TARGET SAFETY:
PROGRAMS FOCUSED ON PREVENTING SPECIFIC HAZARDS/INJURIES

By

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TABLE OF CONTENTS

APPENDIX

LIST OF TABLES

LIST OF FIGURES

Abstract of Thesis Presented to the Graduate School of the
University of Florida in Partial Fulfillment of the Requirements
for the Degree of Master of Science in Building Construction

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Safety programs in the construction industry have historically been examined to see how overall safety management is used to pursue the zero-injury objective. Such studies have not examined the details of how specific programs are developed or successfully implemented to reduce specific types of injuries. While safety culture of a project might be well established, details of the implementations of specific programs have not been examined.

The purpose of our study was to answer the following question: How do construction firms and projects develop, structure, and successfully implement effective programs to prevent specific types of worker injuries?

Our study describes in detail those practices of contractors that provide the greatest success in addressing specific types of injuries. The practices were examined with a specific focus on the procedures used to ensure success in program implementation.

Our study focused on the development and implementation of specific types of programs intended to address specific safety objectives. For example, a particular program might focus on preventing specific injuries (such as back injuries, fall injuries, hearing loss, eye injuries, hand injuries, or fatigue). A variety of focused safety programs were examined. These programs are expected to vary in a number of ways, including the motivation to address the injuries and the manner in which they were addressed. Our study includes the analysis of data collected from construction firms that have devised specific programs to target specific types of injuries, whether initiated at the corporate or project level. We particularly focused on procedures used by contractors to effectively implement successful safety practices.

CHAPTER 1
INTRODUCTION

The construction industry continues to be one of the most demanding and dangerous industries in the United States. The diversity of construction projects and their ever changing nature expose workers, unlike any other work setting, to new hazards virtually every day. Projects in construction are unique. They are rarely designed or built exactly in the same manner as previous projects and they are always constructed with differing site conditions. Factors such as the landscape, weather, and physical location cause every project to be unique. These factors also have a significant impact upon safety characteristics of each project. While most personnel in the construction industry find this project uniqueness to be an attractive attribute for a career in construction, it can have an adverse effect upon their well being.

The U.S. Bureau of Labor Statistics reported 4,365,200 total non-fatal recordable cases in 2003 in all industries. They estimate that more than 6.8 of every 100 full-time construction workers experience a work-related injury each year that requires medical treatment. Such injuries are called Occupational Safety and Health Administration (OSHA) recordable injuries. Considering that the construction industry employs about 6.5 million people (estimates vary considerably), it can be conservatively estimated that 450,000 OSHA recordable injuries occur each year. These incidents include all injuries and fatalities.

In general, the construction workforce is highly mobile. For this reason, some contractors are reluctant to invest capital to train those who may soon be someone else's

employees. The result is an untrained construction workforce that often does not recognize the consequences of working in an unsafe manner.

To counteract this, proactive construction companies have taken major steps in identifying and eliminating the causes of accidents on job sites. As a result, safety has become one of the most important aspects of concern on many construction projects. Construction firms are realizing that the initial investment and continuous efforts to maintain a good safety record do pay off by reducing injuries on the job site, and also by contributing to "on time" and "within budget" project delivery.

In the past, safety programs in the construction industry have been examined to see how overall safety management is used to pursue the zero-injury objective. These studies have not examined the details of how specific programs are developed or successfully implemented to reduce specific types of injuries. While the safety culture of a project might be well established, the details of implementation of specific programs have not been examined.

Our purpose was to answer a fundamental question, "How do construction firms and projects develop, structure, and successfully implement effective programs to prevent specific types of worker injuries?" We examined in detail those practices of contractors that provide the greatest success in addressing specific types of injuries. The practices were examined with a specific focus on the procedures used to ensure success in program implementation. For example, a particular program might be focused on preventing specific injuries (such as back injuries, fall injuries, hearing loss, eye injuries, hand injuries, or heat exhaustion). A variety of focused safety programs will be examined. These programs are expected to vary in a number of ways, including the motivation to

address the injuries and the manner in which they will be addressed. The study includes the analysis of data to be collected from construction firms that have devised specific programs to target specific types of injuries, whether initiated at the corporate or project level.

Safety practices were examined with a specific emphasis on the procedures used to ensure success in program implementation. Our study focused on the development and implementation of specific types of programs that are intended to address specific safety objectives. Identifying methods proven effective in reducing worker injuries, could provide the construction community with guidance on effective ways to pursue the zero-incident objective. Since no prior study focuses on preventing specific injuries, our study was undertaken. Sufficient approaches were examined so that the information will be of value to firms planning to devise their own programs to address other types of injuries.

Our results outline procedures construction firms can best implement for programs targeting specific types of injuries. We describe the specific procedural steps to implement successful programs. Where applicable, safety programs to target specific safety hazards were outlined in detail.

CHAPTER 2
LITERATURE REVIEW

While prior studies have provided considerable information on ways to enhance safety performance, They have not provided any details of how specific safety initiatives might be implemented.

Since the early 1990s, a series of studies identified practices successfully implemented in pursuit of the zero-injury objective. The first widely publicized study was conducted for the Construction Industry Institute (CII 1991). The CII identified 5 high-impact techniques (and the most significant sub-elements) used on projects that were completed with exemplary safety records (CII 1991). These techniques, included:

1. Safety pre-project/pre-task planning
    a. Pre-project (safety goals, safety person/personnel, preplacement employee evaluation)
    b. Pre-task (task hazard analysis, task training)
2. Safety orientation and training
    a. Owner involved in orientation
    b. Safety policies and procedures
    c. Project specific orientation
    d. Formal safety training
3. Written safety incentive program
    a. Cents per hour for workers
    b. Spot cash incentives used with workers
    c. Milestone cash incentives given to workers
    d. End of project incentives given to workers
4. Alcohol and substance abuse programs (ASAP)
    a. Screening done for alcohol and drugs

b. Screening conducted at random
c. Inspections for contraband conducted
d. Post accident screening done for all employees
e. All project contractors have ASAPs

5. Accident/incident investigations

a. Incidents reported to home office
b. Accidents without injury investigated
c. Project accident review team established for all accidents or incidents
d. Project work exposure hours and safety statistics reported to home office

A 1995 construction safety study of the 400 largest construction firms in the United States confirmed the importance of staffing for safety, drug testing, worker training, safety meetings, worker recognition & awards, and accident investigations (Eich 1996).

A follow-up study to the CII (1991) study was conducted to validate the original findings. That study showed that the industry continued to use the zero injury techniques, but that the techniques were being implemented differently than initially reported. For example, the follow-up study found that proactive firms also investigated near misses, not just injury accidents. While the earlier study reported the value of safety incentives, the follow-up study showed that many firms had replaced safety incentives with safety recognition programs. Essentially, this follow-up study showed that the construction industry had matured since the earlier study. The results of this study were used as a justification of repeating the CII Zero Injury study.

The follow-up study identified nine areas of best practices (some variation of the initial five high-impact techniques, and four new techniques).

1. Top management commitment to safety
2. Staffing for safety
3. Pre-project and pre-task planning
4. Worker training
5. Worker recognition
6. Worker involvement in the safety process
7. Drug testing

8. Incident investigations
9. Subcontractor management

An extensive search of available literature resulted in identifying a few articles that addressed the subject of targeted safety programs. Little has been written about the importance of these programs and whether these programs are a common practice within the construction industry. Most of the applicable articles were found in industry journals and periodicals (Hinze 2002).

