained. Sometimes the owner or architect will initiate revisions to the bidding documents in response to changes of circumstances or requirements. In these circumstances, written addenda, including drawings or other graphic documents, are issued to modify or interpret the bidding documents before bids are received or the contract is executed (AIA., 2008, page 566.)

Architecture: The art and science of designing structures and their surroundings in keeping with aesthetic, functional or other criteria. The distinction made between architecture and building, is no longer accepted. Architecture is now understood as encompassing the totality of the designed environment, including buildings, urban spaces and landscape (Fleming, 1998, Page 21.)

Change order: An amendment to the construction contract signed by the owner, architect, and contractor that authorizes a change in the work, an adjustment in the contract sum or the contract time, or both (Bowen, 2002, page 528.)

Construction documents: They are the drawings and specifications prepared by the architect setting forth the requirements for the construction of the project (Demkin, 2008, page 988.)

Construction management: In architecture, it is the services provided to an owner to manage a project during the design phase, construction phase, or both. Such services may include advice on the time and cost consequences of design and construction

decisions, scheduling, cost control, coordination of contract negotiations and awards, timely purchasing of critical materials and long-lead-time items, and coordination of construction activities (Demkin, 2008, page 988.)

Construction Process: Follows the completion of the construction drawings and specifications and the subsequent bidding process. The steps in a generic construction project are as follows (Hopper, 2007):

1. Preconstruction planning, scheduling, construction management, and oversight;
2. Utility location;
3. Construction preparation;
    a. Site security;
    b. Erosion control;
    c. Tree protection and existing elements preservation, demolition and site preparation;
4. Layout;
5. Primary infrastructure installation;
6. Foundations and primary elements construction;
7. Rough grading;
8. Secondary elements construction;
9. Secondary infrastructure and systems installation;
10. Flatwork;
11. Specialty paving;
12. Landscaped areas and site furnishings;
13. Site cleanup;
14. Postconstruction evaluation;

15. Postconstruction management.

Descriptive observation method: Descriptive or unstructured observation attempts to capture what is going on during the observer's presence, and is especially useful when the observer wants to capture a broad picture of a lesson rather than focus on a particular aspect of it. The field notes made as a result of descriptive observation are called "written ethnographies" (Day, 1990, page 44) or "narrative field notes" (Dornyei, 2007, page 179; Nugrahenny, 2012, page 137.)

Design: In architecture, a professional that composes a plan for a building; the architectural concepts of a building as represented by plans, elevations, renderings, and other drawings; any visual concept of a constructed object, as of a work of art (Burden, 2002, Page 99.) In landscape architecture, it is the process of taking ideas and producing a work of art, a work to complete, a visual or written instruction for completing a work (Christensen, 2005, page 108.)

Detailed estimate of construction cost: A forecast of construction cost prepared on the basis of a detailed analysis of materials and labor for all items of work, as distinguished from a preliminary estimate of construction cost based on current area, volume, or similar conceptual estimating techniques (AIA, 2008, page 993.)

Guaranteed maximum pricing: A sum established in an agreement between owner and contractor as the maximum compensation to be paid by the owner to the contractor for performing specified work on the basis of the cost of labor and materials plus overhead expenses and profit (AIA, 2008, page 993.)

Landscape architect: For the purpose of this thesis, a licensed professional performing landscape architecture by designing changes in land and features thereon for human enjoyment and by planning effective placement of structures, vehicular and pedestrian ways, plantings, earthwork, drainage facilities, buildings, land uses, and

producing construction documents for the building of such. They are concerned with stewardship of natural, constructed, and human resources in providing environments that serve useful, aesthetic, safe, and enjoyable purposes (Christensen, 2005, page 201.)

Landscape architecture: A profession encompassing both the un-designed and built environments. It involves a multidisciplinary design work composed of some understanding of soil science, civil engineering, landscape ecology, design aesthetics, horticulture, arboriculture, botany, irrigations systems, land planning, transportation planning, environmental issues, art, drafting, etc. Those adequately trained in this profession have a well-rounded knowledge of the un-designed and built environment useful in managing multidisciplinary developments or land planning efforts (Christensen, 2005, page 108.)

Landscape construction: Work in constructing such items as (including but not limited to) walls, paths, sprinkler systems, drainage systems, outdoor lighting, water features, trails, paths, driveways, paving, decks, and patios. These are professionally designed by landscape architects and constructed by landscape contractors (Christensen, 2005, page 108.)

MASTERFORMAT/MASTERSPEC: Consists of sixteen divisions and is the specification development tool popular within the building design and construction industry. The newest versions offer architects powerful tools for preparing project specifications. MASTERSPEC is a product of the AIA and is published and supported by ARCOM. Landscape scopes of work is listed in Division 2-Site Construction (Demkin, 2002, page 294.)

MASTERFORMAT 1995 EDITION

Before November 2004, MasterFormat was composed of 16 Divisions:

Division 1 — General Requirements

Division 2 — Site Construction

Division 3 — Concrete

Division 4 — Masonry (Ex. Concrete block)

Division 5 — Metals (Ex. Beams)

Division 6 — Wood and Plastics

Division 7 — Thermal and Moisture Protection

Division 8 — Doors and Windows

Division 9 — Finishes

Division 10 — Specialties

Division 11 — Equipment

Division 12 — Furnishings

Division 13 — Special Construction

Division 14 — Conveying Systems

Division 15 — Mechanical (Ex. Plumbing and HVAC)

Division 16 — Electrical

Preliminary estimate of construction cost: The Preliminary Cost Estimate is developed based on the best available information, considering that the project is typically at approximately 30% completion. Preliminary cost estimates should be conservative but realistic since they are typically used to determine project funding; therefore, in addition to calculating the preliminary construction costs (costs incurred by the contractor), the preliminary cost estimate should also include costs for items such as construction engineering, change orders, environmental mitigation and right-of-way (ROW) acquisitions including off-site land acquisition for mitigation. (NJTPA, 2015)

Qualitative methods: The process of comparing and cataloging data for the research and development of themes from descriptive data such as interviews (Taylor, 1998, page 7.)

Quantitative methods: This is the systematic investigation of measureable properties and phenomena and their relationships. The objective of quantitative research is to develop and employ mathematical models, theories, and/or hypotheses pertaining to phenomena (Brown, 2011, page 287.)

## 1.4 Summary

Chapter one introduced the objective of this study, which is to understand how accurately the detailed cost estimate helps landscape architects forecast construction costs. Chapter one also described data collection methods, the research study's questions and finally it listed the definition of terms used throughout this study.

# Chapter 2

# Literature Review

## 2.1 Introduction

It is common for architects or landscape architects to prepare preliminary cost estimates, but historically they have not often prepared detailed cost estimates (Dell'isola, 2003.) The researcher focuses on literature available to architecture because literature specific to preparation of preliminary cost estimates by landscape architects was not available or limited. Dell'Isola explains that the importance of detailed estimating is due, in part, to its ability to verify whether the cost of a project as predicted by the conceptually developed construction documents is indeed the final cost. In his book titled *A Cost Estimator's Reference*, Mr. Stewart can be quoted for saying, "To be a truly powerful, credible, and useful function, cost estimating must be considered a dynamic and integral part of the technical and financial functions of an organization or business activity (Stewart, 1995, page 1".) Therefore, there must be an inseparable and active relationship between the cost estimating, cost accounting, and cost management functions (Stewart, 1995,) as shown in Fig 1.1.

At a certain point during the design development, landscape architects may disseminate plan drawings, construction details and construction specifications for the purpose of receiving actual costs for the installation of the landscape in the market where the site is located. According to Leonard, "A cost estimate is the summation of individual cost elements, using established methods and valid data, to estimate the future costs of a program, based on what is known today (Leonard, 2009, page 1.") In addition to the value that the detailed cost estimate provides to architects in regards to local economic and market influences, the client also benefits from this service because it validates

project construction budgets, establishes a benchmark for a construction bid or negotiation and establishes a basis for financing (Dell'isola, 2003.)

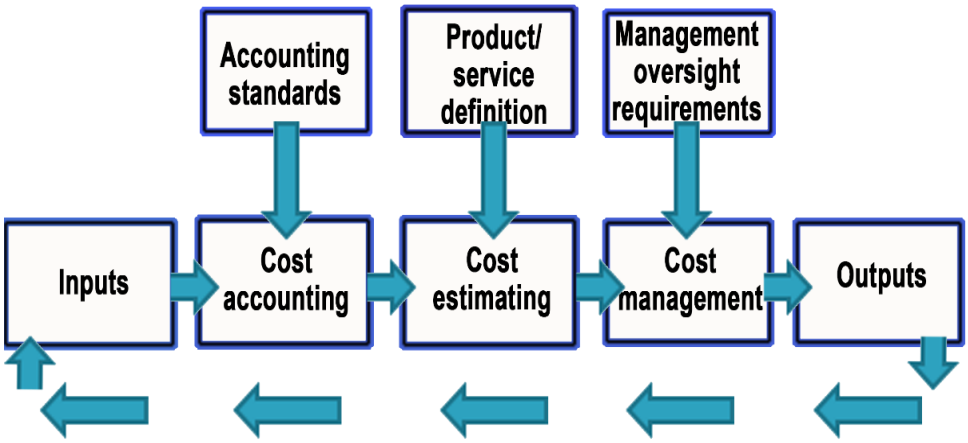



Figure 2.1 Cost estimating relationship activities (Stewart, 1995)

Providing a basic knowledge of construction estimating processes, this section explains the reasons why detailed cost estimating is important to both landscape architects and other interested professionals alike. The first section is about the role of estimating in the landscape architect's design process. Following, the second section titled '*What is Detailed Cost Estimating*', explains the various methods used within detailed cost estimating and distinguishes it from the other similar methods. In the third section, the cost breakout process is described to help further explain the detailed cost estimating process. The fourth section, describes the implication of information provided in construction documents and explains how the data were considered. Finally, the fifth section explains the value of detailed cost estimating to landscape architects and interested individuals alike.

## 2.2 The Role of Estimating

When an owner decides to engage in construction, he must consider the costs of the project (Bowen, 2002.) Therefore a project's estimated cost that exceeds the amount borrowed or raised may have to be reevaluated. Raising money for construction based of of preliminary estimates may cause uncertainty as it is difficult to accurately predict a project's final construction cost. This means that the architect and landscape architect are responsible for estimating and meeting construction costs as detailed in the owner-architect agreement (Bowen, 2002.) These may include the following:

- Budget evaluation. Project scope, quality, schedule, and construction budget are interrelated, and design generally begins with an evaluation of each in terms of the other (Demkin, 2002;)
- Cost estimates. AIA Document B141 specifies that the architect provide a preliminary opinion of probable cost of the work when the project requirements have been sufficiently identified. The owner must be advised of any adjustments to the previous estimates that result from updates and refinements of the preliminary design (Demkin, 2002;)
- Construction contract administration. As part of construction contract administration, the architect reviews and certifies amounts due to construction contractor when the contractor requests payment. Change orders are also evaluated and agreed upon (Demkin, 2002.)

Bowen points out that AIA Document B163 contains a list of possible services that (landscape) architects may offer the owner (Bowen, 2002, page 344) as follows:

- Market research studies;
- Economic feasibility studies;
- Project financing studies;

- Analysis of construction alternatives or substitutions;
- Construction contract cost accounting;
- Life cycle cost analysis;
- Value analysis, engineering, or management;
- Bills of materials;
- Quality surveys;
- Detailed cost estimating.

In 2000, sixty-five percent of AIA member firms offered cost estimating services. Of these, nineteen percent offered cost estimating as a stand-alone service (A.I.A. Firm Survey 2000-2002.) Not all architects are interested in or able to provide these additional services. For example, Bowen explains that detailed construction cost estimating requires the firm to be in touch with the construction marketplace in which the project will be built (Bowen, 2002, page 345.) Some firms may have specialist on staff while others may rely on construction cost consultants or contractors. According to Bowen, following is a list of the cost services and responsibilities of professionals who offer estimating services:

- Cost Consultants. They provide estimates and advice on constructability, scheduling, and the construction cost implications of functional and design alternatives;
- Contractors and Construction Managers. They offer cost and constructability expertise during design. These firms may remain as advisors to the owner or architect without competing for the actual construction work, or at a predetermined time they may assume responsibility for construction, including construction cost. Some architects also offer construction management services;

- Design-build Firms. These entities assume construction cost responsibility (Bowen, 2002.)

## 2.3 What is Detailed Cost Estimating

Projects should have detailed cost estimates done early in the design process and should include as much detail as possible (Demkin, 2008, page 572.) The earlier detailed cost estimates are done, the less likely bias and unrealistic expectations become uncontrollable factors. According to Bowen, successful cost management depends on sound estimating skills (Bowen, 2002, page 346.) Estimating involves two basic steps: quantifying the amount of work to be estimated; and applying reasonable unit prices to these quantities. While there are many estimating approaches and systems, they generally fall into one of three basic categories that contributes to detailed cost estimating (Bowen, 2002, Liebing, 1999) as discussed below. Although bidding and estimating are related, they have unique and different concepts and processes. This means that bidding is a procurement process, while estimating is a predictive process (Dell'isola, 2003.)

### *2.3.1 Area, Volume, and Single-Unit Rate Methods.*

The least detailed of all the methods, this method is useful during the predesign and even in preliminary design stages. The approach of these method is based on units of accommodation or on building area or volume. Bowen explains these estimating methods suffer from oversimplification and can produce widely varying estimates (Bowen, 2002, page 349.)

For preliminary estimates, architects often use computations based on square feet or in cubic feet for construction. As Bowen explains, "When using historical cost data for area or volume costs of construction, the architect should ensure that the project or group of projects selected for comparison is similar to the project being estimated (Bowen, 2002.") AIA Document B141 requires architects to provide preliminary

construction cost estimates “based on current area, volume, and similar conceptual estimating techniques (A.I.A., 2002, page 195.”) Furthermore, it should be noted that published single-rate unit cost figures customarily do not include site improvements and landscaping.

*2.3.2 Elemental (Assemblies and Subsystems) Methods.*

Elemental methods of estimation is an approach that falls between single-unit methods and the extremely detailed quantity survey method. This approach allows the architect to price subsystems even though no layouts have been designed (AIA, 2002, page 349.) In some instances, site improvements and landscaping are sent out to bid using this method in order to determine that project is on track to adhering to its budget. The objective of using elemental methods is to produce an estimate by approaching a building as a sum of its systems and components and does not concern itself with the smaller construction details (Bowen, 2002.)

*2.3.3 Quantity Survey Methods.*

According to Bowen, this method is the most detailed. It involves detailed calculation of all the components necessary to construct the project, followed by the pricing of each component (Bowne, 2002, page 350.) Additionally, it applies prices to the materials involved in each construction operation, including allowances for waste, labor (crew sizes and makeup), installation time, equipment used, and appropriate allowances for the contractor’s overhead and profit. Contingencies and reserves should also be included in the detailed cost estimate in consideration of price escalation and unforeseen changes during construction.

