MEASURING SAFETY CLIMATE AS AN INDICATOR OF EFFECTIVE SAFETY AND HEALTH PROGRAMS IN THE CONSTRUCTION INDUSTRY

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DEDICATION

This work is dedicated to my children and to all those who helped and encouraged me along the way.

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ABSTRACT

The purpose of this study was to measure the safety climate, safe behaviors, and EMR, of construction companies in southeastern Louisiana, and to measure selected demographic variables of construction workers employed at these companies. Two hundred and eight workers from twenty nine construction companies agreed to participate in the study.

The Safety Climate Survey (SCS) was utilized to measure the safety climate level and safe behaviors of participants and collect selected demographic variables. Additionally, companies were asked to provide their Experience Modification Rates and North American Industry Classification System codes.

A six-item Likert-type scale was utilized to measure safety climate perceptions and safe behavior experiences. Responses suggest that participants' overall perceptions of their companies' safety climates were good and that this did correlate to safe behavior at their respective companies. A small negative correlation was detected between education levels and Experience Modification Rates. A multiple regression analysis revealed that the variables safe behavior and safety coordinator explained 36.2% of the variance in safe behavior. A second multiple regression analysis revealed that the variable of education level explained 4.4% of the variance in Experience Modification Rates.

CHAPTER 1: INTRODUCTION

Worker Safety in the U. S.

The history of the United States has traditionally been marked by high levels of production through the pairing of the nation's abundant natural resources with its human resources. However, this history has not always safeguarded these human resources. The latter half of the 19th century saw tremendous industrial growth in the United States and with it, an alarming rise in work related deaths. This period was also marked by a rapid increase in the formation of worker's unions for the protection of their safety and health (Dubofsky et al., 2004) and the founding of the National Safety Council in 1913 which began tracking work related deaths. Throughout much of the 20th century, they found that work related deaths were increasing, and by the 1960's work related fatalities were exceeding 10,000 annually. In response, the United States passed the William Steiger Act or Occupational Safety and Health (OSH) Act in 1970, which led to the creation of the Occupational Safety and Health Administration or OSHA (OSHA, 2009).

From the inception of the OSH Act, work related fatalities have continually declined. Researchers cite two crucial changes that occurred during this period of industrialization that have had a profound impact on the way companies approach safety in the workplace. The first had to do with the nature of accidents themselves. Rather than being just merely a simple human factor, i.e., dropping a tool or falling off a ladder, accidents became associated with the increase in complexity of technological systems being invented to increase worker productivity (Hollnagel, 2008). In other words, prior to this period worker knowledge was about understanding the relatively simple aspects of how to perform their particular job. After this period and now, there was/is a need for workers to understand the technology of the overall system to avoid accidents (Hollnagel, 2008). This developing phenomenon of the need to have a more in-depth understanding of the overall system in which the individual is working has been designated as the company's safety climate (Zohar, 1980). This has given rise to a secondary change in the way in which companies approach safety. There has been a movement away from reactive safety training and program implementation based purely on retrospective data or lagging indicators such as work related fatalities and accident rates, towards a more proactive approach by looking at leading indicators such as safety audit data which may give insight to what the true measure a company's safety climate might be (Flin et al., 2000). These predictive measures can enable safety condition monitoring, rather than waiting for the system to fail in order to identify weaknesses and take remedial actions (Flin et al., 2000). This can also be conceptualized as a switch from "feedback" to "feedforward" control (Flin et al., 2000). The shift of focus has been driven by the awareness that organizational, managerial, and human factors rather than purely technical failures are prime causes of accidents (Flin et al., 2000; Heinrich, 1931). Firms are realizing that their human resources represent the social capital of their business and should be managed as carefully as their financial assets and capital investments (Schaufelberger, 2009).

Tracking Worker Safety in the U. S.

In 1976, the U. S. Bureau of Labor Statistics began collecting census data annually on work related injuries and fatalities. The latest published report shows that 4,551 people died in work related accidents in the United States in 2009 (Bureau of Labor Statistics [BLS], 2011). Of these fatalities, 834 were in the construction industry. This was the largest sub-group of fatalities by occupation. Since the inception of this procedure, the BLS has collected demographic characteristics to assist in sorting and analyzing work related injury and fatality data. These demographic characteristics include gender, age group, ethnicity, and occupation. For statistical purposes, gender is defined as the distinction between male and female. Age group is defined as inclusive ranges of ages of injured or ill workers grouped by age ranges (typically a 5-year range). Race and ethnicity is a construct for classifying people with similar biological, social, and cultural heritage into four race groups (White, Black, American Indian/Alaska Native, and Asian/Pacific Islander) and one ethnicity group (Hispanic or Latino) (BLS, 2011). Occupation is based upon company self-selection of either a six digit North American Industry Classification System (NAICS) code or four digit Standard Industrial Classification System (SIC) code to facilitate reporting and analyses of data by industry (U. S. Census Bureau, 2007).

Additionally, OSHA, BLS, and other organizations interested in analyzing injury statistics utilize incident rates to facilitate comparison of injury and illness data across organizational, occupational, and industry variables. Two commonly used incident rates are the Days Away, Job Restriction, Job Transfer Rate (DART) and the Total Recordable Incident Rate (TRIR). The 2009 fatality incident rate per 100,000 workers was 3.5 for all workers while it was 9.9 for construction workers (BLS, 2011). Such statistics have resulted in the construction industry in the United States being characterized for poor safety and as an inherently dangerous profession in the United States (Nahmens & Ikuma, 2009). These rates are in turn utilized to calculate a company's Experience Modification Rate (EMR), which has a direct impact on the amount of worker's compensation insurance costs that a company will have to pay to conduct business. A company's EMR is used by insurance companies as both an indicator of their past safety performance as well as a predictor of their future safety performance. In short, it is a ratio of a company's actual losses to its expected losses where expected losses are determined by the loss data of all companies performing similar type work (Hinze et al., 1995). Therefore, an EMR of 1.0 is considered an industry average or starting point, while a score less than 1.0 is considered above average and greater than 1.0 indicates poor safety performance.

There are many reasons for a construction firm to be concerned with the safety of its workers. Cost and productivity are important to the success of any business. Businesses need to produce profits in order to remain viable. Workplace injuries resulted in over $53.42 billion in direct workers compensation costs in 2008 (Liberty Mutual, 2010). Additionally, as a company's EMR goes up due to increases in DART and TRIR rates, worker compensation costs go up, making the company less competitive. In general, productivity increases with fewer workplace accidents and injuries, making a company more competitive. Another factor is a company's desire to become more socially responsible. Construction companies have found a competitive advantage to having a good safety track record. Residential customers are increasingly asking about a company's safety record before hiring them as they will typically live with and in the end product (Maroushek & Firl, 2009). A final factor that cannot be ignored is that safety is legally required under the OSH Act and responsibilities are delineated in OSHA's 29 CFR 1926 Construction Industry regulations (OSHA, 2011). Failing to understand and comply with these regulations can lead to fines and work delays.

Need for the Study

While benefits from safety can be shown to improve productivity which leads to increased competitiveness and profits, as well as an enhanced reputation for being a socially responsible company (Maroushek & Firl, 2009), this study will focus on the overall effectiveness of construction company safety practices in the construction industry in southeastern Louisiana and how these practices help define a company's safety climate (Zohar, 1980). OSHA places responsibility for developing a positive safety environment or climate on the management teams of construction companies through its general duty clause which states that, "Each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees" (OSH Act, Section 5 (a) (1)). However, how each organization achieves an acceptable level of effectiveness is left up to each company. As a performance standard, this does not clarify the precise steps that a company must take with regards to the safety system utilized. However, this does not diminish the company's responsibility for insuring that it is utilizing best practices with regard to its workers' safety and health. Training techniques have ranged from employee orientation, on the job experiences, and weekly toolbox talks to more formal techniques utilizing Job Safety Analysis (JSA) and Behavior Based Safety techniques (BBS). Overall, the goal and responsibility of each company is to constantly monitor and assess the effectiveness of their safety program. A preemptive method of measuring company safety climate could provide a proactive data based on a predictive model rather than a responsive model (Williamson et al., 1997). Research focused on validating a means of measuring safety climate is warranted.

Purpose and Objectives

The purpose of this study is to determine if a predictive model exists that explains safe behavior and EMR of construction companies in the Baton Rouge area and determine the amount of variance in safe behavior and company EMR that is explained by the safety climate variable as well as selected demographic variables in order to determine if a predictive model exists. The objectives of this study are as follows:

1. Describe construction companies in southeastern Louisiana on the following characteristics:
    i. NAICS or SIC code
    ii. Experience Modification Rate (EMR)

2. Describe construction workers in southeastern Louisiana on the following characteristics:

    i. Gender
    ii. Age
    iii. Education level
    iv. Years of work experience
    v. Occupation
    vi. Country of birth

3. Measure the employees' perception of the company's safety climate on the following characteristics factors as measured by the Safety Climate Survey (Mohamed, 2002). The first 10 scales listed measure Safety Climate and the last scale listed measures safe behavior.

    i. Management Commitment to Safety
    ii. Management Communication of Safety
    iii. Safety Rules and Procedures
    iv. Supportive Work Environment
    v. Supervisory Environment
    vi. Employee Involvement
    vii. Appreciation of Personal Risk
    viii. Work Site Risks
    ix. Work Pressure
    x. Employee Competence
    xi. Safe Behavior

4. Determine if selected variables explain a substantial proportion of the variance in the safe behaviors of construction company employees. The potential explanatory variables that will be used in this analysis are the 10 safety climate constructs as well as age, gender, ethnicity, educational level, and years of work experience in the construction industry.
5. Determine if selected variables explain a substantial proportion of the variance in the EMR of construction companies. The potential explanatory variables that will be used in this analysis are the 10 safety climate constructs as well as age, gender, ethnicity, educational level, and years of work experience in the construction industry.

Significance of the Study

Typical measures of safety performance have generally relied on some form of accident or injury data (Mohamed, 2002). In other words, this data is collected after the fact and is generally expressed in a company's TRIR and DART rates. The problem with this is that such data "…are insufficiently sensitive, of dubious accuracy, retrospective, and they ignore risk exposure" (Mohamed, 2002) (p 377). Approaching almost a century ago, Heinrich (1931) identified a number of reasons why accident data, or similar outcome data, are poor safety indicators. Heinrich (1931) proposed that for every 1 major injury, there were 29 minor incidents, and 300 near misses not resulting in an injury. Although actual accident statistics are widely used throughout the construction industry, it is almost impossible to use only accidents as a safety indicator for a single construction site (Mohamed, 2002). In part, this is because of the random variations between construction sites, where many sites will have no accidents, and it is not possible to determine whether these sites with zero accidents are safer than sites with four or five accidents (Mohamed, 2002). In view of the above reasons, this study adopts a measure of the safety climate as the safety indicator. This is based on the assumption that unsafe behavior is intrinsically linked to workplace accidents. Therefore, high levels of safety climate are positively associated with higher levels of self-reported safe work behavior and are a more accurate measurement of the effectiveness of safety efforts on a construction site (Mohamed, 2002). While accident records may be a lagging indicator, these statistics are growing within the residential construction industry to the point that OSHA has made it a point of specific focus. This study will attempt to measure the safety climate on construction sites in southeastern Louisiana to see if a correlation exists between their incident rates and their safety climates.

Figure 1. The Foundation of a Major Injury (Heinrich, 1931)

Definitions of Terms

The following terms are defined for use in this study. References have been provided for those definitions that were taken from the literature.

- **Safety Climate** – is a summary of perceptions of safety levels that employees share about their work environment at a given moment (Zohar, 1980).

- **Safety Culture** – is an assembly of characteristics and attitudes in organizations and individuals which establishes that company's priorities over time (Zohar, 1980).
- **Experience Modification Rate** – assesses whether a company's losses are greater than or less than average by comparing a company's payroll and claims history with other businesses in the same industry (Cooper & Phillips, 2004).
- **NAICS Code** – is the standard used by federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy (U. S. Census Bureau, 2007).

CHAPTER 2: REVIEW OF LITERATURE

Safety in the Workplace

Concern over personal safety is an inherent part of human nature. The need for safety is seen as a prerequisite to fulfilling higher order needs (Maslow, 1943) both personally and as worker motivation technique to improve productivity (Schaufelberger, 2009). Additionally, accidents and injuries could be directly tied to increased costs and decreased production (Heinrich, 1931). Therefore, some of the earliest research into worker safety focused on determining accident causation as a means of effective accident prevention (Heinrich, 1931). While working for Traveler's Insurance in the 1920's, H. W. Heinrich examined thousands of industrial work related accidents and developed a domino theory of accident causation that is still the basis for many theories today. He concluded that accidents can be subdivided by cause into two categories, unsafe acts or unsafe conditions. He further concluded that the majority of accidents were caused by unsafe acts. In other words, human behavior was the biggest contributing factor to accidents in the workplace.

Heinrich proposed that a scientific application of accident prevention should be founded on four fundamental principles. These were executive interest and support, cause analysis, selection and application of remedy, and executive enforcement of corrective practice (Heinrich, 1931). While this early research was motivated by the cost savings to businesses, the groundwork was laid to suggest that a truly safe work environment was one in which the management level took the steps necessary to create a climate of safety within the organizational culture (Zohar, 1980). Researchers began to recognize that a truly safe environment in the workplace is evidenced by the safety climate within a given company or organization (Zohar, 1980).