Occupational injury rates in the construction trades are high compared to the general workforce in the United States. The Bureau of Labor Statistics (BLS) reported an overall rate of lost time or medical injuries or illnesses of 8.4 per 100 full-time workers in 1994. During the same year, a rate of 11.8 per 100 full-time workers was reported among the construction trades as defined by the Standard Industrial Classification (SIC) codes 15 (building construction by general contractors). BLS data, the primary source of data on occupational injuries and illnesses in the construction trades, are based on a sample of injury reports provided to the Occupational Safety and Health Administration (OSHA) by selected employers. Employment statistics are used to estimate full-time workers.

Construction workers not only have higher overall rates of work-related injuries than other trade groups, but they are also among the most likely workers to experience serious occupational injuries. Fatal and lost work time injuries in the construction trades continue to rank among the highest in the United States, clearly documenting the need for preventive action.

What is World-Class Safety?

What is world-class safety, and how can companies achieve it? While people may have differing definitions the core attribute is: moving beyond safety compliance toward

safety excellence. The 2003 American Society of Safety Engineers Professional Development Conference offered an interesting and timely roundtable discussion on this topic. While the participants' answers to the question varied, they agreed upon several companies that in their estimation, defined world-class safety.

Three of those companies mentioned (Bechtel Group Inc., DuPont and Johnson & Johnson) were chosen as America's Safest Companies by Occupational Hazards for 2003. From the relatively small and safety-oriented Quincy Compressor of Bay Minette, AL (a small firm recognized for its outstanding safety performance), with its 141 employees, to mighty Johnson & Johnson, with 108,000 employees in 54 countries, what do America's Safest Companies 2003 have in common? They all treat safety as a core business value, not a priority. It is not a process, and not a program, but a value. Representatives of several firms that are proactive in safety contributed to the discussion of being world class in safety.

"When you prioritize something, that means it's not always going to be at the top of your list. A core value is woven into everything you do, every business decision you make," says Kevin S. Berg, principal vice president and manager of Environmental, Safety and Health Services at Bechtel. "Safety is considered a very essential part of our business functions," reveals Chris Andrews, safety and training coordinator at Bon L Manufacturing of Newnan, GA.

In addition, many of the 2003 class of America's Safest Companies use safety as a measure of business success. "Safety is a key indicator of organizational excellence. A safe plant typically has high employee morale, high productivity and minimal product

defects," says Joseph Van Houten, Ph.D., CSP, worldwide director of planning, process design and delivery, Johnson & Johnson Safety & Industrial Hygiene.

Others acknowledge that business success would not be possible without a safe workplace and safe workers. James A. Buzzard, the president of MeadWestvaco, calls employees "the most important resource we have and we depend on them for the success of MeadWestvaco. Implementing the processes and systems for safety excellence, and integrating them into our everyday activities, develops safe behavior and a safe workplace for our employees." Keith Shumacher, plant manager at Quincy Compressor stated that, safety "is a race with no finish."

The firms recognized for their exemplary safety performances are those where safety is aggressively promoted at the corporate or top management level. This research was interested in how these ideals were actually transformed into specific approaches that are applied on construction projects. A few articles that were identified provided some insights into this process (Blue Book 2004).

Jacksonville Electric Authority (JEA)

Heat stress is a problem that affects up to an estimated 10 million workers in the United States each year. Workers who regularly toil in hot, humid, strenuous conditions and those who must wear heavy protective apparel may know the signs. In severe cases, heat stress can lead to nausea, fainting, collapse, or even unconsciousness. At any stage in the heat stress continuum, worker productivity and alertness suffers. Other problems commonly caused by heat stress include: increased accidents, absenteeism, and low employee morale. Dehydration is a prime cause of heat stress and can quickly occur when workers do not have easy access to fluids. In hot, hardworking conditions, workers can lose up to 1.5 liters of water each hour in the form of sweat. Sweat-laden skin and

clothing reduce the heat dissipation normally performed by the body. The National Institute for Occupational Safety and Health recommends drinking five to eight ounces of cool fluid (water) every 15 to 20 minutes when working in a heat stress-prone setting. This recommendation can be difficult to satisfy for some workers when water coolers are not nearby or when it is impossible to carry portable water bottles to the jobsite.

Worker hydration is a problem that was addressed by the Jacksonville Electric Authority (JEA). As the eighth-largest municipal electric utility in the nation, JEA provides electricity, water, and waste water services to more than 750,000 accounts in a 900-square-mile service area in and around Jacksonville, Florida. For the JEA field workers, the biggest issue to getting proper hydration was for workers working in trenches that were 6 feet or more in depth, making a quick break for water quite difficult. To solve the problem, JEA implemented a two-pronged approach to avoiding dehydration and heat stress. The first prong was a corporate culture change to a behavior-based safety program. The program effectively standardized numerous safety practices across JEA and put in place a training and education component focusing on safety topics- heat stress and dehydration among them. The second prong involved adopting a new tool for staying hydrated, anywhere and any time. The tool is a hydration system, a backpack-style system containing an insulated, 70-ounce drinking reservoir that provides sufficient cool drinking water for 2 or 3 hours. An insulated tube delivers water via a patented valve mechanism from which users drink by biting down and sipping, similar to drinking from a straw. The system is filled with water through a port on the outside of the unit.

JEA established a written procedure for protecting employees from hazards associated with work in high-heat atmospheres and to increase employee awareness of

such hazards. It was decided that the specific heat stress monitoring and work cycle management procedures would be instituted when the temperature exceeds 85 degrees (70 degrees F if the worker was wearing semi-impermeable or impermeable clothing, or an encapsulating suit): measuring heart rate and temperature, interrupting exposure to heat once excessive discomfort is felt or symptoms of heat-related disorders are detected, fluid replacement, personnel protective apparel, including reflective clothing, ice vests, wetted clothing, and water-cooled garments (Occupational Health and Safety).

Intel Corporation

Intel Corporation has been recognized throughout the world as a leader in the design and manufacture of integrated circuits; and recently, Intel has been gaining worldwide recognition as one of the safest places to work. Intel's safety performance has achieved world-class status and continues to improve as a result of detailed data collection and analysis and its focus on three main elements: 1) strong programs, 2) individual commitment, and 3) leadership. Since 1994, the Intel employee recordable injury rates have dropped 84% to a level of 0.18 (2001). Just as impressive is the safety performance improvement that has been realized on Intel construction Projects. From 1994 to 2001, the recordable injury rates on Intel construction projects dropped 86 percent, to 0.86. To understand the significance of this accomplishment, one has to keep in mind that these rate reductions have occurred against the backdrop of phenomenal company growth, including a 200% increase in construction activity (OH&S).

Five-year construction injury data collected on Intel construction projects indicated cuts and lacerations were the most frequently occurring injury on Intel's construction sites. Of these injuries, the vast majority were cuts to the hands or forearms. Based on these data, Intel's Project EHS professionals, representing all six Intel regions throughout

the world, developed a plan of action to achieve hand injury elimination. Jim Braun, Intel Projects EHS engineer, stated "Many cuts are caused by tools, such as utility knives, that some might call 'inherently dangerous.'" "There are alternatives that pose little or no risk of causing a cut to the hand or forearm. Our job is to convince construction workers that they should adapt the alternatives."

Faced with the knowledge that reducing or eliminating hand cuts would make a dramatic impact on injury rates, Intel construction management and Intel Project EHS set about engaging the entire construction community at Intel to solve the problem. Task forces were formed for each of the six major regional construction projects. These teams, made up of Intel, general contractors, and the trade representatives, initiated a traditional safety approach to assessing and mitigating risk. Using six key steps, the teams developed and implemented their plans. These steps included

1. Assessing the risk
2. Developing job hazard analysis
3. Training the foremen and crews
4. Observing the crews
5. Measuring results
6. Repeating the process

Blake Devine of Baugh Construction explained the process as, "We coach our trade contractors that getting rid of the hazard altogether is the best way to prevent injuries" (OH&S).