*2.3.4 The Detailed Cost Estimating Process*

As discussed previously, the detailed cost estimate requires more data when compared with the other methods of cost estimating. “For this estimate each item is

estimated separately (Baasel, 1990, page 297.") For instance, when a plan shows a symbol for a shade tree, the cost for planting that tree is estimated by determining the exact size of the tree's root ball, the size of the excavated pit, the amount of gravel, drainage pipe, soil amendments, amount of mulch, tree stakes, and so forth. The cost of material can be calculated according to what the local market factors determines is fair value. The time allotments are typically determined from tables. The total time obtained is then multiplied by the cost of labor per hour and divided by an efficiency factor to obtain the cost for installing the tree. Therefore, the detailed cost estimate is a breakdown of both the direct and associated costs for the project. Construction costs include the cost of materials, labor, and equipment (Dell'isola, 2003.) This type of estimating is used to keep close control on costs during the construction phase (Merriam-Webster, 2015.) Figure 2-1 illustrates a diagram that presents a breakdown of the cost estimating process in a hierarchy order. According to Dell'Isola, direct costs include materials and installation (Dell'isola, 2003.) Special burdens for shipping and handling of premiums associated with managing labor such as travel may be added to direct cost or may be carried separately as an extended general conditions cost.

Costs associated with managing building construction are usually aligned with provisions in the general conditions of the construction contract. Bonds, permits, and insurance costs allocated to the project are also included in this category. Dell'Isola also explains that all contractors and subcontractors working on-site incur costs associated with general conditions management (Dell'Isola, 2003.) This is of relative importance because general conditions and general notes are an important function commonly included in the construction documents.

Finally, markups are considered before total hard cost is finalized. Dell'Isola writes the following: "Markups for overhead associated with the main office of each

contractor include salaries of home office staff, certain insurance costs, various home office overhead costs (job procurement, marketing, advertising, etc.), and profit. depending on the degree of risk associated with a project, a contingency may be carried

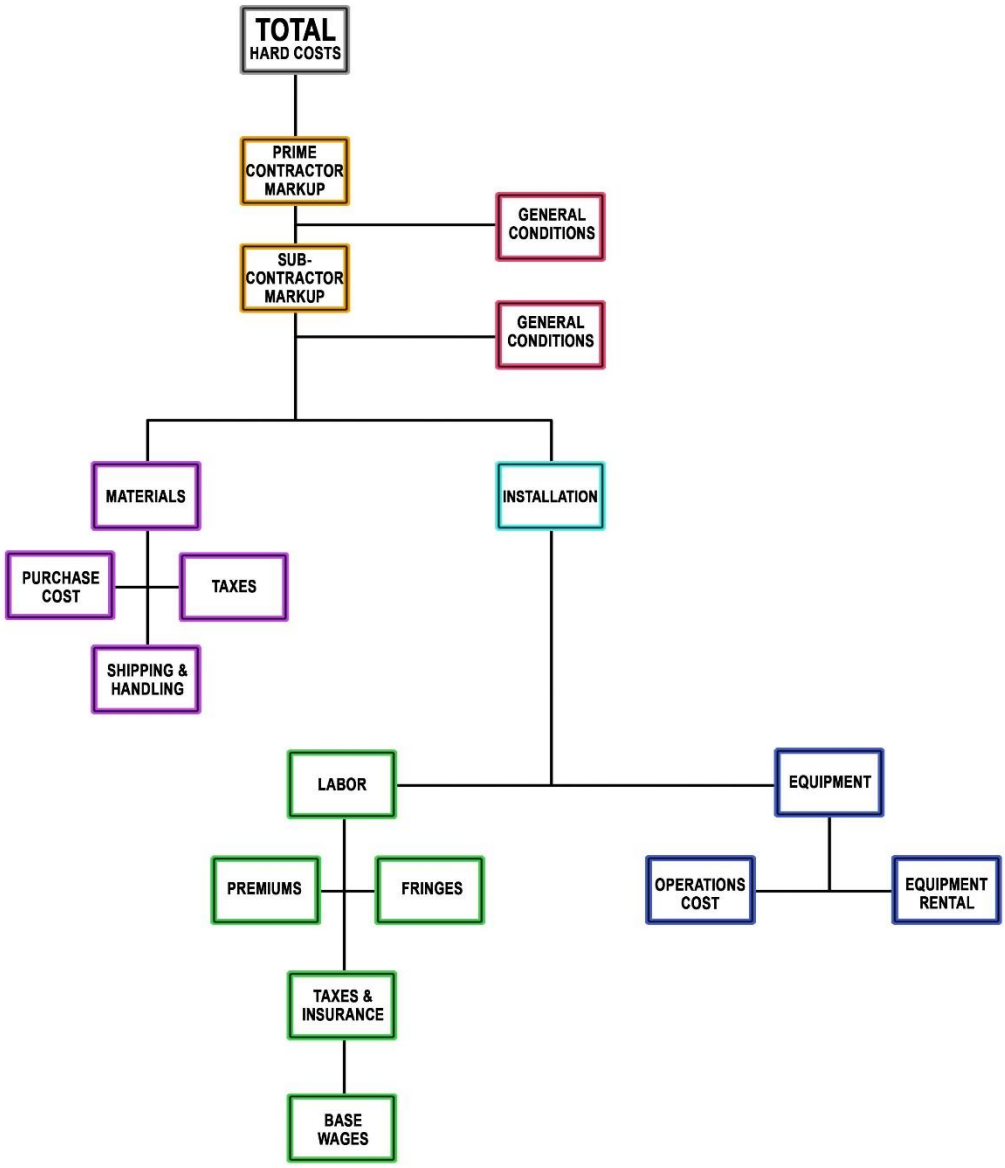



Figure 2-2 Breakdown of Construction Costs (AIA, 2003)

as part of the general conditions and/or markup (AIA, 2003, page 4.") During the detailed cost estimating process, these sorts of markups are often considered on a per line item basis.

*2.3.5 The Role of Construction Documents in the Detailed Cost Estimating Process*

Once a design has been developed and approved, the architect prepares the drawings and specifications that set forth the requirements for construction. The development of the construction documents is an extension of the design process. Decisions on details, materials, products, and finishes all serve to reinforce the design concept and begin the process of translating the concept into reality (Greenwald, 2001.) Of all project phases, the preparation of the construction documents typically takes the most time and resources. "Construction documents describe what is to be built, how contractors are to be selected, and how the contracts for construction will be written and administered. The process of ordering the construction documents strives for efficiency, comprehensiveness, and quality (Greenwald, 2003, page 282.") As Greenwald further explains, it is important that all parties understand that construction documents are not intended to be a complete set of instruction on how to construct a facility (Greenwald, 2003.)

During the early stages of the project formation, when little detail is known, the parametric cost estimating process is the best method to use. Later, a detailed cost estimate is needed as a basis for contract pricing, operating budgets, and cost control (Thamhain, 2005.) Thamhain adds that the level of estimating detailed depends on the level at which the project cost is to be controlled. The roles of construction documents are listed below in the following subsections.

2.3.5.1 Organization and Content

According to Greenwald, “The construction documents are written and graphic documentation used to communicate the design and administer the project (Greenwald, 2003, page 4”.) Typically, the construction documents include the following:

- Bidding requirements which may include the invitation to bid, information and instruction to bidders; bid forms; and requirements for bid security (Greenwald, 2001;)
- Contract forms (the form of agreement to be used between owner and contractor; forms for bonds and certificates) (Greenwald, 2001;)
- Contract conditions (the general conditions of the contract for construction, which outline the rights, responsibilities, and duties of owner and contractor as well as others involved in the construction process, including the architect; supplementary conditions particular to the project)(Greenwald, 2001, AIA, 2008;)
- Drawings which may include architectural, structural, mechanical, electrical, civil, landscape, interior design, and other specialty drawings)
- Specifications (outlines the levels of quality and the standards to be met in the construction of the project) (Greenwald, 2001, AIA, 2008;)
- Addenda (additions to any of these documents issued by the architect during the bidding or negotiation process (Greenwald, 2001;)
- Contract modification (orders for minor changes in the work, construction change directives, and change orders) (Greenwald, 2001.)

Liebing states: “One of the nobler professional goals of every architect should be that every project is completed, closed-out, and delivered with the same verve, intensity, anticipation, interest, effort, attention to detail, dedication, enthusiasm, skill, poise, and

concern for the project, as were present and employed when the project first came into the office, all to the client's complete satisfaction and pleasure (Liebing, 1999, page 4.") To help achieve this goal, landscape architects use construction document to organize and communicate design intent. Construction documents serve multiple purposes:

- They communicate to the owner, in detail, what a project involves (Greenwald, 2003;)
- They establish the contractual obligations the owner and contractor owe each other during a project, and they lay out the responsibilities of the architect or any other party administering or managing construction contracts for the owner (Greenwald, 2001;)
- They communicate to the contractor the quantities, qualities, and configuration of the elements required to construct a project. The contractor, in turn, uses the documents to solicit bids or quotations form subcontractors and suppliers (Greenwald, 2003;)
- They may be the basis for obtaining regulatory and financial approvals needed to proceed with construction (Greenwald, 2003;)

2.3.5.2 Legal and Contractual Information

To serve the above purposes, the construction documents include three basic types of information: Legal and contractual, procedural and administrative; and architectural and construction information. The contract forms and conditions establish the legal framework of a project by setting forth the rights, duties, and responsibilities of the owner and contractor (Greenwald, 2003, page 283; AIA, 2003.) On larger projects it has been customary to separate the contract form from the contract conditions. What this means is that the former is the "agreement between owner and contractor enumerating the contract documents, specifying the time of performance, and stating the contractor's

compensation where the latter is the services that must be performed in order to be compensated (Greenwald, 2001, page 283.")

As a legal protection for the project owner, the landscape architect's responsibility is set forward by the standard AIA owner-architect agreement forms, and state that the landscape architect shall "assist the project owner in the development and preparation of: (1) bidding and procurement information which describes the time, place and conditions of bidding; bidding or proposal form; and the form of agreement between the Owner and the Contractor; and (2) the Conditions of the Contract for Construction. (Liebing, 1999, Greenwald, 2003, page 283.)

Regarding the owner's responsibility, Greenwald clearly explains that the owner is responsible for furnishing the necessary legal, accounting, and insurance services to accomplish a project. (Greenwald, 2003.) Therefore the owner, with the advice of the owner's legal counsel, approves the bidding requirements, contract forms, and conditions.

2.3.5.3 Procedural and Administrative Information

This information is typically found in three places in the construction documents: in the conditions of the contract, in Division 1 of the specifications, and in the opening articles (Part 1) of Divisions 2 through 16 of the specifications (Greenwald, 2001, page 284.) In addition to the legal and contractual information, the general conditions include requirements for a variety of contract administration activities, including submission of shop drawings and samples, contractor payment requests, changes in the work, procedures for uncovering construction for examination by the architect or for recommending that work be stopped, contractor's responsibility for job site safety, and final contract closeout (Greenwald, 2001.)

2.3.5.4 Architectural and Construction Information

According to Greenwald, this encompasses the quantities, qualities, and configuration of the elements required for the project. Quantities and relationships are usually best indicated on the drawings; qualities and standards of workmanship are best placed in the specifications. Regarding level of detail, that depends on the needs of the project and of those who will own, regulate, and build it (Greenwald, 2001.)

*2.3.6 Drawings*

The construction drawings show, in graphic and quantitative form, the extent, configuration, location, relationships, and dimensions of the work to be done (Greenwald, 2001.) “They generally contain site and building plans, elevations, sections, details, diagrams, and schedules. In addition to drawn information, they may include photographs, other imported graphics, and printed schedules (Greenwald, 2001, page 286.)

The need to communicate a large amount of information in a limited space commonly dictates the use of symbols and abbreviations. Designations on the drawings should be coordinated with those used in the specifications. According to Greenwald, when drawings and specifications are separate, statements on quality and workmanship are made in the specifications. Notes on the drawings should be limited to the minimum needed to convey design intent clearly. She goes on to explain schedules. “Information best presented in tabular form is most commonly shown in a schedule (Greenwald, 2001, page 289”.)

*2.3.7 Specifications*

The specifications present written requirements for materials, equipment, and construction systems as well as standards for products, workmanship, and the construction services required to produce the work. The specifications are often

presented in the project manual, along with the bidding requirements, contract forms, and conditions of the contract (Greenwald, 2003.)

According to The Architect's Handbook of Professional Practice, there are five methods of specifying as listed below:

- Descriptive specifying. Many architects use descriptive specifications, describing exact characteristics of materials and products without listing proprietary names;
- Performance specifying. These specify the end result required and allow contractors, manufacturers, and fabricators the most flexibility and creativity in meeting the requirements;
- Specifying with reference standards. Architects sometimes rely on industry associations and testing organizations for specifications. This allows contractors to use industry-accepted standards of practice and performance;
- Proprietary specifying. Known for their brevity and simplicity, architects use these because they are familiar with the qualities of the specific products being specified. These specifications are frequently augmented with reference to standards, narrative descriptions of materials' qualities, and performance requirements;
- Restrictive specifying. The architect determines how restrictive the specifications are to be. Whether they will permit only on manufacturer's product, several products, or any product that meets specified criteria (AIA, 2003.)

*2.3.8 Other Construction Documents*

In addition to drawings and specifications, construction documents may include any or all of the following (AIA, 2001, Demkin, 2003:)

- Bidding requirements, including bid invitation, information and instruction for bidder, bid forms, and bid bonds;
- Contract forms, including proposed owner-contractor agreement, certificates, and performance and payment bonds;
- General and supplementary conditions of the contract for construction
- Addenda issued during bidding;
- Modifications made after the construction agreements are signed.

## 2.4 The Importance of the Detailed Cost Estimate

The Governmental Accountability Office (GAO) reported more than 40 years ago that realistic cost estimating was imperative when acquiring new systems (Leonard, 2009.) In 1972 the GAO reported that uniform guidance on cost estimating practices and procedures would be the basis for formulating valid, consistent and comparable estimates was lacking within the Department of Defense (Leonard, 2009.) Their conclusion was that without realism and objectivity in the cost estimating process, bias and over-optimism crept in, and the estimates were too low. The detailed cost estimate process offers such a uniform estimating procedure.

As mentioned, it is common for landscape architects to prepare preliminary cost estimates, but historically they have not often prepared detailed cost estimates. For these, they have relied on scope specific sub-contractors, specialists within their firms, or outside professional estimating organizations. According to Dell'Isola, detailed estimating "…is important because it verifies whether the cost of a project as predicted in a conceptually developed estimate is indeed the actual cost." Dell'Isola continues to explain

that while detailed estimates are typically prepared by different parties, it is still important that the estimate be reconciled and assessed (Dell'isola, 2005, page 1.")

