DESIGNERS' AND CONTRACTORS' PERCEPTIONS OF EACH OTHER

By

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To my parents, Dale and Willis Devier; and to my sisters, Claudia and Colleen Devier, for all their love and support.

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First of all I would like to thank my parents for all their support. I would also like to thank my Uncle for helping with my survey. I also need to thank my best friend for all her advice and support. Finally, I need to thank all the companies who contributed to this survey.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AEC	Architecture, Engineering and Construction
AIA	American Institute of Architects
ADA	Americans with Disabilities Act of 1990 (US)
ENR	Engineering News-Record
HVAC	Heating, Ventilation & Air Conditioning
NCIDQ	National Council for Interior Design Qualification
PE	Professional Engineer

Abstract of Thesis Presented to the Graduate School
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The purpose of this study is to investigate the underlying issues that lead to miscommunication and resulting delays between General Contractors and Designers (Engineers and Architects). It has been observed that certain misperceptions exist between the two disciplines, hindering the establishment of cohesive and collaborative work environments. These issues are reoccurring. By examining the issues and finding there origination these issues can be resolved. As a construction project goes on and more issues arise the project tends to slow down. Tension can cause both disciplines on the project to feel as though they need to defend themselves. One member of the group transmits their tension to another member, who in turn feels the burden and transmits their stress along the chain eventually affecting everyone working on the project. The General Contractor can then begin to transfer tensions to the subcontractors. The subcontractors are then placed under a great deal of strain and there work effort suffers as a result. If the designer and contractor continue working on the same projects, more than likely conflict will continue to arise. These conflicts could easily be addressed and resolved with just a little more understanding on both sides of the spectrum, thus, creating a better work environment for everyone. The issues will not disappear but hopefully this study will help reestablish

communication between Contractors and Designers and will help break ground for a firm and mutual understanding.

A survey questionnaire was developed and distributed in order to investigate the perceptions of Designers and Contractors in the construction industry. The results concluded that there is no significant difference between the response patterns of Designers and the response patterns of Contractors. Therefore, the responses of Designers and Contractors are the same even if stereotypes and personal conflicts are evident on the project. This conclusion is logical considering Designers and Contractors should be working towards the same goal, regardless of whether or not the disciplines are working collaboratively.

CHAPTER 1
INTRODUCTION

Interaction in the Construction Industry

The construction industry today and in the past has heavily relied on good communication in order to keep a project on the right track. Currently, it would appear that communication and collaboration are even more important. A traditional construction project in the past would begin with the owner hiring the architect. The architect would represent the owner and help the owner decide on a contractor. In this situation, the owner communicates with the architect, who in turn communicates with the contractor. This system is beneficial to the owner because it limits the amount of nagging for approval. But it hinders interaction between the team. The contractor is no longer an equal. However, the industry has been moving towards a design build delivery system. This system allows the owner to deal with one party, the design/build team. Delivery systems that are run in this manner need to maintain open streams of communication. Each person on the team needs to be aware of every part of the project. This delivery system depends on collaboration.

Impacts on Industry

For any project in the construction industry to succeed there must be communication. It is crucial that professionals in each discipline be capable of communicating with their own personnel as well as with other professionals on the team. A lack of communication between Contractors and design professionals leads to complications. Communication problems can result in excess money, time, inferior quality workmanship and unsatisfied customers. These problems reflect poorly on all parties involved and can affect the companies' future endeavors. This paper intends to explore the possible mindsets of each discipline regarding skills and respect that further breakdown communication by investigating the underlying stereotypes responsible

for keeping these two disciplines at odds. Defining the roles of each discipline involved, tracing relationships, investigating disputes, and seeking open communication will help to eliminate the territorial or "Me First" attitudes of each discipline and establish understanding and commonalities necessary to build respect and a collaborative attitude.

Key Causes

It is believed that issues between design professionals and Contractors do exist. Some of the issues stem from stereotypes that are commonly placed upon each profession. These issues are possibly related to education. Architects and engineers go through a longer period of educational study to attain professional licensure. In the construction industry, it is common to encounter Contractors who grew up in the family business following in parental foot steps. Others enter the construction industry starting with an entry level position, doing manual labor and work their way through the ranks. The route taken to become a either a top construction or design professional is rather diverse. This variation in educational and training may be a reason why the construction industry is perceived as a blue collar job, while architecture, interior design, and engineering roles are viewed as white collar jobs. However, the flaw in this concept is who decides which wealth of knowledge is more substantial, as both forms of learning have certain benefits. Other causes relate more specifically to the daily tasks of the industry. Chapter 2 discusses the importance of communication, collaboration and personal conflict which are contributors to delays on a project. Chapter 2 discusses these delays in more detail and possible solutions that are in place now and that will be needed for the future.

Objectives

The purpose of this thesis is four-fold. First, since communication is essential for collaboration it is necessary to investigate the importance of communication between and within each discipline. Second, it is crucial to define the roles of each disciple on a project. Next, it is

important to investigate the issues and problems that each discipline deals with on a project. Finally, this study aims at clarifying issues found in the industry today, making sense of the main issues that can and have become barriers between the professions and hamper collaboration between the professions. The results of this study may suggest ways to provide improved communications and relations between the disciplines, allowing for greater collaboration and efficiency.

Hypothesis

The hypothesis for this study is that while most problems are a result of technical issues in the construction industry, there are underlying personal issues that exacerbate the overall dilemmas. These personal conflicts contribute to overall larger complications on the project and at the jobsite.

Methodology

This study analyzed the views of Designers and construction employees in their respective fields throughout the United States. The analysis was conducted through surveys. The surveys were distributed to the bottom 100 commercial construction companies (Engineering News-Record's 2006 Top 400 Contractors) and the bottom 100 design firms (ENR's 2006 Top 500 Design Firms). The first step conducted in the methodology was collecting literature. During the literature review special attention was paid to issues of lack of communication and lack of collaboration. Other topics reviewed during the research phase were construction delays, causes for litigation, construction management, and the specific roles of each discipline. The literature collected gave an idea of what information needed to be collected through the survey. The survey was seeking to find out both qualitative and quantitative information. The surveys were distributed through surface mail system and via the Internet, and then recollected. Finally, the survey data were analyzed using standard statistical methods.

Summary of Study

In the following chapter, Chapter 2, communication and collaboration are defined. The importance of these skills in the construction industry is exemplified. Chapter 2 also establishes the roles of architects, Contractors, engineers, and interior Designers. Articles that demonstrate the importance of communication are reviewed. A literature review of construction disputes, communication between Designers and Contractors, litigation causes, partnering, and collaboration are imparted. Chapter 3 discusses the methodology and the survey in more detail. Chapter 4 conveys the results drawn from the survey. Finally, Chapter 5 discusses the problems identified, possible solutions, conclusions and recommendations for future studies.

CHAPTER 2
LITERATURE REVIEW

Communication is essential to all collaborative endeavors. In the construction industry, communication is especially crucial, as there are numerous parties involved, including the client, architect, engineer, designer, and general contractor. By defining each party's role, professional expectations of each member, and delivery systems for disseminating information to all members of the team, one can work to eliminate the break down in the traditional construction management delivery system. Each person on the team needs to be aware of every aspect of the project to create a cohesive and collaborative work environment.

Importance of Collaboration and Communication

Communication is the process by which information is exchanged between individuals through a common system of symbols, signs, or behaviors. It is a technique for expressing ideas effectively. The collaborative exchanging of ideas and plans between professionals on a construction project is integral to its success. In the construction industry, poor communication becomes an obstacle to overcome. Although it is important to avoid flawed design and outright mistakes, the number one cause of professional liability claims among design professionals is a breakdown in communication. "Communication is at the heart of most problems on a project and must be the focus of attention" (Schrag 2004, p.50). Too often in the construction industry, each discipline tends to be ego-centric, concerned with their needs and instead of the overall needs of the project.

In the past, construction projects were completed by a single company. Today however, collaborative team projects are the norm. On any given project, one may likely find architects, engineers, Designers, Contractors, and trades people working together. Specialty fields have also been developed, adding more parties to the team. As the number of team members grows,

so does the importance of communicating, understanding, and cooperating together and is especially true for technically complicated projects, which necessitate a different balance among the typical cast of characters (Schrag 2004).

With so many construction perspectives influencing a project, roles and relationships play a fundamental part. Each discipline wants to be right and wants to avoid being the source of an erroneous decision. For example, consultants and architects, outwardly acknowledge that if one is going to build something, it will require teamwork from a variety of people with different areas of expertise. "Too often, however, they go about their business as if they were natural adversaries competing for turf, jealously guarding their own interests, and looking for ways to trick the other into ceding the advantage to them" (Schrag 2004, p. 449). Negotiation and collaboration become a part of the communication. If no one is willing to bend, then moving forward is no longer an option. "Negotiation is about reaching a goal, not winning. It involves the use of common sense and basic communication skills" (Kasimer 2003, p. 12).

A recent study on the potential causes of inconsistencies between design and construction investigated large building projects in Saudi Arabia (Arain et al. 2006). During the course of the study there was a major boom in construction in Saudi Arabia, resulting in an unusually high rate of construction within a limited period of time. Results identified 45 potential causes within three categories; design phase, construction phase, and design-construction phase. Results indicated the top five causes for inconsistencies (in rank order from one to five) are: 1) involvement of designer as consultant, 2) communication gap between constructor and designer, 3) insufficient working drawing details, 4) a lack of human resources, and 5) a lack of designer's knowledge of available materials and equipment. Strong communication was recommended by the researchers, as a way to solve the various inconsistencies seen throughout a project.

A similar survey by Jahren and Dammeier (1990) also recognized communication as an important step in avoiding disputes. This survey interviewed Contractors, architects, and attorneys about various construction disputes and asked them to give recommendations for avoiding them in the future. Results were categorized into three areas: people, policy, and communication. Outcome indicated that to avoid construction disputes, implementation of good management techniques with regard to people, policy, and communication are more effective than attempting to shift risk to other parties by using exculpatory clauses in contracts or narrowing the scope of services.

A collaborative study between the University of Florida and the University of Illinois at Urbana-Champaign, suggested a lack of collaboration during the education process occurs and may perpetuate as Designers and Contractors enter the construction industry. "Only 46% of all architecture alumni responding to a recent survey felt their school did a good job fostering their ability to work cooperatively in interdisciplinary teams" (O'Brien 2003, p. 78). In the study, a Collaborative Design Process course was designed for masters students, in which students at each university worked on collaborative teams with members from the other university, simulating the Architecture, Engineering and Construction (AEC) industry. Members collaborated through the use of off-the-shelf computer technology. Each team consisted of one architect, one structural engineer, and one project manager. The students worked together towards completing a set of architectural design files, an estimate, project schedule, and the structural design. At the end of the project, a virtual jury of students and the faculty provided a critique. Each member of the team critiqued their own work and then the group critiqued themselves. Finally, the students were asked to provide recommendations for future collaboration efforts. Since students were thousands of miles apart, they communicated through

technology and never met face to face. All collaboration was conducted via the internet and was an added effort used to simulate a typical relationship seen in the AEC industry. Results of the study identified problems occurring in dissemination of information. Three potential approaches or strategies for transferring information via distance collaboration were identified; Serial, Concurrent, and Integrative (Figure 2-1).