Bechtel

In the construction sector, serious injuries to the hands occur at almost twice the rate as in all of private industry, but not at global giant Bechtel, where the rate is a fraction of the industry average. The fact that injuries to the hands, wrists and fingers

remain a serious problem for U.S. companies is probably not news, but what may be surprising is how many of these cases are serious enough to cause lost workdays.

According to the Bureau of Labor Statistics in all industries, there were nearly a quarter million injuries (cuts, abrasions, etc.) and illnesses (dermatitis, etc.) to the hands, wrists and fingers involving days away from work in 2002, more than one-sixth of the total for that year. The incidence rate for this type of problem in all of private industry was 37.2 per 10,000 full-time workers, but it was far higher in manufacturing (55.1) and higher still in construction (67.7). Despite the prevalence of hurt hands in its industry, one construction company, San Francisco based Bechtel Group Inc., drove its global hand, wrist and finger lost workday case rate down to an almost incredible rate of 3.0 per 10,000 full-time employees.

Bechtel's enviable record with hand protection takes place in the overall context of an organization that is committed to achieving "zero accident performance," according to Kevin Berg, manager of the company's environmental, safety and health services. Berg contends that while construction by its nature poses more hazards to the hands, many of the things one must do to protect the hands are simply the hallmarks of any good safety program. "Almost everything we do is actually done by people with their hands," says Berg. Roughly 30% of the company's recordable injuries involve the fingers, hands and wrists.

When asked about the biggest challenge in hand protection, Berg's unhesitating reply was: worker participation. Worker Participation is key to success. In some ways, hand protection is very simple: all the education programs in the world do not amount to much unless workers actually don the gloves. "We can put all the processes in place, but

if the worker isn't engaged, it's only on paper," asserts Stephen Walter, site safety representative for Bechtel at its Hanford, WA. construction site. "We have to make it come alive for them." Early last year, after performing observations, Walter discovered that during any given 15-minute period, 4% of the 600 workers at Hanford were not wearing hand protection. "That means you have a considerable number of people at risk," he explains. So last June, the four weekly toolbox meetings were devoted solely to making the case for hand protection. "We challenged our supervisors to focus on this so we could see improvement." How can you spend a month talking about gloves? Walter explained that hand injuries took up one week. Workers then learned about the various types of gloves, another week was spent on explaining how to use them and in the final week all the points covered were reviewed.

The effort paid off: by August, observations revealed workers were wearing hand protection 99% of the time when it was required, and Walter said that number has held up since then. In order to encourage workers to wear appropriate hand protection, Bechtel has adopted a behavior-based observation process that employs two perspectives. "We reinforce positive behavior, and question at-risk behavior." Both approaches are essential for the success of the program, according to Phil Williams, a carpenter who works with Walter at Hanford. Many of the craft workers on site at Hanford are not used to working for Bechtel and "are more oriented to production than safety," he explains.

Questioning those who should be wearing gloves, but are not, is the most effective way of leading people to internalize safe work habits, according to Williams. Many craft workers are not used to wearing hand protection and when questioned, the answer they most often give is, "I forgot," Williams explains. "But if you ask them, 'Why aren't you

wearing gloves?' they will decide for themselves to put them on. I've seen this several times."

At Bechtel's Hanford, Wash. project, eliciting worker participation in safety involves more than performing observations and asking questions, however. Employees are involved in the selection of gloves and Bechtel has a wide variety of styles available, so that workers can choose hand protection that is appropriate to the specific task. "We make an effort to educate workers on the types of gloves we have available," says Walter. "When you have eight types of gloves, you have something for many different types of activities. If one kind of glove doesn't work, we tell them to try another." As a result of improvements in the design of hand protection, Walter contends that, provided many different styles are available, gloves rarely interfere with a particular job. "Fifteen years ago, you didn't have a lot of choice beyond cloth or leather, but now gloves provide greater protection and are more comfortable," says Walter. Finally, as in any excellent safety program, PPE is used only when engineering solutions are impractical. "We try to empower workers to make engineering suggestions, instead of wearing PPE," Walter explained. For example, workers had been required to wear gloves while doing computer wiring, but after some workers suggested a way to do the work without using box cutter knives, the company decided gloves were no longer necessary.

"Instead of seeing workers as adversaries, where the company tries to force you to work safe, workers are taking responsibility to make improvements with the help of the company," Williams stated. "From a craft point of view, the fact that the company is allowing workers to be part of the solution is the best thing we have going for us out there." From a safety point of view, it may also be the best thing going for Bechtel.

When it comes to identifying the biggest challenge for hand safety, Jim Lapping, the vice president for safety, health and environment at Power Maintenance and Constructors in O'Fallon, Ill,. agreed with his colleague at Bechtel: it is getting workers to wear the gloves. "Being able to wear the gloves and work effectively at the same time is another way of saying the same thing," explained Lapping, whose company does repair and maintenance work at coal-fired power plants. "The trend in glove design is to create gloves that more effectively balance comfort and dexterity with the level of protection that is needed," stated Portia Yarborough, Ph.D., a research chemist with DuPont in Wilmington, Del. "People seem to want lighter and thinner gloves with a palm dip to enhance the grip," noted Elizabeth Parrish, global marketing manager for cut protection in the Advanced Fibers and Composites group at Morristown, N.J.-based Honeywell International. Both women said that progress in developing synthetic fibers has allowed glove manufacturers to offer workers what they want: improved dexterity that does not compromise protection. "Many gloves also have some type of form-fitting stretch component, such as spandex, that also improves dexterity," added Yarborough.

Safety managers may want to be aware of something else going on in the hand protection industry. ASTM International (formerly the American Society for Testing and Materials) established the cut standards used to determine the level of protection that gloves provide. Effective March 1, ASTM revised its "Standard Test Method for Measuring the Cut Resistance of Protective Apparel" (F1790-04). The changes in test protocol mean that the same glove may receive a lower cut protection performance value as compared to the previous ASTM standard. "Safety managers should be aware that when buying new gloves, the new numbers may be lower even though the glove

performance hasn't changed," explained Yarborough. "If injuries are occurring, they should take a look at these numbers, but if they aren't having injury problems, then it's probably not a concern" (Occupational Hazards 2004).

Alertness Solutions Fatigue Countermeasures Group

Alertness solutions is a scientific consulting firm that translates knowledge of sleep, circadian rhythms, alertness, and performance into practical strategies that improve safety and productivity in our 24-hour society. Modern society operates around the clock, but this 24-hour requirement challenges the human brain and body by degrading the quantity and quality of sleep, disrupting the body clock, and creating fatigue. These factors take a toll on alertness, performance, productivity, and safety. Our society- at both the organizational and individual levels- continually pays a high price for fatigue-related risks that result in errors, incidents, and accidents. Alertness solutions creates tailored strategies and comprehensive approaches that: improve safety, performance, and productivity. In addition they devise innovative ways to address the complex and diverse aspects of managing alertness. The mission of Alertness Solutions is to develop and evaluate countermeasures to mitigate the adverse effects of these factors and maximize performance and alertness .