Clients today have many expectations of their design and construction team. They expect that an accurately defined budget will be prepared early in a project and that the project will be completed to required scope, meeting quality and performance expectations while within budget and without compromise to excellence in design (Dell'isola, 2003.) Clients don't want to pay additional fees for redesigns, therefore design teams tend to include a detailed cost estimate as part of their deliverable (Christensen, 2005.) Dell'Isola points out,while not required as a deliverable, "…preparation of a detailed estimate demonstrates a design team's commitment to cost management (Dell'isola, 2003, page 1.")

## 2.5 Summary

This chapter was a review of the literature and introduces the roles and processes of the detailed cost estimate, as well as cost estimating in general. The purpose of this research is to investigate the detailed cost estimating process to determine how accurately it helps landscape architects forecast construction costs. While it is common for landscape architects to prepare preliminary cost estimates, historically they have not often prepared detailed cost estimates. By collecting information, provided by landscape architects via descriptive observations of the construction documents, and an online survey, the study determines the accuracy of detailed cost estimation as a construction cost tool for landscape architects.

The study group was delimited to commercial development and construction projects that have been constructed in the Dallas-Ft. Worth metropolitan area within the last five years. Therefore this research relied on understanding the role detailed cost estimates have within landscape architects design processes. The significant differences

amongst the three main types of cost estimating methods as well as the detailed cost estimating process itself was explained in this chapter. This information, in addition to understanding the legal and contractual role of construction documents, further explained the valuable role the detailed cost estimate has in the design process. This literature review illustrates that the detailed cost estimate is an accurate predictor of actual landscape construction costs. Therefore this review contributes to the field of landscape architecture, an understanding of how the detailed cost estimate is an important part of the design process, as well as a powerful tool to manage overall cost and budget adherence.

# Chapter 3

# Research Methods

## 3.1 Introduction

This research is about detailed cost estimating, which is the process of accurately predicting the final cost of installing a landscape through quantitative analysis. This chapter will explain why it was necessary for this study to employ strategies that collected data for the purpose of preparing an analysis of the responses from various individuals on the construction teams. An online survey was given to construction teams made up of: project owners, landscape architects and prime contractors. Additionally, descriptive observations of construction data unique to each project were made. When possible, secondary documents, such as notes and construction details, were considered sources of contributable data. Using the feedback provided by the construction team members, the research evaluated the level of accuracy, and importance, of the detailed cost estimate perceived by landscape architects.

## 3.2 Methodological Approach

### *3.2.1 Limits and Limitations*

This study invited landscape architects who are familiar with submitting Requests for Proposals (RFP) to participate in an online survey. RFP's provide the construction documents the contractors use in determining construction costs. RFP's may also include additional sources of data including conceptual model drawings and construction specifications. Also invited to participate in this study's online survey were prime general contractors, and project owners. These individuals are familiar with detailed cost estimating and share an obligation of controlling construction costs on behalf of the owner. Therefore, the limits set on this study are as explained below.

The geographical limit sets a restriction that the projects must be located in the Dallas – Fort Worth metropolitan area. For projects to be considered by this study, a limit was set at a minimum budget of $25,000.00 for the landscape construction scope of work. This minimum dollar amount was set as a limit because projects that are at least this size typically have the team of professionals made up of at least one project owner, one landscape architect and a prime general contractor. Therefore each project listed below in figure 3.1, has a construction team made up by a project owner or their representative, a landscape architect and a prime contractor. The chronological limit was set to, at most, twelve months ranging from September 30, 2015, back to September 30, 2014, in which the owner received final proposals. This chronological limit was chosen because of the time limitation imposed via the completion date of this research. Due to these limits, a study group of seven projects were chosen, from a pool of forty-six perspective projects, as a representation of commercial development and construction projects; because they successfully satisfied all of the aforementioned limits as described in Figure 3.1. Figure 3.1 illustrates the comparison of the selected projects against the limits imposed by this study.

| | STUDY PROJECTS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| STUDY LIMITS | | A<br>Great Southwest Parkway Gateway | B<br>The Streat HUB Addition | C<br>Alliance Medical Center | D<br>First Choice Emergency Room | E<br>The Village at Main Street | F<br>Brain Performance Institute | G<br>First Baptist Medical |
| | Location | X | X | X | X | X | X | X |
| | Construction Estimate | X | X | X | X | X | X | X |
| | Construction Team | X | X | X | X | X | X | X |
| | Within Last Twelve Months | X | X | X | X | X | X | X |
| | Construction Documents | X | X | X | X | X | X | X |

Figure 3.1 Study Projects and Study Limits Comparison

| KEY | |
|---|---|
| X | Fits within limits |
| **Location** | Project must be located within DFW metroplx |
| **Construction estimate** | Project must be at least $25,000.00 in construction cost |
| **Construction Team** | Project must have at least one project owner, one landscape architect and one prime contractor on the team |
| **Within Last Twelve Months** | Project must have received some sort of cost estimate not more than twelve month from: September 30, 2015 |
| **Construction Documents** | Project must have items such as notes, specifications and bid instructions |

Figure 3.2 Projects and Study Limits Comparison Key

This study worked within limitations imposed by the challenge of collecting data, accessing public records and obtaining the target group of professional's contact information. The projects A through G, as listed in Figure 3.1, were found via proposal lead generation web-based services such as: BlueBook.com, iSqFt.com and public bid rooms such as those found in the Dallas City Hall. The projects in the group relied on different divisions of trade including structural, electrical, HVAC, and civil. What this means is that the different professions had to work together as a team in order to successfully build the project in a timely and profitable manner. This study focused on Division 2 of the MASTERSPEC AIA Master Systems list (1999) (AIA, 2002, page 294) which contains the AIA standards on specifications and covers the scope of landscape construction. This research also relied on information from the construction document packages specific to each project considered in the case study. For example the landscape construction specifications, landscape construction design notes, construction details, subcontractor notes and other factors related to estimating landscape construction costs were considered in the study. A further limitation of this research was the way it collected the quantitative data from the detailed cost estimate process especially when attempting to view the construction proposals owners received.

*3.2.1 Data Collection*

Because the objective of this research is to determine the benefits to landscape architects in receiving detailed cost estimates, this thesis analyzes the responses from project owners, landscape architects and finally prime contractors who have received detailed cost estimates prior to the project's construction and determines if they are more satisfied with the outcome of the project than clients who do not receive such estimates. This is important because the following professionals were involved in the design/build process of the project. Therefore, the study focuses on these groups of individuals, through an online survey to better determine the satisfaction level of those individuals that received detailed cost estimates compared to those that did not. The participants of the survey were asked to select the section that best described their professional field of practice, and only submit answers for that specific question set.

The sections contained some questions that were identical in the other two sections, and some unique profession specific questions unique were placed into their respective section. The professionals sampled in this study were:

- Project owners and their representatives, who specialize in assembling construction teams made up of professionals each with a specific scope of work related to the construction needs of the project;
- Landscape architects, who are familiar with submitting construction documents for construction pricing and suggesting qualified prime general contractors;
- General contractors, who are familiar with issuing requests for proposals and disseminating construction documents to potential subcontractors.

This research studies the detailed cost estimation. According to Dell'Isola detailed cost estimating "…is different from a preliminary estimate of construction cost,

which is usually based on current area, volume, or similar conceptual estimating techniques. Generally, detailed cost estimating is appropriate when documentation is sufficient to properly measure and price individual items, usually during design development or construction documentation (Dell'Isola, 2003, page 1.") Two issues required consideration during the field observations. First, the MASTERSPEC division and specifications guidelines were reviewed to verify they were applicable to the project site. Second, the construction documents were reviewed to determine that they supplied sufficient information to properly measure and price individual line items.

The research data collection procedure for the descriptive observation portion for this study is as follows:

- Examine, catalog and determine themes that evolve from the study of construction documents to provide insight into how drawings, notes, instructions and specifications effect actual construction cost;
- Perform descriptive observations and record construction cost attributes of the diagrammatic plans found in both physical and online bidding rooms, as well as zoning and permitting departments from various municipalities located in the Dallas-Fort Worth area. Methods of data collection include note taking, photographs via a smartphone camera and capturing images via screenshots from a personal computer connected to the worldwide web;
- Collect, catalog and use a form of descriptive study known as 'ethnography' (Stewart, 1995, page 135) to compare the data from observations, and the survey answers to determine trends and themes. According to Taylor, "In ethnographies, researchers try to paint a picture of what people say and how they act in their everyday lives. Descriptive

ethnographies are marked by minimal interpretation and conceptualization (Taylor, 1998, page 135.")

3.2.1.1 Descriptive Observation

This research relies on descriptive observation and uses this strategy to collect data. According to Deming, descriptive observation, as part of the overall case study strategy, is a "complex multifaceted investigation into a particular place to help "achieve explanatory value. The value of this method is that it "narrows and focuses the investigation (Deming, 2011, page 65.") This is important because it gives the researcher a better understanding of the issues. This study does not employ the entire case study process as described by Deming, instead uses the descriptive observation strategy, which is a key component of the case study process, to collect data. This method was chosen because it works well for collecting and analyzing these data that could not be altered by the researcher.

3.2.1.2 Survey

The primary goal of this study is to understand how accurately the detailed cost estimating process help landscape architects forecast construction costs. This study examines the role of landscape architects in providing detailed cost estimates to their clients as a deliverable during the design process. Therefore, survey questions using both multiple choice questions with the Likert scale and open-ended questions, specific to each of the individual professions represented on the construction team were sent out via email. Upon review and approval by the Institutional Review Board, the email message sent after the participant's acceptance of the informed consent included a link to the online version of the survey posted on the University of Texas at Arlington's QUALTRICS website. Specifically, a set of questions specific to owners where directed to owners only, while a set of questions specific to landscape architects and finally a set of questions

specific to prime contractors were sent out via the online survey in this research. Therefore, this was the method employed in order to learn and understand the importance of the detailed cost estimate from the viewpoint of the individual's professional insight and in accordance with their experiences.

3.2.1.3 Study Population

Project owners, landscape architects, and prime general contractors were chosen in a select sampling from different large scale commercial landscape development projects in the Dallas-Fort Worth metropolitan area, put out to bid, within the twelve month period ranging from September 30, 2015 back to September 30, 2014. This sampling allowed the researcher to obtain a diversity of insights and individual experience. In addition to select sampling, the researcher utilized 'snowball sampling (Taylor, 1998, page 7,) which is a sampling technique used to recruit future participants based on existing participants' referrals. The snowball sampling allowed the researcher to gather more accurate information from individuals that were directly involved in the development of similar projects. The participants were anonymous and the survey responses were deleted after the presentation of these findings.

3.2.1.4 Survey Questions

The survey questions were developed in order to examine if detailed cost estimating accurately forecast construction costs by comparing the responses of the individuals who have received detailed cost estimates with those who have not. The survey includes both closed and open ended questions. The survey is broken into three specific sections and are listed in Appendix B: Survey Questions. Survey questions were submitted to the Institutional Review Board (IRB) located in the Office of Research Integrity and Compliance on the University of Texas at Arlington campus. An introduction

of the research was enclosed along with a list of the questions as listed below, and attached, in its entirety including response choices, as appendix B to this study.

**A. Questions for Owners**

**a. Importance of the detailed cost estimate**

i. On projects with landscape construction, how important was it that you received a detailed cost estimate in order to obtain third party financing?

ii. On projects with landscape construction, how important was it that you received a detailed cost estimate in order to self-finance?

**b. Acquisition of the detailed cost estimate**

i. Which one of the following best describes who you typically acquire detailed cost estimates form?

**c. Benefit to customer of detailed cost estimate**

i. Requests for detailed cost estimates should be considered a separate billable service?

ii. Are you willing to pay an extra fee to receive detailed cost estimates?

**d. Accuracy of the detailed cost estimate**

i. Detailed cost estimates you've received were accurate forecasts of the project's actual costs?

ii. What is your level of confidence that detailed cost estimates are more accurate than other forms of cost estimating?

iii. Do you think that actual costs were more accurate on projects where the detailed cost estimate process was used compared to those that weren't?

**Additional information**

Is there something else you'd like to say about your experiences with detailed cost estimates? Please explain:

**B. Questions for Landscape Architects**

**a. Importance of the detailed cost estimate**

i. Do you request detailed cost estimates as a part of your landscape design process?

Why is the detailed cost estimate important to your landscape design process?

**b. Acquisition of the detailed cost estimate**

i. Which one of the following best describes who you acquire detailed cost estimates from?

What stage of the design process do you request a detailed cost

ii. estimate?

**c. Benefit to customer of detailed cost estimate**

i. Providing the client with a detailed cost estimate should be considered

ii. a separate billable service?

iii. Does your firm bill its clients an extra fee for detailed cost estimates?

What prevents your firm from offering detailed cost estimates?

**d. Accuracy of the detailed cost estimate**

i. The detailed cost estimates you've received were accurate forecasts of the project's actual costs.

**Additional information**

Is there something else you'd like to say about your experiences with detailed cost estimates? Please explain:

**C. Questions for Prime Contractors**

**e. Importance of the detailed cost estimate**

i. Do you request detailed cost estimates as a part of your invitation to bid process?

What other forms of estimates do you accept?

**f. Acquisition of the detailed cost estimate**

i. Which one of the following best describes how you acquire detailed cost estimates for your projects?

**g. Benefit to customer of detailed cost estimate**

i. Providing the client with a detailed cost estimate should be considered a separate billable service?

ii. Does your firm bill its clients an extra fee for detailed cost estimates?

**h. Accuracy of the detailed cost estimate**

i. The detailed cost estimates you've received were accurate forecasts of the project's actual costs.

**Additional information**

Is there something else you'd like to say about your experiences with detailed cost estimates? Please explain:

## 3.3 Data Analysis

Collecting information provided by project owners, landscape architects and prime contractors via construction documents, field observations and answers from an online survey, this study determines the accuracy of detailed cost estimation as a construction cost tool for landscape architects. What this means is that this study determined the benefits for landscape architects in providing detailed cost estimates to their clients as a deliverable during the design process by employing descriptive observation and an online survey to collect data.

This study uses seven selected construction projects with a minimum budget of $25,000.00 in landscape installation, and completed within the 1 year chronological limit, from the Dallas-Fort Worth Metropolitan area as its focus group. Descriptive statistics and frequencies were used as the method of analysis for the online survey. The responses from project owners who are also considered as the 'clients' in this study, landscape architects, and finally prime contractors who received detailed cost estimates prior to the project were analyzed via the Descriptive statistics method. The frequencies determined the perceived accuracy by landscape architect of detailed estimates, and if they are more satisfied with the outcome of the project than clients who do not receive such estimates.