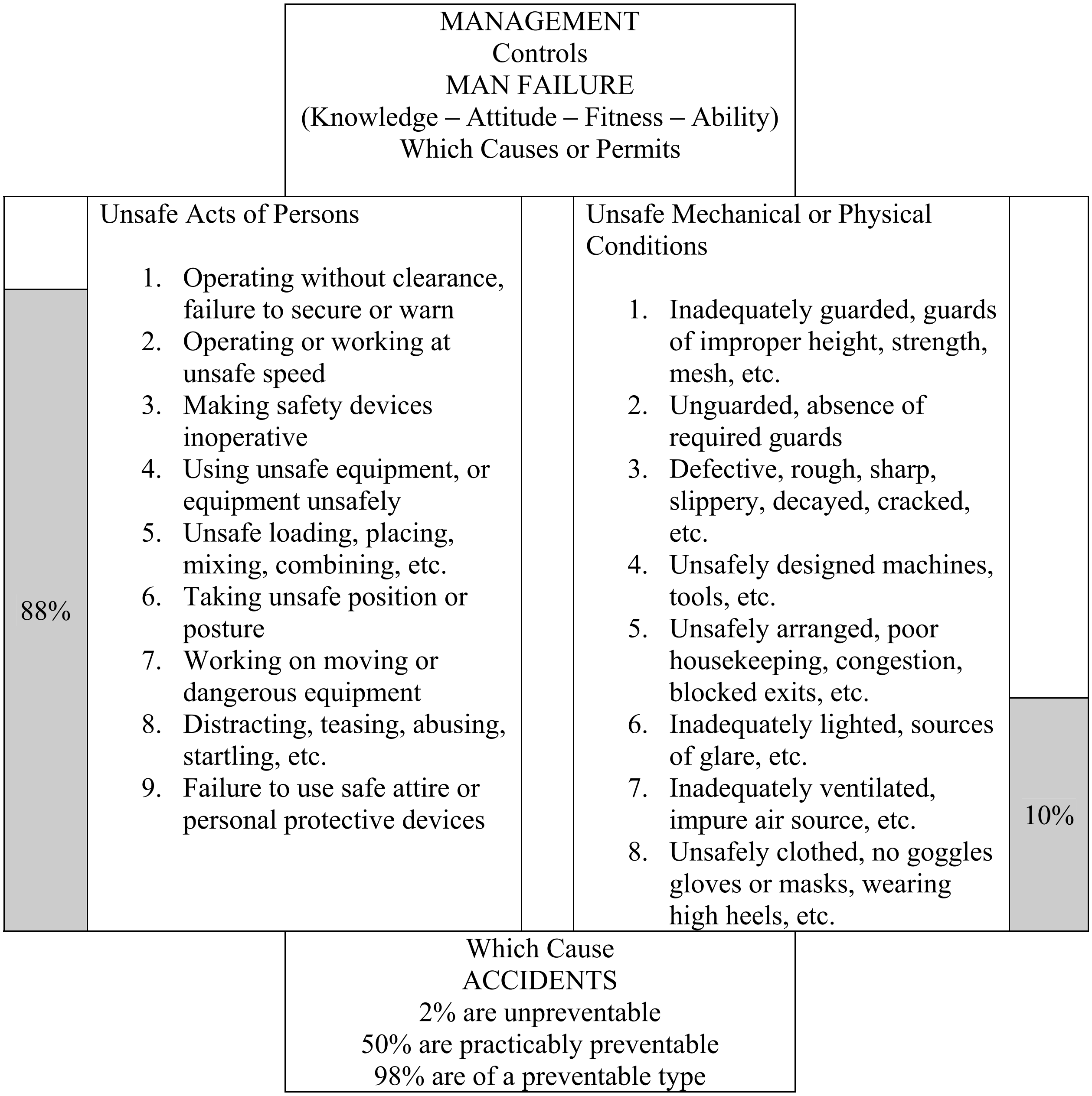

Figure 2. Chart of Direct and Proximate Accident Causes (Heinrich, 1931)

W. W. Lowrance (1976) voiced concern that even the very term safety "…has so far been poorly defined, widely misunderstood and often misrepresented. " He then stated that, "Much of the widespread confusion about the nature of safety… would be dispelled if the meaning of the term safety were clarified" (Lowrance, 1976). William Montante (2006) noted that, “This perceptual difference is more than a barrier or gap-it may take on the proportions of a chasm in many companies” (p 36). Lowrance (1976) concluded that safety should be defined as a judgment of the acceptability of risk. Today’s safety professionals generally define the term as the state in which the risk of harm by accident to persons or of property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and risk management (Hollnagel, 2008). Given that most workplace accident causes can be traced to human behavior (Heinrich, 1931), many health and safety programs in the workplace still tend to focus on the prevention or elimination of workplace hazards. Meanwhile, research indicates that only a small portion of reported accidents are a result of unsafe conditions. Therefore, these interventions addressing unsafe conditions have limited effect in preventing accidents and injuries in the workplace (Williams, 2010). More recent research has explored factors such as safety perceptions and attitudes in an attempt to understand safety climate within a company (Holzner, 2001).

Safety in Construction

In 2009, there were 4,551 work related deaths in the U. S. Of these, 834 fatalities were in the construction industry, making this the largest group of fatal accidents by occupation (BLS, 2011). Accordingly, it is not a stretch to say the construction industry is a high risk occupation. In trying to apply accident causation theories to this work environment, some view the nature of construction work as inherently dangerous and, therefore, accidents are going to occur regardless of the steps taken to prevent them. However, accidents in construction shouldn’t be viewed as unique to this industry because they can be attributed to more universal causes associated with unsafe acts, such as recklessness, apathy, or lack of knowledge and training (Sawacha & Fong, 1999). It still remains, however, that the nature of the construction industry does contain challenges to safety programs that general industry frequently does not. These challenges can include a constantly shifting worksite and conditions (Sawacha & Fong, 1999). Others contend that construction injuries are common because of many of the inherent characteristics of the construction industry including dynamic work environments, proximity of multiple crews, and industry culture. Each of these characteristics may contribute to unsafe conditions or unsafe behaviors (Hallowell, 2008). Other possible variables in the fatality rates were age and gender. Of the 4,551 fatalities in 2009, 93% were male while 7% were female. Additionally, the fatality rate for workers aged 18-44 was below the national average while it was above the national average for workers aged 45-65 (BLS, 2011).

Safety Climate in Construction

Rather than relying on lagging accident data as an indicator of overall safety, more research now points to a measure of safety climate as a more reliable indicator of the effectiveness of safety policies and practices within a given industry. While Heinrich laid the groundwork for defining safety climate by citing executive interest and support, and executive enforcement of corrective practice among his four fundamental principles for accident prevention, he did not identify them as key elements to defining safety climate within an organization. The term "safety culture" first appeared in literature in a 1986 International Safety Advisory Group's Safety-Series 75-INSAG-4 report on the Chernobyl accident (Teo & Feng 2009). From this, Zohar (1980) developed the term "safety climate" to mean '…a summary of molar perceptions that employees share about their work environments' (p. 96). Research now points towards safety culture and especially the more measurable safety climate as an effective indicators of a company's safety practices (Teo & Feng 2009).

While the two are related, there are some differences between organizational culture and organizational climate (Denison, 1996). Studying culture requires the utilization of qualitative methods while climate can be studied with quantitative methods (Denison, 1996). "If researchers carried field notes, quotes, or stories, and presented qualitative data to support their ideas, then they were studying culture. If researchers carried computer printouts and questionnaires and presented quantitative analysis to support their ideas, then they were studying climate" (Denison, 1996) (p. 621). Culture researchers are more interested in the evolution of social systems over time while climate researchers tend to focus on organizational members' perceptions of observable practices and procedures that may be a result of culture (Denison, 1996).

A Comparison of Selected Dimensions Used by Culture and Climate Researchers

	Culture Researchers			**Climate Researchers**		
Component	**Hofstede (1990)**	**O'Reilly & Chatman (1992)**	**Cooke & Rousseau (1988)**	**Litwin & Stringer (1968)**	**Hellriegel & Slocum (1974)**	**Koys & DeCotlis (1991)**
Structure	Authority	Stability	Conventional culture	Structure	Centralization	---------
Support	Power distance	Respect for people	Humanistic culture	Support	Supportiveness	Support
Risk	Security	Innovation	Avoidance culture	Risk	Innovation	Innovation
Cohesiveness	Collectivism	Teamwork	Affiliative culture	Identity	Peer Relations	Cohesion
Outcome Orientation	Results orientation	Outcome orientation	Achievement culture	Standards	Motivation to achieve	Pressure

Figure 3. Denison's Table of Culture versus Climate Comparison (Denision, 1996, p. 631)

Denison (1996) also included the idea that safety climate and culture were part of the more inclusive organizational climate and culture. Denison (1996) explored how organizational culture studies published in the late 1980's and early 1990's began to look like organizational climate studies from 20 years prior. He felt the two concepts were becoming unrecognizable from each other. This blending of ideas does not seem to have occurred with respect to the study of safety climate and safety culture. Safety climate and safety culture are discussed in research with clear differences, yet still related. This is something not frequently encountered in organizational climate and culture studies (Holzner, 2010). Later studies also found that safety climate and safety culture were related, where company safety climate was one measureable indicator of a company's safety culture (Teo & Feng 2009). Research trends in the 1980's continued this development of the concept that safety climate was just one of several climatic elements that help to create the overall organizational climate (Holzner, 2010). Zohar compiled and analyzed factors from multiple sources which created a snapshot of companies with successful safety programs. The factors identified by Zohar were related to strong management commitment to safety, again reflecting back to Heinrich's principals of executive interest and support, and executive enforcement of corrective practice. Zohar postulated that five key elements to indicating a strong safety climate were that top management were personally involved in safety activities on a routine basis, the rank and status of the company's safety officers, open and frequent communication links between employees and management, good housekeeping and environmental control, and a stable workforce with less turnover and older workers (Zohar, 1980).

While the exact definition of climate as used in the term safety climate varies among researchers, Wiegmann et al. (2004) proposed that safety climate is a psychological phenomenon that is usually defined as the perceptions of the state of safety at a particular time, that safety climate is closely concerned with intangible issues such as situational and environmental factors, and that safety climate is a temporal phenomenon, a "snapshot" of safety culture, relatively unstable and subject to change. (p. 124)

Teo and Feng (2009) studied the relationship between safety climate and safety culture in an attempt to establish a measure of safety climate as a reliable indicator of safety in construction companies. Through the use of a quantitative questionnaire developed for their study, Teo and Feng (2009) were able to measure relationships between safety climate and three distinct areas: the psychological, behavioral, and situational aspects of safety (Holzner, 2010). Teo and Feng (2009) concluded that the safety could be reliably predicted by a safety climate assessment. Teo and Feng (2009) utilized a survey instrument to measure factors that are important indicators of the effects of safety climate. Others postulated that businesses exhibiting positive safety climate would have lower occupational injury and illness rates (Molenaar et al. 2002). Teo and Feng (2009) concluded that safety climate does have a significant impact on all three aspects of safety, that it further clarifies the distinction between safety climate and culture, and sheds new light on the development of tools for measuring the safety climate within construction companies (Teo & Feng, 2009).

In general, research has tended to focus in one of four areas. The first is designing psychometric instruments and ascertaining their underlying factor structures, the second is developing and testing theoretical models of safety climate to ascertain determinants of safety behavior and accidents, the third is examining the relationship between safety climate perceptions and actual safety performance, and the fourth is exploring the links between safety climate and organizational climate (Cooper & Phillips, 2004). Some studies did find associations between the occurrence of injuries among construction workers and the safety climate of the organization (Abbe et al., 2011). This study will focus on examining the relationship between safety climate perceptions and actual safety performance. Research is still trying to finalize a predictive model of safety climate as an indicator of safe performance or behavior. Studies by Zohar (1980), Glendon et al. (1994), Thompson et al. (1998), Flin et al. (2000), and Mohamed (2002) identified similar constructs in a safety climate model utilizing multiple regression analysis to demonstrate that perceptions of the safety climate by workers may be predictive of actual levels of safety behavior (Cooper & Phillips, 2004). It should be noted that there is still some disagreement among researchers as to which model and instrument most accurately predicts safe behavior in a company (Cooper & Phillips, 2004). However, most seem to agree that there are some promising results indicating that continued study of safety climate models and measuring of safety climate perceptions is warranted to eventually produce a predictive model that is not based on lagging indicators such as accidents in which someone has already been injured (Cooper & Phillips, 2004). While Heinrich's observations proposed four areas of safety management in order to reduce accidents, the last few decades of research have produced models of the safety climate ranging from 8 (Zohar, 1980) to 10 (Mohamd, 2002) constructs in order to explain safe behavior. Mohamed's (2002) study identified the following safety climate constructs: management commitment, communication, rules and procedures, supportive and supervisory environments, workers' involvement, personal appreciation of risk, appraisal of work environment, work pressure, and competence, applied to construction(Mohamed, 2002). Mohamed (2002) developed a survey based on previous studies and was able to conclude that a positive association existed between safety climate and safe work behavior. Mohamed's work confirmed Zohar's (1980) earlier assertion that management commitment was central to instituting truly safe work practices, which seems to harken back to Heinrich's (1931) earlier assumptions of the importance of executive level support for the reduction of accidents. This study will utilize Mohamed's (2002) study as its basis for three reasons. First, his study does show that he based his model and survey instrument on previous studies in an effort to try to ascertain if an accurate safety climate model could be developed. Second, his results did achieve some level of success. Third, he has agreed to allow the use of his instrument in this study and provide input into any changes made to it.

Measuring Safety Climate

The theoretical framework and model for this study is based on the definition of safety climate as proposed by Weigmann et al. (2004) and on Denison's (1996) notion that safety climate is indeed a measureable and quantifiable phenomenon. While several studies have developed an instrument for measuring safety climate, this study will build upon Mohamed's (2002) model of the relationship between safety climate and resulting safe behaviors by employees as his study focused on construction workers and other studies did find that constructs could be specific to the type of industry being measured (Cooper & Phillips, 2004). Mohamed (2002) verified a model of these relationships by measuring and comparing the employees' perception of their company's safety climate to their safe work behavior within construction companies and utilizing factor analysis to evaluate the constructs. Factor analysis has been the most commonly used method to identify the included dimensions of safety climate (Glendon et al, 1994). In general, researchers agree that safety climate refers to the degree to which employees believe true priority is given to organizational safety performance, and its measurement is thought to provide an early warning of potential safety system failure (Cooper & Phillips, 2004). Even though researchers have struggled over the last few decades to find empirical evidence to demonstrate actual links between safety climate and safety performance, more recent studies utilizing multiple regression analysis have demonstrated that perceptions of the safety climate were predictive of actual levels of safety behavior (Cooper & Phillips, 2004), and that it remains a promising area in need of more research noting that a statistical link between safety climate perceptions and safety behavior will be more firmly established when sufficient behavioral data is collected. While Cooper (1995) had earlier identified eleven constructs for a construction safety climate, Mohamed's (2002) model refined it to ten constructs that contribute to a company's safety climate. From Mohamed's (2002) concepts, Teo and Feng (2009) developed and defined three conceptual elements or groupings of these constructs of safety climate and culture which are the person/psychological, the situation/environment, and the behavior.

The first construct is the role that management has in promoting safety within the organization. Harkening back to Heinrich's (1931) model, management's commitment to safety remains a key issue (Zohar 1980). As Heinrich (1931) pointed out, management's role has to go beyond organizing and providing safety policies and working instructions. Several studies show that management's commitment and involvement in safety is the factor of most importance for a satisfactory safety level (Jaselskis et al., 1996). Langford et al. (2000) found that when employees believe that the management cares about their personal safety, they are more willing to cooperate to improve safety performance. These findings led to the hypothesis that the greater the level of management commitment toward safety, the more positive the safety climate (Mohamed, 2002).