The first strategy identified for transferring information is the Serial approach, in which team members perform their specific task and then hand off to the next team member, it is also referred to as the "over the wall" method. The second approach, Concurrent, consists of team

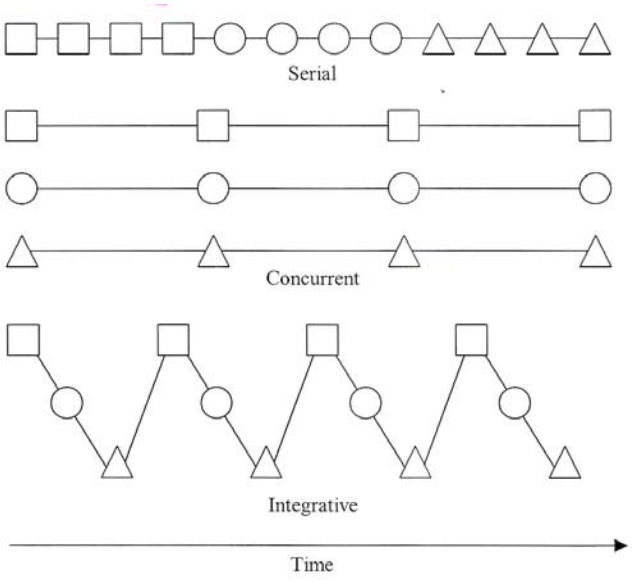

Figure 2-1. Alternative approaches to collaborative work (O'Brien 2003).

members who work on their own task but also work parallel to each other. The third strategy is the Integrative approach, in which team members are frequently exchanging information while working on their respective tasks at shorter durations. Although the Integrative approach would have likely been a better approach for the AEC industry, and more specifically, the best option for the students involved in the Collaboration Design Process, information obtained from the study reveals the students actually used the Serial approach. This study demonstrated the social,

professional, and technological challenges of collaboration affecting the AEC industry and illuminating the failures in current off the shelf technologies. Current technologies are geared towards the Serial approach, restricting the industries ability to collaborate over distance and demonstrate the need to gradually reshape the curricula of architecture, engineering, and construction programs to encourage collaboration and exchange of ideas among students. (O'Brien 2003)

Halpin stated " . . . the construction process involves the interaction and coordination of a large variety of agents who regard, and participate in, the construction process from different points of view and with different technical and professional responsibilities" (Halpin 1980, p. 4). The organization of the construction process defines the nature of the relationships and establishes the order in which these agents interact. The relationships between these professionals can be categorized into four different types: master-servant, business-service, contractual, and intimate cooperation of equals. The Master-Servant relationship occurs when one person hires another professional and pays them for their services. The Business-Service relationship revolves around the exchanging of goods in the industry. The third type, Contractual or formal obligation, occurs when one group freely binds themselves to another group to provide a service defined by a contract. The final relationship is the Intimate Cooperation of Equals, in which the bond is defined by open communication between agents and an obligation to one another. (Halpin 1980)

Weak communication and collaboration can have an overwhelmingly negative effect on any project, as well as construction industry. Almost every cause for a delay on a job site can be linked to some level of poor communication. Therefore, it is imperative each member remain in contact and aware of changes, updates, budgets, deadlines, and schedules for the project.

Maintaining a standard level of contact and being persistent at keeping all team members informed is an important step towards keeping a project on schedule.

Defining the Roles

On any construction project there are several key members, including the owner, the architect, the engineer, and the contractor. By clarifying each member's role, other members will gain an understanding of their unique skills and abilities. A lack of understanding about specialized skills, training, certification, and education of another member's role can lead to miscommunication, unnecessary errors and delays as the project progresses.

The American Institute of Architect (AIA) documents provides a standard to be used on construction projects. This document helps to mediate overlaps in scope of work and mass confusion which would certainly arise with out a set standard. Therefore, examining and defining the various roles of team members on a construction project will help all individuals on a project. The information below is based on 2006-2007 U.S. Departments of Labor Bureau statistics and the AIA contract document A201.

Architects

General view

Architects are licensed professionals trained in the art of science and building design. Architects transform the needs of people into concepts. Their concepts are then turned into images and building plans, which can then be constructed. Architects generate the plans for a wide variety of spaces that people need such as living spaces, work, play, govern, learn, worship, entertain, eat, shop, and sleep. People spend 90% of their time inside these places, emphasizing the importance of aesthetics, space and functionality. An architect should consider the end user of the building and create a space that suits the user's needs. When creating their designs, architects have an obligation to keep the public safe. Certain codes must be adhered to by all

architects. These codes are dependent upon the area or state in which the building is located. It is important that architects stay up to date on current codes and obligations in their jurisdiction. If an architect is drawing plans for a building that is not in his/her jurisdiction they must follow the codes in that region or whichever set of codes is more stringent. (Occupational 2006)

Education and licensing

Architects must also abide by Americans with Disabilities Act (ADA). Architects must be licensed before practicing in the United States, the District of Columbia, and Puerto Rico. Licensure requires completion of a professional degree in architecture and have interned under a licensed architect for three years. After these requirements have been met, architects are eligible to sit for the Architect Registration Examination and must pass all 9 divisions of the exam. Once licensed most states require some form of continuing education. In addition, architects must learn and know the building codes and regulations within each area they design for. For example, the building code for wind impact resistance for a building in south Florida will be different than building code requirements for the same building built in northern Florida. An architect must know the codes and regulations within each area their designs are built.

Construction documents are drawn up for the contractor to read and then build the structure. A successful architect must be able to communicate their vision persuasively and visually. Since few members or clients on a project can visualize a space in the same manner as an architect, they must use various techniques to communicate their ideas on to paper. A typical program used by architects today is Computer-Aided Design and Drafting software, which is replacing the traditional pencil and drafting board. At times, a model might be built for the owner or client to better visualize the end result. Perspectives of a type two dimensional drawing show the client a three dimensional view of the space (Occupational 2006).

The American Institute of Architects contract

According to AIA document A201 Article 4, the duties, responsibilities, limitations, and authority of the architect are stated in the contract and shall not be restricted, modified, or extended without written consent from the owner. The architect will administer the contract and act as the representative of the owner during construction. Figure 2-2 shows a breakdown of the contractual relationships. The owner and contractor do not normally speak to each other. Therefore, all interactions should be carried out through the architect and he/she must be in constant contact with the contractor.

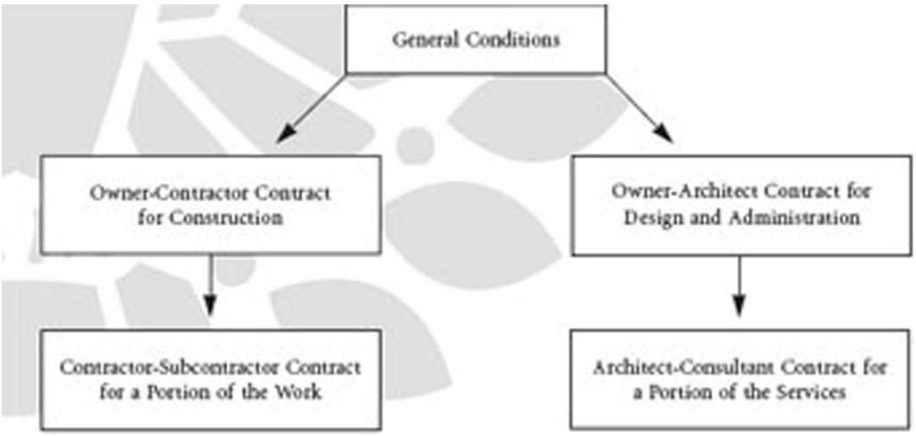

Figure 2-2. Breakdown of contract relationships in the construction industry (The Architect's, 2001).

Architects start out in a contractual relationship with the owner, and between the two of them, they decide the aesthetic vibe of a building. The architect will then generate a set of plans. Once construction begins, the architect will occasionally visit the site making sure that the construction process is on time and budget. While on site, the architect is responsible for making sure the contractor is carrying out the quality of work for the building. However, the architect does not have the authority to decide the means and methods for construction. All submittals are cleared by the architect, as well as payment applications, change orders, and substantial

completion. It is the architect's responsibility to resolve claims and disputes even when pertaining to errors or omission. The goal for every dispute or claim is to solve it through the architect and avoid mediation, arbitration, and or litigation. In summary, communication plays an integral role in an architect's daily routine and overall responsibility on a project.

Engineers

General view

Engineers design, test, specify functions, and evaluate overall effectiveness, safety, cost, and reliability of products and procedures. They link a perceived social need with the commercial applications by applying the principles of mathematics and science to develop economical solutions to technical problems. Within the engineering field, there are a variety of types of engineering and most are certified in their related field. For the purpose of this thesis, only engineers that impact the construction industry will be discussed. These would include civil engineers, electrical engineers, mechanical engineers, and occasionally health and safety engineers.

Engineers should be creative, inquisitive, analytical, and detail orientated and should be capable of working in a team setting. Oral and written communication skills are also imperative as engineers frequently have to communicate with people outside of the engineering filed. Civil engineers have the most interaction with the construction industry. Within this arena, civil engineers design and supervise the construction of airports, buildings, road, tunnels, damns, bridges, water supply and sewage systems. Just as with architects, there are many factors that an engineer has to consider while designing these structures, as well as following the codes and regulations.

Electrical engineers design, develop, test, manufacture, and supervise the manufacturing and specification of electrical equipment. In the construction industry, these engineers specify

the wiring and lighting systems for a building and control the transmission of electricity from the utility source.

Mechanical engineers work on the air conditioning and heating systems for buildings. These engineers develop and design any elevator or escalators designated in the plans. Mechanical engineering is one of the broadest engineering disciplines, so finding engineers specific to HVAC and conveying systems is beneficial.

The final type of engineer that contributes to the construction industry is the health and safety engineering. These engineers may not be seen on site, but their work has a major influence on the industry. They promote worksite and product safety. Using a specialized knowledge, they identify and measure potentially hazardous situations for people and properties. They design and implement procedures to reduce the risk of injury or damage. They must be able to anticipate recognize and evaluate hazardous conditions and methods to control those conditions.

Education and licensing

A bachelor's degree in engineering is required for almost all entry level positions in the engineering field, although college graduates with degrees in other backgrounds are occasionally acceptable. Students have the option of possibly practicing in a different form of engineering then the degree they received, as long as the degrees are related. Every state in United States, the District of Columbia, and Puerto Rico requires licensing of engineers who offer services to the public. Generally, in order to get licensed an engineer must have a degree from a program accredited by the Accreditation Board for Engineering and Technology. After graduating, an engineer must work for 4 years. An examination is also a part of licensure for engineers. The test can be split between immediately after graduation and after working for 4 years. Beginning engineers usually work under the supervision of an experienced engineer. The first portion of

the exam is the Fundamentals of Engineering and the second half of the exam is the Principles and Practice of Engineering. An engineer who achieves licensure is called a professional engineer or PE. After acquiring a license, engineers can achieve various certifications offered by professional organizations displaying technical competency in specific areas. (Occupational 2006)

Interior Designers

General view

Interior Designers draw upon different disciplines to enhance the interior spaces of buildings. Designers are involved in planning the interior spaces of a wide variety of buildings. When designing, this group of professionals considers the aesthetics of a space, the functionality, space planning, color schemes, and detailing. An interior designer and architect work at a different scale. Interior Designers have the ability to enhance the interior spaces. Designers help to boost office productivity, increase sales, attract various clienteles, and create relaxing hospital rooms. Interior Designers work very closely with the client. The most important aspect for Designers is to create a space that has everything the client needs. This process of meeting and defining the client's needs is known as programming. After meeting with a client, Designers will develop a scheme for the space and begin creating drawings to allow the client to visualize the end result. This process is can either be done by hand or again by Computer-Aided Design and Drafting software. After finalizing a plan for the space, a designer will then begin specifying materials, finishes, and furnishings for the new space. If a project requires any structural changes, a designer will have to consult either an engineer or an architect. Eventually, a designer will need to hire a contractor to finish the interior space. The designer is responsible for creating a schedule and budget and keeping the contractor on task. Many people assume interior Designers simply pick out colors and furniture, adding layers to interior surfaces. In the past,

this was a common occurrence. However, there is a difference between interior Designers and decorators, the main difference being that Designers are licensed. (Occupational 2006)

Education and licensing

A bachelor's degree is recommended for an entry-level position at an interior design firm. The education restrictions for interior Designers are not as strict. A person who graduates from a 2 year or 3 year program for design receives an associate's degree and can qualify as an assistant to a designer. If a person graduates from a 4 year program, they are eligible for an entry level position at a design firm. After graduating, most Designers will begin working under a licensed interior designer or architect for 1 to 3 years. After that time period, a designer would be eligible to sit for the licensing exam. Eligibility to sit for the exam includes 6 years of combined education and experience in the field of interior design. The exam is administered by the National Council for Interior Design Qualification (NCIDQ). Just like engineers and architects, continuing education is required for interior Designers. Currently, 24 states in the United States require licensing as well as the District of Columbia, and Puerto Rico.

Construction Managers

General view

Construction managers plan, direct, and coordinate a wide variety of construction projects, including the building of all types of residential, commercial, plants, schools, hospitals, civil, and industrial structures. A project can be overseen by a construction manager for portions of the construction process or all of the construction process. A construction manager is not involved with the actual physical and laborious part of the construction process. A construction manager will sometimes have other construction managers or supervisors working under them. Construction managers set up the schedule and keep it up to date. Before construction begins, the construction manager's job is to select, hire, and oversee any subcontractors for the project.