## 3.5 Summary

The objective of this study is to understand how accurately the detailed cost estimating process helps landscape architects forecast construction costs. This study utilizes descriptive observation and an online survey as research collection strategies in addition to note taking and gathering other supporting construction documentation. Collecting data from the projects studied in this research was the first step. Next was the descriptive observation that gave the researcher an understanding of the main attributes

of construction documents as well as the detailed cost estimate process. Following was the formulation and posting of the online survey via the University of Texas at Arlington's QUALTRICS website. Once 'live', the researcher invited potential participants identified as landscape practitioners with knowledge of the detailed cost estimate process.

Data from descriptive observation were developed separately from interviews and cataloged into groups as indicated in tables located in chapter 4 of this study. The data from the online survey, categorized by the three types of participants; based on profession, were read individually, compared and analyzed. The following chapter describes the process of analyzing data and findings.

# Chapter 4

# Analysis and Findings

## 4.1 Introduction

This chapter identifies how accurately the detailed cost estimating process help landscape architects forecast construction costs. Analysis of survey responses and the perceptions of professionals who made up a typical construction project team. Via the descriptive observation strategy confirmed the online survey results relative to detailed cost estimate attributes, especially in terms of importance to landscape architects as a tool to accurately forecast construction costs. In this study, out of thirty-four potential participants, five were successfully recruited, including one project owner, two landscape architects and two prime general contractors. The input from these participant's from the detailed cost estimate survey questions were compared and cataloged according to the set of profession specific survey questions they answered. Following the data collection process, the survey analysis evaluated the detailed cost estimate and considered other significant themes found from the answers to the survey questions. The findings helped identify the various degrees of importance explained by each of the participants, and as identified by the survey results. The analysis determined that the participants of this survey found the detailed cost estimate to be a valuable part of the design and construction process. Four themes became apparent by evaluating these data. These themes are: visibility; perception of accuracy; level of reliance on expertise; and value of data.

## 4.2 Descriptive Observation

The purpose for descriptive observation of the construction documents is to categorize the specifications and notes, typically provided by the landscape architect. These attributes provide deeper insights into the design intent of the landscape architect

and directly influences the project's construction cost. The following narrative discusses cost attributes in:

Title blocks;

Material lists;

Details;

Landscape notes;

General notes;

Landscape data;

Specifications.

*4.2.1 Title Block*

Title blocks from the seven projects were compared to one another in order to understand if these data provided information regarding attributes for the detailed cost estimate. The study of title blocks produced the following results, where 'X' indicates the project title block contained the attribute and a blank space indicates the project title block did not contain the attribute:

Contact Information provided;

Table 4-1 Title block analysis

| PROJECT | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| COMPANY NAME | X | X | X | X | X | X | X |
| COMPANY ADDRESS | X | X | X | X | X | X | X |
| COMPANY PHONE | X | X | X | X | X | X | X |
| COMPANY FAX | X | X | | X | X | X | X |
| COMPANY LOCATIONS | X | | | | | X | |
| COMPANY WEBSITE | | X | | | | X | |
| EMAIL ADDRESS | | X | | | | | |

According to the findings from Table 4-1, all seven landscape architects include their company name, company address and company phone number. However the vast majority don't list a company website or email address. This makes it difficult to use the internet to quickly research the landscape architecture firm, and to contact the landscape architect directly via email.

Professional landscape architect stamp present;

Table 4-2 Professional stamp analysis

| PROJECT | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| STAMP | X | X | X | X | | X | X |
| SIGNATURE | X | X | X | X | | X | X |
| DATE | X | | X | X | | X | X |

A majority of landscape architects considered in this research applied their professional stamp to the construction documents with only one not indicating a date in which the stamp was applied. Applying a date to construction documents is important to the accuracy of the detailed cost estimate because it indicates the point in time in which market based pricing took place.

Project title present;

Table 4-3 Project title analysis

| PROJECT | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| PROJECT NAME | X | X | X | X | X | X | X |
| PROJECT NUMBER | X | X | X | X | X | X | |
| PROJECT OWNER | | X | | X | | X | |
| PROJECT LOCATION | X | X | X | X | X | | X |
| PROJECT ADDRESS | | X | | X | | | |
| ISSUE DATE | X | X | X | X | | X | X |
| REVISIONS NOTE | | | | | | | |
| SHEET TITLE | X | | X | X | X | X | X |
| SHEET NUMBER | X | X | X | X | X | X | X |
| TOTAL SHEETS | | | | | | | |
| DESIGNED BY | X | | | | X | | |
| DRAWN BY | X | | X | X | X | X | X |
| REVIEWED BY | X | | | X | | X | X |

All seven projects contained a title block. An analysis of those title blocks found that landscape architects were consistent in their communication of project name, project number, project location, issue date, sheet title, sheet number and drawn by annotations. Information such as project owners, project address, revision notes total sheets and designed by annotations were found to be lacking. It is important to the detailed cost estimate that this information is present. For example, the address to the construction site is important because the physical address affects construction costs such as freight costs, deliveries and local labor allocation.

Table 4-4 Project design status

| PROJECT | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| FOR CONSTRUCTION | X | X | X | | | X | X |
| FOR PERMIT - NFC | | | | X | | | |
| 90% DESIGN DEVELOPMENT | | | | | X | | |

Project design status was present on all seven construction documents. This is important as it explains if the project design is complete enough to receive a final detail cost estimate. It is this final cost estimate that serves as an accurate prediction of actual construction costs for these projects.

Construction team contact information clearly presented;

Table 4-5 Construction team contact information analysis

| PROJECT | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| PROJECT OWNER | | X | | X | | X | |
| LANDSCAPE ARCHITECT | X | X | X | X | X | X | X |
| PRIME CONTRACTOR | X | | X | X | X | | |

It is apparent the project owners of the project wished not to be identified as a source of contact. The three that were listed on the construction documents appeared to be public entities such as department of transportation work and hospital work. Landscape architects listed contact information in all seven projects.

*4.2.2 Materials List*

Materials lists for the seven projects were compared to one another in order to understand if these data provided information regarding detailed cost estimate attributes. The study of these material lists produced the following results where 'X' indicates that the project material list contained the attribute and a blank space indicates the project title block did not contain the attribute:

Table 4-6 Material list analysis

| PROJECT | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| SYMBOL GRAPHIC | X | | X | X | X | | X |
| KEY | X | | X | | | X | X |
| COMMON NAME | X | X | X | X | X | X | X |
| SCIENTIFIC NAME | X | X | X | X | X | X | X |
| SIZE | X | X | X | X | X | X | X |
| REMARKS | X | | X | | | | X |
| QUANTITY | | X | X | X | X | X | X |
| SPECIFICATION | | X | | X | X | | |
| CONTAINER SIZE | | X | X | X | X | | X |
| DESCRIPTION | | | | X | | | |
| SPACING | X | X | X | X | | X | X |
| | | | | | | | |
| | | | | | | | |

Landscape architects were consistent in providing information for the material in line attributes such as: common name; scientific name; size; quantity; and spacing. They were also consistent in failing to provide specific information such as: key; remarks; and a description. This information is important to detailed cost estimating because it provides the detail necessary to better understand the landscape architect's design intent.

### 4.2.3 Details

Details from the seven projects were compared to one another in order to understand if these data provided information regarding the attributes for the detailed cost estimate. The study of these details produced the following results where 'X' indicates the details contained attributes considered by the detailed cost estimate method and a blank space indicates the project details did not contain the attribute:

Table 4-7 Project details analysis

| PROJECT | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| PLAN VIEW DETAILS | X | | | | X | | X |
| SECTION VIEW DETAILS | | | X | X | X | | X |
| CURVED BED LAYOUT | X | | | | | | |
| PLANT SPACING DIAGRAM | X | | | | | | |
| TREE PLANTING | | | X | X | X | | X |
| TREE STAKING | | | X | | X | | X |
| PLANTING ON A SLOPE | | | X | | | | |
| SHRUB/GROUNDCOVER | | | X | X | X | | X |
| TREE PROTECTION | | | X | | X | | |
| POOR DRAINAGE CONDITION | | | X | | X | | X |
| PARKING SPACE/CURB | | | X | | | | |
| PLANTS AT ISLANDS | | | | | X | | X |
| BED EDGING | | | X | | X | | X |
| ENLARGEMENTS | | | | | | | X |

Detail drawings are an important source of detailed information for the detailed cost estimate. This information is used to further determine cost factors such as labor costs, delivery charges and local market availability of materials. Every detail not

explicitly mentioned in the construction documents allows for bias and assumptions to be introduced into the detailed cost estimate.

*4.2.4 Landscape Notes*

Landscape notes for the seven projects were compared to one another in order to understand how these data provide information regarding the attributes for the detailed cost estimate. The study of these landscape notes produced the following results where 'X' indicates the details contained attributes considered by the detailed cost estimate method and a blank space indicates the project's landscape notes did not contain the attribute:

Table 4-8 Landscape notes analysis

| PROJECT | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| TEMPORARY IRRIGATION | X | | | | X | | |
| CITY SPECIFIC NOTES | | X | X | X | X | | X |
| GENERAL NOTES | | X | | X | X | X | |
| EXISTING TREE DATA | | X | X | | X | X | X |
| LANDSCAPE DATA | | X | | X | | | |
| PROPERTY INFORMATION | | | X | X | X | | |
| TREE PRESERVATION/MITIGATION | | X | X | | X | X | |
| PARKING AREA CALCULATIONS | | | | X | | | |
| FULFILLMENT OF REQUIREMENTS | | | | | | | |
| PLANTING NOTES | X | | | | X | | X |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

An analysis of the landscape notes produced findings that helped this research determine the accuracy of the detailed cost estimate. For example, the information provided by the city specific notes attribute provides the exact cost for the environmental impact fees the city will charge the project for connecting to its storm water system.

*4.2.5 Specifications*

Specifications for the seven projects were compared to one another in order to understand how these data provide information regarding attributes for the detailed cost estimate. The study of these specifications produced the following results where 'X' indicates the details contained attributes considered by the detailed cost estimate method and a blank space indicates the project's specifications did not contain the attribute. An analysis of the specifications found that the landscape architects in this study group do not follow a profession wide protocol in terms of including information for items that typically found in all seven projects. The most consistent attribute found among the group was maintenance. A majority of the projects failed to provide detailed information on, considerably fundamental landscape construction elements, such as tree planting.

Table 4-9 Project specifications analysis

| PROJECT | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| SCOPE OF WORK | | | X | | X | | |
| PROTECTION OF EXISTING STRUCTURES | | | X | | | | |
| PROTECTION OF EXISTING PLANTS | | | X | | | | |
| MATERIALS | | | X | | | | |
| SOIL MIXTURE | | | X | | | | |
| WATER | | | X | | | | |
| FERTILIZER | | | X | X | | | |
| MULCH | | | X | | | | |
| DIGGING AND HANDLING | | | X | | | | |
| CONTAINER GROWN STOCK | | | X | | | | |
| COLLECTED STOCK | | | X | | | | |
| NATIVE STOCK | | | X | | | | |
| MATERIALS LIST | | | X | | | | |
| FINE GRADING | | | X | | | | |
| PLANTING PROCEDURES | | | X | | | | X |
| LAWN SODDING/SEEDING | | | X | | | | |
| CLEANUP | | | X | | | | X |
| PLANT MATERIAL MAINTENANCE | | | X | | | | |
| MAINTENANCE | | | X | X | X | X | X |
| FINAL INSPECTION/ACCEPTANCE | | | X | | | | |
| WARRANTY | | | X | | X | | |
| SOIL PREPARATION | | | | | X | | |
| MISCELLANEOUS MATERIALS | | | | | X | | |
| CONDITION OF SURFACES | | | | | X | | |
| TREE PLANTING | | | | | X | | X |
| SHRUB PLANTING | | | | | X | | |
| GROUNDCOVER PLANTING | | | | | X | | |
| SEASONAL COLOR PLANTING | | | | | X | | |
| JOB CONDITIONS | | | | | X | | |
| EMERGENCIES | | | | | | | X |
| IRRIGATION SYSTEM | | | | X | | | |
| QUALITY ASSURANCE | | | | | X | | X |
| SODDING | | | | | X | | |
| SUBMITTALS | | | | | X | | X |
| EDGING | | | | | | | X |

## 4.3 Survey Analysis

The online survey of participants are listed in the question format (Appendix B) in accordance with the three professions represented in this study. By evaluating the responses of this study's participants, the research determines that construction costs were in fact accurately predicted by the detailed cost estimation process. Additionally, the responses between this study's participants who received detailed cost estimates prior to the project are compared to the responses of those who did not receive these estimates. Using the feedback provided by project owners, landscape architects and prime contractors, the study compares the perceived level of accuracy as well as its importance, of the detailed cost estimate to landscape architects. These combination, classification and interpretation of different sources of data are good candidates for this type of descriptive observation research strategy.

### *4.3.1 Participants' Profiles*

As discussed in Chapter Three, to understand the individual's perspectives of the detailed cost estimate attributes more clearly, the online survey participants were selected in terms of three profession oriented groups. Project owners, landscape architects, and prime general contractors were chosen in a select sampling from different large scale commercial landscape development projects in the Dallas-Fort Worth metropolitan area, that have received bids within the last twelve months. The snowball sampling technique was also used in an effort to recruit additional participants by asking participants of this study to suggest professionals who were knowledgeable about the Dallas – Fort Worth metropolitan's landscape construction market. The researcher sought to find participants to share their knowledge about the detailed cost estimate and who could provide deeper insight. Invitations to participate in an online survey went out to thirty-four candidates via e-mail and once they returned to the researcher a signed

consent form, a link to the survey was sent to them that allowed twenty-four hour a day access from October 22, 2015 to November 8, 2015, including weekends. In this study, out of thirty-four potential participants, five were successfully recruited, including one project owner, two landscape architects and two prime general contractors.

### *4.3.2 Project Owners*

#### 4.3.2.1 Importance of the Detailed Cost Estimate

The importance of the detailed cost estimate are based on the participants' response to survey question O-Q1, "On projects with landscape construction, how important was it that you received a detailed cost estimate in order to obtain third party financing?" And question O-Q2, "On projects with landscape construction, how important was it that you received a detailed cost estimate in order to self-finance?" Question O-Q1 is intended to help the researcher understand the role the detailed cost estimate has in helping project owners obtain financing from financial sources such as banks for example. Question O-Q2 is intended to help the researcher understand the role the detailed cost estimate has in helping project owners determine if they should invest their own holdings into the project, or not. Both questions asked the participant to select one of the following answer choices: very important; somewhat important; neutral. Somewhat unimportant or; not important.