An international group of scientists identified fatigue as “the largest identifiable and preventable cause of accidents in transport operations (between 15 and 20% off all accidents), surpassing that of alcohol or drug related incidents in all modes of transportation. Fatigue engendered by sleep loss and circadian disruption can degrade all aspects of human capability. Significant reductions in operator performance can affect judgment, decision-making, attention, reaction time, alertness, memory, and mood. These degraded performance factors can increase fatigue-related risks and reduce the

operational safety margin. In spite of these well-documented effects, the contributory or causal role that fatigue may play in an accident is often underestimated or potentially ignored. One reason for underestimating its contribution is that there is "no blood test for fatigue." To include or exclude fatigue as contributory or causal in an accident requires the evaluation of two specific aspects of the accident. First, were identifiable fatigue factors present at the time of the accident? Second, if fatigue factors were present, did fatigue-related performance decrements contribute to or cause the accident? Four specific physiological factors related to fatigue are:

1. amount of sleep (acute loss and cumulative debt)
2. continuous hours of wakefulness
3. circadian rhythms (time-of-day)
4. sleep disorders

Fatigue created by sleep loss and circadian disruption can decrease waking performance, vigilance, and mood. These decrements are known to affect errors, accidents, and safety. Accident investigations frequently find evidence that fatigue-related performance was contributory or causal in the accident. The findings include fatigue factors such as: degraded judgment and decision making, cognitive fixation, poor communication/coordination, and reduced reaction time. By applying these principles, notable reductions have been recorded by recorded by various firms (Rosekind 1996).

CHAPTER 3
METHODOLOGY

Introduction

The objective of this research was to determine how construction firms and projects develop, structure, and successfully implement effective programs to prevent specific types of worker injuries and to protect workers from specific hazards. Safety practices were to be examined with a specific focus on the procedures utilized to ensure success in program implementation. The study focus was on the development and implementation of specific types of programs that are intended to address very specific safety objectives.

The focus area of this study was suggested to CII as a potential research topic by another CII project team that had participated in a prior safety research study. A research proposal on this subject was submitted to CII by Dr. Jimmie Hinze and was funded in June 2004. Shortly after the proposal was funded, CII organized a project team to provide guidance and support for the research effort. This team of approximately fifteen individuals met periodically, at least quarterly, to review progress on the research and to provide assistance in data collection. It was also during this period that a review of the literature was conducted.

Research Survey

In early discussions of the CII project team, it was decided that a large sample size was most desirable for this research effort. This was based on the realization that construction firms may implement a variety of safety interventions to address specific hazards (falls, cave-ins, heat, noise, etc.) or specific types of injuries (hand, eye, back,

foot, etc.). To accomplish the objective of obtaining a large sample size (over 100 responses) it was decided by the project team that the project team members would play an active role in data collection.

To have consistency in the information about specific safety interventions on construction projects, a survey was developed. An initial version of this survey was prepared, and this survey was the central focus of discussion at the first meeting of the project team. As a result of this discussion, considerable modifications were made to the survey. The survey, considerably changed from the first version, was examined again at the second meeting of the project team at which time the survey was improved further.

After the survey was considered reasonably refined, it was decided that a pilot study should be conducted. One of the team member companies (an owner) was sponsoring a safety forum for several of its contractors during the second week of August. The researchers were asked to give a presentation at this forum and were also afforded the opportunity of administering the pilot study with the forum attendees. Participation was voluntary, but 28 attendees provided responses to the survey. After the pilot study was conducted, it was apparent that additional revisions to the survey were needed. By September 2004, the final version of the survey was approved by the University of Florida Institutional Review Board (IRB).

Information was sought on a variety of safety interventions or programs that were implemented. These programs were expected to vary in a number of ways, including the motivation to address specific issues and the manner in which they were addressed. The final survey consisted of five sections which were as follows: general project information, project work force and subcontractors, project safety performance, specific

safety programs- project level, and programs implemented on past projects. Surveys asked about descriptive information about the projects (size, type contract, labor arrangement, duration, cost, etc.). Most of the survey questions asked for information pertaining to the specific interventions that were implemented to address specific hazards or specific types of injuries. Some questions could be answered by simply checking a box or by providing some numerical information. Other questions requested open-ended responses. A copy of the survey, titled "Target Safety Questionnaire," is presented in Appendix A.

Data Collection

The surveys were provided to all of the CII project team members. In some cases, the project team members distributed the surveys to their own personnel on construction sites, while some surveys were distributed to companies with some type of affiliation with the project team members. Many surveys were completed by firms that were not CII members. As a result, the findings of this research are not unique to CII members. Once the surveys were completed, they were sent directly to Dr. Jimmie Hinze at the M.E. Rinker Sr. School of Building Construction at the University of Florida for inclusion in the database.

Data Analysis

The statistical program, Statistical Package for the Social Services (SPSS), was selected to analyze the data. This program enables data manipulation and facilitates statistics generation. All of the raw data, aside from the narrative comments provided in the survey, were included in the data analysis.

In this research study, the data of particular interest, related to those safety programs that had innovative approaches. In addition, the statistical analysis sought to

identify those practices that were associated with improved safety performances. Safety performance, measured in terms of the TRIR values achieved on the projects, were examined as to the extent that they were influenced by various practices.

SPSS, allowed for rapid analysis of the data. Of particular interest were correlations between specific practices and the perceived effectiveness of the various safety interventions. Reports that were generated by the SPSS program displayed the level of statistical significance associated with the comparison of two variables. The level of significance between the correlations of two variables demonstrated the strength of the relationship between the variables. The level of significance indicated the probability that the relationship between variables occurred by chance. As the significance level approaches zero, the probability becomes smaller that this relationship occurred by chance. For this study, a correlation was considered statistically significant when the level of significance was below 0.05 (or less than 5 in 100).

CHAPTER 4
DATA ANALYSIS AND RESULTS

Introduction

Prior safety studies have not examined the details of how specific programs are developed or successfully implemented to reduce specific types of injuries or to address specific hazards. While the safety culture of a project might be well established, the details of the implementation of specific programs have not been extensively examined. This study captured data of specific program implementation through five different portions of the survey which were as follows: general project information, project workforce and subcontractors, project safety performance, specific safety programs-project level, and programs implemented on past projects.

This study identified attributes that contribute to successful target safety programs. A target safety program was defined as a technique, program or approach that was implemented at one or more construction sites to reduce or eliminate specific hazards or to address specific types of injuries. There were initially 225 completed surveys that were received. When these were examined, it was determined that some respondents provided information on programs that did not satisfy the description being used to define target safety programs. For example, some respondents described programs in which they implemented safety incentive programs on their projects to reduce worker injuries. Surveys that described these types (not focused on a specific hazard or particular injury) of programs were eliminated from the sample. This resulted in 120 valid and usable responses to the survey. This study sought to identify and understand attributes

associated with targeted safety programs and for this reason, only the 120 responses that dealt with targeted programs were analyzed (i.e., only information and data obtained on these programs are displayed in the tables and figures).

Respondent Characteristics

Before presenting information on the target programs, information will be provided on the types of projects represented by the 120 respondents. This will help to characterize the nature of the projects that are represented in the data. By most standards, the projects could be characterized as being either medium or large. The average budgeted cost of the projects was over $128 million (the median was $38.5M). The median total construction duration was estimated to be 18 months while the median duration to date was 10 months (55% complete (one project had not begun while 16 were 100 % complete) with 96,000 hours expended to-date). The median number of subcontractors on a project was 12.0 with these subcontractors (10 projects did not subcontract work out while 20 projects utilized subcontractors for 100% of the work) completing 57.7% of the work (Table 4-1).

Table 4-1: Descriptive Information about Projects Included in the Study

Case processing summary	Mean	Median	Minimum	Maximum
Cost ($), n=110	128,200,000	38,500,000	70,000	2,500,000
Total duration (months)	22.4	18.0	2	120
Duration to date (months)	12.9	10.0	0	54
Estimated project hours (#)	827,232	253,000	375	8,000,000
Hours to date (#)	397,840	96,000	0	4,000,000
Percent complete	57.4	55.0	0	100
Percent subcontracted	70.0	57.7	0	100
Number of subcontractors	21.8	12.0	0	300
Percent negotiated	15.9	15.9	0	100

The survey respondents were individuals who were familiar with the programs being implemented on the construction sites. While the survey respondents could be employed by virtually any party associated with the construction of the project, it was generally felt that the type of firm represented by the respondent would not bias the data. Nearly three-fourth of the respondents represented contractors and most of the remaining respondents represented owners. A few respondents considered their employer's role to be that of a contractor/owner client (Table 4-2; Target Safety Questionnaire, Question 1). In terms of geographic dispersion of the projects, 98% (all but two) were located in the United States while one was located in Europe and another was located in South America.