The second construct of the model looks at management's capacity to communicate their commitment to safety to their employees. It is expected that management should use a variety of formal and informal means of communication to demonstrate their commitment to safety (Baxendale and Jones 2000). It is suggested that openness is critical for suggesting safety improvements and reporting near misses as well as unsafe conditions and practices (Simon, 1991). This led to the second hypothesis that the more effective the organizational communication dealing with safety issues, the more positive the safety climate (Mohamed, 2002).

The third construct relates actual safety rules and policies to the safety climate. At the core of any safety program is compliance and adherence to safety rules, regulations, and procedures. Hood (1994) notes that problems related to safety can often be traced to inconsistently applied or nonexistent operating procedures. Cox and Cheyne (2000) cite that the extent to which employees perceive that safety rules and procedures are promoted and implemented by the company as a major contributing factor to the safety level within that organization. Based on these findings, the third hypothesis that the better the perception of safety rules and procedures, the more positive the safety climate (Mohamed, 2002).

The fourth construct looks at the supportive environment within the workplace. This refers to the level of trust and support within a group of employees. This can also include the level of confidence that people have in working relationships with each other as well as the overall morale in the company. The existence of a supportive work environment shows the employees' concern for the safety of themselves and their coworkers and fosters closer ties between them (Mohamed, 2002). Typically, coworkers' attitude toward safety has been often been included in safety climate studies (Goldberg et al., 1991). This leads to a fourth hypothesis; the higher the level of support given by coworkers, the more positive the safety climate (Mohamed, 2002).

The fifth construct examines the success of safety program based upon the premise that safety is both a management responsibility and a line function (Mohamed, 2002). Upper level management typically develops and implements the program. However, its lower level or line management must implement the policies, and the actual success generally depends upon the ability of those personnel to ensure that the program is carried out during daily operations (Agrilla, 1999). Langford et al. (2000) note that the more relationship-oriented supervisors are, the more likely it is that their subordinates will perform safely. Based on these findings, a fifth hypothesis is that the more safety aware and relationship oriented the supervisors, the more positive the safety climate (Mohamed, 2002).

The sixth construct examines the level of empowerment employees feel they possess in the safety process through a willingness of management to delegate some decision-making responsibilities to the workforce allows them to become more actively involved in developing safety interventions and safety policies (Williamson et al., 1997). Evidence suggests that it is not just the role that management plays in safety policies and procedures, but participation and involvement in safety activities on the part of employees is also important. The extent to which management encourages employee involvement rather than simply assigning them the more passive role of the recipient of policies can affect the safety climate (Niskanen, 1994). Employee involvement may include involvement in developing company procedures for reporting injuries and potentially hazardous situations as well as near miss reporting. From this, a sixth hypothesis is that the higher the level of workers' involvement in safety matters, the more positive the safety climate (Mohamed, 2002).

The seventh construct looks at the overall attitudes workers have towards their own safety. As discussed previously, a clear definition of safety is sometimes an elusive thing. Some employees are inherently more willing to take risks than others (March & Shapira, 1992). Therefore, Cox and Cox (1991) argue that the attitudes toward safety of the employees themselves are one of the most important indicators of the safety climate. Rundmo (1997) found that employee attitudes toward safety have been found to be associated with personal risk perception. Therefore, the seventh hypothesis is that the higher the level of workers' willingness to take risk, the less positive the safety climate (Mohamed, 2002).

The eighth construct looks at hazards in the work environment. Hazards on the job site do not necessarily result in accidents, but they may lurk in work environments, waiting for the right combination of circumstances to come together (Heinrich, 1931). Therefore, one of the aims of site layout is to produce a working environment that will maximize efficiency and minimize risks (Gibb & Knobbs, 1995). Site layout planning should address such elements as access and traffic routes, material and storage handling, site offices and amenities, and the site enclosure (Anumba & Bishop 1997). Previous research shows that tidy and well planned sites are more likely to provide a high level of safety performance (Sawacha et al., 1999). For the purpose of his study Mohamed (2002) defined workplace hazards as tangible factors that may pose risks for possible injuries. Therefore, the eighth hypothesis proposed is that the greater safety's integration in site layout planning to identify safety hazards, the more positive the safety climate (Mohamed, 2002).

The ninth construct looks at the amount of pressure workers are under to perform at a certain speed that they may not be comfortable sustaining safely. Construction employees are frequently under pressure to perform their tasks within a specific schedule. The degree to which employees feel this pressure to complete work, and the amount of time to plan and carry out work is referred to as work pressure (Glendon et al., 1994). Other studies identify the tight construction schedule as the most serious factor that adversely affects the implementation of construction site safety (Ahmed et al., 1999). Sawacha's et al. (1999) findings also support this where they found that productivity bonus pay could lead workers to achieve higher production, but through performing tasks in a more risky or unsafe manner. Langford et al. (2000) found that some supervisors may be willing to turn a blind eye to unsafe practices on a site due to the pressure to achieve targets set by contractual obligations to deliver a project. All of these studies argue that the seemingly ingrained practice in industry of valuing expediency over safety has to be overcome in order for safety management to be effective (Mohamed, 2002). This conclusion leads to a ninth hypothesis; the higher the perception of valuing expediency over safety, the less positive the safety climate (Mohamed, 2002).

The tenth construct looks at the ability on the part of the employees themselves to detect, recognize, and avoid a hazard plays an important role in determining the overall safety levels within a company (Simon & Piquard 1991). Many researchers found that training in hazard detection to be a major factor influencing job site safety levels (Jaselskis et al., 1996). Therefore, the employees' perception of the general level of their own qualifications, knowledge, and skills To assess and identify hazards is a contributing factor to the overall safety climate (Mohamed, 2002). The employees' confidence that they possess the skills to perform a given job or task safely leads to the tenth and final hypothesis that the greater one's experience and knowledge of safety issues, the more positive the safety climate (Mohamed, 2002).

These 10 independent variables, or constructs, create the foundation for measuring a company's safety climate in Mohamed's (2002) model. Higher levels of these 10 constructs should indicate a positive safety climate within the company. As previously mentioned, traditional measures of a company's safety performance generally rely primarily on accident or injury data. Even though accident statistics are widely used throughout the construction industry, Laitinen et al. (1999) state that it is almost impossible to use accidents as a safety indicator for a single construction site. Among a number of reasons why accident data is poor safety indicators, Glendon and Mckenna (1995) point out that one of the main problems with such data is that it is insufficiently sensitive, of dubious accuracy, retrospective, and typically ignores risk exposure. For example, many sites will have no reportable accidents; therefore, it wouldn't be possible to determine if a zero accident site is truly safer than a site with two or three accidents. For these reasons, Mohamed's (2002) study adopted observable safe behavior or actions as the safety indicator. This is based on Thompsons et al.'s (1998) assumption that unsafe behavior is intrinsically linked to workplace accidents. Additionally, it is further supported by findings from studies and models developed based on an unsafe behavior concept (Krause 1997; Smith & Arnold 1991; Staley 1996). These findings allowed Mohamed (2002) to hypothesize that if the 10 independent variables create the safety climate, then high levels of the safety climate are positively associated with higher levels of self-reported safe work behavior. Additionally, high levels of safety climate should also be associated with better than industry average Experience Modification Rates. Examining the amount of variance in EMR as explained by the potential explanatory variables that will be used in this analysis is a relatively unexplored area of research at this time (Chi et al., 2005).

The research model used for this study examines the hypothesis that safe work behaviors, as well as the reciprocal of unsafe behaviors, are results of the existing safety climate. It is based on Mohamed's (2002) model which was determined by five independent sets of factors identified in the literature; management, safety, risk, work pressure, and competence. These factors divide the model into three distinct parts: antecedents to safety climate; the current safety climate itself as perceived by the workers in the work environment; and the outcome of safety climate as reflected in safe work behavior (Mohamed, 2002). Additionally, this study will investigate if any variance in a company's EMR can also be explained by the safety climate model constructs. To date, research has not looked at this relationship even though it does note that EMR has long been considered a relatively objective measure of a company's safety performance (Hinze et al., 1995).

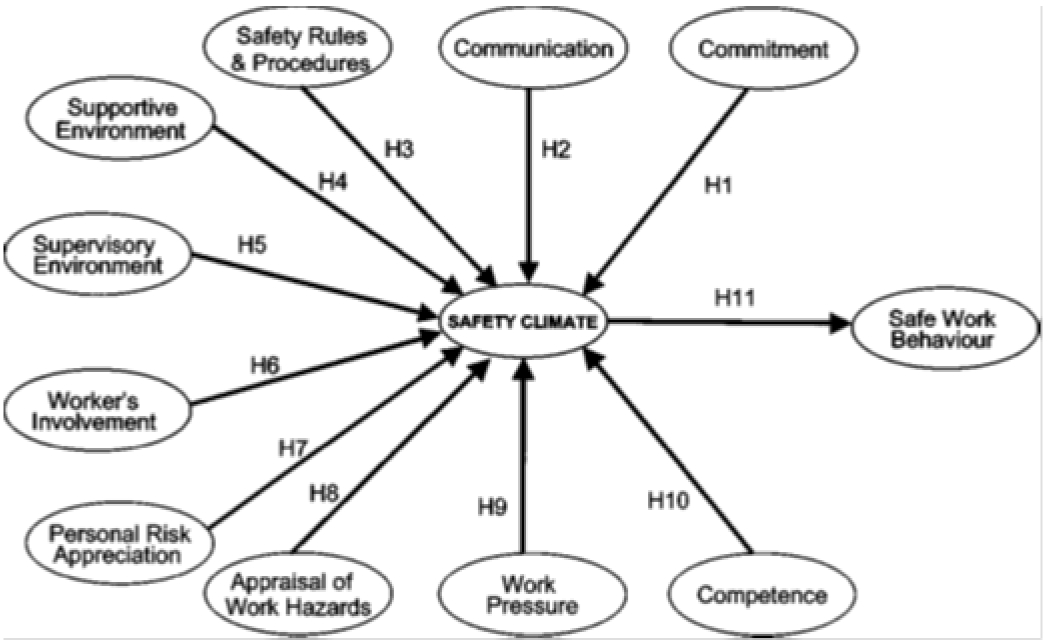

Figure 4. Model of Safety Climate (Mohamed, 2002, p. 376).

Safety Climate Surveys

Several researchers have developed questionnaires or surveys to try to measure the safety climate within an organization. The general approach has been to design these instruments to measure employee perceptions of safety and health within their respective organizations. Carder and Regan (2003) were able to show a survey could be used to measure the factors associated with the safety climate of an organization before and after actions are taken to improve the safety performance of the company. Carder and Ragan (2003) administered a modified version of the Minnesota Perception Survey (MPS) and concluded that the perception of management's commitment to safety was weak. The company took specific action to address the issue, and eight months later a follow-up survey indicated that the areas specifically targeted for improvement saw a statistically significant improvement (Carder & Ragan 2003). Mohamed (2002) utilized a similar approach specifically with construction sites, whereas Carder and Ragan focused on general industry. His instrumentation was also able to show a correlation between perceived safety climate and incident rates (Mohamed, 2002).

In addition to measuring the constructs of the safety climate model, this study will also include measuring the demographic employee characteristics of gender, age group, ethnicity, and occupation. As discussed earlier, the BLS has continuously collected these demographic characteristics along with injury reports to assist in sorting and analyzing the data and issues a yearly summary based on these characteristics sorting the data by company SIC/NAICS codes (BLS, 2011). It is felt that similar collection of these variables is warranted for several reasons. First, collection of these same characteristics will allow for comparison to BLS data base information and findings. Second, there is evidence to suggest that these characteristics can impact safety climate. In researching safe behaviors, Nelson et al. (1998) did find that their results demonstrated that self-reporting of behaviors were correlated to gender, age, ethnicity, and education level. Their study found that males, ages 18-24, both white and black, and with less than a college education were most likely to report unsafe behaviors (Nelson et al., 1998).

The notion that these preexisting characteristic could impact a company's safety climate can be traced all the way back to the domino theory of accident causation proposed by Heinrich (1931) in which he noted ancestry, ethnicity, and societal formation of an individual could predispose them to a particular view of what is or isn't safe behavior. In Mohamed's (2002) study, these characteristics are viewed as a reflective of independent variables that could affect each of the 10 constructs of the safety climate model (Mohamed, 2002). In other words, they could affect how an individual employee perceives their safety climate. In a safety climate study conducted by Cooper & Phillips (2004), these researchers did detect significance in how respondents replied to the safety climate constructs based on age and years of experience (Cooper & Phillips, 2004). Yet another study conducted by Chi et al. (2005) looked at construction site accidents utilizing similar demographic variables of age, gender, and years of work experience. They concluded that gender and age could make a difference in perceptions of safety behavior (Chi et al., 2005). However, they also noted that female workers and older age groups are a much smaller proportion of the construction site workforce as expected (Chi et al., 2005). Citing relatively low percentages of females (7.9%) and workers over the age of 55(18.2%) found in their drawn sample did raise the question of how much impact these characteristics had on the overall study (Chi et al., 2005).

Additionally, data from the Bureau of Labor Statistics' most recent annual report does show a continuing trend in work related deaths based upon the demographics of age and gender (Bureau of Labor Statistics, 2011). In their report, data indicated that 93% of all work related deaths for 2009 were men. The BLS also provides data in the form of incident rates, i.e. the number of fatalities per 100,000 workers. In looking at BLS age group statistics, all workers in the five combined age groups of 18-54 were at or below the national fatality rate of 3.5 per 100,000 workers while the age group 55-64 rose to 4.3 and age 65 and over rose to 12.1 (Bureau of Labor Statistics, 2011). Other research has also shown that in the self-reporting of safe behaviors, there is greater risk taking in males in younger age groups but that the gender gap diminishes with age (Byrnes et al., 1999). Literature also indicates that age, gender, and work experience can have effects on safe work behaviors over and above those constructs of which the safety climate model is comprised (Brown et al., 2000).

Overall, it was felt that these demographic characteristics should be collected for this study for the following 4 reasons. First, the studies cited above did find varying levels of significance in their analysis based on these variables that warrant their inclusion. Second, a review of literature did show that age and gender at least partially explains safe behavior. Third, it allowed for more meaningful comparisons between the data collected for this study and data from other studies as well as Bureau of Labor Statistics annual census of occupational injury reports. Finally, it allowed a verification of the drawn sample to see if it was within the expected parameters of these characteristics in the population. Finally, it should also be noted that this data was analyzed with great sensitivity to the fact that the Equal Employment Opportunity act does not allow companies to use this information to exclude any group from its hiring practices under the guise that they're trying to create a safer environment.