Once it begins, they are responsible for ensuring a project is completed on schedule and within budget. Construction managers work hard to develop appropriate delivery systems, including the most cost effective plan and schedule for completing the project. They work to make sure all steps in the process are logical and meet all set deadlines. A construction manager will usually work out of the main office, but in some cases they will work at the on site office. This will

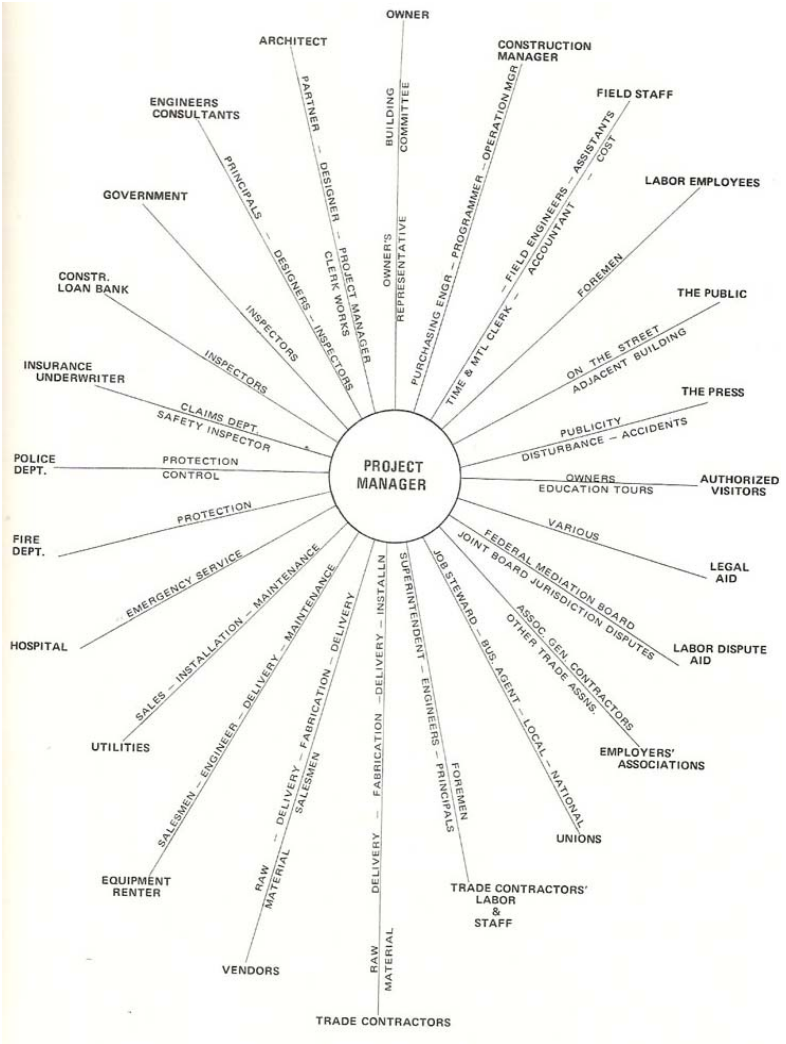

Figure 2-3. All of the project manager's obligations (Bush, 1973).

usually depend on the type of project and how the company is run. The construction manager is also responsible for safety on the jobsite and making sure that all subcontractors and their

laborers are aware of safety meetings and procedures. They are responsible for making sure that all materials, tools, and equipment are delivered to the jobsite on time. In addition, they take care of permits and licensing, depending on the contract documents.

Traveling is a common occurrence for construction managers, especially if the job site is not close to the office. The construction manager is usually on call 24 hours a day in order to handle any and all emergencies, delays, and weather issues on the site. Good oral and written communication skills also are important, as are leadership skills. "Managers must be able to establish a good working relationship with many different people, including owners, other managers, Designers, supervisors, and craft workers" (Occupational 2006). Figure 2-3 shows graphically all the tasks of a project manager.

Education and licensing

Construction managers should have a solid knowledge of building science, business, and management. They must be capable of reading plans, specs, and contracts and be familiar with the means and methods of construction. Construction managers should be flexible as they must be able to coordinate multiple people and tasks during extremely tense and stressful situations. Employers are more attracted to hire individuals who have a bachelor's degree in construction science or something related. Working experience is also important to employers. Traditionally, someone could become a construction manager after having substantial knowledge in a certain trade, craft or supervision. However, the industry is becoming more complex and employers are placing more importance on postsecondary education. Many colleges offer a 4 year program in construction management or construction science and some also offer a master's degree program in construction management or science. Several industry associations offer further education programs linked with several 2 year programs. There is no license required to become a construction manager; however there is a push in the industry for this to take place. Voluntary

certification is a good way to verify a construction manager is competent. Two associations that offer these certification exams are the American Institute of Constructors and the Construction Management Association of America. In order to achieve these certifications, one must meet certain requirements and pass an examination. Again, these are voluntary certifications and there is no industry standard as of yet for licensing of construction managers.

The American Institute of Architects contract

According to AIA contract document A201 Article 3, the contractor shall read over all sections of the document and all the construction drawings. He/she should carefully review the items and fully understand what is stated in them. It is the job of the contractor to go to the site and see the layout and ascertain any information that will be necessary for the production of the project. Any design errors or omissions that are discovered by the contractor, either on site or while reviewing the documents and drawings, should be immediately presented to the architect. Any errors in this process could result in increased time and money, causing the contractor to file a claim for these additional expenses. In regards to errors and omissions, the contractor will not be held liable unless he/she knowingly knew of the errors and failed to report them to the architect.

The contractor shall be responsible for the means, methods, and coordination of all the work that falls under their contract and is responsible for supervising and directing the work on the site. If a procedure is specified in the documents, then the contractor shall follow those steps unless he/she feels it is unsafe and/or risky. In which case, the contractor should inform the architect and wait for a response before completing the task. The contractor is responsible to the owner for performance of the contractor's employees, the subContractors and their agents, and anyone else that performs work on the site for both the contractor and the subcontractor.

According to AIA 201A Article 3 the contractor shall pay and supply all materials, supplies, tools, equipment, machinery, water, heat, utilities, transportation, and any other facilities necessary for the work to be performed. The contractor may make changes to the specifications, but only after the architect has reviewed them and the owner has approved. The proper steps for this procedure are known as a change order and shall be completed appropriately for each change.

Contractors must ensure all employees working on the site are of good character and capable of handling tasks given to them. The contractor has a warranty with the owner and architect, that all materials and equipment shall be of proper quality and new unless otherwise stated in the documents. In addition, all work completed by the contractor shall be free from defects unexpected. The contractor is responsible for acquiring and paying for all building permits, providing the project schedule and keeping it up to date, providing allowances, providing an intelligent superintendent, maintaining samples and documents on the site, providing shop drawings, and cut sheets. As for the site, the contractor is responsible for remaining within the site boundaries, providing access to the site for the owner and architect, and cleaning up at the end of the project.

Owners

The owner's first task is to designate in writing a representative to assume authority for all decisions requiring the owner's approval. The owner is required to provide the contractor with any information necessary for the mechanics of lien rights. Except for payments mentioned in the previous section the owner is responsible for all other costs. Surveys of the site shall be paid for by the owner. These surveys provide necessary information for the contractor. Any information or services needed by the contractor shall be handled promptly. The owner will provide the contractor with drawings and project manuals free of charge. Owners have the right

to stop work if the contractor has not adequately performed certain tasks. Also the owner has the right to carry out work, meaning if the contractor fails to finish something properly the owner has the right to request it be redone. If the contractor refuses to fix the work they are given a second warning, if in which the contractor still does not comply the owner can then issue a change order and deduct costs from the contractor.

Major Causes for Delays

Delays on a construction project are realistic. However, Arain's study attempts to remediate some of the common delays which occur on construction projects in Saudi Arabia. These delays were often the result of communication barriers and personal issues between the disciplines. The key factor to be considered for successful completion of a project is communication between the disciplines. "It is postulated that disagreements between these two parties have caused barriers in the design phase and construction process" (Arain et al. 2006, p. 74). A study conducted by Arain and his colleges established 45 possible causes of delays in the construction process. These 45 causes (Table 2-1) were compiled in a list to be ranked by Contractors.

This list included predominant causes of delays occurring on a majority of construction projects. Among this list were several causes that relate more specifically to this thesis, communication and personal interaction which would include; communication gap between constructor and designer, lack of mutual respect between constructor and designer, lack of coordination between the parties, obstinate nature of participants, participants honest wrong belief, and personal conflicts of professionals. Looking over the results of the survey, the average mean of all delays was 2.85. However, the average mean for delays related to communication or interpersonal conflicts is at or well above the 2.85 mean, implying these are prominent issues amongst the construction industry.

Table 2-1. Causes for inconsistencies in Saudi Arabia

Number	Causes	Top 5 delays	Mean
1	Involvement of contractor in the design conceptual phase		2.26
2	Involvement of contractor in the design development phase		2.30
3	Lack of data		3.11
4	Delay in preparing construction documents		3.07
5	Lack of human resources in design firm	4	3.48
6	Time limitation in the design phase		3.19
7	Lack of designer's knowledge of available matierals and equipment	5	3.41
8	Incomplete plans and specifications		3.41
9	Insufficient working details	3	3.56
10	Communication gap between constructor and designer	2	3.62
11	Lack of mutual respct between constructor and designer		2.85
12	Exotic designs and technology		2.44
13	Ambiguous design details		2.41
14	Lack of specialist construction manager		2.52
15	Material changes during the construction phase		2.81
16	Shortage of construction materials		2.59
17	Design errors		3.22
18	Procurement delays		2.70
19	Material approval		2.81
20	Lack of coordination between parities		3.56
21	Construction errors at job site		2.85
22	Lack of skilled manpower		3.11
23	Designer's lack of awareness about ongoing construction process		2.81
24	Contractor's lack of comprehension of drawing details and specifications		3.11
25	Involvement of designer as consultant	1	3.63
26	Contractor's lack of knowledge about newtechnology		2.78
27	Desing complexity		2.96
28	Buildability		2.85
29	Building codes		2.44
30	Government regulations		2.30
31	Lack of professional experience and judgement		2.67
32	Project delivery systems		2.41
33	Obstinate nature of participants		3.04
34	Participant's honest wrong belief		3.37
35	Economic situation		2.78
36	Fast track construction		2.33
37	Weather conditions		1.96
38	Nationalities of partiipants		2.15
39	Change orders		2.67
40	Preparation and approval of shop drawings		3.30
41	Personal conflicts of professionals		3.19
42	Unforseen problems		2.26
43	Design omissions		3.30
44	Involvement of contractor as consultant		2.78
45	Project management as individual professional service		1.78
		average	2.85

(Arain et al. 2006)

Failure with in the structure of the delivery system is also a major issue. This failure can lead to complications throughout the entire process, from design to construction. The traditional delivery system is typically where the complications begin. A traditional delivery system intends to evoke coordination and team effort. However, this is rarely the case. In addition to the 45 causes mentioned prior, there is one which appears to have been overlooked, economic differences. The designer wants to provide the client with a design at the lowest possible cost to

the design firm, while generating an income which covers the firm's costs and labor. The client is seeking to protect his/her investment by purchasing a highly functioning facility at the lowest possible cost. The contractor is looking to produce the building for their client at the lowest possible cost, while maintaining sufficient quality to last through the warranty. Each member of the team is united in desiring the best product for the absolute lowest price. However, price is not distinguished the same by each member. "The dichotomy of goals creates adversity between key participants. At some point in the construction process – the carefully fashioned construction team begins to unravel" (Kavanagh 1978, p. 28).

As a project begins, a design is chosen and the contractor selected. As the contract states, the contractor is responsible for mentioning any errors found in the construction documents. This is the first juncture at which the design usually comes under attack and creates tension between the team. The contractor begins to review plans and point out any infractions. The designer becomes defensive, protecting both the company and their design. The project starts to slow down due to paperwork and disputes. Pressure is placed on the owner, as they need to approve of final changes and make decisions quickly to keep the project moving. As the process continues, delays creep up from weather, design issues, labor problems, and other uncontrollable events. These delays bring up change orders and requests for more time. As confrontations develop, each party begins to defend themselves out of self-interest. Usually the designer and the owner will unite as they tend to share the same vision. "As a result, conflict develops among the owner, the design team, and the Contractors. In fact the antagonism is inherent even before the Contractors are selected; usually it is a carryover from prior projects" (Kavanagh 1978).

Delays on a construction project can often be linked to the drawings and specifications. A lack of awareness and communication is once again a factor on these issues. A questionnaire

created by Fisk (1978) sought to investigate contractor's reactions to specifications. After the Contractors responded to the survey he then took the reactions to architects and engineers. Fisk wanted to get the responses of the architects and engineers after reading the Contractors reactions. Contractor's responding to this survey emphasized that specifications were not at the level needed for construction. The architect's agreed with contractor's response on a majority of questions. Specifications are written by a specifications writer and not the engineer directly. If the specification writer is unaware of the construction process or materials than the specifications will not be up to professional requirements and the contractor will have to request more information or a change order. Often, the writer will try to copy specifications from previous jobs, or use a performance based specification, instead of perspective specifications. Contractors prefer this; however it places the burden of designing the connection on the contractor, when clearly this is a procedure that should be done by the engineer. Contractors are not licensed to make this decision, nor having to wait for a response. Sometimes a writer will over specify, just to make sure they do not omit anything. This is another way of protecting the engineer and putting the risk on the contractor. However, it leads to many problems on the site. It appears that specifications can cause a lot of tension on the project. Engineers should make sure their specification writers are qualified and understand the construction process. Improving the specifications can help alleviate a little tension between the Designers and the Contractors.