Table 4-10 Project owners' responses to survey question O-Q1

| | Question | Answers Choices | PO1 | Subtotal |
|---|---|---|---|---|
| O-Q1 | On projects with landscape construction, how important was it that you received a detailed cost estimate in order to obtain third party financing? | Extremely Important | 1 | 1 |
| | | Very Important | 0 | 0 |
| | | Neither Important nor Unimportant | 0 | 0 |
| | | Very Unimportant | 0 | 0 |
| | | Not at all Important | 0 | 0 |
| | | Total | | 1 |

Table 4-11 Project owners' responses to survey question O-Q2

| | Question | Answer Choices | PO1 | Subtotal |
|---|---|---|---|---|
| O-Q2 | On projects with landscape construction, how important was it that you received a detailed cost estimate in order to self-finance? | Extremely Important | 1 | 1 |
| | | Very Important | 0 | 0 |
| | | Neither Important nor Unimportant | 0 | 0 |
| | | Very Unimportant | 0 | 0 |
| | | Not at all Important | 0 | 0 |
| | | Total | | 1 |

Project owner one (PO1) selected 'extremely important' for question O-Q1. This indicates that the project owner finds the detailed cost estimate invaluable in obtaining third party financing. Only one project owner, out of five who were invited, volunteered to participate in this study. PO1 also found detailed cost estimates 'extremely important' for consideration of self-financing a project's construction. O-Q1 was assigned a score scale of one to five, where the answer, 'not at all important' has a score of one and 'extremely

important' is score five. O-Q1 received a total score of five. O-Q2 also received a total score of five.

4.3.2.2 Acquisition of the Detailed Cost Estimate

How project owners acquire their detailed cost estimates are based on the participants' response to survey question O-Q3, "Which one of the following best describes who you typically acquire detailed cost estimates form?" Question O-Q3 is intended to to help the researcher understand who project owners sought detailed cost estimates from. Project owners were asked to select from one of the following answer choices: not applicable; from and architect; from a landscape architect; from the price general contractor; from professional estimating organizations; from the trade specific subcontractor; other. Please explain.

Table 4-12 Project owners' responses to survey question O-Q3

| | Question | Answer Choices | PO1 | Subtotal |
|---|---|---|---|---|
| O-Q3 | Which one of the following best describes who you typically acquire detailed cost estimates form? | Not applicable | 0 | 0 |
| | | From an architect | 0 | 0 |
| | | From a landscape architect | 0 | 0 |
| | | From the prime general contractor | 1 | 1 |
| | | From professional estimating organizations | 0 | 0 |
| | | From the trade specific subcontractor | 0 | 0 |
| | | Other, please explain: | 0 | 0 |
| | | Total | | 1 |

PO1 typically receives their detailed cost estimates from the prime general contractor. This indicates that the project owner relies on a member of the construction team for accurate forecasts of construction costs.

4.3.2.3 Benefit to Customer of Detailed Cost Estimate

The perceived benefits of using detailed cost estimates are based on participants' response to survey questions O-Q4, "Requests for detailed cost estimates should be considered a separate billable service?" And question O-Q5, "Are you willing to pay an extra fee to receive detailed cost estimates?" Question O-Q4 is intended to help the researcher understand if there are any perceived benefits for project owners receiving detailed cost estimates as separate service aside from the various other services landscape architects provide, such as construction management for example. Question O-Q5 is intended to help the researcher understand if the project owner finds enough value in the detailed cost estimate to pay an additional fee for it.

Table 4-13 Project owners' responses to survey question O-Q4

| | Question | Answer Choices | PO1 | Subtotal |
|---|---|---|---|---|
| O-Q4 | Are you willing to pay an extra fee to receive detailed cost estimates? | Strongly Disagree | 0 | 0 |
| | | Disagree | 0 | 0 |
| | | Neither Agree nor Disagree | 0 | 0 |
| | | Agree | 0 | 0 |
| | | Strongly Agree | 1 | 1 |
| | | Total | | 1 |

Table 4-14 Project owners' responses to survey question O-Q5

| | Question | Answer Choice | PO1 | Subtotal |
|---|---|---|---|---|
| O-Q5 | Are you willing to pay an extra fee to receive detailed cost estimates? | When suggested by the architect | 0 | 0 |
| | | When suggested by the landscape architect | 0 | 0 |
| | | I typically decline the detailed cost estimate service | 0 | 0 |
| | | I'm typically provided the detailed cost estimate free of charge | 0 | 0 |
| | | I typically request the detailed cost estimate service expecting to be charged | 1 | 1 |
| | | Total | | 1 |

According to their response to question O-Q4, PO1 'strongly agrees' the detailed cost estimate is valuable enough to warrant an additional fee. This suggests that PO1 finds a significant value for obtaining a great deal of detailed data on those attributes that contribute to an accurate forecast of construction costs and budget control. This determination is further reinforced with PO1's response to question O-Q5 where they indicate that they "typically request the detailed cost estimate expecting to be charged" an additional fee. O-Q4 was assigned a score scale of one to five, where the answer, 'strongly disagree' has a score of one and the answer 'strongly agree' has a score of five. O-Q4 received a total score of five.

#### 4.3.2.4 Accuracy of the Detailed Cost Estimate

The perceived accuracy of the detailed cost estimate is based on the participants' response to survey question O-Q6, "Detailed cost estimates you've received were accurate forecasts of the project's actual costs." And question O-Q7, "What is your level of confidence that detailed cost estimates are more accurate than other forms of

cost estimating?" And also question O-Q8, "Do you think that actual costs were more accurate on projects where the detailed cost estimate process was used compared to those that weren't?" The intention of question O-Q6 is to determine the level of agreement the project owner has with detailed cost estimates being accurate forecasts of construction costs. The intention of question O-Q7 is to determine the project owners' confidence level regarding the accuracy of the detailed cost estimate when compared with other types of cost estimating methods. Question O-Q8 intended to determine if project owners notice a difference between their projects that received detailed cost estimates and their projects that had not received such estimates.

Table 4-15 Project owners' responses to survey question O-Q6

| | Question | Answer Choices | PO1 | Subtotal |
|---|---|---|---|---|
| O-Q6 | Detailed cost estimates you have received were accurate forecasts of the project's actual costs. | Strongly Disagree | 0 | 0 |
| | | Disagree | 0 | 0 |
| | | Neither Agree nor Disagree | 1 | 1 |
| | | Agree | 0 | 0 |
| | | Strongly Agree | 0 | 0 |
| | | Total | | 1 |

Table 4-16 Project owners' responses to survey question O-Q7

| | Question | Answer Choices | PO1 | Subtotal |
|---|---|---|---|---|
| O-Q7 | What is your level of confidence that detailed cost estimates are more accurate than other forms of cost estimating? | Very confident | 0 | 0 |
| | | Somewhat confident | 1 | 1 |
| | | Neutral | 0 | 0 |
| | | Somewhat not confident | 0 | 0 |
| | | Not confident | 0 | 0 |
| | | Total | | 1 |

Table 4-17 Project owners' responses to survey question O-Q8

| | Question | Answer Choices | PO1 | Subtotal |
|---|---|---|---|---|
| O-Q8 | Do you think that actual costs were more accurate on projects where the detailed cost estimate the detailed cost estimate process was used compared to those that were not? | Not applicable | 0 | 0 |
| | | Yes | 0 | 0 |
| | | Neutral | 0 | 0 |
| | | No | 1 | 1 |
| | | I notice no difference | 0 | 0 |
| | | Total | | 1 |

Regarding question O-Q6, PO1 would neither agree nor disagree that detailed cost estimates are better at forecasting construction costs when compared to other cost estimating tools they may have used. This indicates that PO1 isn't convinced that the detailed cost estimate is indeed the best tool for accurately forecasting construction costs. This assessment is further confirmed by PO1's reply to O-Q7 where they were

‘somewhat confident’ that detailed cost estimates are more accurate than other forms of cost estimation. Finally, PO1 replied ‘no’ to question O-Q8. This indicates that this project owner may have experienced where other forms of cost estimation produced equal or better results when compared to detailed cost estimates. O-Q6 was assigned a score scale of one to five, where the answer, ’strongly disagree’ has a score of one and ‘strongly agree’ is score five. Question O-Q6 received a total score of 3. Question O-Q7 was assigned a score scale of one to five, where the answer, ’not confident’ has a score of one and ‘very confident’ has a score of five. Question O-Q7 has a total score of three.

4.3.2.5 Additional Experiences

The participants who answered the project owner question set were also presented with question O-Q9, “Is there something else you’d like to say about your experiences with detailed cost estimates?” The intention of question O-Q9 is to allow the project owner to share their individual experience and perceptions about the detailed cost estimate.

Table 4-18 Project owners’ responses to survey question O-Q9

| | Question | Answer Choices | PO1 | Subtotal |
|---|---|---|---|---|
| O-Q9 | Is there something else you'd like to say about your experiences with detailed cost estimates? | Please explain: | 1 | 1 |
| | | Total | | 1 |

Given PO1’s responses to the previous eight questions, this study would have benefited from their insight and individual experience as allowed by question O-Q9. However, due to technical issues, the project owner’s response failed to display properly.

*4.3.3 Landscape Architects*

4.3.3.1 Importance of the Detailed Cost Estimate

The importance of the detailed cost estimate are based on the participants' response to survey questions LA-Q1, "Do you request detailed cost estimates as a part of your landscape design process?" And LA-Q2, "Why is the detailed cost estimate important to your landscape design process?" The intention of question LA-Q1 is to determine if the landscape architect considers the detailed cost estimate important enough to implement into the design process. The landscape architect is asked to select one of the following questions: not applicable; yes, for all projects; yes, but not for all projects; almost never; and not at all. Question LA-Q2 allows the landscape architect to explain why they find detailed cost estimates an important part of the design process, or not.

Table 4-19 Landscape architects responses to survey question LA-Q1

| Question | Answer | LA1 | LA2 | Subtotal |
|---|---|---|---|---|
| Do you request detailed cost estimates as a part of your landscape design process? | Not applicable | 0 | 0 | 0 |
| | Yes, for all projects | 0 | 0 | 0 |
| | Yes, but not for all projects | 1 | 1 | 2 |
| | Almost never | 0 | 0 | 0 |
| | Not at all | 0 | 0 | 0 |
| | Total | | | 2 |

Table 4-20 Landscape architects responses to survey question LA-Q2

| | Question | Answer Choices | LA1 | LA2 | Subtotal |
|---|---|---|---|---|---|
| LA-Q2 | Why is the detailed cost estimate important to your landscape design process? | Please explain: | 1 | 1 | 2 |
| | | Total | | | 2 |

2

2

The importance of the detailed cost estimate are based on landscape architects responses to survey questions LA-Q1 AND LA-Q2. Landscape architect one (LA1) and landscape architect two (LA2) both imply that for question LA-Q1, the detailed cost estimate is a valuable part of their landscape design process. LA1 explains why the detailed cost estimate is important to their design process in their response to question LA-Q2, “Both to see where the contractor's cost are and for the client in the event of adds or deductions to the bid.” This has meaning because it indicates that the detailed cost estimate accurately forecasts the cost for construction and helps the client to control construction costs. LA2 states that they find detailed cost estimates are important because “Owners have budgets. We have to meet them for a successful job.” This implies that this landscape architect in particular depends on various attributes of detailed cost estimates to successfully meet client budget expectations. LA-Q1 was assigned a score scale of one to five, where the answer, ’not at all’ has a score of one and ‘yes for all projects’ is score five. Question LA-Q1 has a total score of six.

4.3.3.2 Acquisition of the Detailed Cost Estimate

The ways landscape architects acquire their detailed cost estimates are determined by the participants’ response to survey questions LA -Q3, “Which one of the following best describes who you acquire detailed cost estimates from?” and LA-Q4, “What stage of the design process do you request a detailed cost estimate?” Question

LA-Q3 is intended to to help the researcher understand who landscape architects sought detailed cost estimates from. Landscape architects were asked to select from one of the following answer choices: not applicable; from a specialist within the firm; from the prime general contractor; from professional estimating organizations; from the trade specific subcontractor; and other; where the participant was allowed to fill in their own answer. Question LA-Q4 is intended to to help the researcher understand the stage of the design process landscape architects decide to request a detailed cost estimate from their source.

Table 4-21 Landscape architects responses to survey question LA-Q3

| | Question | Answer Choices | LA1 | LA2 | Subtotal |
|---|---|---|---|---|---|
| LA-Q3 | Which one of the following best describes who you acquire detailed cost estimates from? | Not applicable | 0 | 0 | 0 |
| | | From a specialist within the firm | 0 | 0 | 0 |
| | | From the prime general contractor | 1 | 1 | 2 |
| | | From professional estimating organizations | 0 | 0 | 0 |
| | | From the trade specific subcontractor | 0 | 0 | 0 |
| | | Other. Please explain: | 0 | 0 | 0 |
| | | Total | | | 2 |

Table 4-22 Landscape architects responses to survey question LA-Q4

| | Questions | Answer Choices | LA1 | LA2 | Subtotal |
|---|---|---|---|---|---|
| LA-Q4 | What stage of the design process do you request a detailed cost estimate? | Never | 0 | 0 | 0 |
| | | 50% | 0 | 0 | 0 |
| | | 75% | 0 | 0 | 0 |
| | | 90% | 0 | 1 | 1 |
| | | 100% | 1 | 0 | 1 |
| | | Other. Please explain: | 0 | 0 | 0 |
| | | Total | | | 2 |

Both LA1 and LA2 selected “From the prime general contractor” as their answer to question LA-Q3. This implies that these landscape architects rely on other members of the construction team to provide these data necessary in order to stay within a budget. LA1 requests a detailed cost estimate at the 100% mark of the design process, whereas LA2 requests a detailed cost estimate at 90%. This implies that landscape architects request detailed cost estimates at a relatively late stage of the design process.

4.3.3.3 Benefit to Customer of Detailed Cost Estimate

The benefits of the detailed cost estimate are based on the participants’ response to survey questions LA-Q5, “Providing the client with a detailed cost estimate should be considered a separate billable service?”, question LA-Q6, “Does your firm bill its’ clients an extra fee for detailed cost estimates? And question LA-Q7, “What prevents your firm from offering detailed cost estimates?” Question LA-Q5 is intended to help the researcher understand if there are any perceived benefits for landscape architects receiving the detailed cost estimate as separate service aside from the various other services landscape architects provide, such as: value analysis; engineering; or management for example. Question LA-Q6 is intended to help the researcher understand

if the landscape architect finds enough value in the detailed cost estimate to justify paying an additional fee to receive it. Question LA-Q7 allows the landscape architect to share their experiences and hindrances regarding offering the detailed cost estimate to the client as as separate billable service.