CHAPTER 3: METHOD

Population

According to the BLS, there were 121,566 construction employees in Louisiana during the first 6 months of 2011 (BLS, 2011) employed in approximately 7,500 construction firms of all sizes. Based on the number of employees and the number of construction firms, the average number of employees per firm was 16.21 (121,566/7,500). Based on the Workforce Assessment Baton Rouge Area Report (Baton Rouge Area Chamber, 2011) there were approximately 29,000 construction workers in the nine parish region surrounding Baton Rouge. The target and accessible populations for this study were employees that work for construction companies that have registered with the Construction Industry Advisory Board (CIAC) in the Baton Rouge area. The total population of companies in the Baton Rouge area registered with CIAC was 84. A listing of the companies registered with CIAC is given in Appendix A. The CIAC executive director reviewed the list and determined that some registered companies did not participate directly in construction, but were rather support businesses. These were removed from the list bringing the total to 46 companies.

Sample

A cluster sampling approach was used to collect the data for this study. Utilizing Cochran's (1977) sample size formula, the minimum returned sample size for this study was calculated. The following criteria were utilized to determine the appropriate sample size:

- Number of construction workers in the Baton Rouge area: N = approximately 29,000. (Baton Rouge Area Chamber, 2011)
- Significance level*:* An *alpha* level of .05 was preset for the study, with the *t*-value for an *alpha* level of .05 being 1.96.
- The items in the scale were measured utilizing a 6-point Likert-type scale.

- The acceptable margin of error (*e*) for the study was 3%, which indicates that the mean of the variables estimated to be within a 3% range above or below the mean reported.
- The estimated standard deviation has been set at 1 which was estimated by dividing the number of points on the primary scale (6) by the number of standard deviations for the *alpha* level indicated above (6); therefore, 6/6 = 1.
- The anticipated response rate was 100% since data was being collected in person..

Therefore, the sample size calculation was:

$$n_o = \frac{(t)^2 * (s)^2}{(d)^2} = \frac{(1.\ 96)^2 * (1)^2}{(6*.\ 03)^2} = 119$$

Therefore, the required returned sample size calculated was 119. No correction was required as this amount did not exceed 5% of the estimated population size of approximately 29,082 (Bartlett et al., 2001).

Instrumentation

An extensive literature review determined that an existing instrument created and utilized by Mohamed (2002) was best suited to this study. In creating the questions for the survey, Mohamed (2002) utilized statements drawn from scales previously created and used by the researchers Cox and Cox (1991), Cox and Cheyne (2000), Glazner et al. (1999), Lee and Harrison (2000), and Tomas and Oliver (1995). Mohamed (2002) modified some of the items to reflect the nature of the construction industry. Additionally, other questions were developed to obtain the demographics of participants in the study based on the same demographics utilized by the Bureau of Labor Statistics in analyzing work related accidents in the United States. The instrument was screened for language and content validity prior to use with the study sample by a panel safety experts. Modifications were made according to the suggestions and comments received from this panel. Additionally, Mohamed (2002) agreed to review any changes to his original instrument.

The instrument itself was quantitative in nature and was chosen to examine potential correlations between the safety climate indices and safe behaviors. A hard copy format of the instrument was utilized in order to facilitate the collection of information from construction sites where ready access to electronic data collection techniques was not widespread. See Appendix B for a copy of the initial survey instrument.

Through exploratory interviews Mohamed (2002) identified 10 constructs as being reflective of workers' perceptions of the role safety plays in the workplace. The independent variables or constructs measured by this instrument include the following:

1. Management Commitment to Safety
2. Management Communication of Safety
3. Safety Rules and Procedures
4. Supportive Work Environment
5. Supervisory Environment
6. Employee Involvement
7. Appreciation of Personal Risk
8. Work Site Risks
9. Work Pressure
10. Employee Competence

The dependent variable measured by this instrument was observable safe behaviors on the construction job site.

Instrumentation Reliability and Validity

Mohamed (2002) examined three measurement properties prior to data analysis to ensure that the model has a satisfactory level of reliability and validity. First, he looked at individual item reliability in which he assessed correlations of the items on their respective constructs in order to determine internal consistency. Second, Mohamed (2002) utilized convergent validity as the second measurement property. Finally, he utilized discriminant validity, or the extent to which each construct differs from other constructs in the model (Mohamed, 2002). Through all of these techniques, he found the instrument to have sufficient validity. Additionally, to insure acceptable levels of measurement reliability and validity, Mohamed created a draft questionnaire which was pretested on construction safety management as well as students in the construction field (Mohamed, 2002). Their input was used to refine the original questionnaire to its final form of a total of 82 statements about safety issues at the organizational, group, and individual levels. Mohamed noted that while most previous construction safety surveys targeted upper management and safety managers, his research targeted construction workers, to include contractors and subcontractors, as the main purpose of his research was to determine if correlation existed between the safety climate and work behavior of employees in construction site environments (Mohamed, 2002).

The safety climate survey (SCS) instrument consisted of 12 parts. Parts 1 through 10 each consisted of 7 questions, part 11 consists of 12 questions, and part 12 consists of 6 demographic variables which are: gender, age, level of education, years working in construction, occupational title, and ethnicity. A panel of five safety content experts was contacted by email to establish the content validity of the instrument. The panel consisted of one expert who had 26 years of experience as a safety director and was a former president of the Louisiana Loss Prevention Association, two who were professors with doctoral degrees with research specializing in safety and workplace design, one was the president of a safety consulting firm which develops safety training materials, and one was a retired senior level manufacturing executive with a doctoral degree focusing on safety and was a Certified Occupational Safety Specialist (COSS). Additionally, four of the five were OSHA authorized outreach instructors. Mohamed was contacted for this study as well. He agreed to the use of his instrument, and also reviewed and approved the final version of the instrument created by the validation process utilized by this study.

The content experts were instructed to rate each item using a four point scale: (1) not relevant, (2) fairly relevant, (3) relevant, or (4) very relevant (Appendix G). A Content Validity Index (CVI) was calculated utilizing the content experts' ratings (Rubio et al., 2003). This was done by calculating the CVI of each item and then determining the total CVI of the instrument. The CVI of each item was calculated by counting the number of experts who rated the item as (3) or (4), using the scale above and then dividing that number by the total number of content experts evaluating the instrument. A CVI rating of 1.0 was calculated for 59 items. The CVI rating for 16 items was .80 and for the remaining 7 items was .60. The CVI for the instrument was then determined by averaging the CVI across all items. A CVI of .80 was the standard used to confirm content validity. The SCS had an overall CVI rating of .90. These results indicate that there was 90% agreement among content experts on the content validity of the instrument. Although the overall CVI was acceptable, all items that scored below 1.0 were reviewed and were reworded to improve clarity.

A pilot study was conducted with junior and senior level baccalaureate construction management students enrolled in safety courses at Louisiana State University in the fall of 2012. The researcher provided a cover letter required by the university's Institutional Review Board committee (Appendix E) and a copy of the SCS pilot survey to each student present at the beginning of a scheduled class session. After receiving a brief description of the purpose of the study and directions for completing the SCS, students were also guaranteed anonymity, reassured that completing the SCS would have no influence on any of their course grades, and informed that completion of the survey indicated informed consent for participation in the pilot study. A total of 67 junior and senior level baccalaureate construction management students were present when the survey was distributed and 67 agreed to participate in the pilot study by submitting a completed survey.

The time required for participants to complete the pilot test survey ranged between 5 to 12 minutes with the average time being 8.25 minutes. Following completion of the survey, participants were also asked to comment on their assessment of the survey instrument. Several students commented that the readability of the survey seemed to be worded at too high of a reading level for the average construction worker and that could add to the amount of time required for workers to complete the survey. Most students indicated that they had no difficulty with the directions on the survey. The comments from the pilot study were also reviewed in light of the feedback from the content experts.

Additionally, the Flesch Reading Ease Test (FRET) and Flesch-Kincaid Grade Level (FKGL) scores were determined for the instrument. Overall, the FRET was 39.8 and the FKGL was 10.7. For a group of adults where the expected education levels can vary from less than a high school diploma to post graduate studies, the recommended levels are 60-70 for FRET and 7.0-8.0 for FKGL. Additionally, keeping the FKGL below a 9th grade level insured comprehension for all education levels and reduce the amount of time required to read and respond to the instrument. Several of the items and item distractors were revised in an effort to provide more clarity and improve the quality of the survey items. These revisions were also made in an effort to reduce reading time required to take the survey. After rewording the instrument, it had a FRET of 65.9 and a FKGL of 7.8. After these changes were complete, a Spanish language version of the instrument was also created with the assistance of a native speaker of Spanish possessing a doctoral degree in industrial engineering. The final draft of the SCS utilized for data collection can be viewed in Appendix C.

Data Collection

After receiving approval to proceed from the Louisiana State University Institutional Review Board (IRB) (see Appendix D), a multiple-phase approach was used to collect data for the study. A master list of the accessible population was constructed from the sources indicated earlier resulting in a list of 46 companies. At this point, the researcher trained baccalaureate level students from the college of engineering at LSU enrolled in junior level construction safety courses to administer the SCS to construction workers. Ninety-one students agreed to participate and were placed in groups of 2 to 4, forming 31 teams. Prior to administering the survey, all groups participated in a presentation outlining the nature and goals of the study as well as possible threats to the study's validity and the importance of following the script and procedure provided (Appendix E). Each team was provided with the script to read to all participants and the surveys in both English and Spanish. The list of companies was placed in a random order, and each team was assigned to a company and provided with contact information for the company. Each team was also asked to notify the researcher if a company was either unresponsive or refused to participate. Those teams receiving no response were them assigned to another company. Of the 46 companies identified, 6 companies either refused to participate or would not respond to telephone calls or emails; 29 companies allowed their employees to participate. 2 teams were not successful in completing the survey with a company, and there were not enough groups to assign to the remaining 11 companies. At the participating companies, the average number of surveys administered was 7.2 with a range of 1 to 23. Nine of the surveys were administered using the Spanish language version. As anticipated, teams were primarily allowed access to workers during weekly safety meetings which are commonplace in the construction industry. As these were done on construction sites, digital formats were not practical, and paper copies were utilized in this study. It was also anticipated that many companies would be reluctant to respond with information related to their safety practices and records as there may be legal ramifications to some of this information. Those selected were notified at the initial contact that all data would be collected with anonymity to respondents.

Each presentation to employees began with an explanation of the intent of the measurement and an explanation of how to complete the form. Employees with insufficient literacy skills to complete the form individually were offered assistance on site. Data was then collected by administering a paper version of the instrument to the workers. The respondents were asked to return their survey instruments to the teams who then placed all surveys from a single company into one envelope to ensure that the responses were paired with the EMR of that company. Responses were then entered into an electronic database and rechecked for accuracy. After all data had been collected, a follow up letter expressing the researcher's appreciation was sent to all companies giving permission for their employees to participate.

Data Analysis

The data for this study was analyzed as outlined below.

Objective 1: Company Demographic Characteristics

Objective one of the study was to describe the safety related characteristics of the construction companies on:

i. NAICS/SIC code
ii. Experience Modification Rate (EMR)

The data collected was analyzed using descriptive statistics. Variables were summarized using means, standard deviations, numbers, and percentages, as appropriate.

Objective 2: Employee Demographic Characteristics

Objective two of the study was to describe the demographics of the drawn sample of construction employees on:

i. Gender
ii. Age
iii. Education level
iv. Years of work experience
v. Occupation
vi. Country of birth

The data collected was analyzed using descriptive statistics. Variables were summarized using means, standard deviations, numbers, and percentages, as appropriate.

Objective 3: Measure Safety Climate and Safe Behavior

Objective three of the study was to measure the employees' perception of the company's safety climate and the self-reporting of safe work behaviors with a survey instrument. The following six point scale was utilized:

1-Strongly disagree

2-Disagree

3-Somewhat disagree

4-Somewhat Agree

5-Agree

6-Strongly Agree

Based on the 10 constructs presented in Mohamed's (2002) model, means and standard deviations were calculated for each item in each construct and summated means and standards deviations were calculated for each construct. Item and construct means were summarized using means, standard deviations using the following interpretation scale:

Scale mean 1.00-1.59: Strongly disagree

Scale mean 1.50-2.49: Disagree

Scale mean 2.50-3.49: Somewhat disagree

Scale mean 3.50-4.49: Somewhat Agree

Scale mean 4.50-5.49: Agree

Scale mean: 5.50-6.00: Strongly Agree

Objective 4: Safety Climate And Safe Behavior Correlations

Objective four of the study was to determine if selected variables explained a substantial proportion of the variance in the safe behaviors of construction company employees. The potential explanatory variables that were used in this analysis were the 10 safety climate constructs as well as age, gender, ethnicity, educational level, and years of work experience in the construction industry.

The independent variables were examined for the presence of collinearity by examining their variance inflation factor (VIF) and tolerance according to the guidelines published by Hair, Black, Babin, Anderson, and Tatham (2006). No multicollinearity existed among the independent variables. Forward regression analysis was used to analyze the data. Additionally, the effect size of each statistically significant variable that entered the multiple regression model was interpreted as follows according to the standards published by Cohen (1988):

R^2 > .0196 small effect

R^2 > .13 moderate effect

R^2 > .26 large effect

Objective 5: Safety Climate And Experience Modification Rates Correlations

Objective five of the study was to determine if selected variables explain a substantial proportion of the variance in the EMR of construction companies. The potential explanatory variables that will be used in this analysis are the 10 safety climate constructs as well as age, gender, ethnicity, educational level, and years of work experience in the construction industry.

The independent variables were examined for the presence of collinearity by examining their variance inflation factor (VIF) and tolerance. No multicollinearity existed among the independent variables. Forward regression analysis was used to analyze the data. Additionally, the effect size of each variable was interpreted using the standards established by Cohen (1988) as follows:

R^2 > .0196 small effect

R^2 > .13 moderate effect

R^2 > .26 large effect

CHAPTER 4: FINDINGS

The purpose of this study was to measure the safety climate, safe behavior, NAICS code, and EMR of construction companies in the Baton Rouge, Louisiana area, and to measure selected demographic characteristics of construction workers employed at these construction companies. Additionally, this study sought to determine if two relationships exist at these companies. The first was to investigate if a relationship exists between the independent variables of safety climate and selected demographic characteristics and the dependent variable of safe behaviors at these companies. The second was to investigate if a relationship exists between the independent variables of safety climate and selected demographic characteristics and the dependent variable of EMR at these companies. If any relationships were found to exist, the goal was to then determine if a predictive model exists that explains safe behaviors and EMR at these companies and to determine the amount of variance in safe behaviors and company EMR that is explained by the independent variables of safety climate and the selected demographic characteristics. The selected demographic variables consisted of age, gender, education level, years of work experience, ethnicity, and occupation.