Solutions in the Industry

Partnering

Partnering utilizes the concept of team building. It is a newer concept in the industry and is based on 5 core values. The first value is commitment by management to communicate their support to all workers and laborers throughout the project. Management encourages decision making on all levels and are constantly working to instill partnering characteristics to employees

on every level. The second core value is a mutual trust developed between all individuals of the team. This is achieved by helping others to succeed and trusting they will. Core value number three is open communication. This quality inspires people to trust more and integrate themselves within the team. The more communication they see, the more willing they are to open up and trust in the future. The fourth value is sharing responsibilities, which also means sharing the risk and benefits. It becomes every member's responsibility to keep the project on course. If one fails, all fail. This may be seen as a push to help and encourage each other to succeed. The final core value is a common goal. Together the team creates a goal and makes sure that everyone is working together for that goal. This process encourages collaboration and a team effort and is a great solution to the many problems that drive the industry apart.

A correctional facility which was built in Florida was a success, mostly due to the use of the partnering process. "Ask any member of the project team how they were able to overcome the odds, and they'll tell you that partnering was the number one reason . . . We're convinced it's the way of the future" (Galey 1996, p. 124). The project had many factors that could slow it down; the amount of materials, location, size, and time. The team managed to get the job completed on time and in budget. A partnering meeting was set up and the disciplines met together, conducting personality tests, accessing goals, and practicing problem solving. At the conclusion of the meeting, an agreement was made and signed. When problems arose on the jobsite, they were handled at that level and only passed to upper management as a last resort. The project was a success because all parties involved worked together towards a common goal; completion.

Design/Build

The design build delivery process provides the owner with one contact. No longer does the owner have to contract with the architect and contractor separately. Design build companies

can either have the architect, engineers, and Contractors all in one office or they can subcontract out some of the work. The benefit to the owner is that more coordination is placed on the design builder. Although, the contractor may loose the system of checks and balance in this system, the result is the same, al members working for the same goal of producing a quality facility for the owner. An advantage to design build team is that a project can be built at a faster pace. In most cases, drawings are still being completed while construction has begun and time wasted on waiting for feedback from the designer is shortened, as it is done in house. Feedback from an owner is likely shortened too, because the contractor no longer has to go through the architect to get to the owner. As long as collaboration between the disciplines continues, this form of delivery is a great solution.

The Need for Change

"Success in the construction industry can be achieved and amplified when the value of cooperation is accepted" (Carr 1999, xvii). Unfortunately, in the construction industry this is rare and requires more commitment from all parties involved. Without collaborative working relationships the consequences can be disastrous. The amount of litigation and construction disputes in the last few decades has increased tremendously. The cost of these situations is substantial and can become overwhelming to all parties involved. Due to an underlying breakdown of relationships in the construction industry, change is necessary. Each party has maintained a separate agenda and conflicting objectives. As a result, each has contributed to this breakdown and they have become opponents. Distrust in the industry increased and communication was hindered, thus claims increased. Solving technical jobsite problems slows down production, while increasing money and time. Because of these confrontations, Designers and Contractors lose profits and owners end up paying more.

> The need for change is great, but cultural norms that have evolved over decades are not easily changed. A simple fix cannot reverse the system of confrontation and conflict in place for years. A cultural change in the mindsets of construction organizations is required. This is a significant paradigm shift for many organizations. To make such a shift, those in the construction industry not only have to recognize the need for change and be fully committed to making it, they also require a clear path to follow for building better relationships. (Carr 1999, p. xviii)

This need for change is still an issue in the industry today. There are several solutions that are in place already. These solutions work to a degree, however, the industry still needs to accept this need to change in order to grow. While these solutions address the problems, they still have are not sufficient. Even though these solutions have been around for several decades, the industry has neglected to implement them. The construction industry continues to mask the problems by changing the delivery system. Unfortunately, this fails to address the underlying issues of communication and adversarial relationships within the industry and perpetuates the problem. Communication and collaboration are integral to the success of any project. The industry needs to strengthen this skill within each individual company and amongst all disciplines.

CHAPTER 3
METHODOLOGY

Currently there is little information available on the opinions of professionals in the design and construction industry. The research conducted for this study analyzed the roles of professionals to define each disciplines obligations and responsibilities. While conducting the literature review the value of collaboration throughout the industry was investigated. Communication proved to be a critical part of the success or failure on a construction project, according to the literature examined. The development of delays is evidently linked to communication and other underlying issues. In order to get an indication about the experience and opinions of professionals on collaboration in the construction industry a survey was developed. The survey allows professionals to anonymously express their opinions on topics within the industry.

Design of the Survey

The survey (Appendix A and B) was designed to ask both qualitative and quantitative questions in order to get an understanding of the employee's background and how it does or does not affect there views of associated disciplines. It was important that the same survey be used for all disciplines in the construction industry. By conducting the survey in this format it keeps every employee on the same level. However, it became evident that there was a need for two surveys to be drawn up. The questions on each survey were exactly the same, but in order to decipher the disciplines one survey geared all questions towards Designers and the other survey towards Contractors. The questions asked included demographic information, as well as educational level, and work history. The survey also sought information about past work experiences with other disciplines. In the survey questions asked employee's their view on collaboration with other disciplines. The questions asked were for the most part closed- ended,

resulting in a direct response. However, a few open-ended questions allowed the employee's to say as little or as much as they felt necessary to get their opinion across. At the end of the survey space was provided for participants to add comments, concerns, and common stereotypes of their profession. This section can not be statistically analyzed; however the information is still applicable and can be categorized.

Sample Selection

The sample selection is based on a company's interaction with various disciplines in the construction industry. Commercial work was specifically surveyed because of the scale and variety of work done in this arena. Both sides of the industry needed to be asked in order to get a complete understanding of the issues. Otherwise the answers would only provide one view. ENR top 500 Design Firms from 2006 was the list used to select design professionals. ENR top 400 Construction Companies from 2006 was the list used to select Contractors. Initially the idea was to select the top 100, however this was reevaluated. The bottom 100 companies were selected from each list. The top 100 companies were assumed to be at a point were collaboration was integrated into the company policies. It was assumed that the bottom 100 companies would not be at the same level as the top 100 companies. The surveys were mailed to each company along with a consent form. Surveys were either addressed to the attention of design professional(s) or project manager(s). In some cases the survey were sent either electronically or through a facsimile due to time. Out of the 100 surveys sent to construction companies 21 responded. Only 20 design firms have responded out 100 surveys that were distributed.

Analysis of the Results

The results from the surveys were entered into a MS Excel spreadsheet. The answers were totaled and separated into construction or design responses. The survey can be broken into four separate sections based on the formatting of questions and responses. Each section has to be

analyzed differently. The data collected from the quantitative questions sets the parameters for the study, which in this case is very broad. Section 1 and 3 were analyzed using the chi-squared test. Section 2 used a rank correlation analysis. Every question in each section was analyzed separately, comparing the responses given by design professionals with those given by construction professionals. The response to each question is discussed in Chapter 4.

CHAPTER 4
SURVEY ANALYSIS

Surveys were sent to ENR top construction and design companies, all together 200 surveys where sent out. The bottom 100 out of ENR, Engineering News Record, top 400 were selected for construction and the bottom 100 of ENR's top 500 design firms were selected. The surveys sent to Designers asked questions relating to their interaction with Contractors, while surveys sent to Contractors asked questions relating to their interaction with Designers. Out of the 100 surveys sent to the design companies 25 surveys were returned and out of the surveys sent to the construction companies 26 surveys were returned. All the data collected from the surveys were compiled and analyzed for this study.

Demographics

Section 1 of the survey asked participants to provide some information about themselves. The questions asked were regarding age, geographical location, gender, job title and level of education. The ages of Designers responding ranged from 30 to 60 years of age. Respondents to the construction survey where between the ages of 24 and 65. A majority of the participants were male: 23 from construction and 24 from design. There was 1 female Designer who responded and 3 female construction employees who responded. All participants had a college education, some more advanced then others. Out of all design respondents 16 had a bachelor's degree, 7 respondents had a master's degree, and 1 had a Ph.D. Of all construction respondents, 18 had a bachelor's degree and 6 had a master's degree. All the respondents were in management positions. Over half of the respondents were upper level management, such as Presidents, Vice Presidents, or Principles. The surveys were sent to companies all over the United States so locations varied. Surveys were collected from cities located in 23 different

states. The one common link among all these companies was their listing among the ENR top construction and design companies for 2006.

Section 1

Section 1 of the survey inquired about the amount of interaction that takes place between the two disciplines. This section also investigated the nature of their interaction, be it positive or negative. A Chi-squared test was performed on all the questions in this section and a 90% level of confidence was assumed. The analysis of Section 1, Question 1 will be explained in detail with the remaining questions in this section following the same procedures.

A Contingency Table calculation was employed to determine if a significant difference in the distribution of responses existed between Designers and Contractors. The procedure is illustrated in Table 4-1. The Observed responses of the Designers and Contractors are shown in the second and third columns for each of the possible response categories. The total number of responses from each group is shown in the bottom row. The total number of responses for the two groups combined in each category is displayed in the 4th column. The percentages in the 5th column represent the distribution in each category of the Designers and the Contractors combined.

In order to perform a Chi-squared test of the hypothesis that there is no significant difference between the distribution of responses given by the Designers and the Contractors, it is necessary to calculate "expected" response rates. If there is no difference between the two groups of respondents, then the percent of responses in each response category should be about the same. Thus, the percentage distribution of the combined respondents that is shown in the 5th column is used to compute the expected response rates. This step involves multiplying the Observed percentage responses in each row of the 5th column times the total number of Designer respondents to produce the Expected response frequencies for the Designers in column 6. This

process is repeated using the percentage in the 5th column and the total number of Contractor respondents to produce the Expected response frequencies for Contractors shown in the 7th column.

Question 1-1:

How often do you work with a Contractor/ Designer?

The Chi-square value for testing the null hypothesis uses the Observed response rates and the Expected response rates to produce a Chi-square value with three degrees of freedom [d.f.=(rows-1)(col-1)]. As shown in Table 4-1, the Chi-square value for the Designer responses is 0.10 and the Chi-square for the Contractor responses is 0.09. The critical value of Chi-square with 3 degrees of freedom at the 90% confidence level is 6.25 (Ostle and Malone 1988). Since the calculated Chi-squared value is less than the tabulated value it can be concluded with 90% confidence that there is no significant difference between the response patterns of the Designers and the response pattern of the Contractors. There is a minimal deviation between the expected

Table 4-1. Responses for Question 1-1

	Observed				Expected		(O-E)^2/E	
Response	Designers	Contractors	Total	%	Designers	Contractors	Designers	Contractors
Never	0	0	0	0.00	0	0	0	0
Seldom	0	1	1	1.96	0	1	0	0
Often	11	10	21	41.18	10	11	0.10	0.09
Frequently	14	15	29	56.86	14	15	0.00	0.00
Total	25	26	51		24	27	0.10	0.09

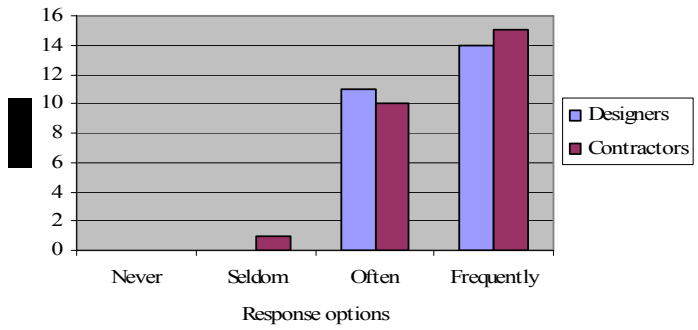

Figure 4-1. Analysis of Question 1-1 responses

and the observed results. It is evident in the chart that (See Figure 4-1) there was a slight, but significant, difference in opinions between the disciplines. However, responses received were either categorized as often or frequent with one Contractor responding seldom.

Question 1-2: The resolution of conflicts is usually?