Table 4-23 Landscape architects responses to survey question LA-Q5

| | Question | Answer Choices | LA1 | LA2 | Subtotal |
|---|---|---|---|---|---|
| LA-Q5 | Providing the client with a detailed cost estimate should be considered a separate billable service? | Strongly Disagree | 0 | 0 | 0 |
| | | Disagree | 0 | 1 | 1 |
| | | Neither Agree nor Disagree | 0 | 0 | 0 |
| | | Agree | 1 | 0 | 1 |
| | | Strongly Agree | 0 | 0 | 0 |
| | | Total | | | 2 |

Table 4-24 Landscape architects responses to survey question LA-Q6

| | Question | Answer Choices | LA1 | LA2 | Subtotal |
|---|---|---|---|---|---|
| LA-Q6 | Does your firm bill its clients an extra fee for detailed cost estimates? | Not applicable | 0 | 0 | 0 |
| | | Cost estimating is included in our base price | 0 | 1 | 1 |
| | | We offer detailed cost estimating for an additional fee | 1 | 0 | 1 |
| | | We don't offer detailed cost estimating | 0 | 0 | 0 |
| | | Other. Please explain: | 0 | 0 | 0 |
| | | Total | | | 2 |

Table 4-25 Landscape architects responses to survey question LA-Q7

| | Question | Answer Choices | LA1 | LA2 | Subtotal |
|---|---|---|---|---|---|
| LA-Q7 | What prevents your firm from offering detailed cost estimates? | Please explain: | 1 | 1 | 2 |
| | | Total | | | 2 |

LA1 agrees with the premise of question LA-Q5 in providing the client with detailed cost estimates as a separate billable. However, LA2 disagreed with this premise. Of particular interest to this study is LA1, according to their response to question LA-Q6, offers detailed cost estimates as an additional billable service, while LA2 indicates that they're cost in providing this service is built into the base service cost. LA-Q5 was assigned a score scale of one to five, where the answer, 'strongly disagree' has a score of one and 'strongly agree' has a score of five. LA-Q5 has a total score of six.

4.3.3.4 Accuracy of the Detailed Cost Estimate

The perceived accuracy of the detailed cost estimate is based on the participants' response to survey questions LA-Q8, "The detailed cost estimates you've received were accurate forecasts of the project's actual costs." The intention of question LA-Q8 is to determine the project owners' confidence level regarding the accuracy of the detailed cost estimate when compared with other types of cost estimating methods.

Table 4-26 Landscape architects responses to survey question LA-Q8

| | Question | Answer Choices | LA1 | LA2 | Subtotal |
|---|---|---|---|---|---|
| LA-Q8 | The detailed cost estimates you have received were accurate forecasts of the project's actual cost. | Strongly Disagree | 0 | 0 | 0 |
| | | Disagree | 0 | 0 | 0 |
| | | Neither Agree nor Disagree | 0 | 0 | 0 |
| | | Agree | 1 | 1 | 2 |
| | | Strongly Agree | 0 | 0 | 0 |
| | | Total | | | 2 |

Both LA1 and LA2 agree with question LA-Q8. What this means is that they share a perception of the detailed cost estimate as an accurate forecast of construction costs. Question LA-Q8 was assigned a score scale of one to five, where the answer, ‘strongly disagree’ has a score of one and ‘strongly agree’, has a score of five. Question LA-Q8 has a total score of eight.

4.3.3.5 Additional Experiences

The participants who answered the landscape architect question set were presented with question LA-Q9, “Is there something else you’d like to say about your experiences with detailed cost estimates?” The intention of question LA-Q9 is to allow the landscape architect to share their individual experiences and perceptions about the detailed cost estimate and the importance it has for accurately forecasting construction cost.

Table 4-27 Landscape architects responses to survey question LA-Q9

| | Question | Answer Choices | LA1 | LA2 | Subtotal |
|---|---|---|---|---|---|
| LA-Q9 | Is there something else you'd like to say about your experiences with detailed cost estimates? | Please explain: | 1 | 0 | 1 |
| | | Total | | | 1 |

When presented with question LA-Q9, LA1 replied, “Prefer an estimate that uses unit prices that include markup and overhead.” By definition, the detailed cost estimate includes, among other attributes, unit pricing complete with markups and overhead items, such as labor burden and insurance bonds, as a part of its cost estimating process.

*4.3.4 Prime Contractors*

4.3.4.1 Importance of the Detailed Cost Estimate

The importance of the detailed cost estimate are based on the prime contractors’ response to survey questions PC-Q1, “Do you request detailed cost estimates as a part of your invitation to bid process?”, and PC-Q2, “What other forms of estimates do you accept? The intention of question PC-Q1 is to determine if the prime contractor considers the detailed cost estimate during the design process. Question PC-Q2 allows the prime contractor to share their individual experiences and perceptions for accepting alternative forms of cost estimates.

Table 4-28 Prime contractors' responses to survey question PC-Q1

| | Question | Answer Choices | PC-1 | PC-2 | Subtotal |
|---|---|---|---|---|---|
| PC-Q1 | Do you request detailed cost estimates as a part of your invitation to bid process? | Not applicable | 0 | 0 | 0 |
| | | Yes, for all projects | 1 | 0 | 1 |
| | | Yes, but not for all projects | 0 | 1 | 1 |
| | | Almost never | 0 | 0 | 0 |
| | | Not at all | 0 | 0 | 0 |
| | | Total | | | 2 |

Table 4-29 Prime contractors' responses to survey question PC-Q2

| | Question | Answer Choices | PC1 | PC2 | Subtotal |
|---|---|---|---|---|---|
| PC-Q2 | What other forms of estimates do you accept? | Please explain: | 1 | 1 | 2 |
| | | Total | | | 2 |

Prime contractor participant number one (PC1) response to PC-Q1, 'Yes, for all projects", indicated that they request detailed cost estimates for all bids. PC1's answer to PC-Q2, "T&M with hourly rates and material charges", indicates that this prime contractor also uses an alternate form of cost estimating known as 'Time and Material' where the contractor requests a sub-contractor's hourly labor charges and their unit material costs. What this means is that the sub-contractor must indicate how much the prime contractor will be charged for each type of labor and material used on the project. For example, a labor crew foreman hourly rate is $55.00 and a labor hourly rate is $45.00. Regarding materials, a 'per cubic yard of mulch installed' rate is $42.00 and a 'per square yard of solid sod installed' rate is $3.10, for example. PC-Q1 was assigned a score scale of one

to five, where the answer, 'not at all' has a score of one and 'yes for all projects' has a score of five. Question PC-Q1 has a total score of nine.

Prime contractor participant number two (PC2) response to PC-Q1, "Yes, but not for all projects", indicates they don't request detailed cost estimates on all of their projects that go out to bid. PC2's answer to PC-Q2, "Lump Sum, Quantity Breakdowns (ultimately, it's all relevant to the complexity and size of the project)", explains that this prime contractor uses specific attributes unique to each project as limits, such as project size, or complexity, in determining the method of cast estimation they want to receive

#### 4.3.4.2 Acquisition of the Detailed Cost Estimate

How prime contractors acquire their detailed cost estimates are based on the participants' response to survey question PC-Q3, "Which one of the following best describes who you typically acquire detailed cost estimates form?" Question PC-Q3 is intended to to help the researcher understand who prime contractors sought detailed cost estimates from. Prime contractors were asked to select from one of the following answer choices: not applicable; a specialist within the firm; from professional estimating organizations; from the trade specific subcontractor; and other, which allowed the prime contractor to explain their perceptions and individual experience.

Table 4-30 Prime contractors' responses to survey question PC-Q3

| | Question | Answer Choices | PC1 | PC2 | Subtotal |
|---|---|---|---|---|---|
| PC-Q3 | Which one of the following best describes how you acquire detailed cost estimates for your projects? | Not applicable | 0 | 0 | 0 |
| | | From a specialist within the firm | 0 | 1 | 1 |
| | | From professional estimating organizations | 0 | 0 | 0 |
| | | From the trade specific subcontractor | 1 | 0 | 1 |
| | | Other, please explain: | 0 | 0 | 0 |
| | | Total | | | 2 |

PC1 choose 'From a trade specific subcontractor' as their answer to question PC-Q3. This implies that they either don't have an in-house specialist, or they simply don't have the desire to perform landscape construction scopes of cost estimation within the firm. PC2 replied, "From a specialist within the firm." This prime contractor apparently has an in-house resource in which to approach for detailed cost estimates for landscape construction scopes of work.

4.3.4.3 Benefit to Customer of Detailed Cost Estimate

The benefits of the detailed cost estimate are based on prime contractors' response to survey questions PC-Q4, "Providing the client with a detailed cost estimate should be considered a separate billable service?", and question PC-Q5, "Does your firm bill its' clients an extra fee for detailed cost estimates? Question PC-Q4 is intended to help the researcher understand the perceived benefits for prime contractors receiving the detailed cost estimate as separate service aside from the various other services they provide, such as construction consulting for example. Question PC-Q5 is intended to help

the researcher understand if the prime contractor finds enough value in the detailed cost estimate to justify paying an additional fee to receive it.

Table 4-31 Prime contractors' responses to survey question PC-Q4

| | Question | Answer Choices | PC1 | PC2 | Subtotal |
|---|---|---|---|---|---|
| PC-Q4 | Providing the client with a detailed cost estimate should be considered a separate billable service? | Strongly Disagree | 0 | 0 | 0 |
| | | Disagree | 1 | 1 | 2 |
| | | Neither Agree nor Disagree | 0 | 0 | 0 |
| | | Agree | 0 | 0 | 0 |
| | | Strongly Agree | 0 | 0 | 0 |
| | | Total | | | 2 |

Both PC1 and PC2 choose the answer 'Disagree' to survey question PC-Q4. This implies that prime contractors don't believe the time and effort used to put together a detailed cost estimate qualifies for additional billable service fee. Or they understand the amount of time and effort required to successfully build a detailed cost estimate for their projects and the 'fee' is already a part of their basic service to their clients. PC-Q4 was assigned a score scale of one to five, where the answer, 'strongly disagree' has a score of one and 'strongly agree' is score five. Question PC-Q4 has a total score of four.

Table 4-32 Prime contractors' responses to survey question 5

| | Question | Answer Choices | PC1 | PC2 | Subtotal |
|---|---|---|---|---|---|
| PC-Q5 | Does your firm bill its clients an extra fee for detailed cost estimates? | Not applicable | 0 | 0 | 0 |
| | | Cost estimating is included in our base price | 1 | 1 | 2 |
| | | We offer detailed cost estimating for an additional fee | 0 | 0 | 0 |
| | | We don't offer detailed cost estimating | 0 | 0 | 0 |
| | | Total | | | 2 |

Both PC1 and PC2 choose ‘Cost estimating is included in our base price’ for survey question 5. These responses indicate that prime contractors find value in providing their clients with detailed cost estimates.

4.3.4.4 Accuracy of the Detailed Cost Estimate

The perceived accuracy of the detailed cost estimate is based on the participants’ response to survey questions PC-Q6, “The detailed cost estimates you’ve received were accurate forecasts of the project’s actual costs.” The intention of question PC-Q6 is to determine the level of agreement the prime contractor has with detailed cost estimates being accurate forecasts of construction costs.

Table 4-33 Prime contractors’ responses to survey question PC-Q6

| | Question | Answer Choices | PC1 | PC2 | Subtotal |
|---|---|---|---|---|---|
| PC-Q6 | The detailed cost estimates you have received were accurate forecasts of the project's actual cost. | Strongly Disagree | 0 | 0 | 0 |
| | | Disagree | 0 | 0 | 0 |
| | | Neither Agree nor Disagree | 0 | 0 | 0 |
| | | Agree | 1 | 1 | 2 |
| | | Strongly Agree | 0 | 0 | 0 |
| | | Total | | | 2 |

Regarding this question about the perception of detailed cost estimates being accurate forecasts of actual project cost, both PC1 and PC2 ‘agreed’. What this means is that detailed cost estimates are valued for their ability to accurately predict a project’s actual cost. PC-Q6 was assigned a score scale of one to five, where the answer, strongly disagree’ has a score of one and ‘strongly agree’ has a score of five. Question PC-Q6 has a total score of eight.

4.3.4.5 Additional Experiences

Participants who answered the prime contractor question set were also presented with question PC-Q7, “Is there something else you’d like to say about your experiences with detailed cost estimates?” The intention of question PC-Q7 is to allow the landscape architect to share their individual experiences and perceptions about the detailed cost estimate and the importance, it has for accurately forecasting construction cost.

Table 4-34 Prime contractors’ responses to survey question PC-Q7

| | Question | Answer Choices | PC1 | PC2 | Subtotal |
|---|---|---|---|---|---|
| PC-Q7 | Is there something else you would like to say about your experiences with detailed cost estimates? | Please explain: | 1 | 1 | 2 |
| | | Total | | | 2 |

PC1 presented the following as their response to question PC-Q7, “Estimating is based on a thorough understanding of the the job and the expectations of the client. This is why we walk each job with our subcontractors and communicate expectations as a GC and also expectations from the client. As a GC, it is very important to vet subs and their qualifications/ quality.” PC1 finds value in asking for detailed cost estimates because the process clearly explains the expectations of the owner and the client. PC1 explains further that there is additional value in hiring on subcontractors who are qualified to install quality construction as determined by the detailed cost estimate process.

PC2 stated that detailed cost estimates are valuable to their firm because the process is a “Good way of finding out if the work is overpriced.” The implication here is

that this prime contractor uses the detailed cost estimate to compare prices among sub-contractors.

## 4.4 Themes of Value

The objective of this study sought to understand how accurately the detailed cost estimating process helps landscape architects forecast construction costs. This research uses quantative research methods to study detailed cost estimating to determine how accurately this estimating procedure forecast construction costs. Additionally, this study sought to determine the benefits for landscape architects in providing detailed cost estimates to their clients as a deliverable during the design process. The research recorded detailed cost estimation attributes on projects located in the Dallas – Fort Worth metropolitan area, based on descriptive observation and an online survey. The study also recorded these data, experience and perceptions provided by landscape practitioners. This analysis evaluates these data of the descriptive observation and the online survey, whereby the key attributes are abstracted into four broad themes. The four themes developed by both the descriptive observation and online survey portions of this study were: visibility; accuracy perception; expertise reliance; and value of data.

*4.4.1 Project Owners*

Table 4-35 Themes of value amongst project owners

| Project Owners | Data Source | Theme | Finding(s) |
|---|---|---|---|
| | Construction Documents | Low Visibility | Contact information non-existant or vague |
| | | | Virtually no input in terms of directions or expectations |
| | Detailed Cost Estimate | Moderate Accuracy Perception | Did not convey a strong belief that the detailed cost estimate was better at forecasting accurate construction costs |
| | | High Expertise Reliance | Relied heavily on other team members for these data for construction cost |
| | | High Value on Data | Considered valuable for both in-house and third party financing |
| | | | Willing to pay additional cost to acquire detailed cost estimate |

Regarding the project owner who participated in this study, the themes of value developed by an analysis of the findings indicate that he was absent from the contact information portion of the construction documents. Also, he had virtually no input in terms of providing directions or expectations of the detailed cost estimate. His perception of the accuracy of detailed cost estimates did not convey a strong belief it is the best tool for receiving accurate forecasts of construction costs. The project owner conveyed a high level of reliance on the expertise of professionals on the construction team and found the

data provided to him to be highly valuable; to the point where he is willing to pay an additional cost in order to receive accurate pricing.