Twenty-nine construction companies in the Baton Rouge area agreed to participate in the study. Data collection took place during the fall of 2012. A total of 208 construction workers at these 29 companies consented to participate in the study. Data from three respondents were removed from the data set because their surveys were missing responses to a substantial number of items and were less than half complete. Eleven other respondents from 2 different companies were removed from the data set when their demographic responses indicated that these employees performed office work rather than construction related activities. Additionally, a preliminary review of the data for descriptive statistics such as means, standard deviations, numbers, percentages, and frequencies revealed that 5 additional respondents answered their survey with either all sixes or all ones for the SCS and Safe Behavior portion of the survey. As multiple survey questions were reverse worded, a participant reading the questions would not have been able to accurately respond in this manner. It was determined that these were invalid responses and were also removed from the data set. Finally, responses from two additional respondents had an outlier statistic of greater than 3.00 and were also removed. This brought the final number of participant responses included in the data set to 187 respondents from 28 companies.

Objective 1: Company Demographic Characteristics

Objective 1 sought to answer the question, what are the selected characteristics of construction companies in southeastern Louisiana on the characteristics of North American Industry Classification System (NAICS) code and Experience Modification Rate (EMR). As the employees were being given the SCS, one representative of management from each company was asked to provide their company's NAICS code and EMR. The majority of construction companies reported that they are either commercial and institutional building construction companies (NAICS 236220 at 31%) or heavy civil construction companies (NAICS 237990 at 21%). It should be noted that company NAICS codes are self-selected by each company for reporting purposes.

Company EMR's were provided by a management representative of each company as this is not typically known by the employees. It should be noted that the EMR of a company was assigned to the responses of all employees from that particular company. Therefore, there are only 24 unique company EMR responses distributed to the 187 respondents utilized in the data set. While each company did report a unique EMR for their company, the EMR's for this study are being reported in ranges so that an individual rating cannot be traced back to a specific company in order to protect their identity. The largest range of EMR's reported was between

.80-.99 (46%). It should be noted that a company's EMR must be calculated by an independent third party analyst rather than internally. The data in Table 1 presents the NAICS distribution of participants, while the data in Table 2 presents the EMR distribution of participants. Four companies allowed their employees to be surveyed, but either refused to provide their NAICS code or EMR. There were 14 surveys completed by employees of these four companies.

Table 1. North American Industry Classification System Codes for Respondent Construction Companies in the Baton Rouge Area

NAICS #	Description	Companies	%	Employees	%
236220	Commercial and Institutional Building Construction	9	32.1	46	24.6
237990	Other Heavy and Civil Engineering Construction	5	17.9	38	20.4
237130	Power and Communication Line and Related Structures Construction	3	10.7	20	10.7
236210	Industrial Building Construction	3	10.7	18	9.6
237120	Oil and Gas Pipeline and Related Structures Construction	2	7.1	18	9.6
238130	Framing Contractors	1	3.6	7	3.7
238110	Poured Concrete Foundation and Structure Contractors	1	3.6	5	2.7
Missing	No Response	4	14.3	35	18.7
	Totals	28	100	187	100.0

Table 2. Experience Modification Rate for Respondent Construction Companies in the Baton Rouge Area

EMR	Companies	%	Employees	%
0.40-0.59	3	10.7	30	16.0
0.60-0.79	4	14.3	28	15.0
0.80-0.99	13	46.4	76	40.6
1.00-1.39	4	14.3	37	19.8
Missing	4	14.3	16	8.6
Totals	28	100	187	100

Note: EMR scores ranged from .40-1.39.

Objective 2 : Employee Demographic Characteristics

Objective 2 sought to answer the question, what are the selected characteristics of construction workers in the Baton Rouge area on the characteristics of age, gender, education level, years of work experience, occupation, and country of birth. Participants were asked to enter their age and years of work experience, and to select their gender, level of education, job description, and where they were born from a list of choices.

The mean age of participants was 36.12 (*SD* = 10.58) with the youngest reporting an age of 18 and the oldest participant reporting an age of 63. The largest group of participants (22.5%) fell between 26 and 30 years of age. Only three participants were under 20 years of age and only three were over 60 years of age. The data in Table 3 presents the age distribution of participants.

Table 3. Age Distribution of Construction Workers in the Baton Rouge Area

Age in Years	*N*	*M*	*SD*	*n*	%
Age in Years	187	36.12	10.58		
Age by category					
18-20				3	1.6
21-25				23	12.3
26-30				42	22.5
31-35				36	19.3
36-40				25	13.4
41-45				18	9.6
46-50				14	7.5
51-55				12	6.4
56-60				9	4.8
61-63				3	1.6
Missing				2	1.1
Total				187	100.0

Note: Age scores ranged from 18-63.

The majority of construction workers that agreed to participate in the study were male (94.7%) and only a small percentage (4.3%) were female. Two participants did not respond to the gender item. The data in Table 4 presents the gender distribution of participants.

Table 4. Gender Distribution of Construction Workers in the Baton Rouge Area

Gender	#	%
Male	177	94.7
Female	8	4.3
Missing	2	1.0
Total	187	100.0

Participants were also asked to select their level of education. The choices provided included: Did Not Finish High School, GED Diploma, High School Diploma, Associate Degree, College Degree, Master's Degree, or Doctoral Degree. As no participants selected Doctoral Degree, so this was dropped from the analysis. The largest group of participants (85, 45.5%) indicated that they had completed high school while the second largest group of participants (40, 21.4%) had earned a college degree. The data in Table 5 presents the education level distribution of participants.

Table 5. Education Level Distribution of Construction Workers in the Baton Rouge Area

Education Level	#	%
High School Diploma	85	45.5
College Degree	40	21.4
Did not finish High School	22	11.8
GED	19	10.2
Associate Degree	15	8.0
Master's Degree	1	.5
Missing	5	2.7
Total	187	100.0

The participants' mean years of work experience in construction was 14.11 (SD = 10.74) with the least reporting 1 year of experience and the participant reporting the most experience had 42 years. The largest group of participants (24.6%) fell between 1 to 5 years of work experience and the second largest group has between 6 and 10 years of experience (35, 18.7%). The data in Table 6 presents the age distribution of participants.

Table 6. Work Experience Distribution of Construction Workers in the Baton Rouge Area

Variable	*N*	*M*	*SD*	*n*	%
Years Work	187	14.11	10.74		
1-5				46	24.6
6-10				35	18.7
11-15				27	14.4
16-20				27	14.4
21-25				16	8.6
26-30				5	2.7
31-35				7	3.7
36-42				10	5.4
Missing				14	7.5
Total				187	100.0

Note: Years of Work Experience score ranged from 1-42.

Participants were also asked to select their job title. The choices provided included Construction Laborer, Construction Manager, Carpenter/Framer, Roofer, Electrician, Equipment Operator, Painter, Truck Driver, Plumber, or Other with a space provided to write in the other job title. The largest group of participants (27.8%) indicated that they were construction laborers, the second largest group reported they were construction managers (40, 21.4%), and the third largest group indicate "Other" (37, 19.8%). The data in Table 7 presents the job title distribution of participants.

Table 7. Job Title Distribution of Construction Workers in the Baton Rouge Area

Job Title	#	%
Construction Laborer	52	27.8
Construction Manager	40	21.4
Other	37	19.8
Equipment Operator	18	9.6
Carpenter/Framer	11	5.9
Electrician	6	3.2
Truck Driver	5	2.7
Painter	2	1.1
Plumber	2	1.1
Missing	14	7.4
Total	187	100.0

There were 36 participants who selected other as their job title. The largest group of participants who selected other (38.9%) indicated that they were pipe fitters/welders. Other responses also included superintendents, safety coordinators, and field engineers. The data in Table 8 presents the job title distribution of participants responding other.

Table 8. "Other" Job Title Distribution of Construction Workers in the Baton Rouge Area

Other Job Titles	#	%
Pipe Fitter/Welder	14	38.9
Superintendent	11	30.6
Safety Coordinator	8	22.2
Field Engineer	3	8.3
Total	36	100.0

Finally, participants were asked to select the country in which they were born. The choices provided included the U.S., Mexico, Central America (not Mexico), Canada, Asia, Europe, Caribbean, Africa, or Other. No participants selected Canada, Asia, Caribbean, or Africa. Most of the participants (91.4%) indicated that they were born in the U.S. The data in Table 9 presents the country of origin distribution of participants.

Table 9. Country of Origin Distribution of Construction Workers in the Baton Rouge Area

Country Born	#	%
U.S.	171	91.5
Mexico	8	4.3
Central America	3	1.6
Europe	1	.5
Missing	4	2.1
Total	187	100.0

Objective 3 : Measure Safety Climate and Safe Behavior

Objective 3 sought to answer the question, what is the construction workers' perception of the safety climate level and safe behavior level of construction workers in the Baton Rouge area as measured by the Safety Climate Survey (SCS). In order to measure safety climate, the SCS consisted of 10 parts with 7 questions in each part to assess the employees' perceptions of the companies' safety climates, and one section of 12 questions to assess their perceptions of safe behavior. The 10 components of the safety climate model were management commitment to safety, management communication of safety, safety rules and procedures, supportive work environment, supervisory environment, employee involvement, appreciation of personal risk, work site risks, work pressure, and employee competence. On all questions, participants were asked to select from a six point Likert-type scale where 1 = Strongly Disagree, 2 = Disagree, 3 = Somewhat disagree, 4 = Somewhat Agree, 5 = Agree, and 6 = Strongly Agree. The data in Table 10 presents the responses to safety climate perceptions while the data in Table 11 presents the responses to safe behavior perceptions.

Responses for each construct were analyzed for internal consistency within each of the SCS subparts. Any construct which had a Cronbach's *alpha* of below .70 caused the researcher to review the analysis of the individual items of that construct. Nine of the 11 constructs initially produced a Cronbach's *alpha* below .70. The researcher tried to reverse code the negatively worded items in question to see if this would impact the internal consistency. It had no effect on the *alpha* level. Based on the reliability analysis, the researcher decided to drop the items from the survey which were causing any construct level to be below .70. Fourteen of the original 82 items were removed from the survey; these items are presented in bold font in Table 11. It appears to the researcher that the items removed were primarily worded negatively or had other wording issues which may have been confusing to the construction workers in this study which lead to their lack of contribution to the scale reliability. At this point, all constructs had an alpha level above .70 except for the construct of Appreciation of Personal Risk, which had an *alpha* of .69. Removing any additional items from the Appreciation of Personal Risk scale would have

Table 10. Responses to the Safety Climate Survey Responses by Employees of Construction Companies in the Baton Rouge Area

Item	*N*	Minimum	Maximum	*M*	*SD*
A. Management Commitment To Safety					
2. My boss is concerned if safety procedures are not followed.	187	1	6	5.37	.75
1. My boss clearly thinks safety is as important as getting the work done.	186	1	6	5.36	.84
4. My boss acts quickly to correct safety problems.	186	1	6	5.20	.90
3. My boss acts decisively when a safety concern is raised.	186	1	6	5.18	.88
7. My boss disciplines employees for working unsafely.	186	1	6	4.88	1.03
6. My boss praises employees for working safely.	186	1	6	4.73	1.03
5. My boss acts only after accidents have occurred.	**187**	**1**	**6**	**2.91**	**1.64**
B. Management Communication of Safety					
3. I can talk to my boss anytime about safety issues.	187	1	6	5.29	.77
4. My boss wants us to talk to him about safety issues.	187	1	6	5.22	.79
7. My boss works hard to promote safe working practices.	184	1	6	5.15	.77
2. My boss continues to bring safety information to our attention.	187	1	6	5.14	.81
1. My boss clearly communicates safety issues to everyone in the company.	187	1	6	5.13	.79
5. My boss listens to and acts upon the safety concerns we bring to him.	187	1	6	5.13	.82
6. My boss shares lessons from accidents so that everyone can learn how to work more safely on the job.	187	1	6	5.03	1.02

(table continues)

Table 10 (continued)

Item	*N*	Minimum	Maximum	*M*	*SD*
C. Safety Rules and Procedures					
1. Our safety rules and procedures are there to protect us from accidents.	187	1	6	5.53	.79
6. Our safety rules and procedures enforce the use of personal protective equipment whenever necessary.	187	1	6	5.44	.77
2. Our safety rules and procedures provide enough information on safety.	186	1	6	5.14	.86
5. Our safety rules and procedures require us to report any unsafe acts by a fellow worker.	187	2	6	5.01	1.03
7. Our safety rules and procedures require detailed work plans from subcontractors or self-employed individuals that work with us.	187	1	6	4.94	.99
3. Our safety rules and procedures are so complicated that some workers do not pay much attention to them.	**185**	**1**	**6**	**2.68**	**1.49**
4. Our safety rules and procedures should be looked at only by new recruits.	**185**	**1**	**6**	**2.24**	**1.49**
D. Supportive Work Environment					
3. We all believe it is our business to maintain a safe workplace environment.	187	2	6	5.26	.75
4. We all always offer help when needed to perform the job safely.	185	3	6	5.22	.72
5. We all endeavor to ensure that individuals are not working by themselves under risky or hazardous conditions.	186	2	6	5.17	.75
6. We all maintain good working relationships.	187	2	6	5.09	.82
2. We all often remind each other on how to work safely.	187	2	6	4.96	.94
7. We all ensure that the workload is reasonably balanced among ourselves.	186	1	6	4.86	.88
1. We all take a no-blame approach to pointing out unsafe work behavior.	**186**	**1**	**6**	**3.95**	**1.49**

(table continues)

Table 10 (continued)

Item	*N*	Minimum	Maximum	*M*	*SD*
E. Supervisory Environment					
2. My safety manager truly believes that safety is very important.	184	2	6	5.36	.76
4. My safety manager welcomes us reporting safety hazards and accidents to them.	184	1	6	5.30	.85
5. My safety manager is a good person to ask for solving safety problems.	183	1	6	5.22	.94
1. My safety supervisor always acts safely themself even if they think no one is watching.	183	3	6	5.17	.76
3. My safety manager usually helps give safety talks on a regular basis.	184	1	6	5.16	.95
7. My safety manager values my ideas about improving safety when significant changes to working practices are suggested.	184	1	6	4.87	.93
6. My safety manager tells us to work around safety procedures to meet important deadlines.	**184**	**1**	**6**	**2.99**	**1.84**
F. Employee Involvement					
1. We all aim to achieve high levels of safety performance at work.	186	3	6	5.27	.74
5. We all have the responsibility to think about safety practices at work.	187	1	6	5.15	.92
2. We all take an active role in identifying job site hazards.	186	2	6	5.10	.72
3. We all report accidents, incidents, and potentially hazardous situations we see at work.	187	3	6	5.04	.80
7. We all help create job safety analysis (JSA's) when asked.	187	1	6	4.87	.96
4. We all participate in job site safety planning.	187	1	6	4.79	1.15
6. We all try to avoid being involved in accident investigations.	**186**	**1**	**6**	**3.83**	**1.66**