Table 4-2: Type of Respondent, n = 118

Type of Respondent	Number	% of Total
Contractor	88	74.6%
Owner Client	28	23.7%
Contractor / Owner Client	2	1.7%

Construction projects included in this study were constructed for both private and public owners. Respondents were asked to provide information on the type of facility owner. Nearly 70% of the projects were being constructed for private owners (Figure 4-1, Target Safety Questionnaire, Question 2).

The payment arrangements on construction projects are carefully addressed in the construction contracts. These arrangements will often have implications on how financial risks are allocated between the contractor and the owner. Under one general scheme, contractors are asked to stipulate a price for which the facility will be constructed (referred to as a lump sum or fixed price contract). In another, the contractor is asked to carefully document specified construction costs with the understanding that these costs

will be reimbursed, along with an allowance for overhead and profit. In the latter case, the contractor is asked to assume less risk. Over 80% of the projects were lump sum projects (Table 4-3, Target Safety Questionnaire, Question 9). Cost plus, as well as time and materials, represents payment arrangements in which the contractor is reimbursed for construction related costs plus a pre-arranged labor rate and or fee. Cost reimbursable includes what is traditionally referred to as cost plus and time and materials.

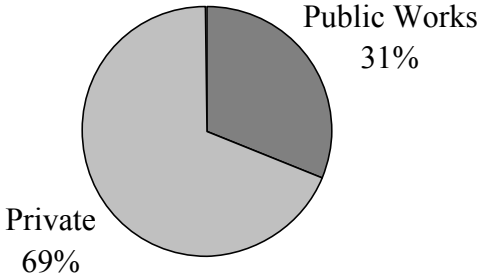

Figure 4-1: Type of Owner: Public or Private, n=113

Traditionally, every employer on the construction site obtains its own insurance coverage for such items as builders risk, workers' compensation, general liability, and automotive policies. In recent years, two alternative approaches to obtaining insurance have emerged. These are arrangements whereby the insurance for a project is obtained by a single party. During the past decades the most common arrangement of this type was for the owner to obtain the project insurance. These were historically known as wrap-up programs, but are now also referred to as owner-controlled insurance programs (OCIPs). The other arrangement is one in which the contractor obtains the insurance coverage for the project. These are called contractor-controlled insurance programs (CCIPs). While these were historically only employed on very large projects (over $1

billion), OCIPs and CCIPs have begun to be employed to a greater extent on smaller projects ($100 million and even less) in recent years as the cost of insurance can be reduced as a result of buying in bulk.

Table 4-3: Type of Payment Arrangement, n = 120

Type of Payment Arrangement	Number	% of Total
Fixed Price (Lump Sum)	100	83.3%
Cost Reimbursable	20	16.7%

This study includes thirty-five projects (of the 120 total) that were estimated to cost over $100 million dollars and hence the rather large representation of non-traditional insurance programs among the population of this study (Table 4-4, Target Safety Questionnaire, Question 22).

Table 4-4: Type of Insurance, n = 118

Type Insurance	Number	% of Total
Traditional	79	66.9%
OCIP	30	25.4%
CCIP	9	7.6%

Projects included in this study were comprised of: new construction (61%), renovation and expansion (16% each), maintenance (3%), and other (4%).

There are various forms of contracting arrangements that can be employed for project delivery. The majority of the projects included in this study were undertaken with the general contract format. Some of the other arrangements utilized on at least some projects included CM at-risk, multiple primes, design-build, CM-agency, joint venture, and direct hire (Figure 4-2, Target Safety Questionnaire, Question 8).

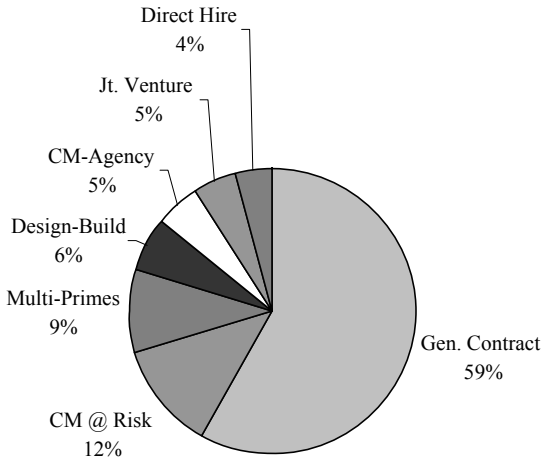

Figure 4-2: Type of Contracting Arrangement, n=119

The survey questions also asked about the type of facility being constructed on the project site. Projects included in this study were varied in that virtually all sectors of the construction industry are represented (Figure 4-3, Target Safety Questionnaire, Question 5). No particular segment of the construction industry dominated in the representation of the surveys.

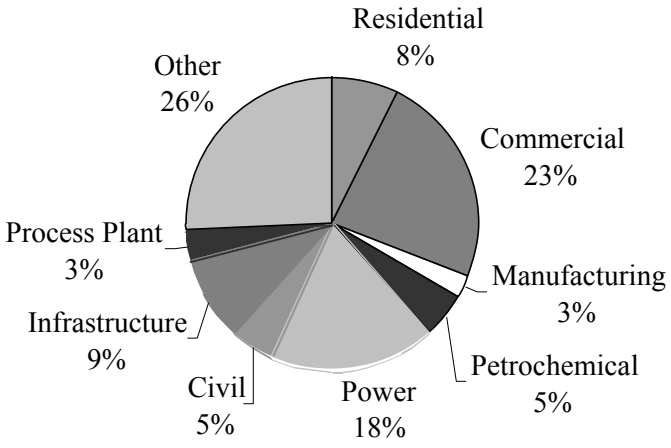

Figure 4-3: Type of Facility, n=120

Respondents were asked about the type of labor conditions that existed on their projects. The labor force could be union shop in which the workers are represented by a labor union. An open shop is used to define arrangements whereby the workers are not members of a labor union or that their union affiliation does not influence the employer/employee relationship. The analysis of the data indicated that there was a fairly even distribution of projects among union shops (43%), open shops (34%), and mixed (23%). The projects described as "mixed" were those in which some employers were signatory to labor agreements and some were not.

Safety Performance

Information was sought on the safety performance that was realized on the various projects (questions 18 to 21). Safety performance is typically measured by TRIR. TRIR is the total OSHA recordable injury rate. For 2003 (the most recent year for which data are available) the industry average was 6.81. For sampled respondents in this study the median TRIR was 0.0. A total of 51 projects in this study had a TRIR equal to zero. It is evident that the TRIR of the survey participants was much better than the industry average. The median number of lost time incidents was 0.0 while the median number of first aid cases was 5.0. The median number of full time safety personnel was 1.0 (Table 4-5).

Table 4-5: Descriptive Information about Safety Performance

Case processing summary	Mean	Median	Minimum	Maximum
TRIR, n=102 51 projects had a TRIR=0	2.41	0.0	0	35.86
Lost Time Incident Rate, n=114 78 projects had a LTIR=0	0.87	0	0	16
First Aid Incident Rate, n=113 18 projects had a FAIR=0	25.5	11.0	0	400
Full Time Safety Personnel (#), n=117 19 projects had zero FTSP	1.84	1.0	0	12

Safety performance in relation to established goals were: better (27%) and on target (39%) while utilizing target safety programs (Table 4-6).