*4.4.2 Landscape Architects*

Table 4-36 Themes of value amongst landscape architects

| Landscape Architects | Data Source | Theme | Finding(s) |
|---|---|---|---|
| | Construction Documents | High Visibility | Contact information clearly displayed |
| | | | Professional seal authorizes construction |
| | | | Authority in regards to directions and expectations |
| | | | Sets construction specifications |
| | Detailed Cost Estimate | High Accuracy Perception | Strong belief that detailed cost estimates are accurate forecasts of construction cost |
| | | | Seem to prefer detailed cost estimates over other forms of cost estimates |
| | | Low Expertise Reliance | Some reliance on other members of the costruction team to obtain construction costs |
| | | High Value on Data | Values data from qualified and quality sources |

Regarding the landscape architects that participated in this study, the themes of value developed by an analysis of the findings indicate the construction documents clearly and prominently their contact information and identified them as the authority to contact for questions regarding design intent and construction direction. Landscape architects believe that detailed cost estimates are accurate forecasts of construction

costs and seem to rely on them more than any other types of cost estimates. Lastly, landscape architects place a high level of value on receiving detailed cost estimates from reputable and qualified sources.

*4.4.3 Prime Contractors*

Table 4-37 Themes of value amongst prime contractors

| Prime Contractors | Data Source | Theme | Finding(s) |
|---|---|---|---|
| | Construction Documents | Moderate Visibility | Logo and contact information appears on every drawing sheet |
| | | | Acted as the middle-man between |
| | Detailed Cost Estimate | High Accuracy Perception | Very concerned with working within budget constraints set by project owner |
| | | | Typically sought detailed costs that included unit and labor costs along with markups |
| | | High Expertise Reliance | Reliant on sub-contractors for local market construction costs |
| | | | Willingness to 'shop' bids with different sub-contractors |
| | | High Value on Data | Values data from qualified and quality sources |

Prime contractors who participated in this study contribute data that, when analyzed, produced themes of value indicating that construction documents were important attributes to convey their involvement in the project and act as the liaison between the construction team members and sub-contractors. Detailed cost estimates

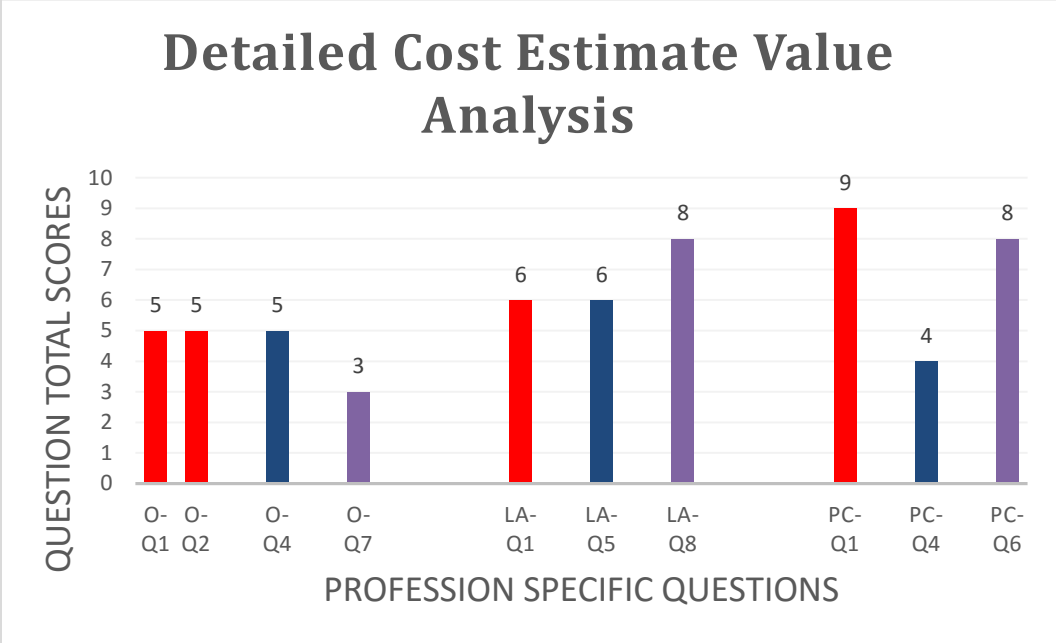
were important to general contractors because the estimates set the budget perimeters for the general contractors to adhere to. Also of high importance to general contractors is that the detailed cost estimate shows material unit and labor costs unique to the local market. Prime general contractors conveyed that they seek detailed cost estimates from multiple sources in order to compare competitive prices and have options within the local market.

## 4.5 Summary

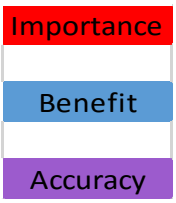
The findings from the analysis of the descriptive observation and online survey illustrates that the detailed cost estimate contains various levels of value for the three groups of professionals involved in this study. Landscape architects seem inclined to remove themselves from the construction cost estimating process of their designs, especially in regards to the more detailed specific types of cost estimating. They appear to not be interested in following the AIA's suggestion of providing the client with a cost estimate as soon as the design allows, let alone making an attempt in selling the detailed cost estimate as a separate billable service. Four themes were developed by the findings of both the descriptive observation and online survey portions of this study. The four themes are: visibility; accuracy perception; expertise reliance; and value of data. The following chapter explains the implications of the discovery of these themes, recommendations for further study and the conclusion of this research.

Table 5-1 illustrates the value analysis from comparing the answers from the three professions studied in this research. The graph illustrates that the project owner found some value, while landscape architects fell in the middle of the score curve, with prime contractors placing a relatively high value on the detailed cost estimate.

Table 4-38 Detailed cost estimate value to landscape practitioners' analysis




Themes of Value Key




The findings of this study contributed to the field of landscape architecture by collecting and cataloging these data whose analysis explains how the detailed cost estimate is used during the design process to control construction budget expectations and is an accurate construction cost forecasting tool.

Table 4-39 Total scores for the three professions

| **Total Scores** | |
|---|---|
| | |
| Owners | 18 |
| | |
| Landscape Architects | 20 |
| | |
| Prime Contractors | 23 |

# Chapter 5

# Conclusion

## 5.1 Introduction

This chapter discusses the findings of the descriptive observation and online survey strategies that were applied to score how accurately the detailed cost estimate helps landscape architects accurately forecast construction costs. The descriptive observation included a review of construction documents and secondary documents revealing the implications these data located on the title blocks, material lists, details, landscape notes and specifications have on the detailed cost estimate. The data from these five groups compared and combined in Chapter Four described how four themes – visibility, accuracy perception, expertise reliance, and value of data; emerged to answer the research questions:

1. Does the cost estimating process accurately forecast construction costs;
2. Is there a benefit to landscape architects in providing detailed cost estimating services to their client;
3. Are the apparent benefits of the detailed cost estimating process, as established in the literature review, actually realized by the participants involved in this study?

Participant's responses to the online survey were also considered in the determination of the aforementioned themes. This chapter also explains the relevance of these findings to the profession of landscape architecture as well as recommendations for further study.

## 5.2 Findings and Discussion

This section discusses this study's findings and explains how these findings are based on the four themes developed from construction documents, secondary

documentation and the online survey; especially as they relate directly to the research question presented in Chapter 1. Based on scores calculated from the survey questions, it is clear that the detailed cost estimate is a valuable tool to landscape architects because it is an accurate forecast of actual construction costs. What wasn't immediately clear was the fact that landscape practitioners were very reliant on either other members of the construction team, or outside third party sources, such as sub-contractors, for detailed cost estimates.

1. Does the cost estimating process accurately forecast construction costs?

Responses from a project owner, landscape architects and prime contractors indicated that they find great value in obtaining detailed cost estimates and typically require them for financing, setting construction budgets and communicating expectations to perspective bidders. For the project owner, receiving the detailed estimate did not necessarily mean that they had the most accurate forecast of construction costs. However, they didn't outright reject its value on other attributes. For landscape architects, these data clearly showed not only did they value detailed cost estimates, but they considered receiving such estimate as an indicator of professionalism and quality assurance of the contractor. Surprisingly, prime contractors overwhelmingly agreed that, as far as they were concerned, the detailed cost estimate proved valuable because they used these data to inform their client, namely the project owner, of the actual, market based construction cost for the project.

2. Is there a benefit to landscape architects in providing detailed cost estimating services to their client?

While the researcher was unable to locate a similar survey among landscape architects, this question is applicable because as defined in Chapter 1, Section 3 of this study, the lines between architecture and landscape architecture are virtually non-

existent. According to the findings from the online survey, the project owner was not convinced that detailed cost estimates were the most valuable tool for forecasting construction cost. However, the project owner apparently believed detailed cost estimates are of some benefit because they are willing to pay an additional fee in order to receive such estimates according to their survey responses. The findings clearly show that landscape architects found detailed cost estimates beneficial because they both sent out their concepts at the 90% and 100% design development stages for accurate construction pricing according to their survey responses. Prime contractors found various reasons the detailed cost estimate benefited them. First, they used these data of the detailed cost estimate has accurate forecasts of construction and abided by the client's budget expectations. Secondly, they determined that detailed cost estimates informed the sub-contractors in terms of design intent and installation expectations. Lastly, they utilized the detailed cost estimate process as a method by which to compare pricing among several sub-contractors of similar scope, in the local market place in order to verify that they were in fact receiving accurate construction costs.

3. Are the benefits of the detailed cost estimating process actually realized by the landscape practitioners involved in this study?

The literature review, found in Chapter 2 of this study, illustrates that detailed cost estimating was an important part of overall cost management and budget adherence because: "It verifies whether the cost of a project as predicted in a conceptually developed estimate is indeed the actual cost (Dell'isola, 2003, page 1.") The project owner responses to O-Q4 and O-Q5 reveal that the detailed cost estimate has a clear, and apparent role to play in assisting them in obtaining the data needed in order to manage design and construction costs. The answer to this question of benefits actually being realized by participants is a clear and resounding yes as far as landscape

architects and prime contractors are concerned. However, both landscape architects and prime contractors typically steered away from charging the client a separate billable fee. Instead, according to their responses to the survey, they incorporate the cost for obtaining detailed cost estimates into their base service price to the client. This implies that both landscape architects and prime contractors realize the benefits insomuch its attributes are included, by default, into the base service charge.

The construction teams are made up of landscape practitioners who find value in obtaining detailed cost estimates. However, these values, in themselves, were unique to their specific professional needs. The data collected clearly describes how these professions were dependent on one another, especially for data provided by the detailed cost estimate. Furthermore, it appears that the detailed cost estimate offered a major method of communication where these professionals were able to effectively convey their expectations, design intentions, budget constraints and priorities, amongst themselves and to subcontractors. However, an area of opportunity for improvement of this study is that the online survey did not provide enough opportunity for the respondents to offer additional experience and insight to many of the questions in the form of follow up. One of the weaknesses for the survey is that the researcher could not be certain that the participant completely understood the definition of the ‘detailed cost estimate’ as it is commonly lumped together with other forms of cost estimation.

## 5.3 Relevance to Landscape Architecture Profession

This study is important to the field of landscape architecture because accurate forecasts of construction costs are used by landscape practitioners to meet clients’ budget expectations effectively. By evaluating the construction documents and administrating an online survey, this research determined that construction costs were in fact accurately forecasted by the cost estimation process.

## 5.4 Recommendations for Further Study

Recommendations for future study are based on data findings as well as the limitations of this study's research. Therefore, the following recommendations for further research related to detailed cost estimation that accurately forecast construction costs and assist landscape architecture practitioners to manage budget expectations listed below and include attributes that are good subjects for further research:

- Test larger projects with more hardscape elements, such as retaining walls, flat-work and landscape art pieces;
- Test validity of detailed cost estimating at various price points of construction costs;
- Evaluate published estimating guides against actual constructed projects in the DFW Metropolitan area;
- Compare estimates to actual cost using unit pricing as well as detailed cost estimates as these were attributes survey participants mentioned being of value to them;
- Examine themes from specific projects from other time periods and with other professions such as civil engineers and government permitting officials;
- Score how much more accurate is the detailed cost estimate and is acquiring that level of accuracy worth the price;
- Get larger sample size for each category
- Compare these findings from this study to a least five other metropolitan areas that have projects of similar size and scope;
- Study against other project types such as multifamily, residential, parks and trails, and the etc.;

The attributes examined in this study indicated that there is value in obtaining the detailed cost estimate during the design process. Beyond it just being an accurate tool for determining construction budgets, it appears to be a common thread whereby landscape practitioners use it to communicate expectations and make critical design and financing decisions. Ultimately, detailed cost estimates appear to lead to satisfactorily constructed projects.

Appendix A

IRB Approval Letter

**Institutional Review Board**
**Notification of Exemption**

October 21, 2015

Charles L. Shy
Dr. Pat Taylor
School of Architecture / Urban and Public Affairs
Box 19108

Protocol Number: **2016-0082**

Protocol Title: *DETAILED COST ESTIMATION: AN INDICATOR OF FINAL CONSTRUCTION COSTS*

**EXEMPTION DETERMINATION**

The UT Arlington Institutional Review Board (IRB) Chair, or designee, has reviewed the above referenced study and found that it qualified for exemption under the federal guidelines for the protection of human subjects as referenced at Title 45CFR Part 46.101(b)(2).

- (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless:(i) information obtained is recorded in such a manner that human subjects can be identified, either directly or through identifiers linked to the subject; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

You are therefore authorized to begin the research as of **October 21, 2015**.

Pursuant to Title 45 CFR 46.103(b)(4)(iii), investigators are required to, "promptly report to the IRB ***any*** proposed changes in the research activity, and to ensure that such changes in approved research, during the period for which IRB approval has already been given, are **not initiated without prior IRB review and approval** except when necessary to eliminate apparent immediate hazards to the subject." Please be advised that as the principal investigator, you are required to report local adverse (unanticipated) events to the Office of Research Administration; Regulatory Services within 24 hours of the occurrence or upon acknowledgement of the occurrence. All investigators and key personnel identified in the protocol must have documented Human Subject Protection (HSP) Training on file with this office. Completion certificates are valid for 2 years from completion date.

The UT Arlington Office of Research Administration; Regulatory Services appreciates your continuing commitment to the protection of human subjects in research. Should you have questions, or need to report completion of study procedures, please contact Alyson Stearns at 817-272-9329 or astearns@uta.edu. You may also contact Regulatory Services at 817-272-3723 or regulatoryservices@uta.edu.