Question 2 had 3 responses to choose from, positive, negative and no change. One of the participants did not answer this question. Therefore, this question has a different total and there are only 2 degrees of freedom. The critical value of Chi-square with 2 degrees of freedom at the 90% confidence level is 4.61. The hypothesis states that there is no significant difference between Designers and Contractors relative to the resolution of conflicts. The results indicated that the differences observed are a random occurrence. Based on the responses in Table 4-2 there is minimal and insignificant deviation between the expected and the observed results. The data also indicate with a 90% confidence that there is no significant difference between the

Table 4-2. Responses for Question 1-2

	Observed				Expected		(O-E)^2/E	
Response	Designers	Contractors	Total	%	Designers	Contractors	Designers	Contractors
Positive	22	24	46	92.00	23	23	0.04	0.04
Negative	0	1	1	2.00	1	1	0.50	0.50
No change	3	0	3	6.00	2	2	1.50	1.50
	25	25	50		25	25	2.04	2.04

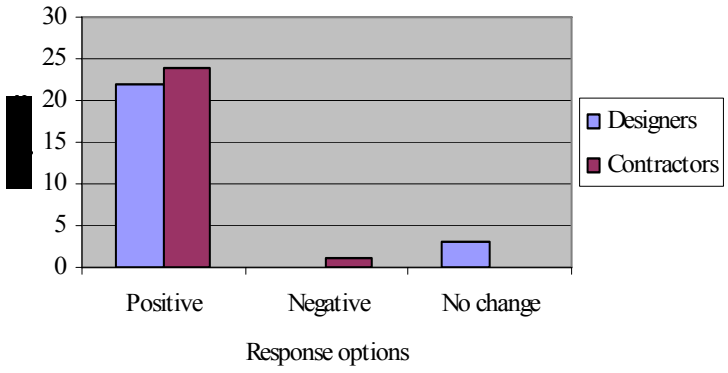

Figure 4-2. Analysis of Question 1-2 responses

response pattern of the Designers and the response pattern of the Contractors. All but 4 participants felt that conflicts were solved positively. "No change" was selected by 3 of the participants and 1 Contractor experienced negative resolution. Figure 4-2 graphically represents the participant's responses.

Question 1-3: How often are conflicts resolved in your favor?

Question 3 is evaluated using 3 degrees of freedom again. Therefore, the critical value of Chi-square with 3 degrees of freedom is 6.25. The hypothesis in this question states that there is no significant difference between Designers and Contractors relative to conflicts being solved in their own favor. This is a true assumption according to the surveys collected. Data collected for question 3 again concluded a random occurrence with minimal deviation between the observed and expected values. The data in Table 4-3 supports the conclusion with a 90% confidence, the conclusion that there is no significant difference between the response pattern of the Designers

Table 4-3. Responses for Question 1-3

	Observed				Expected		(O-E)^2/E	
Response	Designers	Contractors	Total	%	Designers	Contractors	Designers	Contractors
Never	0	0	0	0.00	0	0	0.00	0.00
Seldom	2	3	5	9.80	2	3	0.08	0.08
Often	19	21	40	78.43	20	20	0.02	0.02
Frequently	4	2	6	11.76	3	3	0.38	0.37
	25	26	51		25	26	0.48	0.46

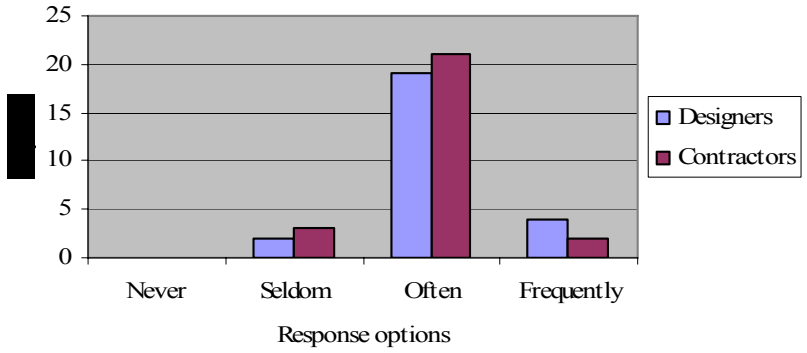

Figure 4-3. Analysis of Question 1-3 responses

and the response pattern of the Contractors. Majority of respondents stated that conflicts were often resolved in their favor for both disciplines, which is interesting, and suggests a cooperative association between the 2 groups. However, considering both parties are working towards the same goal or end result, their responses should be the similar as illustrated in Figure 4-3.

Question 1-4: How often do you agree with the Contractor/Designers methods?

Hypothesis: there is no significant difference between Designers and Contractors relative to how often they agree with the other discipline's methods. The hypothesis for this question could not be rejected with 90% confidence. The differences observed were regarded as a random occurrence. The data in Table 4-4 supports the conclusion with 90% confidence and with 3 degrees of freedom that there is no significant difference between the response pattern of the Designers and the response pattern of the Contractors. (See also Figure 4-4) Majority of participants stated they often agreed with the methods used by either the Contractor or Designer.

Table 4-4. Responses for Question 1-4

	Observed				Expected		(O-E)^2/E	
Response	Designers	Contractors	Total	%	Designers	Contractors	Designers	Contractors
Never	0	0	0	0.00	0	0	0.00	0.00
Seldom	0	1	1	1.96	1	0	0.51	0.53
Often	21	20	41	80.39	21	20	0.00	0.00
Frequently	5	4	9	17.65	5	4	0.04	0.04
	26	25	51		26	25	0.55	0.57

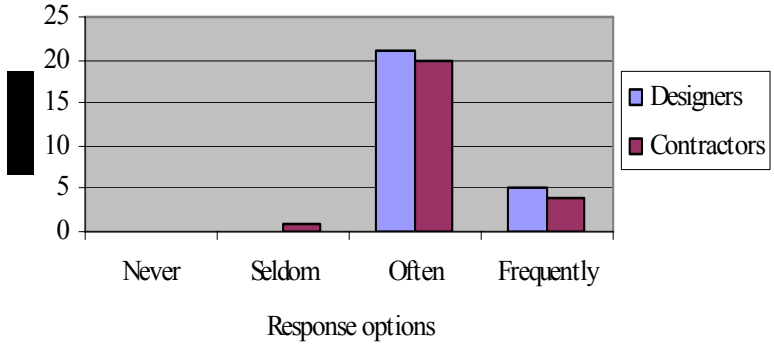

Figure 4-4. Analysis of Question 1-4 responses

Question 1-5: How often do you communicate with the Contractor/Designer?

Data collected for question 5 show the greatest difference between the two discipline's responses in Figure 4-5. However, the Chi-square calculated values are still not large enough to result in rejection of the hypothesis. The hypothesis for question 5 states that there is no significant difference between Designers and Contractors relative to how often they communicate. Therefore, the data shown in Table 4-5 indicate with 3 degrees of freedom at a 90% confidence level that there is no significant difference between the response pattern of the Designers and the response pattern of the Contractors.

Table 4-5. Responses for Question 1-5

	Observed				Expected		(O-E)^2/E	
Response	Designers	Contractors	Total	%	Designers	Contractors	Designers	Contractors
Never	0	0	0	0.00	0	0	0.00	0.00
Seldom	2	2	4	7.84	2	2	0.00	0.00
Often	13	8	21	41.18	10	11	0.71	0.68
Frequently	10	16	26	50.98	13	13	0.59	0.57
	25	26	51		25	26	1.30	1.25

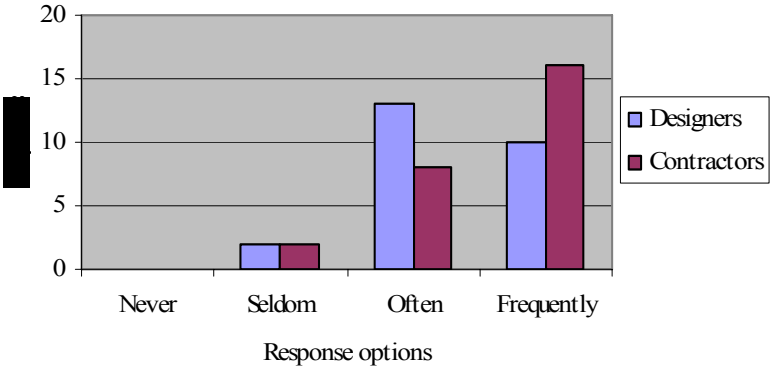

Figure 4-5. Analysis of Question 1-5 responses

Section 2

The second section of questions asked participants to rank the importance of 6 aspects of the construction and design industries. In order to analyze the data collected Spearman's Coefficient of Rank Correlation was used. A confidence level of 90% was used again for this

section of the analysis. This section of the survey was important in order to verify if design professionals and Contractors view different facets of the project with the same level of importance. Here are the 6 aspects respondents where asked to rank: client, project, schedule, budget, quality and employer. The analysis of the first aspect will be explained in detail. The remaining aspects will be analyzed in the same manner.

Section 2, Client

The surveys were collected and the results tallied for each aspect and then separated according to the type of survey completed. The next step was to create a graph for each aspect. Figure 4-6 shows the order in which both disciplines ranked the client with 1 being the most important. This analysis showed the magnitude of the correlation and helped determine if the hypothesis would be accepted or rejected. Table 4-6 was used to calculate the difference and then the difference squared in order to calculate Spearman's Rank Correlation Coefficient (Rs). Rs was computed as: $Rs=1-[6\sum d^2/n(n^2-1)]$. Where n is the total number of pairs of ranks, in this section n will always be 6. According to Spearman's coefficient of rank correlation the degrees of freedom are calculated as the number of ratings. In this section (n) will always be 6 and therefore there will always be 6 degrees of freedom. In order for the hypothesis to be rejected the critical value with 6 degrees of freedom at a 90% confidence level must be greater then 0. 83.

The hypothesis for the ranking of the client in section 2 states that there is no significant difference between Designers and Contractors relative to their view on the importance of the client. As shown in Table 4-6, Rs equals 0.63. Since the Rs is less than the critical value of 0.83 with 6 degrees of freedom at the 90% confidence level, the null hypothesis that there is no statistically significant difference between the ranks assigned by Designers and Contractors is accepted with 90% confidence. The numbers collected show that Contractors place slightly,

although not significantly, more importance on the Client as the most important aspect of the project. Figure 4-6 illustrates that the disciplines ranked the clients importance in a similar manner.

Table 4-6. Response rank of the client

Rank	Designers	Contractors	d	d^2
1	18	19	1	1
2	3	4	1	1
3	1	2	1	1
4	3	0	3	9
5	0	0	0	0
6	0	1	1	1
T	25	26	7	13
Rs	0.63			d.f. 6

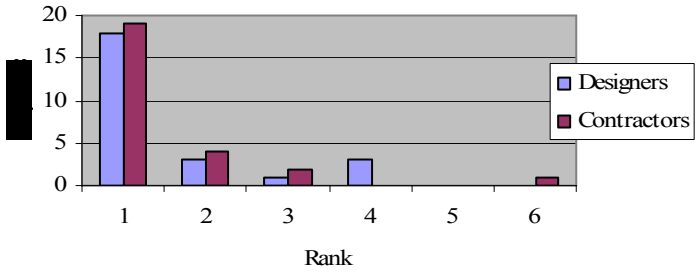

Figure 4-6. Analysis of client response

Section 2, Quality

Hypothesis: there is no significant difference between Designers and Contractors in regard to the importance of quality. The hypothesis for quality could not be rejected with 90% confidence. The Rs value calculated in Table 4-7 is -0.34 indicating there is a weak, but not significant, negative correlation. Since the Rs is less than the critical value of 0.83 with 6 degrees of freedom at the 90% confidence level, the null hypothesis that there is no statistically significant difference between the ranks assigned by Designers and Contractors is accepted with 90% confidence. The views of Designers and Contractors differ in the ranking of quality. Contractors regard it as the second most important aspect on a project. Designers ranked it

evenly between the second and fifth most important aspect. (See Figure 4-7) According to the Rs value there is a weak, although not significant, negative correlation between the 2 parties regarding quality.