Table 4-6: Safety Performance in Relation to Goal, n = 118

Safety Performance in Relation to Goal	Number	% of Total
Better	32	27.1%
On Target	46	39.0%
Worse	26	22.0%
No Goals Were Set	7	5.9%
Do Not Know	7	5.9%

Target Programs

The purpose of this research was to answer a fundamental question, "How do construction firms and projects develop, structure, and successfully implement effective programs to prevent specific types of worker injuries or eliminate/reduce specific types of hazards?" This study examined those practices of contractors that provided the greatest success in addressing specific types of injuries or hazards. The practices were examined with a specific focus on the procedures utilized to ensure success in program implementation. For example, many programs were focused on the prevention of specific injuries, such as back injuries, hearing loss, eye injuries, hand injuries, heat exhaustion, etc. A variety of these focused safety programs were examined. Some programs were focused on specific hazards, such as fall hazards. The programs that were described varied in a number of ways, including the motivation to address the injuries/hazards and the manner in which they were addressed. The study examined data collected from construction firms that have devised specific programs to target specific types of injuries/hazards, whether initiated at the corporate or project level.

Target safety programs are often untried and unproven efforts that are designed to improve safety performance. As a result, smooth implementation is not assured. In fact, there may even be barriers to successful implementation. The survey asked about such problems with implementation. Major obstacles to implementation of specific target safety programs were encountered on 59 % of the projects with target safety programs. The obstacles were noted as follows:

- Resistance to Initiative or resistance to change (33.3%)
- Old School Mentality (14.3%)
- Enforcement Difficulties (11.9%)
- Difficulties in Training (9.5%)
- Language Barriers (4.8%)

Half of the target safety programs included in this study were initiated at the project level while the others were initiated at the corporate level. See Table 4-7 for attributes of target programs (Target Safety Questionnaire, Questions 28, 30, 31).

Worker involvement in the safety process is one of the most important aspects of project safety. Many safety professionals have stated that most injuries are the result of unsafe actions or behavior and that the unsafe conditions play a minor role. With such a focus on the actions of workers as being the major cause of injuries, it would appear prudent to take special notice of them. Perhaps the most significant innovations in construction safety in recent years relate to means by which workers are involved in the construction process. This is essentially based on the view that workers are not just a valuable resource to be protected but also a resource that can contribute to achieve the goal of zero accidents (Hinze 2002). While one would expect worker involvement in program development to be associated with better safety performance, this was not conclusion was not supported by the data (Target Safety Questionnaire, Question 29).

Table 4-7: Attributes of Target Programs

Source of Target Program n=110	% of Total
Developed from Scratch	37%
Modified Existing Program	39%
Used Existing Program as-is	24%

Champion of Program Implemented n=119	% of Total
Corporate Level Individual	46%
Corporate Level Individual	43%
Consultant	8%
Ad hoc Committee	3%

Source of Guidance Program n=117	% of Total
Other Company Project	55%
Owner	24%
Insurance Carrier	15%
Purchased One	6%

Basic Steps to Implementation n=116	% of Total
Education & Training	1%
Person Was Assigned to Implement	5%
Promoted the Program	13%
Combination of the three above	81%

Workers were involved in implementation 72% of the time while not being involved in implementation 28 percent of the time (Figure 4-4, Target Safety Questionnaire, Question 32).

Management commitment for safety is essential to convey to others in the firm that the costs, schedule, and quality do not take priority over safety. This can be demonstrated in a variety of ways. The circumstances may dictate those means that are perhaps most feasible. The motivation must be sincere and it must be conveyed to the worker level (Hinze 2002). This motivation to develop the target safety programs tends

to come from different sources depending on the particular project, facility owner, or contractor involved. As shown in Figure 4-5 (Target Safety Questionnaire, Question 27), the motivation to develop the program came from various sources, including contractor mandates (27%), owner mandates (24%), owner and corporate mandates (13%), unacceptable numbers of injuries (21%), and other (15%).

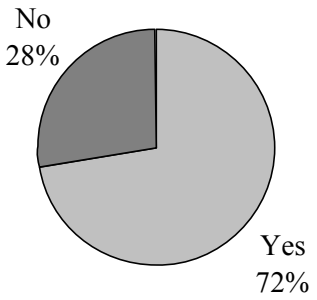

Figure 4-4: Were Workers Involved in Implementation, n=112

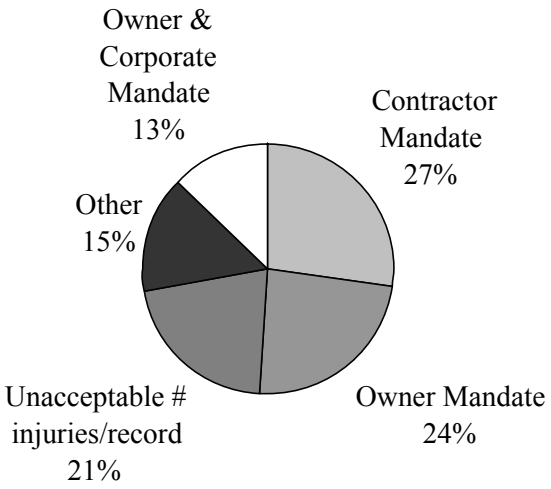

Figure 4-5: Motivation to Develop the Program, n=118

The target safety programs described by respondents to the survey consisted of numerous and varying accident countermeasures. The most dominant categories, however, were that of falls and personal protective equipment (38% each). Fall prevention programs were primarily focused on establishing a 100% tie-off for workers working at elevations above six feet. Programs on personal protective equipment were focused encouraging workers to wear protective equipment such as gloves, eyewear, proper clothing, etc. Other target programs (Figure 4-6, Target Safety Questionnaire, question 25) focused on:

- Training (12%),
- Drug programs(2%),
- Lock-out-tag-out(LOTO) (2%),
- Hot work(2%),
- Scaffolding(2%),
- Confined space(2%),
- Incentives (2%).

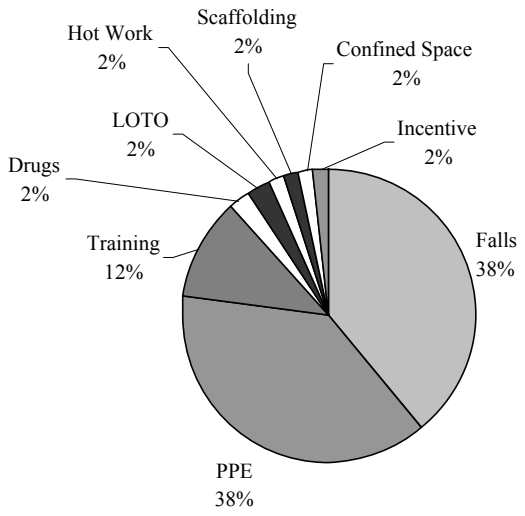

Figure 4-6: Focus of Target Program, n=120

Goals or metrics that were established to monitor the program success (Target Safety Questionnaire, Question 34) include:

- Zero injuries
- Reduction in number of specific hazards/injuries including lacerations and back injuries
- Corrective action summary
- Trend analysis
- Performance safety audits
- Documentation of unsafe acts with data

Formal documentation of the target safety plan (as a written policy or procedure) occurred on 97 of the 115 projects that provided a response (Target Safety Questionnaire, Question 36). Of these 97 projects, 40 agreed to furnish a copy of their target safety plan for future study. Other additional comments given on a voluntary basis (Target Safety Questionnaire, Question 37) about target safety programs were as follows:

- Enabled achievement of zero lost time injuries
- Contain detailed checks and balances that minimize injury frequency
- Transformed negative program of past into a successful program
- Beneficial for company and employees
- Designed by proactive contractor with a goal of setting a positive safety culture

CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The most important conclusion that can be drawn from this study is that the achievement of zero injuries is a realistic goal. On many construction projects, safety has become one of the most important emphasis areas and this is clearly demonstrated by the innovative safety programs being implemented. Construction firms are realizing that investments in safety do pay off. Costs associated with lost time injuries and job shut downs as a result of safety mishaps are not covered by insurance. Construction industry firms and managers of construction projects have embraced the zero injury objectives and many have achieved this goal. This was clearly evidenced in this study as half of the firms that implemented target safety programs had achieved an OSHA recordable injury rate of zero.