(table continues)

Table 10 (continued)

Item	*N*	Minimum	Maximum	*M*	*SD*
G. Appreciation of Personal Risk					
3. I am clear about what my responsibilities are for safety.	186	2	6	5.25	.77
4. I am aware that safety is the number one priority in my mind while working.	187	2	6	5.18	.83
5. I believe some rules are really necessary to get the job done safely.	187	1	6	5.13	.93
2. I am sure I can influence the level of safety performance.	186	1	6	4.94	.90
7. I cannot do the job safely without following every safety procedure.	**187**	**1**	**6**	**4.26**	**1.44**
6. I believe some rules and policies are not really practical.	**187**	**1**	**6**	**3.73**	**1.56**
1. I am sure that it is only a matter of time before I am involved in an accident.	**186**	**1**	**6**	**2.75**	**1.66**
H. Work Site Risks					
6. At our job site working with defective equipment is not allowed under any circumstances.	**187**	**2**	**6**	**4.99**	**1.03**
1. At our job site safety is a primary consideration when determining site layout.	**186**	**1**	**6**	**4.91**	**.97**
7. At our job site potential dangers and consequences are identified prior to execution.	**186**	**1**	**6**	**4.89**	**.99**
4. At our job site working conditions may keep us from working as safely as we want.	187	1	6	3.13	1.48
3. At our job site the chances of being involved in an accident are quite large.	185	1	6	2.88	1.59
5. At our job site detecting potential hazards is not a major aim of the site planning exercise.	187	1	6	2.67	1.58
2. At our job site poor site layout is an accepted part of the construction industry.	187	1	6	2.64	1.40

(table continues)

Table 10 (continued)

Item	*N*	Minimum	Maximum	*M*	*SD*
I. Work Pressure					
7. It is not acceptable to delay periodic inspection of plant and equipment.	**186**	**1**	**6**	**4.26**	**1.54**
1. I work under a great deal of tension.	187	1	6	3.24	1.42
6. I tolerate minor unsafe behaviors performed by coworkers.	187	1	6	2.85	1.51
4. I perceive operational targets in conflict with some safety measures.	187	1	6	2.71	1.39
2. I am not given enough time to get the job done safely.	187	1	6	2.39	1.23
3. It is necessary for me to depart from safety requirements for production's sake.	187	1	6	2.34	1.43
5. It is normal for me to take shortcuts at the expense of safety.	187	1	6	2.25	1.38
J. Employee Competence					
7. I am capable of using relevant protective equipment.	186	1	6	5.37	.79
5. I am capable of identifying potentially hazardous situations.	187	1	6	5.32	.76
2. I am aware, through training, of the safety rules procedures of my job.	187	1	6	5.25	.85
4. I am skilled at avoiding the dangers of workplace hazards.	186	1	6	5.23	.82
1. I received adequate training to perform my job safely.	187	1	6	5.20	.84
6. I am proactive in removing workplace safety hazards.	187	2	6	5.17	.76
3. I fully understand current safety laws and legislation.	187	2	6	5.07	.89

Note. Items in bold were later removed due to a Cronbach's *alpha* of .70 or below.

reduced the internal consistency of this scale. Therefore, the researcher chose to proceed at that level. The data in Table 12 shows the initial Cronbach's *alpha* levels for the data collected and the data in Table 13 shows the levels after removing the following items: A5, C3, C4, D1, E6, F6, G1, G6, G7, H1, H6, H7, I7, and K5. The Cronbach's *alpha* levels were determined to be sufficient to proceed with the analyses. Additionally, a factor analysis was conducted on each of the constructs with the items noted above removed to see if there were multiple factors influencing the results of Cronbach's alpha. This was not found to be the case, and it was again determined that the study could proceed. Results of the factor analyses are presented in the data in Tables A25-A26 found in Appendix I.

Table 11. Responses to the Safe Behavior Scale by Employees of Construction Companies in the Baton Rouge Area

Item	*N*	Minimum	Maximum	*M*	*SD*
K. Safe Behavior					
1. Safety in my current workplace plays an effective role in preventing accidents.	187	1	6	5.31	.87
2. Safety in my current workplace reduces occupational risk.	187	3	6	5.27	.75
4. Safety in my current workplace is of high quality compared to other sites.	187	2	6	5.16	.83
8. Safety in my current workplace inspires me to work more safely.	187	2	6	5.16	.83
3. Safety in my current workplace makes it possible to get the job done.	187	1	6	5.14	.83
10. Safety in my current workplace makes me proud to tell others I am part of it.	187	2	6	5.14	.86
11. I follow all of the safety procedures for the jobs that I perform.	187	2	6	5.14	.90
7. Safety in my current workplace contributes to my work satisfaction.	187	1	6	5.10	.83
9. Safety in my current workplace has a positive influence on morale.	187	1	6	5.09	.92
12. My coworkers follow all of the safety procedures for the jobs that they perform.	187	1	6	4.93	.92
6. Safety in my current workplace helps increase my productivity.	187	1	6	4.78	1.08
5. Safety in my current workplace is not restrictive and superficial.	**187**	**1**	**6**	**4.75**	**1.26**

Note: Items in bold were removed for further analyses because the items did not contribute to the internal consistency of the scale which resulted in the Cronbach's *alpha* for the scale being below .70.

Table 12. Cronbach's *alpha* for the Constructs in the Safety Climate Survey

Construct		Cronbach's *alpha*	# Items
B.	Management Communication of Safety	.91	7
J.	Employee Competence	.90	7
I.	Work Pressure	.87	7
D.	Supportive Work Environment	.78	7
E.	Supervisory Environment	.74	7
F.	Employee Involvement	.74	7
H.	Work Site Risks	.67	7
A.	Management Commitment To Safety	.62	7
C.	Safety Rules and Procedures	.58	7
G.	Appreciation of Personal Risk	.51	7
K.	Safe Behavior	.90	12

Table 13. Safety Climate Survey (SCS) Cronbach's *alpha* Coefficients for the Constructs in the Safety Climate Survey

Construct		Cronbach's *alpha*	# Items
I.	Work Pressure	.88	6
B.	Management Communication of Safety	.87	7
J.	Employee Competence	.87	7
D.	Supportive Work Environment	.83	6
H.	Work Site Risks	.83	4
E.	Supervisory Environment	.82	6
F.	Employee Involvement	.79	6
A.	Management Commitment To Safety	.75	6
C.	Safety Rules and Procedures	.71	5
G.	Appreciation of Personal Risk	.69	4
K.	Safe Behavior	.87	11

The data in Table 14 presents the scores based on the Likert-type scale for each of the 10 constructs of the SCS as well as the variable of safe behavior observations after the items were removed during the internal consistency analysis. The items in each scale of the revised SCS were averaged to provide a mean score for each construct and then the means of all constructs were averaged to produce an overall safety climate mean. This final composite score was referred to as the independent variable, Safety Climate.

Table 14. Descriptive Statistics for the Safety Climate Survey (SCS) Constructs and the Safe Behavior Construct for Construction Company Employees in the Baton Rouge Area.

	Construct	*N*	Minimum	Maximum	*M*	*SD*
J.	Employee Competence	186	1.71	6.00	5.23	.61
C.	Safety Rules and Procedures	186	1.40	6.00	5.21	.61
E.	Supervisory Environment	180	2.50	6.00	5.21	.59
B.	Management Communication of Safety	184	1.00	6.00	5.15	.62
A.	Management Commitment To Safety	182	3.00	6.00	5.13	.58
G.	Appreciation of Personal Risk	186	3.25	6.00	5.13	.62
D.	Supportive Work Environment	184	3.17	6.00	5.10	.59
F.	Employee Involvement	186	3.50	6.00	5.03	.63
H.	Work Site Risks	185	1.00	6.00	2.84	1.24
I.	Work Pressure	187	1.00	6.00	2.63	1.10
	Safety Climate Mean of the Means:				4.66	
K.	Safe Behavior	185	3.55	6.00	5.09	.55

Objective 4 : Safety Climate And Safe Behavior Correlations

Objective 4 sought to determine if selected variables explained a substantial proportion of the variance in the safe behaviors of construction company employees. The potential explanatory variables that were used in this analysis was the safety climate as well as age, gender, ethnicity, educational level, and years of work experience in the construction industry, and occupation.

Using the data collected from objective three, the researcher first determined the correlation between safe behavior and each independent variable of safety climate, age, gender, education level, years of work experience, country of birth, or occupation to the dependent variable of safe behavior (see Table 17). The variable of occupation was divided into the subgroups of construction laborer, construction manager, framer, electrician, equipment operator, driver, pipe fitter/welder, superintendent, safety coordinator, and field engineer. The variable of Country of Birth was divided into two subgroups: Born in U.S. or Born in Hispanic Country. Born in Hispanic Country consisted of 11 participants who indicated they were born in Mexico and Central America. Only one other participant indicated a different country of birth by responding with Germany; a correlational analysis was not conducted with this category of birthplace since there were not enough in the category to conduct the analysis.

It was determined *a priori* that only those variables that were significantly related to safe behavior would be used in the multiple regression analysis. This decision was made because there were 17 potential explanatory variables and Hair et al. (2006) suggested the following regarding the number of cases per potential explanatory variable that were needed for a forward multiple regression analysis: "Although the minimum ratio is 5:1, the desired level is between 15 to 20 observations for each independent variable." Since there were 17 potential explanatory variables, the desired minimum number of responses needed to include all 17 variables in the regression analysis was 255 (17 * 15). Since variables that are not statistically correlated to the dependent variable have little chance of explaining a practically significant proportion of the variance in the dependent variable, only those variables that were significantly related to safe behaviors were used in the regression analysis.

Forward multiple regression analysis (MRA) was used to determine the proportion of variance in safe behavior scores as explained by each of the independent variables components or constructs of the model. The independent variables were then examined for the presence of collinearity by examining their variance inflation factor (VIF) and tolerance; no collinearity existed. Additionally, the effect size of each variable was interpreted using the standards established by Cohen (1988).

The results of the correlational analysis were interpreted using the descriptors proposed by Cohen (1988). Only three of the 17 variables were related to safe behaviors. Safety Climate showed a strong positive correlation (*r*=.57) to Safe Behavior. The occupations of Construction Laborer had a small negative positive correlation (*r*=-.18) and being a Safety Coordinator (*r*=.20) showed a small positive correlation with Safe Behavior. The variables that showed correlations with safe behavior were included in the regression analysis. No other variables showed a significant correlation. The results of the correlational analyses are presented in Table 15.

Table 15. Correlations between Safe Behavior and Selected Variables

Independent Variable	*N*	*r*	*p*
Safety Climate[a]	169	.57	<.001
Education level[b]	180	.12	.110
Age[a]	183	.09	.229
Gender[c]	183	.08	.281
Years of Experience[a]	171	.06	.416
Born in Hispanic Country[c]	185	-.05	.488
Born in US[c]	185	.03	.690
Occupations			
Safety Coordinator[c]	185	.20	.006
Construction Laborer[c]	185	-.18	.015
Construction Manager[c]	185	.13	.088
Truck Driver[c]	185	.12	.094
Framer[c]	185	.09	.245
Superintendent[c]	185	.07	.366
Pipe Fitter/Welder[c]	185	-.04	.588
Electrician[c]	185	.03	.716
Equipment Operator[c]	185	.03	.716
Field Engineer[c]	185	.02	.831

Note. Variables presented in order by correlation coefficient.
[a]Pearson Product Moment correlations. [b]Spearman rank order correlation.
[c]Point bi-serial correlations.

Additionally, all data were examined for outliers by examining the standardized and studentized residuals. A plot of residuals was constructed to test for the assumptions of normality, linearity, and homoscedasticity within the multiple regression analysis. The scatterplot does appear linear in shape indicating even distribution of the residual scores above and below zero, suggesting a strong positive linear relationship between the independent and dependent variables. The scatterplot also suggests that assumption of homoscedasticity has been met since the data is scattered evenly. Figure 5 presents the scatterplot of standardized predicted values and standardized residual values. Two participants had a standardized residual greater than 3.0. As reported previously, these respondents were considered outliers and were removed from the sample.

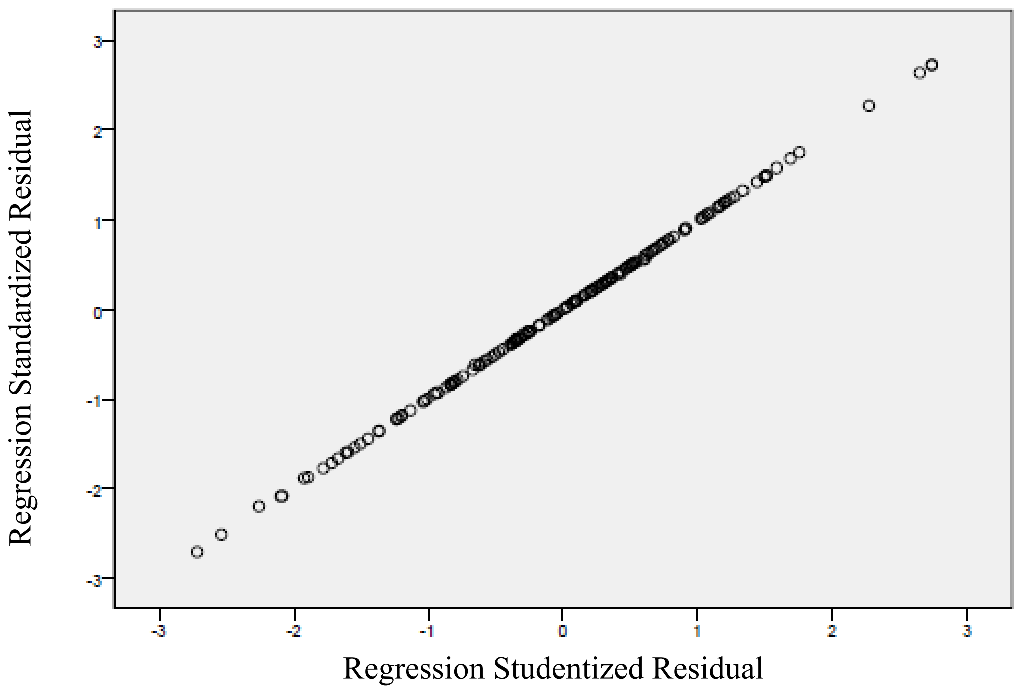

Figure 5. Scatterplot of the Residual Values on Safe Behavior Scores of Construction Workers in the Baton Rouge, Louisiana Area.