Appendix B

IRB Exempt Minor Modification Approval Memo

December 8, 2015

Charles L. Shy
Dr. Pat D. Taylor
Architecture
Box 19108

**IRB No.: 2016-0082**

**Title:** *Detailed Cost Estimation in Landscape Architecture: An Indicator of Final Construction Costs for the DFW Metropolitan Area"*

**EXEMPT MINOR MODIFICATION APPROVAL MEMO**

The UT Arlington Institutional Review Board (UTA IRB) Chair (or designee) reviewed and approved the modification(s) to this exempt protocol on **December 8**, **2015** in accordance with Title 45 CFR 46.101(b). Therefore, you are authorized to conduct your research. The modification(s), indicated below, was/were deemed minor and appropriate for exempt determination/acknowledgment review.

- Change the title of the study to "Detailed Cost Estimation in Landscape Architecture: An Indicator of Final Construction Costs for the DFW Metropolitan Area"
- Revise the title on the Informed Consent / recruitment emails

Pursuant to Title 45 CFR 46.103(b) (4) (iii), investigators are required to, "promptly report to the IRB ***any*** proposed changes in the research activity, and ensure that such changes in approved research, during the period for which IRB approval has already been given, **are not initiated without IRB review and approval** except when necessary to eliminate apparent immediate hazards to the subject."

The modification approval will additionally be presented to the convened board on **January 12, 2016** for full IRB acknowledgment [45 CFR 46.110(c)]. All investigators and key personnel identified in the protocol must have documented Human Subjects Protection (HSP) training on file with the UT Arlington Office of Research Administration; Regulatory Services.

The UT Arlington Office of Research Administration appreciates your continuing commitment to the protection of human research subjects. Should you have questions or require further assistance, please contact Alyson Stearns at astearns@uta.edu or you may contact the Office of Regulatory Services at 817-272-3723.

Appendix C

Survey Questions

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**TITLE OF PROJECT**: DETAILED COST ESTIMATION: AN INDICATOR OF FINAL CONSTRUCTION COSTS

**INTRODUCTION**: Survey Questions

Owners, as well as the members of their construction team, are being asked to participate in a research survey about how accurately detailed cost estimates forecast construction costs. The makeup of construction teams vary from project to project but typically

include, project owners also known as ‘clients’, landscape architects, and prime construction contractors. These construction team members are important to this study because they possess field experience and general familiarity with detailed cost estimation. Therefore, construction teams are asked to participate in this survey because they have directly contributed to either the design or construction development of projects that have used detailed cost estimates to forecast actual construction costs. What this means is that these construction team members may be in a position to offer insight on the effectiveness of detailed cost estimates as an accurate construction cost forecasting tool.

The landscape architects have placed their State of Texas profession seals, along with their contact information, onto the construction documents that are available for public viewing by the general public in physical and online bidding rooms, as well as offices of municipalities were building permits where applied for. The study group consists of projects located sent out for proposal in the Dallas – Fort Worth Metropolitan area, in Northern Texas and have been completely constructed and closed out.

This study describes the implications of detailed cost estimating for landscape architects should they decide to incorporate it into their design process. This is important to the field of landscape architecture because the findings will contribute to understanding how accurate forecasts of construction costs could be used to meet clients’ budget expectations more effectively. Currently, not all landscape architects take full advantage of the detailed cost estimation process or express interest in providing this important service to their clients at all. For those attempt to utilize cost estimates, they often rely on third party entities to provide this valuable service.

**PURPOSE**:

The specific purpose of this research is to measure the ability of the detailed cost estimate to accurately forecast construction costs. Therefore this study seeks to determine the benefits for landscape architects in providing detailed cost estimates to their clients as a deliverable during the design process by employing a case study strategy, and an online survey to obtain data. Landscape architects fail to realize the full potential of detailed cost estimation because it is not a part of their design process. Due to lack of experience in the local/regional construction market and the relatively large amount of time required to assemble an accurate detailed cost estimate, the majority of landscape architects are choosing not to offer this service to the client.

Using selected construction projects with a minimum budget of $25,000.00 in landscape installation, completed and closed out, from the Dallas-Fort Worth Metropolitan area as its focus group, this thesis analyzes the responses from clients, landscape architects and prime construction contractors who received detailed cost estimates and determines if these individuals are more satisfied with the outcome of the project than those who do not receive such estimates.

As stated previously, this study is important to the field of landscape architecture because accurate forecasts of construction costs could be used to meet client's budget expectations more effectively. By evaluating the actual building costs of the study's landscapes, the research will determine if construction costs were in fact accurately predicted by the detailed cost estimation process. The findings of this study will contribute to understanding how detailed cost estimating could be utilized during the design process as an accurate construction cost forecasting tool.

**DURATION**:

Participation in this survey will last approximately twenty minutes.

**PROCEDURE:**

Owners, prime construction contractors and landscape architects will be invited via electronic mail to participate in an online survey. The website www.qualtrics.com will be the online platform that the survey is offered on.

**SURVEY QUESTIONS:**

Definition: Detailed Cost Estimate

For the purpose of this thesis, a forecast of construction cost prepared on the basis of a detailed analysis of materials and labor for all items of work, as distinguished from a preliminary estimate of construction cost based on current area, volume, or similar conceptual estimating techniques. (Demkin, p.533)

**A. Questions for Owners**

**i. Importance of the detailed cost estimate**

i. On projects with landscape construction, how important was it that you received a detailed cost estimate in order to obtain third party financing?

1. Very important
2. Somewhat important
3. Neutral
4. Somewhat unimportant
5. Not important

ii. On projects with landscape construction, how important was it that you received a detailed cost estimate in order to self-finance?

1. Very important
2. Somewhat important
3. Neutral
4. Somewhat unimportant
5. Not important

**j. <u>Acquisition of the detailed cost estimate</u>**

i. Which one of the following best describes who you typically acquire detailed cost estimates form?

1. Not applicable
2. From an architect
3. From a landscape architect
4. From the prime general contractor
5. From professional estimating organizations
6. From the trade specific subcontractor
7. Other, please explain:

_____

**k. <u>Benefit to customer of detailed cost estimate</u>**

i. Requests for detailed cost estimates should be considered a separate billable service?

1. Strongly agree
2. Somewhat agree
3. Neutral
4. Somewhat disagree
5. Strongly disagree

ii. Are you willing to pay an extra fee to receive detailed cost estimates?

1. When suggested by the architect
2. When suggested by the landscape architect
3. I typically decline the detailed cost estimate service
4. I'm typically provided the detailed cost estimate free of charge
5. I typically request the detailed cost estimate service expecting to be charged

**I. <u>Accuracy of the detailed cost estimate</u>**

i. Detailed cost estimates you've received were accurate forecasts of the project's actual costs.

1. Strongly agree
2. Somewhat agree
3. Neutral
4. Somewhat disagree
5. Strongly disagree

ii. What is your level of confidence that detailed cost estimates are more accurate than other forms of cost estimating?

1. Very confident
2. Somewhat confident
3. Neutral
4. Somewhat not confident

5. Not confident

iii. Do you think that actual costs were more accurate on projects where the detailed cost estimate process was used compared to those that weren't?

1. Not applicable
2. Yes
3. Neutral
4. No
5. I notice no difference

iv. Is there something else you'd like to say about your experiences with detailed cost estimates? Please explain:

_____

**B. Questions for Landscape Architects**

**m. <u>Importance of the detailed cost estimate</u>**

i. Do you request detailed cost estimates as a part of your landscape design process?

1. Not applicable
2. Yes, for all projects
3. Yes, but not for all projects
4. Almost never
5. Not at all

ii. Why is the detailed cost estimate important to your landscape design process?

_____

**n. <u>Acquisition of the detailed cost estimate</u>**

i. Which one of the following best describes who you acquire detailed cost estimates from?

1. Not applicable
2. From a specialist within the firm
3. From the prime general contractor
4. From professional estimating organizations
5. From the trade specific subcontractor
6. Other. Please explain:

_____

ii. What stage of the design process do you request a detailed cost estimate?

1. Never
2. 50%
3. 75%
4. 90%
5. 100%
6. Other. Please explain: -

_____

**o. <u>Benefit to customer of detailed cost estimate</u>**

i. Providing the client with a detailed cost estimate should be considered a separate billable service?

1. Strongly agree
2. Somewhat agree
3. Neutral
4. Somewhat disagree
5. Strongly disagree

ii. Does your firm bill its clients an extra fee for detailed cost estimates?

1. Not applicable
2. Cost estimating is included in our base price
3. We offer detailed cost estimating for an additional fee
4. We don't offer detailed cost estimating
5. Other. Please explain _____

iii. What prevents your firm from offering detailed cost estimates?

_____

**p. <u>Accuracy of the detailed cost estimate</u>**

i. The detailed cost estimates you've received were accurate forecasts of the project's actual costs.

1. Strongly agree
2. Somewhat agree
3. Neutral
4. Somewhat disagree
5. Strongly disagree

ii. Is there something else you'd like to say about your experiences with detailed cost estimates? Please explain:

_____

**C. Questions for Prime Contractors**

**q. <u>Importance of the detailed cost estimate</u>**

i. Do you request detailed cost estimates as a part of your invitation to bid process?

1. Not applicable
2. Yes, for all projects
3. Yes, but not for all projects

4. Almost never
5. Not at all

ii. What other forms of estimates do you accept? -

_____

**r. <u>Acquisition of the detailed cost estimate</u>**

i. Which one of the following best describes how you acquire detailed cost estimates for your projects?

1. Not applicable
2. From a specialist within the firm
3. From professional estimating organizations
4. From the trade specific subcontractor
5. Other, please explain:

_____

**s. <u>Benefit to customer of detailed cost estimate</u>**

i. Providing the client with a detailed cost estimate should be considered a separate billable service?

1. Strongly agree
2. Somewhat agree
3. Neutral
4. Somewhat disagree
5. Strongly disagree

ii. Does your firm bill its clients an extra fee for detailed cost estimates?

1. Not applicable
2. Cost estimating is included in our base price
3. We offer detailed cost estimating for an additional fee
4. We don't offer detailed cost estimating

**t. <u>Accuracy of the detailed cost estimate</u>**

i. The detailed cost estimates you've received were accurate forecasts of the project's actual costs.

1. Strongly agree
2. Somewhat agree
3. Neutral
4. Somewhat disagree
5. Strongly disagree

ii. Is there something else you'd like to say about your experiences with detailed cost estimates? Please explain:

_____

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1) The American Institute of Architects, The Architect's Handbook of Professional Practice, Student Edition, Thirteenth Edition, Joseph A. Demkin, AIA, Executive Editor, 2002, page 533

Appendix D

Email Message Before Acceptance of Informed Consent

Dear Perspective Survey Participate,

My name is Charles Shy and I am a graduate student attempting to complete my master's degree in the Landscape Architecture Program at The University of Texas at Arlington. I am conducting research for my masters' thesis titled: Detailed Cost Estimation: An Indicator of Final Construction Costs.

I would like to request you and your organization's participation in my thesis research via an online survey. You are being selected because you have either conducted research, have knowledge of, have worked at, or operate a business that practices landscape architecture or has used detailed cost estimating to forecast actual landscape construction costs. The specific purpose of this research is to measure the ability of the detailed cost estimating process to accurately forecast construction costs. In addition, this study seeks to determine the benefits for landscape architects in providing a detailed cost estimating service to their clients. The findings from this research determines if the actual building costs for construction of the study's landscapes were accurately predicted by the detailed cost estimation process. The survey will take approximately 20 minutes of your time.

Before agreeing to participate in this online survey, I have provided as an attachment to this email, an *Informed Consent Form* for you to read and acknowledge. This form will explain the study in further detail. Participation in the study is completely voluntary. Additionally, if you know of anyone who is interested in completing this survey, please indicate to me how to best contact them and I will do so accordingly.

Thank you very much for your time and consideration. Your effort, support, and participation will be an invaluable part of this research and is greatly appreciated.

Respectfully,

Charles Shy
MLA Candidate – UTA SASLA

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The University of Texas at Arlington
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UTA Mav ID: 1000761700
charles.shy@mavs.uta.edu

Appendix E

Email Message After Acceptance of Informed Consent

Dear Perspective Survey Participate,

Thank you for accepting to be a volunteer participant in this study. My name is Charles Shy and I am a graduate student attempting to complete my master's degree in the Landscape Architecture Program at The University of Texas at Arlington. I am conducting research for my masters' thesis titled: Detailed Cost Estimation: An Indicator of Final Construction Costs.

You are being selected because you have either conducted research, have knowledge of, have worked at, or operate a business that practices landscape architecture or has used detailed cost estimating to forecast actual landscape construction costs. The specific purpose of this research is to measure the ability of the detailed cost estimating process to accurately forecast construction costs. In addition, this study seeks to determine the benefits for landscape architects in providing a detailed cost estimating service to their clients. The findings from this research determines if the actual building costs for construction of the study's landscapes were accurately predicted by the detailed cost estimation process. The survey will take approximately 20 minutes of your time.

The online survey link is available below for your convenience. Participation in the study is completely voluntary. Additionally, if you know of anyone who is interested in completing this survey, please indicate to me how to best contact them and I will do so accordingly.

- If you are a project owner or owner's representative, please respond only to the questions at: https://uta.qualtrics.com/SE/?SID=SV_1BrMNSvSXfKl2WV
- If you are a landscape architect, please respond only to the questions at: https://uta.qualtrics.com/SE/?SID=SV_7V9ZLiP4gbsuRO5
- If you are a prime contractor, please respond only to the questions at: https://uta.qualtrics.com/SE/?SID=SV_807cCErBzVgjpLn

Thank you very much for your time and consideration. Your effort, support, and participation will be an invaluable part of this research and is greatly appreciated.

Respectfully,

Charles Shy
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## Biographical Information

Charles L. Shy Sr. holds a Master in Landscape Architecture degree from the University of Texas at Arlington and a Bachelor of Science degree in Ornamental Horticulture from the University of Illinois at Champaign – Urbana. Charles holds a certificate in Landscape Irrigation System Design from Sundance Irrigation School, Keller, TX. His future career goals are to obtain a state of Texas landscape architecture license and eventually teach landscape construction at the university level in addition to practicing in the field.

Charles has experience with many phases of landscape construction, including sales, purchasing, landscape design and project management. As Construction Estimator for Greener Pastures Landscapes LLC, Dallas, TX, he assists general contractors in successfully bidding on commercial landscape construction and irrigation scopes on private and public projects. Projects range from $5,000.00 to $15,000,000.00 and may carry uniquely specific requirements, such as: disadvantaged and minority sub-contractor participation quotas, prevailing wage or certified payrolls and LEED qualification goals. Charles plans to continue researching the various methods of cost estimating to determine how landscape architects may employ detailed cost estimating into their typical landscape design process. It is his desire that landscape architecture students will continue research into this interesting topic, and integrate detailed cost estimating into their studio design processes.