Over a decade ago in 1993, many of the companies that led the ongoing efforts to improve overall safety on the job site and reduce the number of injuries had implemented the five basic high-impact zero accidents techniques (safety pre-task / pre-project planning, orientation training, safety incentives, alcohol and substance abuse programs, and accident investigations). A follow up report in 2002, reconfirmed the importance of several safety methods and techniques employed by the construction industry. However, many of high impact techniques are no longer being implemented in the manner as reported in the 1993 report. The construction industry has matured in recent years and the safety practices have become more proactive.

The 2002 research findings identified the following general areas of safety:

- Management commitment
- Staffing for safety
- Planning: pre-project and pre-task
- Safety education: orientation and specialized training
- Worker involvement
- Evaluation and recognition / reward
- Subcontract management
- Accident / incident investigations
- Drug and alcohol testing

The findings of this research indicate that implementation of various types of target safety programs can be successful when initiated at the project or corporate level. This study identified some methods being employed with particular effectiveness. To insure success in regard to target safety programs workers must be involved in implementation. Perhaps the biggest change in the past decade has been in the area of worker involvement in the safety process. This is evidenced in the worker safety observation programs, worker safety perception surveys, pre-task planning, safety committees, and other programs that seek the direct input of workers to enhance project safety. It would seem logical that workers also be involved in the development and implementation of target safety programs.

This research did not specifically address the nine basic safety areas, but several of them were still apparent in the study results. Top management commitment has often been reported as being important to the safety agenda. Management must demonstrate its commitment. This can be done in many ways and often relies on the ingenuity of the firm along with a strong corporate commitment from its safety managers. Innovative firms are also recognizing the importance of staffing their sites with safety personnel, individuals who are viewed as valued resources by the site managers. Planning continues

to be an important aspect of project safety, with even greater emphasis being placed on pre-task planning. In addition, if injuries occur countermeasures must be in place to immediately identify hazards that enable managers to change or reduce worker exposure through targeted safety programs. While accident investigations are conducted in a similar manner as a decade ago, more firms are focusing on near misses, not waiting for the occurrence of an injury- causing accident.

In the analysis of the data, an attempt was made to develop a priority rating of the target safety attributes, but this effort provided no additional insights. It is clear that of the effective target safety techniques, there is no "silver bullet." Of particular interest was the finding that the success of targeted programs was not influenced by such variables as size of project, duration of project, size of the workforce, type of labor climate, etc. From this it can be concluded that a target safety program can be successful in virtually any setting.

Recommendations

Although size was not a factor in the success of target safety programs in this study, the larger construction companies have generally been the most aggressive firms in pursuing the goal of zero accidents. Therefore, the safety record and the way safety is structured in these firms are of considerable importance to the industry. Since the large construction firms have made important strides toward improving construction safety, it is important for these techniques to be considered by firms of all sizes. While some techniques will not be implemented in exactly the same manner, the general intent of the techniques will not be different. The strides made in the improvement in safety performances are so significant that injury frequency levels that were once the goals of

firms have now become unacceptable levels of safety performance for many firms. Much can be learned from these firms.

All company managers are encouraged to examine the research results and consider means of implementing techniques that can prove successful in other settings. The communication of management's commitment to safety is a simple task as that commitment should be evident in the daily activities of management. Safety managers should examine injury statistics to determine where target safety programs might be appropriate. They should also examine the data collected through worker observations, site inspections, or pre-task planning meetings to identify problem areas that warrant targeting.

It is clear that efforts to improve safety performance should not be dormant. Therefore it is suggested that this type of research be repeated periodically, perhaps every few years. The wide dissemination of this type of information is also encouraged. Ideally a clearinghouse of information will one day exist so that firms upon identifying a hazard can view solutions as determined by other firms facing their same dilemma. The study of implementing safety techniques should also extend to smaller firms. Small to medium firms may find that safety is implemented differently than in large firms and on large projects. In addition companies should track information so that they can easily identify when they have a problem and can rapidly implement a target safety program that minimizes exposure. Insights from such a research effort could be instrumental in helping drive owners to play a stronger role in the effort to pursue zero injuries on construction projects.

Further research is warranted to obtain more detailed information on the best means of developing and implementing successful target programs. This information could be obtained through a case study approach in which more details will be obtained.

APPENDIX A
TARGET SAFETY QUESTIONAIRE

General Project Information

1. Type of Respondent: contractor *n=88 (74.6%)* owner/client *n=28 (23.7%), other=2 (1.7%)*

2. Is the project owner a public agency or a private firm? public works *n=35 (31%)*

private *n=78 (69%)*

3. Location of project: U.S. *n=117 (98.3%)* Canada Mexico
South America *n=1 (0.8%)* Europe *n=1 (0.8%)* Asia Asia Pacific
Africa Middle East

4. What type of project is this? new *n=74 (61.7%)* renovation *n=19 (15.8%)*

maintenance *n=3 (2.5%)* expansion *n= 19 (15.8%)* other: *n=5 (4.2%)*

5. What type of facility is being constructed? Residential *n=9 (7.5%)* Commercial *n=28 (23.3%)*
Manufacturing n=3 (2.5%) Petrochemical n=6 (5%) Power *n=22 (18.3%)*
Civil *n=6 (5%)* Infrastructure *n=11 (9.2%)* Process Plant *n=4 (3.3%)*
Other *n=31 (25.8%)*

6. Is this an open shop or union project? open shop *n=41 (34.2%)* union shop *n=51 (42.5%)*

mixed/both *n=28 (23.3%)*

7. What is the estimated total cost of this project? $_____ million *n=110 (range = $70,000-$2.5B)*

8. What type of contracting arrangement is involved? General Contract *n=57 (47.9%)*

Multiple Primes *n=9 (7.6%)* CM (agency) *n=5 (4.2%)* CM @ risk *n=12 (10.1%)*

Design-Build *n=6 (5%)* Joint Venture *n=5 (4.2%)*

Direct Hire (self perform) *n=4 (3.4%)*

Other *n=8 (6.7%), combination of above=17 (10.9%)*

9. What type of contract is used on the project? Fixed Price (lump sum) *n=100 (83.3%)*

Cost Plus *n=11 (9.2%)* Time and Materials *n=9 (7.5%)*

10. What is the expected project duration? _____ months *n=119 (mean=22.4 mo.)*

11. When did construction work begin on this project? _____ months ago *n=115 (mean=12.9 mo.)*

12. What is the current percent of completion (in terms of dollars spent)? _____%

n=110 (mean=57.4%)

Project Work Force and Subcontractors

13. What percent of the work is subcontracted to other firms? _____ % *n=118 (mean=57.8%)*

14. How many subcontracts were written on this project? _____ *n=111 (mean=21.9)*

15. Estimated total work hours (including subcontractors) for this project? _____ hours *n=95 (mean=827,232)*

16. How many work hours (including subcontractors) have been expended to date?
_____ hours
n=95(mean=416,078)

17. What percent of the site workers do not communicate well in English? _____ % *n=116 (mean=15.9%)*
What practices/methods, if any, are employed to address the non-English speaking workers?