Table 4-7. Response rank of quality

Rank	Designers	Contractors	d	d^2
1	3	2	1	1
2	4	9	5	25
3	6	2	4	16
4	5	7	2	4
5	4	4	0	0
6	3	2	1	1
T	25	26	13	47
Rs	-0.34			d.f. 6

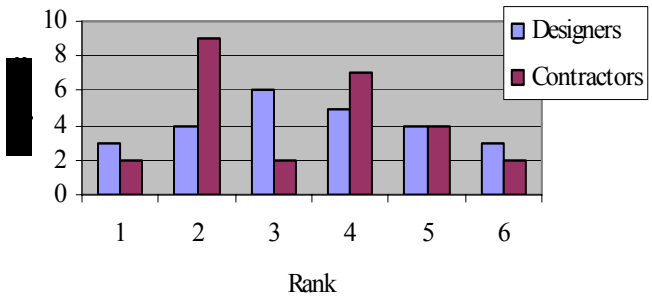

Figure 4-7. Analysis of quality response

Section 2, Budget

Hypothesis: there is no significant difference between Designers and Contractors relative to the importance of budget on a project. Again the hypothesis can not be rejected at the 90 % confidence level. According to Table 4-8 the Rs value is 0.63. Since the Rs is less than the critical value of 0.83 with 6 degrees of freedom at the 90% confidence level, the null hypothesis that there is no statistically significant difference between the ranks assigned by Designers and Contractors is accepted with 90% confidence. Figure 4-8 demonstrates the ranking of participants relative to the importance of budget. Budget was ranked as the third most important

aspect of a project according to both Designers and Contractors. The views of both disciplines on this portion of a project are similar.

Table 4-8. Response rank of the budget

Rank	Designers	Contractors	d	d^2
1	0	2	2	4
2	4	4	0	0
3	9	9	0	0
4	5	7	2	4
5	5	4	1	1
6	2	0	2	4
T	25	26	7	13
Rs	0.63			d.f. 6

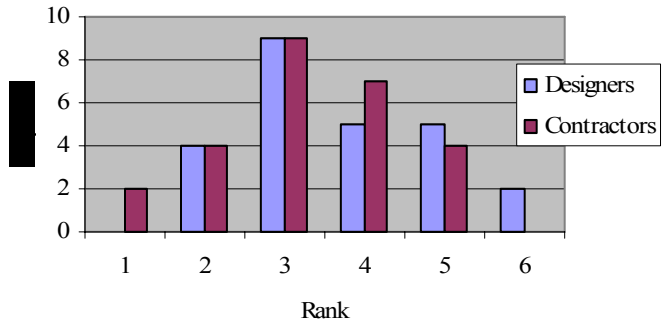

Figure 4-8. Analysis of budget response

Section 2, Schedule

Schedule is seen as the fourth most important characteristic of a project by both Designers and Contractors. Hypothesis: there is no significant difference between Designers and Contractors relative to the importance placed on the schedule. Again the resulting data confirmed an insignificant random occurrence of variation among responses in regards to the schedule. The Rs value calculated in Table 4-9 equals 0.34. Since the Rs is less than the critical value of 0.83 with 6 degrees of freedom at the 90% confidence level, the null hypothesis that there is no statistically significant difference between the ranks assigned by Designers and Contractors is accepted with 90% confidence. The similarity of the responses is shown graphically in Figure 4-9.

Table 4-9. Response rank of the schedule

Rank	Designers	Contractors	d	d^2
1	0	0	0	0
2	5	2	3	9
3	5	7	2	4
4	9	8	1	1
5	5	5	0	0
6	1	4	3	9
T	25	26	9	23
Rs	0.34			d.f. 6

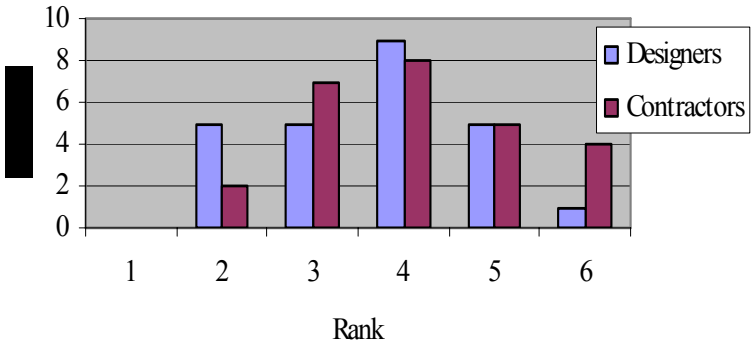

Figure 4-9. Analysis of schedule response

Section 2, Project

The significance of the project itself was ranked as the fifth most important portion of a job by both Designers and Contractors. Figure 4-10 illustrates the participant's survey responses. The views of the Designers and Contractors were very similar in ranking this aspect as may be seen in Figure 4-10. The hypothesis stated that there is no significant difference between Designers and Contractors relative to the importance of the project. Analysis of the results of responses to this question came very close to rejecting the null hypothesis. The data collected in Table 4-10 resulted in an Rs value of 0.80. Since the Rs is less than the critical value of 0.83 with 6 degrees of freedom at the 90% confidence level, the null hypothesis that there is no statistically significant difference between the ranks assigned by Designers and Contractors is accepted with 90% confidence. These results are shown graphically in Figure 4-10.

Table 4-10. Response rank of the project

Rank	Designers	Contractors	d	d^2
1	2	2	0	0
2	5	4	1	1
3	2	4	2	4
4	2	1	1	1
5	11	11	0	0
6	3	4	1	1
T	25	26	5	7
Rs	0.80			d.f. 6

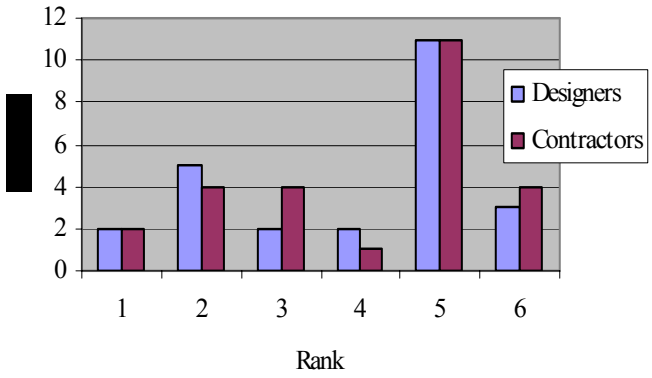

Figure 4-10. Analysis project response

Section 2, Employer

Employer is the sixth aspect discussed in this section. The data show that both Contractors and Designers ranked the employer as the least most important issue on a job. The hypothesis states that there is no significant difference between the Designers and Contractors relative to the importance placed on the employer. According to the data collected and represented in Table 4-11 the null hypothesis is true. The Rs value calculated equals 0.63. Since the Rs value is less than the critical value of 0.83 with 6 degrees of freedom at the 90% confidence level, the null hypothesis that there is no statistically significant difference between the ranks assigned by Designers and Contractors is accepted with 90% confidence. Views of the 2 disciplines were similar for the most part. In Figure 4-11 the response ranking of the employer is graphically demonstrated.

Table 4-11. Response rank of the employer

Rank	Designers	Contractors	d	d^2
1	2	1	1	1
2	4	3	1	1
3	2	2	0	0
4	1	3	2	4
5	0	2	2	4
6	16	15	1	1
T	25	26	7	11
Rs	0.69			d.f. 6

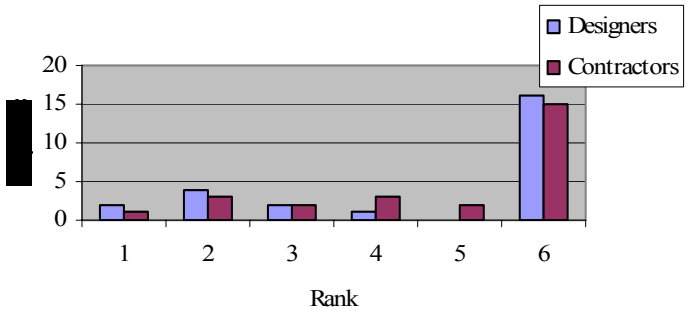

Figure 4-11. Analysis of employer response

Section 3

Section 3 of the survey asked participants questions regarding the other disciplines. This section was intended to verify that each discipline knew the roles and duties of themselves and each other. Also within each question there is a negative option. The negative option needs to be in the survey otherwise the responses would be skewed and anyone who has a negative experience would be inclined to skip the question. This provides respondents the opportunity to select any response they feel is appropriate to their experiences. After the surveys were collected the data was tallied. The Chi-square method was used to verify the responses for this section. In this section each question had 5 options. The fifth being "Other", allowing the participant to write exactly what they thought should be the answer. In this section the total for each question will be different because of the participant's option to check all that apply. Question 1 in this section will be explained in detail. The remaining questions followed the same format.

Question 3-1

What do you think of the Contractors/Designers you work with on a daily basis?

- Knowledgeable about methods of construction.
- Able to make informed decisions.
- Capable of recognizing errors of design or construction
- Able to communicate effectively with other professionals.
- Other (Please specify)

The first step was to tally the responses and separate them into the appropriate category. The survey responses are the observed data, shown in columns 2 and 3 of Table 4-12 and subsequent tables. The next step was to calculate the percentage using the total number for each discipline's response divided by the total number of responses. Then, each percentage can be multiplied by the observed totals providing the expected numbers in columns 6 and 7. After the expected totals are calculated they are applied to the formula: [(O-E)^2/E]. This formula is used for each discipline's response. The results are summed providing the number used to evaluate the hypothesis in the Chi-square chart. In section 3 the degrees of freedom are calculated in the same fashion as section 1, [d.f.=(rows-1)(col-1)]. Therefore, all questions in section 3 have 4 degrees of freedom. The critical value of Chi-square with 4 degrees of freedom at the 90% confidence level is 7.78.

In question 1, the participants are providing information about the other disciplines. The hypothesis for this question states that there is no significant difference between the Designers and Contractors relative to what they think of each other's abilities on a daily bases. Question 1 of section 3 resulted in only random variation in the responses and the hypothesis could not be rejected. Therefore, there is minimal deviation between observed and expected values as shown in Table 4-12 and Figure 4-12. The data supports accepting with 90% confidence that there is no significant difference between the response pattern of the Designers and the response pattern of

Table 4-12. Responses to Question 3-1

	Observed				Expected		(O-E)^2/E	
	Designers	Contractors	Total	%	Designers	Contractors	Designers	Contractors
1	21	14	35	25.18	18	17	0.45	0.49
2	17	17	34	24.46	18	16	0.02	0.02
3	20	16	36	25.90	19	17	0.10	0.11
4	12	19	31	22.30	16	15	1.03	1.10
Other	2	1	3	2.16	2	1	0.13	0.14
	72	67	139		72	67	1.73	1.86

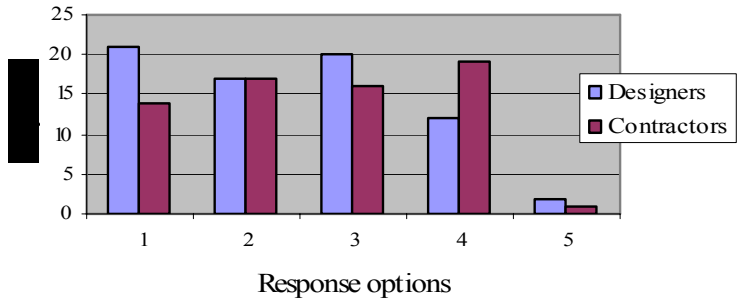

Figure 4-12. Analysis of Question 3-1 responses

the Contractors. Design participants that responded to the 5th option, "Other", commented that the answers are dependent on which Contractor you are working with since some are good and some are bad. The Contractor that responded "Other" stated that Designer's are somewhat knowledgeable of methods and able to make informed decisions.

Question 3-2

Interior Designers differ from interior decorators in that

- They only select colors, fabrics and finishes.
- They plan spaces and consider other building systems in the design.
- They can alter non-load bearing walls in buildings.
- They lack an understanding of the building process.
- Other (Please specify)

Out of all responses 13 participants did not answer this question, 7 Contractors and 6 Designers. In most cases it was because the participant did not work with an Interior Designer. Hypothesis: there is no significant dependence between Designers and Contractors relative to

there perceptions of interior Designers or decorators. The hypothesis was concluded to be acceptable. This question was intended to verify that Contractors and Designers understand the

Table 4-13. Response to Question 3-2

	Observed				Expected		(O-E)^2/E	
	Designers	Contractors	Total	%	Designers	Contractors	Designers	Contractors
1	1	1	2	3.33	1	1	0.00	0.00
2	17	18	35	58.33	16	19	0.03	0.02
3	2	5	7	11.67	3	4	0.49	0.43
4	3	7	10	16.67	5	5	0.60	0.52
Other	5	1	6	10.00	3	3	1.73	1.51
	28	32	60		28	32	2.85	2.49

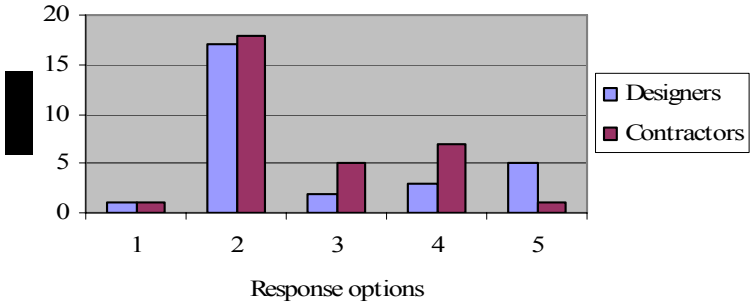

Figure 4-13. Analysis of Question 3-2 responses

expertise of an Interior Designer. The results indicate that there is minimal deviation between the observed and the expected values. Based on Table 4-13 it can be concluded at a 90% confidence level with 4 degrees of freedom that there is no significant difference between the response pattern of the Designers and the response pattern of the Contractors. These data are presented graphically in Figure 4-13. Designers who responded "Other" generally commented that Interior Designers have a broader understanding and are an integral part of the project team. A contractor responded that sometimes Interior Designers are no schedule oriented or lack understanding of the bigger picture.