The independent variables included in the analysis were examined for the presence of collinearity. Variance inflation factors (VIF) of included variables, Safety Climate and Safety Coordinator, were 1.000 and 1.006 respectively, with VIF values of the excluded variable, Construction Laborer, at 1.021. The tolerance levels of independent variables, Safety Climate and Safety Coordinator, were 1.000 and .994 respectively, with tolerance level of the excluded variable, Construction Laborer, at .980. These results suggest that multicollinearity was not present among the variables included in the MRA (Hair et al., 1998).

The three independent variables of Safety Climate, Construction Laborer, and Safety Coordinator were entered into the forward multiple regression analysis model with Safe Behavior as the dependent variable. The results of the analysis of variance (ANOVA) presented in Table 16 indicates that a statistically significant model exists (F = 46.29, P = <.001).

Table 16. Results from the Analysis of Variance for the Forward Multiple Regression Analysis of the Dependent Variable of Safe Behavior and the Independent Variable of Safety Climate.

Model	*SS*	*df*	*MS*	*F*	*P*
Between Groups	17.06	2	8.53	46.29	< .001
Within Groups	30.59	166	.18		
Total	47.65	168			

The first independent variable to enter the model was Safety Climate, which explained 33% of the variance in the dependent variable. The occupation of Safety Coordinator explained an additional 3% of the variance in Safe Behavior scores. The Safe Behavior Scores increased as the safety climate improved and also for those respondents who were safety coordinators. The variable Construction Laborer was rejected from the model. The following standards for interpreting effect size developed by Cohen (1988) were utilized to interpret the results of the MRA: R^2 greater than .0196 = small effect size, R^2 greater than .13 = moderate effect size, and R^2 greater than .26 = large effect size. The results of the forward multiple regression analysis revealed that the Safety Climate and being a Safety Coordinator combined to produce a large effect size on Safe Behaviors according to Cohen's (1988) guidelines. Tables 17 through 19 present the model summary for the forward multiple regression analysis of Safe Behavior scores.

Table 17. Model Summary for the Forward Multiple Regression Analysis of the Safe Behavior Scores.

Model	*R*	R^2	*Adjusted* R^2	*SEE*	*Change Statistics* R^2 *Change*	*F Change*	*Sig. F Change*
Safety Climate	.57	.33	.32	.44	.33	80.75	< .001
Safety Coordinator	.60	.36	.35	.43	.03	8.30	< .004

Table 18. Standardized and Unstandardized Coefficients for the Variables Included in the Forward Multiple Regression Model for the Safe Behavior Scores.

Model	Unstandardized Coefficients		Standardized Coefficients	*t*	*p*
	B	*SE*	*Beta*		
(Constant)	.73	.48		1.51	< .132
Safety Climate	.09	.01	.56	8.94	< .001
Safety Coordinator	.45	.16	.18	2.88	< .004

Table 19. Regression Statistics for the Variables Excluded from the Multiple Regression Analysis of the Safe Behavior Scores.

Variables Excluded from Final Model	*Beta in*	*t*	*p*	Partial correlation	Collinearity statistics	
					Tolerance	*VIF*
Construction Laborer	-.11	-1.83	.069	-.14	.98	1.02

Objective 5 : Safety Climate And Experience Modification Rates Correlations

Objective 5 sought to determine if selected variables explained a substantial proportion of the variance in the EMR of construction companies. The potential explanatory variables that were used in this analysis were the 10 safety climate constructs as well as age, gender, ethnicity, educational level, and years of work experience in the construction industry.

Using the data collected from objective three, the researcher first determined the correlation between EMR and each independent variable of safety climate, age, gender, education level, years of work experience, country of birth, or occupation to the dependent variable of EMR (see Table 19). The variable of occupation was divided into the subgroups of construction laborer, construction manager, framer, electrician, equipment operator, driver, pipe fitter/welder, superintendent, safety coordinator, and field engineer. The variable of country of birth was divided into two subgroups: born U.S. or born Hispanic. Born Hispanic consisted of 11 participants who indicated they were born in Mexico and Central America. Only one other participant indicated a different country of birth by responding with Germany; a correlational analysis was not conducted with this category of birthplace since there were not enough in the category to conduct the analysis.

It was determined *a priori* that only those variables that were significantly related to EMR would be used in the forward multiple regression analysis as discussed under the findings presented for Objective 4. Forward multiple regression analysis (MRA) was used to determine the proportion of variance in safe behavior scores as explained by each of the independent variables components or constructs of the model. The independent variables were then examined for the presence of collinearity by examining their variance inflation factor (VIF) and tolerance; no collinearity existed. Additionally, the effect size of each variable was interpreted using the standards established by Cohen (1988).

The results of the correlational analysis were interpreted using the descriptors proposed by Cohen (1988). Only one of the 17 variables were related to EMR. Education Level showed a small negative correlation (r=-.21) to EMR. The variable of Education Level, which was the only variable that showed a correlation with EMR, was included in the regression analysis. No other variables showed a significant correlation. The results of the correlational analyses are presented in Table 20.

Additionally, all data were examined for outliers by examining the standardized and studentized residuals. A plot of residuals was constructed to test for the assumptions of normality, linearity, and homoscedasticity within the multiple regression analysis. The scatterplot does appear linear in shape indicating even distribution of the residual scores above and below zero, suggesting a strong positive linear relationship between the independent and dependent variables. The scatterplot also suggests that assumption of homoscedasticity has been met since the data is scattered evenly. Figure 6 presents the scatterplot of standardized predicted values and standardized residual values. Two participants had a standardized residual greater than 3.0. As reported previously, these respondents were considered outliers and were removed from the sample.

Table 20. Relationships between the Experience Modification Rate and Selected Respondent Variables

Independent Variable	*N*	*r*	*P*
Education level[a]	180	-.249	.001
Born in Hispanic Country[b]	167	.137	.077
Gender[b]	183	-.134	.083
Born in US[b]	185	-.125	.107
Age[c]	183	.099	.202
Safety Climate[c]	169	.011	.892
Years of Experience[c]	171	-.003	.966
Occupation			
Electrician[b]	185	.121	.119
Equipment Operator[b]	185	.121	.119
Field Engineer[b]	185	-.097	.210
Framer[b]	185	.077	.320
Pipe Fitter/Welder[b]	185	-.070	.371
Construction Laborer[b]	185	-.069	.379
Superintendent[b]	185	.025	.752
Safety Coordinator[b]	185	-.023	.766
Construction Manager[b]	185	-.022	.782
Truck Driver[b]	185	.020	.793

Note. Variables presented in order by correlation coefficient.
[a]Spearman rank order correlation. [b]Point bi-serial correlation.
[c]Pearson Product Moment correlation.

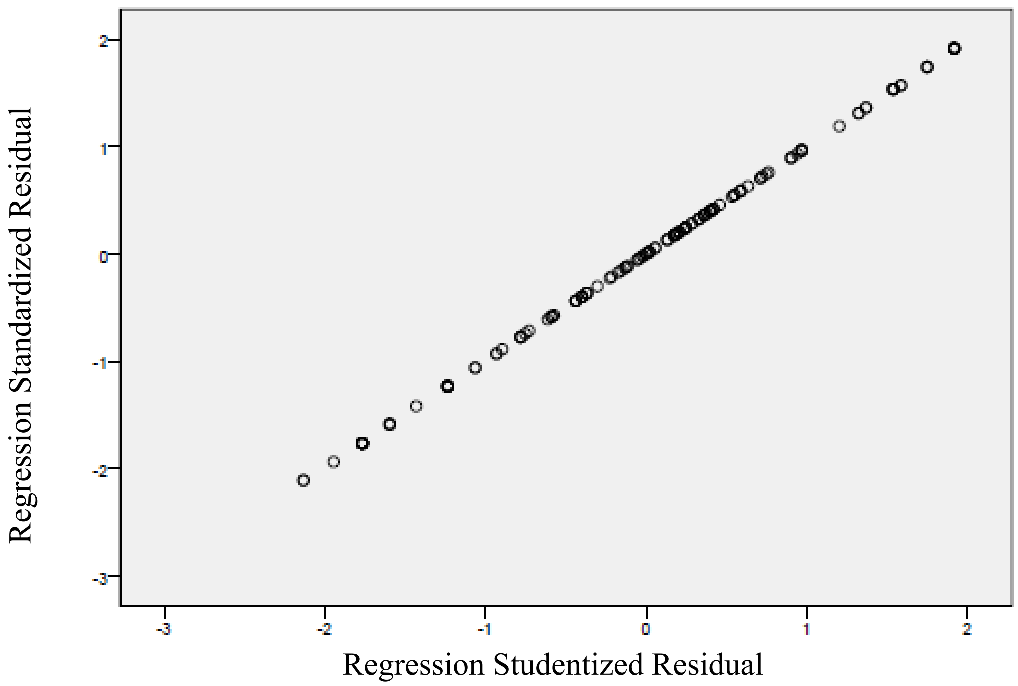

Figure 6. Scatterplot of the Residual Values on EMR Scores of Construction Workers in the Baton Rouge, Louisiana Area.

The independent variable included in the analysis was examined for the presence of collinearity. The variance inflation factor (VIF) of the included variable, Education Level, was 1.000. The tolerance level of the independent variable, Education Level, was 1.000. These results suggest that multicollinearity was not present among the variables included in the MRA (Hair et al., 1998).

The independent variable of Education Level was entered into the forward multiple regression analysis model with EMR as the dependent variable. The results of the analysis of variance (ANOVA) presented in Table 21 indicates that a statistically significant model exists ($F = 7.54$, $P = <.007$).

The independent variable of Education Level entered the model, which explained 3.9% of the variance in the dependent variable. The EMR scores decreased as the education level of respondents went up. The following standards for interpreting effect size developed by Cohen

(1988) were utilized to interpret the results of the MRA: R^2 greater than .0196 = small effect size, R^2 greater than .13 = moderate effect size, and R^2 greater than .26 = large effect size. The results of the forward multiple regression analysis revealed that the Education Level produced a small effect size on EMR scores according to Cohen's (1988) guidelines. Tables 22 and 23 present the model summary for the forward multiple regression analysis of EMR scores.

Table 21. Results from the Analysis of Variance for the Forward Multiple Regression Analysis of the EMR Scores.

Model	*SS*	*df*	*MS*	*F*	*P*
Between Groups	.52	1	.52	7.54	< .007
Within Groups	11.28	162	.07		
Total	11.80	163			

Table 22. Model Summary for the Forward Multiple Regression Analysis of the EMR Scores.

					Change Statistics		
Model	*R*	R^2	*Adjusted* R^2	*SEE*	R^2 *Change*	*F Change*	*Sig. F Change*
Education Level	.21	.044	.04	.26	.04	7.54	< .007

Table 23. Standardized and Unstandardized Coefficients for the Variables Included in the Forward Multiple Regression Analysis of the EMR Scores.

Model	Unstandardized Coefficients		Standardized Coefficients	*t*	*p*
	B	*SE*	*Beta*		
(Constant)	.98	.06		17.56	< .000
Education Level	-.05	.02	-.21	-2.75	< .007

CHAPTER 5: SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Summary

Construction companies in southeastern Louisiana were contact to conduct a Safety Climate Survey (SCS) and collect selected demographic variables. Data analysis was then utilized to see if any of these variables could explain the variance in safe behaviors and the Experience Modification Rate (EMR) of construction companies in the Baton Rouge area.

Purpose and Objectives

The purpose of this study was to determine if a predictive model exists that explains safe behaviors and EMR of construction companies in the Baton Rouge area and determine the amount of variance in safe behaviors and company EMR that is explained by the safety climate variable as well as demographic variables in order to determine if a predictive model exists. The following objectives were addressed in this study:

1. What are the selected characteristics of construction companies in southeastern Louisiana, namely NAICS code and Experience Modification Rate (EMR)?
2. What are the selected characteristics of construction workers in southeastern Louisiana, namely gender, age, education level, and years of work experience, occupation, and country of birth?
3. What is the perception of construction workers of their company's safety climate on the selected characteristics of Management Commitment to Safety, Management Communication of Safety, Safety Rules and Procedures, Supportive Work Environment, Supervisory Environment, Employee Involvement, Appreciation of Personal Risk, Work Site Risks, Work Pressure, and Employee Competence and their observations of safe behavior?

4. Does a relationship exist between the dependent variable of the reported safe behaviors of construction company employees and the potential explanatory variables of safety climate perceptions as well as age, gender, ethnicity, educational level, and years of work experience in the construction industry?
5. Does a relationship exist between the dependent variable of the EMR of construction company employees and the potential explanatory variables of safety climate perceptions as well as age, gender, ethnicity, educational level, and years of work experience in the construction industry?

Procedures

The target population for this study was employees that work for construction companies in the Baton Rouge, Louisiana area that have registered with the Construction Industry Advisory Board (CIAC). A cluster sampling technique was utilized for this study. Data collection took place during the fall of 2012. During this time there were approximately 29,000 construction workers in the Baton Rouge area (Baton Rouge Area Chamber, 2011). A total of 208 construction employees at 29 different construction companies consented to participate in the study.

Following a review of the literature that indicated that an existing instrument was available that would be appropriate for gathering the data required for this study (Mohamed, 2002), permission was secured from the developer to use this survey. There were ten sections included in the instrument: management commitment to safety, management communication of safety, safety rules and procedures, supportive work environment, supervisory environment, employee involvement, appreciation of personal risk, work site risks, work pressure, and employee competence (Appendix C).

After selection of the instrument, a panel of five content experts in the areas of safety rated the content validity of the SCS. Data analysis indicated that there was 90% agreement among the content experts on the content validity of items included on the SCS. This exceeded the recommended rating of 80% for new measures (Davis, 1992) indicating that the items included on the SCS were very relevant to assessing the safety climate perceptions among construction workers. After corrections were made based on the expert panel's recommendations, a pilot study was conducted with junior and senior level baccalaureate construction management students, and comments were gathered from this group. After revisiting comments made by the content experts and data from the pilot study, final revisions were made to the SCS. Prior to distribution of the SCS to the sample, comments were sought from the original survey author who felt the changes were acceptable.

The researcher then utilized student teams to conduct data collection at 29 construction companies on a date scheduled with management from each company. The SCS was distributed to construction workers during scheduled times, primarily during safety meetings. After receiving a brief description of the purpose of the study and directions for completing the SCS, employees were guaranteed anonymity, reassured that completing the SCS would have no influence on their employment, and informed that completion of the survey indicated informed consent for participation in the research study (Appendix E). A total of 208 workers agreed to participate in the study. This was a descriptive study using quantitative data. The statistical program SPSS was used by the researcher to compile and analyze the data.

Summary of Findings

Objective 1: Company Demographic Characteristics

Objective 1 sought to answer the question, what are the selected characteristics of construction companies in southeastern Louisiana on the characteristics of North American

Industry Classification System (NAICS) code and Experience Modification Rate (EMR). Findings indicate that the majority of these construction companies are either commercial and institutional building construction companies (NAICS 236220 at 31%) or heavy civil construction companies (NAICS 237990 at 21%). The largest percentage of these companies (46%) has an EMR between .80-.99 with the range of EMR's going from .40-1.39. 71% of these companies have an EMR below 1.00.