_____

Project Safety Performance

18. To date, what is the total recordable injury rate (including subcontractors) on this project? *n=102 (mean=2.41)*

TRIR = _____

19. How does this safety performance compare with the originally established project safety goal?
☐ better *n=32 (27.1%)* ☐ on target *n=46 (39.0%)* ☐ worse *n=26(22.0%)*
☐ no safety goals were set *n=7 (5.9%)* ☐ don't know *n=7 (5.9)*

20. How many lost time injuries (requiring days away from work) have occurred on this project? _____

21. Approximately how many first aid injuries have been sustained by workers on the project?
_____ first aid injuries ☐ don't know, no log is kept

22. Who provides the workers' compensation insurance on this construction project?
☐ Each firm provides their own *n=79 (66.9%)* ☐ OCIP *n=30 (25.4%)* ☐ CCIP *n=9 (7.6%)*
☐ PCIP ☐ Not known

23. How many full-time safety personnel are assigned to this project? _____

Specific Safety Programs – Project Level

24. Are there any safety programs that were implemented on this project to address specific types of hazards or specific types of injuries?
☐ yes *n=120*
☐ no *n=105 (not included in analysis)*

25. If yes, please name up to two notable programs that were implemented on this project to address specific hazards or specific worker injuries? (for example, hand protection, hearing conservation, heat/temperature extremes, back injuries, electrical contacts, eye protection, etc.)
a) _____*Figure 4-6 Focus of Target Program*_____
b) _____

Of these, which program was most memorable?
_____
NOTE: The following questions relate to this program.

26. Was this program initiated at the project level or by the corporate office?
 project *n=57 (47.9%)* corporate *n=57 (47.9%), both=5 (4.2%)*

 *Who is a corporate-level contact familiar with the program?

_____

27. What was the motivation to develop this program? (check all that apply)
 unacceptable number of specific injuries *n=25 (21.2%)*
 owner-required the program *n=28 (23.7%)*
 contractor mandate *n=32 (27.1%)*
 near miss record, observation data, hazard recognition *n=15 (12.7%)*
 other *n=18 (15.3%)*

28. Who was in charge of developing this program?
 corporate-level individual: (title): _____*n=36 (30.0%)*
 project-level individual (title): _____*n=33 (27.7%)*
 consultant *n=6 (5.0%)*
 ad hoc committee *n=2 (1.7%)*
 existing safety committee *n=1 (0.8%)*
 other *n=41 (34.8%)*

29.Were workers involved in the program development? yes *n=36 (30.8%)*
 no *n=81 (69.2%)*

If yes, please describe: _____

_____

_____

30. Were there some other programs (already developed) that helped set this one up?
 yes *n=72 (62.6%)* no *n=43 (37.4%)*

If yes, who provided them?
 other company project *n=18 (29.0%)* commercially purchased *n=2 (3.2%)*
 other firm *n=1 (1.6%)* owner provided *n=8 (12.9%)*
 insurance carrier *n=5 (8.1%)* trade association *n=1 (1.6%)*
 other *n=4 (6.5%) combination=23 (37.1%)*

If yes, did you modify the program? yes *n=36 (62.1%)*
 no, used as is *n=22 (37.9%)*

31. What steps were taken to implement the program in the field? (check all that apply)
 education and training: _____*n=15 (12.9%)*_____
 promoting the program: _____*n=1 (0.9%)*_____
 assigned responsible party to implement the program: ____*n=6 (5.2%)*_____
combination=94 (81.0%)

32. Were workers involved in the program implementation? yes *n=81 (72.3%)*
 no *n=31 (25.8%)*

If yes, please describe: _____

_____

33. Was there any particular problem or obstacle that made it more difficult to develop or implement the program? ☐ yes *n=46 (41.1%)* ☐ no *n=66 (58.9%)*

If yes, describe the problem/obstacle and how it was overcome:

_____

_____

_____

_____

_____

34. What goals or metrics were established to monitor program success?
_____*bullets located in Chapter 4*_____

_____

35. How effective has the program been? (check all that apply)

- ☐ measurable metrics or goals have been met or exceeded *n=46 (39.7%)*
- ☐ noticeable decline in the targeted injuries *n=28 (24.1%)*
- ☐ noticeable decline in at-risk behavior
- ☐ good acceptance of the program by workers *n=7 (6.0%)*
- ☐ general sense on the project that the program is doing well *n=6 (5.2%)*
- ☐ too early to evaluate *n=3 (2.6%)*
- ☐ no noticeable impact to date *n=1 (0.9%)*
- ☐ other (explain): ___*n=25 (21.5%)*_____

36. Is the program formally documented as a written policy or procedure?

☐ yes *n=97 (84.3%)*
☐ no *n=18 (15.7%)*

If yes, can a copy of this document be obtained for this study? ☐ yes *n=40 (53.3%)*
☐ no *n=35 (46.7%*

37. Please provide any other comments about this program you would like to share?
_____ *bullets located in Chapter 4*_____

_____

_____

_____

_____

Programs Implemented on Past Projects

38. Can you recall any unique programs that were implemented on past projects that were successful in reducing injuries? ☐ yes *n=49 (46.7%)* ☐ no *n=56 (53.3%)*

If yes, please describe the program briefly:

_____

_____

_____

What were the measures of success for this program?

_____

_____

Possible Programs for Implementation on Future Projects

39. Can you think of any programs you would like to see implemented on this project or on future projects? ☐ yes *n=31 (28.7%)* ☐ no *n=77 (71.3%)*

If yes, please describe the program briefly:

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APPENDIX B
COVER LETTER FOR PROJECT SAFETY PROGRAMS

August 5, 2004

To: Project Safety Manager

Subject: Survey about Specific Safety Programs

We, at the M. E. Rinker, Sr. School of Building Construction at the University of Florida, are conducting a study on the implementation of specific safety programs. The focus of the study is to gather information on how specific programs are initiated, how they are developed, how obstacles are overcome, the extent that the workers are involved in the process, and how the programs are implemented on construction projects. When possible, information is sought regarding documented evidence of the extent of success of specific programs.

The survey questionnaire contains a variety of questions related to programs designed to address specific types of injuries and specific types of hazards. Many of the questions can be answered by simply checking the applicable answers. There are no risks associated with participating in this study and the survey can be completed in about five to ten minutes. The expected benefits are the eventual reduction in the incidence of construction worker injuries. Naturally, you are asked to answer only those questions that you wish to answer. Your participation is voluntary and you may withdraw your consent at anytime without penalty.

The results of this study will be compiled and a summary report will be prepared. As a token of our appreciation for participating in the study, we will provide a copy of the summary report to you at no charge. Should you have any questions please feel free to call me at the telephone number provided below or contact me at the email address also shown.

Responses provided by specific firms will be kept strictly confidential to the extent provided by law. Research data will be summarized so that the identity of individual participants will be concealed. You have my sincere thanks for participating in the valuable study.

Yours truly,

Jimmie Hinze
Holland Professor, Director of Center for Construction Safety and Loss Control
Phone: (352) 273-1167 Fax: (352) 392-4537 Email: hinze@ufl.edu"

P.S. For information about participant rights, please contact the University of Florida Institutional Review Board at (352) 392-0433 or Email: IRB2@ufl.edu

LIST OF REFERENCES

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BIOGRAPHICAL SKETCH

Michael Edward Madariaga grew up and spent much of his adult life in Raleigh, North Carolina. He went on to receive a Bachelor of Science in Agricultural Business Management from North Carolina State University (Raleigh) in December 2000. He spent 3 years in commercial construction working for Bovis Lend Lease, before returning to school to pursue a graduate degree. He has currently been fulfilling the requirements for his Master of Science in Building Construction at the University of Florida. Upon graduating in August 2005, he will begin his residential home building career in southwest Florida.