Question 3-3

Architects:

- Only select colors, fabrics and finishes.
- Are more important than Contractors and interior Designers.
- Do not consider clients' or user needs.
- Incorporate user needs, clients' wishes and good design solutions to create built environments.
- Other (please specify)

Hypothesis: there is no significant dependence between Designers and Contractors relative to the characteristics of architects. The hypothesis could not be rejected in this case. Therefore, only a minimal deviation exists between the observed and expected results. The data in Table 4-14 indicates that at a 90% confidence level with 4 degrees of freedom that there is no significant difference between the response pattern of the Designers and the response pattern of the Contractors. The majority of professionals selected option 4 a positive response for the tasks an architect does on a project. However, it can be seen that a few respondents selected the negative options. Out of all the participants 1 selected option 2 and 2 participants selected option 3. These responses can be seen in Figure 4-14. A total of 5 participants responded to option 5. One of the Designers who responded to option 5 noted that architects consider the project holistically. Another participant mentioned that architects need to have an understanding of constructability. The last design response claimed that architects treat engineers as subservient. One Contractor stated that architects work best in a team attitude. The other Contractor mentioned that sometimes architects incorporate the user needs, but not all the time.

Table 4-14. Response to Question 3-3

	Observed				Expected		(O-E)^2/E	
	Designers	Contractors	Total	%	Designers	Contractors	Designers	Contractors
1	0	0	0	0.00	0	0	0.00	0.00
2	1	0	1	1.89	1	0	0.42	0.47
3	0	2	2	3.77	1	1	1.06	1.18
4	24	21	45	84.91	24	21	0.00	0.00
Other	3	2	5	9.43	3	2	0.05	0.05
	28	25	53		28	25	1.53	1.71

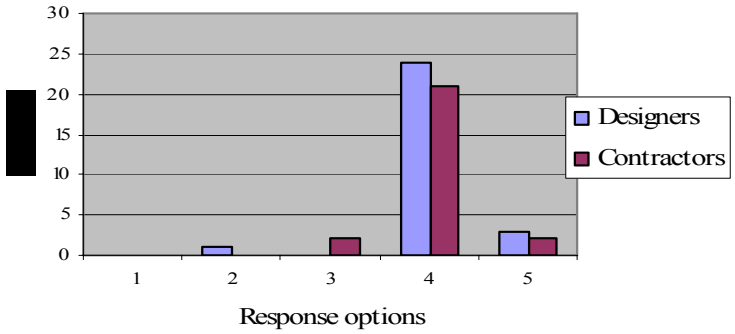

Figure 4-14. Analysis of Question 3-3 responses

Question 3-4

Contractors:

- Are only interested in money and profit on a project.
- Never select the specifications requested by the architect/Designer.
- Work towards the end goal of creating a safe structure.
- Are capable of seeing and interpreting plans.
- Other (Please specify)

The hypothesis for this question states there is no significant dependence between Designers and Contractors relative to the Contractor's characteristics on a project. The hypothesis could not be rejected leading to the conclusion that there is minimal deviation between the observed and expected values. The data in Table 4-15 leads to the conclusion with 90% confidence and with 4 degrees of freedom that there is no significant difference between the response pattern of the Designers and the response pattern of the Contractors. In question 4 the majority of participants selected either one or both of the positive responses. However, there are those few who selected the negative options. (See Figure 4-15) In this case it was only Designers and they felt that Contractors are only interested in money on projects, which is a typical stereotype of Contractors. In general the written responses note that Contractors work toward building a safe, profitable and quality product for the client and Contractors work best in a team oriented setting.

Table 4-15. Response to Question 3-4

	Observed				Expected		(O-E)^2/E	
	Designers	Contractors	Total	%	Designers	Contractors	Designers	Contractors
1	3	0	3	3.03	2	1	1.46	1.48
2	0	0	0	0.00	0	0	0.00	0.00
3	19	24	43	43.43	22	21	0.34	0.35
4	23	23	46	46.46	23	23	0.00	0.00
Other	5	2	7	7.07	4	3	0.61	0.62
	50	49	99		50	49	2.40	2.45

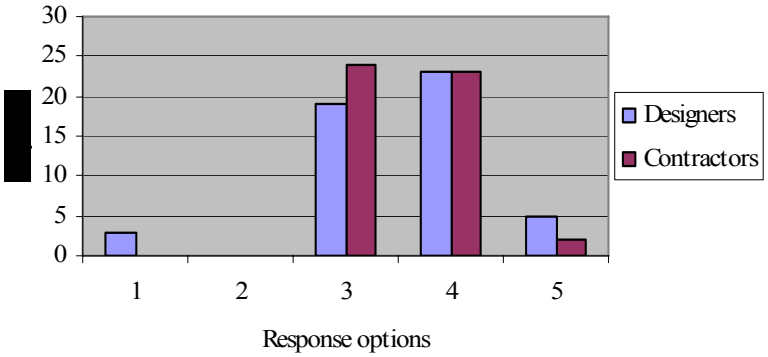

Figure 4-15. Analysis of Question 3-4 responses

Question 3-5

My biggest concern when working with a Contractor/Designer is?

- They do not understand my vision for the project.
- They are only concerned about money.
- They do not understand the building process.
- They do not know how to work with others.
- Other (Please specify)

Question 5 shows a few stereotypes consistent in the construction industry. The hypothesis that there is no significant dependence between the Contractor and Designer when they are working with the opposing discipline is no longer valid. The data in the responses vary greatly which is evident in Figure 4-16. Contractors responded that Designers are not aware of the building process and Designers feel that Contractors do not understand their vision. The results show a large deviation between the observed and expected values. Something other then a random occurrence appears to have created this deviation. The data in Table 4-16 shows that at

Table 4-16. Response to Question 3-5.

	Observed				Expected		(O-E)^2/E	
	Designers	Contractors	Total	%	Designers	Contractors	Designers	Contractors
1	10	3	13	20.97	7	6	1.16	1.40
2	8	0	8	12.90	4	4	2.98	3.61
3	2	13	15	24.19	8	7	4.71	5.72
4	8	4	12	19.35	7	5	0.31	0.37
Other	6	8	14	22.58	8	6	0.37	0.45
	34	28	62		34	28	9.52	11.56

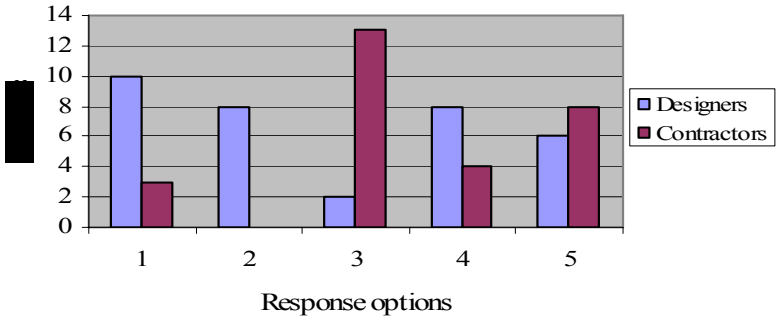

Figure 4-16. Analysis of Question 3-5 responses

a 90% confidence level with 4 degrees of freedom that there is a significant difference between the response pattern of the Designers and the response pattern of the Contractors. A lot of participants responded "Other" and expressed their own opinions. Designers felt that Contractors were not aware of the design process and at times were more concerned with money issues then providing the client what they wanted. The Contractors mentioned issues with contract documents, time, money, schedule and protecting themselves from errors. All of these are typical issues on a construction project.

Section 3, Question 6

When on the jobsite I prefer to work with

- People in my own profession.
- Professionals in other disciplines.
- No one.
- Subordinate professionals.
- Other (Please specify)

Hypothesis: there is no significant dependence between Designers and Contractors relative to whom they prefer to work with on the jobsite. Question 6 again produced random variation among the responses. The hypothesis could not be rejected based on the data collected. Therefore, there is only a minimal amount of deviation between the observed and expected values. The data collected in Table 4-17 and Figure 4-17 illustrates that at a 90% confidence level that there is no significant difference between the response pattern of the Designers and the response pattern of the Contractors. The highest response of both Designers and Contractors was to work with other professionals. A substantial number of the participants responded to the "Other" option. These responses almost all were, "to work with everyone on the team including the owner and the superintendent." A few other comments were people with "common sense", "common goals" or "those that are qualified."

Table 4-17. Response to Question 3-6

	Observed				Expected		(O-E)^2/E	
	Designers	Contractors	Total	%	Designers	Contractors	Designers	Contractors
1	8	12	20	26.67	9	11	0.13	0.10
2	16	14	30	40.00	14	16	0.42	0.35
3	0	0	0	0.00	0	0	0.00	0.00
4	3	6	9	12.00	4	5	0.29	0.24
Other	7	9	16	21.33	7	9	0.01	0.01
	34	41	75		34	41	0.84	0.70

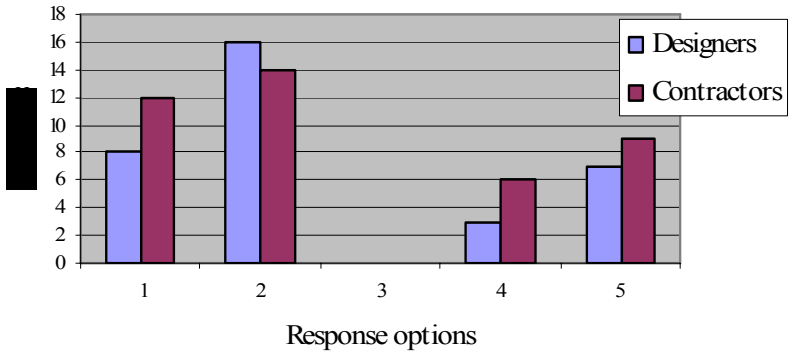

Figure 4-17. Analysis of Question 3-6 responses

After section 3 there was a space provided for participants to provide typical stereotypes of their industry. Many of the participants replied to this portion of the survey. The following is a list of stereotypes common to the design industry:

- Dull/boring
- Architect and Contractor have separate agendas
- Architects are not grounded in reality regarding time, budget, schedule and building process
- Too artistic
- Concerned only with personal design goals
- Arrogant
- Stubborn
- Do not understand the building process
- Just draw plans

The following is a list of common Contractor stereotypes:

- Not professionals
- Uneducated
- Owner and architects do not trust their judgments
- Only interested in money
- Do not understand design
- Dishonest
- Cut corners to save money
- Architects look down on Contractors
- Do not have a similar goal with owner
- Undependable
- Adversarial relationships
- Substitute for quality products selected by the design professional

There were several comments participants were willing to share. These comments were concurrent with the information collected during the literature review. The comments are a major asset to the survey. This portion of the survey was available for participants to express exactly what they have experienced or participants could express there concern for the industries future. A design respondent noted the current arrangements for design and construction promote an adversarial atmosphere between the disciplines. This was also pointed out by Kavanagh in *Construction Management a Professional Approach*. Another common comment mentioned in

several surveys from both Designers and Contractors was communication; honest and frequent communication to resolve problems and work collaboratively is the key successful projects. While reading comments by the participants it is clear that a lack of collaboration is a concern. This survey has the ability to make more professionals aware of the need for change. Out of all 3 sections, 17 questions total, only 1 question resulted in rejecting the hypothesis that there is no significant difference between the Designers and Contractors and that was question 5 from section 3: My biggest concern when working with a Contractor/Designer is? Conclusions and recommendations for the survey will be discussed in Chapter 5.

CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

Conclusions

In the construction industry, the motto "time is money" remains a valid statement and an accurate concern. As projects within the industry progress at an increasing pace, companies are justifiably concerned with any source which becomes an obstacle to the building process. With the addition of more specialized fields on a project, defining the roles and responsibilities of each discipline becomes crucial. Each discipline is aware of its unique and specialized skills. However, often some disciplines have preconceived misconceptions about other disciplines abilities within the industry. These misconceptions are often the basis for inadequate communication and personal conflict from the start of the project. Miscommunication hinders collaboration between the disciplines, causing a ripple effect, which impacts each phase, slowing the process and ultimately impacting the entire project by increasing the overall amount of time and money required. A key factor thwarting open communication is personal conflict. Literature reviewed during the course of this study clearly acknowledges underlying personal issues within the industry. These underlying personal issues are linked to communication, either stemming from a lack of communication or contributing to the resistance to communicate.

Open communication between the disciplines is vital to the collaborative process. In an industry where there are few aspects that can be controlled, communication remains the one constant factor that influences all decisions. However, communication is also the only factor which can be acted upon to produce a positive effect. Educating project members regarding skills and abilities of other disciplines, clarifying roles, and amending commonly held misconceptions leads to shared communication, improved opportunity for joint collaboration, and the basic elements of trust required in order to form the basis of personal relationships.

Developing personal relationships between team members on construction projects strengthens the bond between companies. Since these skills are essential to any business, the construction industry would benefit from taking the initiative to educate its members to become more effective communicators.

In addition to strengthening communication and collaboration among project members, the traditional delivery system currently used within the industry must be reconsidered. This old-fashioned system hinders open communication, creating adversity between disciplines, resulting in unnecessary complications and delays. This system creates tension early in the project, thus fostering unnecessary bias and resentment towards other members. This cycle of mistrust, poor communication, and animosity creates division between project members and obstructs the flow of collaborative exchange of ideas and information.

On any construction project, there is the likelihood that numerous problems may arise, resulting in delays and making it difficult to adhere to the timeline. Working within and around time constraints complicates the collaborative process, making the jobs of Designers and Contractors more difficult. By establishing open communication and collaborative environment, personal conflicts among the disciplines are less likely to develop. If more companies worked on strengthening the necessary skills of communication, collaboration, and improved delivery methods, preconceived misconceptions and their resulting personal conflicts could be eliminated, resulting in benefits towards time, money, and job satisfaction within the construction industry.

Recommendations for Improvement

Review of literature and information collected through this study indicates that the most important step toward improving the industry would be getting the construction industry to acknowledge that there is a problem with the current method of communication on most projects. In order to improve the lack of effective communication, it must be addressed. Improving

communication within the industry will positively impact projects on many levels. Personal relationships will improve, allowing projects to be completed quicker and with less conflict, permitting collaboration between the disciplines. The literature reviewed validates the importance of collaboration on all projects. Collaboration between Designers and Contractors can be complicated, as the two disciplines think and function with different mind sets and opposite areas of the brain. Designers are very visual (left brained) and whereas Contractors rely on hard facts (right brained). Communication between the two disciplines would require using both mind sets (and both sides of the brain). Bridging this gap has the potential to improve the construction industry on the most basic level, communication, which is often overlooked.

Once the construction industry accepts and begins to address these weaknesses in communication, it makes sense to also advocate for similar changes to be advanced in construction education. These necessary adjustments will require a period of time before they are assimilated and begin to impact the construction industry. Education is the best arena to begin implementing the theories of this and previous and studies. Currently the two disciplines are educated in different fashions, making it problematic to interact. This study revealed that only 46% of graduates felt their education prepared them for the collaborative nature of the industry. As students acquire the necessary skills for communication and collaboration, their abilities to effectively communicate with other disciplines will be enhanced.

New graduates entering the workforce have a fresh and untainted outlook on the AEC industry. These new workers have not been ridiculed or scorned by the nature of this industry. They have positive mind set, allowing them to be open to communication and collaboration with all disciplines. Since students are the future of our industry, encouraging them to communicate at the educational level will empower them as they assimilate into the workforce.

Education can improve industry in another way. Construction schools should require all students to take several design courses. Respectively, design schools should require students to take courses relating to construction and construction management. This training will teach students to think more divergently, encompassing both disciplines. Students will gain respect for their counterparts and work to improve situations on future projects within the industry. It would be beneficial for a construction company to establish continuing education programs to address collaboration and communication amongst their employees. Education programs could also be created to inform non-construction employees about the building process, potentially improving their work effort and forming relations within the company. Improvement within the construction industry will take dedication from all disciplines in order to generate change.

Recommendations for Future Research

This survey contained items which were problematic, which could be improved upon in future studies. The first area which could be improved upon would be the selection of companies. In this study, there was no limit on variation, meaning the participants had very few characteristics in common. Also, restricting the survey to a certain region or type of construction may have helped limit the responses to a more specific group. In this survey, companies were selected from various states in the U.S. and were involved in all types of construction. In future studies the survey should be limited to specific regions or types of construction. Since civil companies did not reply to the survey because questions asked did not apply to their type of work, these companies could be eliminated from the list of companies surveyed.

In the demographics section, it would be beneficial to inquire about the profitability of each company and the type of delivery system used; information obtained from these questions further limits the scope of the survey. Several issues were pointed out in the first section that should be reevaluated. The main problem with these questions was the response options, never,

seldom, often and frequently or negative, positive and no change. The difference between the significance of often and frequently is too close, which could be misleading to some participants. Always, should have been an included option, even if none of the participants selected it. The option no change is too vague, there has to be an outcome. The second section is relatively established. One discrepancy exists with the aspect of project. The question asks participants to rank the importance of 6 aspects on a project. By using the word project in the question and the answer, there is the potential for participants to get confused. The third section can be viewed as 6 questions or as 25 questions. Each option can be seen as a question in and of itself. By not selecting an option participants acknowledged the option was false. The survey can viewed in either format; just consider the method of analysis before deciding which format will work the best. Question 6 in section 3 has a discrepancy. The option, subordinate professionals, is not an appropriate response option, because it has a different correlation then the remaining options. The survey can be improved upon for future use; however there is plenty of relevant data available from the survey.

This survey attempted to investigate people's opinions of the industry and their opinions of other disciplines. On average the responses collected were positive. It appears that most participants work well with each other. After all the data was collected, tabulated, and calculated the null hypothesis could not be rejected. Only one question out of the entire survey rejected the null hypothesis. Therefore, the survey concluded that there is no significant difference between the response pattern of Designers and the response pattern Contractors in most situations. Since only 1 question rejected the null hypothesis, all data collected concluded that Designers and Contractors responses where the same. However, the responses are still important and valid; they corroborate that there is a significant conclusion to be drawn from this survey. In

conclusion, the responses are as one would expect them when considering the questions logically. Designers and Contractors are working towards a common goal, completing a satisfactory building for the client. The views of Contractors and Designers are the same according to the rank correlation analysis. Therefore, both disciplines are evaluating the aspects of each job in the same order. If both disciplines goals and views are the same then their responses should be the same as well. The survey demonstrates that regardless of personal opinions, communication, and stereotypes, Designers and Contractors are completing their projects consistent with the main objective, the end product.

Written comments at the end of each survey provide a space for participants to acknowledge common stereotypes within their discipline. These stereotypes signify areas of vulnerability in each discipline. The list of stereotypes in each industry is long, that is why collaboration and communication need to be a part of the process. The more interaction between the disciplines, the easier it will be to breakdown these misconceptions and negative stereotypes, allowing the industry to communicate openly and positively.

APPENDIX A
BLANK CONSTRUCTION SURVEY

Contractor Survey

- **Male_____ Female_____**
- **Age _____**
- **Geographic location City:_____ State:_____**
- **Level of education completed _____**
- **Professional Degrees (check all that apply)**
- ___Architecture/Design _____Construction _____Engineering
- **Job title at current company _____**

How often do you work with an Architect/ Designer?	___Never	____Seldom	___Often	___Frequently
Resolutions of conflicts are usually?	____Positive	___Negative	____No change	
How often are conflicts resolved in your favor?	___Never	____Seldom	___Often	___Frequently
How often do you agree with the Architect/ Designer's methods?	___Never	____Seldom	___Often	___Frequently
How often do you communicate with the Architect/Designer?	___Never	____Seldom	___Often	___Frequently

Prioritize the following items from 1-6 (1 being most important and 6 being least important) in terms of your concerns on a project.

____Client/ Owner satisfaction ____Within budget
____The Project ____On schedule
____My employer ____Quality of materials/workmanship

For the following questions please check all options that apply to your perception of tasks performed by professionals in their respective fields.

What do you think of the design professionals you work with on a daily basis?
___They are knowledgeable about the methods of construction.
___They are able to make informed decisions.
___They are capable of recognizing errors of design or construction.
___They are able to communicate effectively with other professionals.
___ Other (Please specify_____)

Interior Designers differ from Interior Decorators in that Designers:
___ only select colors, fabrics and finishes
___ plan spaces and consider other building systems while designing
___ can alter non-load bearing walls in buildings

___ lack understanding of the building process
___ Other (Please specify_____)

Architects:
___ only select colors, fabrics and finishes
___ are more important than Contractors and interior Designers
___ do not consider clients' or user needs
___ incorporate user needs, clients wishes and good design solutions to create built environments
___ Other (Please specify_____)

Contractors:
___ are only interested in money and profit on a project
___ never select the specs requested by the architect/designer
___ work towards the end goal of creating a safe structure
___ are capable of seeing and interpreting plans
___ Other (Please specify_____)

My biggest concern when working with an Architect/Designer is:
___ they do not understand my vision for the project
___ they are only concerned about money
___ they do not understand the building process
___ they do not know how to work with others
___ Other (Please specify_____)

When on the jobsite I prefer to work with:
___ people in my own profession
___ professionals in other disciplines
___ no one
___ subordinate professions
___ Other (Please specify_____)

Common stereotypes of my profession include:

_____
_____
_____
_____

Comments:

Concerns:

APPENDIX B
BLANK DESIGN SURVEY

Architect/Designer Survey

- **Male_____ Female_____**
- **Age _____**
- **Geographic location City:_____ State:_____**
- **Level of education completed _____**
- **Professional Degrees (check all that apply)**
- ___Architecture/Design _____Construction _____Engineering
- **Job title at current company _____**

How often do you work with a Contractor?	___Never ____Seldom ___Often ___Frequently
Resolutions of conflicts are usually?	____Positive ___Negative ____No change
How often are conflicts resolved in your favor?	___Never ____Seldom ___Often ___Frequently
How often do you agree with the Contractors methods?	___Never ____Seldom ___Often ___Frequently
How often do you communicate with the Contractor?	___Never ____Seldom ___Often ___Frequently

Prioritize the following items from 1-6 (1 being most important and 6 being least important) in terms of your concerns on a project.

____Client/ Owner satisfaction ____Within budget
____The Project ____On schedule
____My employer ____Quality of materials/workmanship

For the following questions please check all options that apply to your perception of tasks performed by professionals in their respective fields.

What do you think of the Contractors you work with on a daily bases?
___They are knowledgeable about the methods of construction.
___They are able to make informed decisions.
___They are capable of recognizing errors of design or construction.
___They are able to communicate effectively with other professionals.
___ Other (Please specify_____)

Interior Designers differ from Interior Decorators in that Designers:
___ only select colors, fabrics and finishes
___ plan spaces and consider other building systems while designing
___ can alter non-load bearing walls in buildings
___ lack understanding of the building process

___ Other (Please specify_____)

Architects:

___ only select colors, fabrics and finishes
___ are more important than Contractors and interior Designers
___ do not consider clients' or user needs
___ incorporate user needs, clients wishes and good design solutions to create built environments
___ Other (Please specify_____)

Contractors:

___ are only interested in money and profit on a project
___ never select the specs requested by the architect/designer
___ work towards the end goal of creating a safe structure
___ are capable of seeing and interpreting plans
___ Other (Please specify_____)

My biggest concern when working with a contractor is:

___ they do not understand my vision for the project
___ they are only concerned about money
___ they do not understand the building process
___ they do not know how to work with others
___ Other (Please specify_____)

When on the jobsite I prefer to work with:

___ people in my own profession
___ professionals in other disciplines
___ no one
___ subordinate professions
___ Other (Please specify_____)

Common stereotypes of my profession include:

_____
_____
_____
_____
_____

Comments:

Concerns:

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BIOGRAPHICAL SKETCH

Charlotte Joy Devier was born in 1982 in Hollywood, Florida. Growing up, she preferred playing sports and being outside as opposed to dolls. She also enjoyed coloring. She attended private school all the way through high school. Before attending the Rinker School of Building Construction, Charlotte earned a bachelors degree in interior design from the University of Florida. At the completion of this degree, she felt it necessary to further her education and strengthen her knowledge of construction and construction management. As a result, she applied to the University of Florida's Building Construction program where she has been working toward a Master of Science in Building Construction degree.