Objective 2 : Employee Demographic Characteristics

Objective 2 sought to answer the question, what are the selected characteristics of construction workers in the Baton Rouge area on the characteristics of age, gender, education level, years of work experience, occupation, and country of birth. Findings indicate that the majority of construction workers in the Baton Rouge area are male (94.7%). The largest group reported that their education level is a high school diploma (45.5%). The average years of construction work experience possessed by these workers is 14 years, while the largest group (24.6%) had 1-5 years of work experience. The majority of workers were born in the U.S. (91.4%). The largest group by job title is construction laborer (27.8%).

Objective 3 : Measure Safety Climate and Safe Behavior

Objective 3 sought to answer the question, what is the safety climate level and safe behavior level of construction workers in the Baton Rouge area as measured by the Safety Climate Survey (SCS). Findings indicate that the majority of respondents (53.2%) somewhat agreed that their company had a good safety climate. The largest group (42%) agreed that they utilized and observed safe behaviors in the work place.

Objective 4 : Safety Climate and Safe Behavior Correlations

Objective 4 sought to answer the question; does a relationship exist between the level of a company's safety climate and the level of safe behaviors observed by employees within a company as measured by the SCS? Findings indicate that there is a positive correlation between the independent variables of Safety Climate and Safety Coordinator and the dependent variable of Safe Behavior. Additionally, there is a strong association between Safety Climate and Safe Behavior, where Safety Climate explains 33% of the variance in Safe Behavior. Additionally, there is a small association between Safety Coordinator and Safe Behavior, where Safety Coordinator explains 3.2% of the variance in Safe Behavior.

Objective 5 : Safety Climate and Experience Modification Rates Correlations

Objective 5 sought to answer the question; does a relationship exist between the level of a company's safety climate and the EMR at a company as measured by the SCS? Findings indicate that there is a negative correlation between the independent variable of Education Level and the dependent variable of EMR. Education Level explains 4.4% of the variance in EMR.

Conclusions

The majority of the Baton Rouge area construction companies registered with the Louisiana State University Construction Industry Advisory Committee (LSU CIAC) are either commercial and institutional building construction companies (NAICS 236220 at 31%) or heavy civil construction (NAICS 237990 at 21%). The largest percentage of these companies (46%) has an EMR between .80-.99 and the EMR's range from .40 to 1.39. Almost three-fourths (71%) of these companies have an EMR below 1.00. EMR levels below 1.00 are generally indicative of effective safety programs. In general, it can be concluded that the majority of the construction companies has adequate to exceptional safety practices based on their EMR ratings.

The average age of the employees at the companies is 36 years. The largest age group is 26-30 years of age (22.5%). The majority of construction workers in the Baton Rouge area are male (94.7%). As expected, female workers and older age groups are a much smaller proportion of the construction site workforce (Chi et al., 2005). Over two-thirds of the construction workers have a high school diploma or less (67.5%), with 45.5% having a high school diploma, 10.2% having a GED equivalent, and 11.8% have not finished high school. The average years of construction work experience possessed by these workers is 14 years, while the largest group (24.6%) has 1-5 years of work experience. The majority of the workers were born in the U.S. (91.4%). The largest group identifies their job title as construction laborer (27.8%).

The Safety Climate Survey (SCS) was utilized to assess the safety climate perceptions of the construction workers at their respective companies as well as their perceptions of safe behaviors at work. The majority of the construction workers perceive that their company's safety climate was good and they utilize and observe safe behaviors in the work place. It is interesting to note that the workers rate utilized and observed safe behavior higher than their overall perception of the safety climate.

There is a positive correlation between Safe Behavior and two variables, Safety Climate and an individual working as a Safety Coordinator. Additionally, there is a strong positive association between Safety Climate and Safe Behavior, while there is a small association between Safety Coordinator and Safe Behavior. One could think that the association between Safety Climate and Safe Behavior could be that both represent measure of perceptions from the same respondents and they therefore are more likely to respond similarly. However, it appears that workers who perceive higher levels of safety climate do work more safely. The small association between the occupation of Safety Coordinator and Safe Behavior may be that the safety coordinator's perceptions are different due to their increased awareness of safety issues. It may also be that they observe more safe behavior as employees are more likely to act in a safe manner when they feel that the safety coordinator is observing their behavior. While other research has shown that in the self-reporting of safe behaviors, there is greater safety risk taking in males in younger age groups but that the gender gap diminishes with age (Byrnes et al., 1999); however, this previously reported behavior did not seem to be the case in this study.

There is a small negative correlation between Education Level and the dependent variable of EMR. As Education Level increases, company EMR's go down. A lower EMR is an indication of a more effective safety program in which a company had less accidents than expected for their industry group. Therefore, this negative relationship suggests that as levels of education increase, workers exhibit safer behaviors which in turn assist a company in attaining lower EMR scores indicating a safer company. However, education levels only explained 4.4% of the variance in the EMR scores. Safety climate, age, gender, education level, years of work experience, country of birth, or occupation as measured by the SCS do not explain a practically significant proportion of the variance in the EMR of construction companies in the Baton Rouge area.

Implications and Recommendations

Based on the strong relationship between safety climate and safe behaviors, construction companies in Louisiana should address the role of management's influence on company safety climate. This supports earlier findings from previous studies that safety climate can be used as an effective indicator of a company's safety practices (Teo & Feng, 2009). Strong management commitment to safety has long been identified as a major influencing factor on safety climate (Zohar, 1980), reflecting even further back to the principals of executive interest and support, and executive enforcement of corrective practice as a means for influencing safety (Heinrich, 1931). The job title of safety coordinator also has a small effect on safe behaviors in the workplace, again reinforcing the notion that management's role does have an impact on safe behavior. However, this could also indicate that employees act differently when they realize that the safety coordinator is observing their actions as many safety coordinators do have the authority to implement corrective and even punitive actions when witnessing unsafe behaviors.

The relationship of variables to EMR was somewhat less clear. A small negative correlation between education level and EMR seems to indicate that higher levels of education explain lower EMR scores. Lower EMR scores should be reflective of a safer work environment. The effect size for this relationship; therefore, education level only explained a small amount of the variance in EMR scores. Still, this does indicate that increased levels of education are related to better EMR scores.

It is also important to note that while this study did find a significant correlation between the dependent variable of Safe Behavior and the independent variables of Safety Climate and Safety Coordinator and it is equally important to note that there was no relationship found between Safe Behavior and the other variables explored in this study. In other words, there seems to be no impact on the dependent variable of Safe Behavior from the independent variables of age, gender, education level, years of work experience, country of birth, or the occupations of construction laborer, construction manager, framer, electrician, equipment operator, driver, pipe fitter/welder, and superintendent. Therefore, demographic diversity in the workforce is not an indicator of a more dangerous worksite.

Similarly, while this study did find a significant correlation between the dependent variable of EMR and the independent variable of Education Level, it is again important to note that there seems to be no impact on the dependent variable EMR based upon the selected demographic characteristics of age, gender, years of work experience, country of birth, or the occupations of construction laborer, construction manager, framer, electrician, equipment operator, driver, pipe fitter/welder, superintendent, and safety coordinator. Selection of construction workers in an effort to increase safety based on these characteristics appears to be unfounded by the results of this study.

Finally, additional research should be conducted to improve and strengthen the Safety Climate and Safe Behavior scales by Mohamed (2002). As noted in the findings, 14 items were removed from the survey because they did not positively contribute to the measurement of the constructs measured. This was somewhat unexpected in that the survey employed in this research utilized a preexisting survey designed specifically to measure safety climate at construction sites (Mohamed, 2002) and the populations studied previously were fairly similar to the population for this study. Previous research has indicated that the ability to accurately measure safety climate can help companies prevent accidents. It would be beneficial to conduct additional research to further develop and strengthen the SCS instrument as an aid to company safety programs and to determine why these items did not contribute to their respective scales as reported in previous studies.

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APPENDIX A: CONSTRUCTION COMPANIES IN THE BATON ROUGE AREA

Table A24. Construction Companies in the Baton Rouge Area Registered with the Construction Industrv Advisory Board

#	Company	Address	City, State Zip
1	A J Gallagher & Company	235 Highlandia Drive	Baton Rouge, LA 70810
2	ABC New Orleans Bayou Chapter	101 Riverbend Drive	St. Rose, LA 70087
3	ABC Pelican Chapter	19251 Highland Road	Baton Rouge, LA 70809
4	Ardent Services LLC	17 Veterans Boulevard	Kenner LA 70062
5	Arkel Constructors	1048 Floida Blvd	Baton Rouge, LA 70802
6	B & K Construction Company, LLC	1905 Highway 59	Mandeville, LA 70448
7	Barriere Construction	1610 Barriere Rd.	Belle Chase, LA 70037
8	Barriere Construction Co.	P.O. Box 1576	Boutte, LA 70039
9	Bayou Lacombe Construction	P.O. Box 1985	Lacombe, LA 70445
10	Bennett Builders, LLC	600 Jefferson St, Suite 407	Lafayette, LA 70501
11	Boh Bros. Construction	12203 Airline Hwy.	Baton Rouge, LA 70817
12	Boh Brothers Construction LLC	P.O. Drawer 53266	New Orleans, LA 70153
13	Brand Energy & Infrastructure	13527 Airline Hwy.	Baton Rouge, LA 70817
14	Broadmoor, LLC	2740 North Arnoult Rd.	Metairie, LA 70002
15	Brock Services	15981 Airline Hwy.	Baton Rouge, LA 70817
16	Bulliard Construction Co., Inc.	P.O. Box 216	St. Martinville, LA 70582
17	Cajun Constructors, Inc	P.O. Box 104	Baton Rouge, LA 70821
18	Cajun Industries, LLC	P.O. Box 104	Baton Rouge, LA 70821
19	Carl E. Woodward, LLC	1019 S. Dupre Street	New Orleans, LA 70125
20	Cecil Perry Improvements	4714 Cameron St.	Lafayette, LA 70506
21	Circle, LLC	1204 Engineers Rd.	Belle Chase, LA 70037
22	Coating & Application Services	P.O. Box 1330	Gonzales, LA 70707
23	Contractors Educational Trust Fund	P.O. Box 3807	Baton Rouge, LA 70821
24	CSRS	6767 Perkins Rd., Suite 200	Baton Rouge, LA 70808
25	Cycle Construction Co, LLC	#6 East Third St.	Kenner, LA 70062
26	Didier Consultants	431 Colonial Dr., Suite B	Baton Rouge, LA 70806

(table continues)

Table A24 (continued)

#	Company	Address	City, State Zip
27	Doggett Machinery Services	10110 Daradale Ave.	Baton Rouge, LA 70816
28	Durr Heavy Construction	817 Hickory Avenue	Harahan, LA 70123-3110
29	Dykes Electric Inc.	10175 Mammoth Avenue	Baton Rouge, LA 70814
30	Excel Contractors Inc.	177474 Airline Hwy.	Prairieville, LA 70769
31	Fabricated Steel Products	2487 N. Flannery Rd.	Baton Rouge, LA 70815
32	Gibbs Construction LLC	5736 Citrus Blvd., Ste. 200	New Orleans, LA 70123
33	Grady Crawford Construction	12290 Greenwell Springs Rd.	Baton Rouge, LA 70814
34	Group Contractors	P.O. Box 83560	Baton Rouge, LA 70884
35	Industrial Design & Construction, Inc.	14061 Highway 73	Prairieville, LA 70769
36	Insulations, Inc.	P.O. Box 231039	New Orleans, LA 70183
37	ISC Constructors, LLC	P.O. Box 77858	Baton Rouge, LA 70879
38	ISC Constructors, LLC	20480 Highland Rd.	Baton Rouge, LA 70817
39	Jacobs Field Services North America	7600 Airline Hwy.	Baton Rouge, LA 70814
40	James Construction Group, LLC	11200 Industriplex Blvd. Suite 150	Baton Rouge, LA 70809
41	JB James Construction	P.O. Box 14271	Baton Rouge, LA 70898
42	La Rents / La Machinery	3799 W. Airline Hwy.	Baton Rouge, LA 70084
43	Landis Construction Co. LLC	P.O. Box 4278	New Orleans, LA 70178
44	Leevac Industries	P.O. Box 1190	Jennings, LA 70546
45	M.R. Pittman Group, LLC	505 Commerce Point	Harahan, LA 70123
46	Magnolia Construction Co. LLC	2654 Mission Ave.	Baton Rouge, LA 70805
47	Manson Gulf LLC	P.O. Box 2917	Houma, LA 70361-2278
48	MAPP Construction	344 Third St.	Baton Rouge, LA 70848
49	MAPP Construction	6737 General Haig	New Orleans, LA 70124
50	Merit Electrical Inc.	P.O. Box 86710	Baton Rouge, LA 70899
51	Milton J. Womack, Inc.	8400 Jefferson Hwy.	Baton Rouge, LA 70809
52	MMR Constructors	15961 Airline Hwy.	Baton Rouge, LA 70817
53	MMR Group, Inc.	P.O. Box 84210	Baton Rouge, LA 70884
54	Moody-Price, LLC	P.O. Box 260044	Baton Rouge, LA 70826
55	Moore Construction	10037 Barringer Foreman Road	Baton Rouge, LA 70809
56	Pala-Interstate, LLC	P.O. Box 15949	Baton Rouge, LA 70895

(table continues)

Table A24 (continued)

#	Company	Address	City, State Zip
57	Pala-Interstate, LLC	16347 Old Hammond Hwy.	Baton Rouge, LA 70816
58	Performance Contractors, Inc.	P.O. Box 83630	Baton Rouge, LA 70884
59	Petrin Corporation	P.O. Box 330	Port Allen, LA 70767
60	Regal Construction LLC	1707 Chantilly Dr., Suite D	LaPlace, LA 70068
61	Russell Pool Company Inc	9195 Mammoth Drive	Baton Rouge, LA 708147
62	Ryan Gottee General Contractors	1100 Ridgewood Dr.	Metairie, LA 70001
63	Satterfield & Pontikes Construction	11000 Equity Drive, Suite 100	Baton Rouge, LA 70809
64	Satterfield & Pontikes Construction Group	13551 River Road	Luling, LA 70070
65	Shavers-Whittle Construction	P.O. Box 5467	Covington, LA 70434
66	Shaw Constructors Inc.	4171 Essen Lane	Baton Rouge, LA 70809
67	Shaw Environmental and Infrastructure	4171 Essen Lane	Baton Rouge, LA 70809
68	Shaw Group	4171 Essen Lane	Baton Rouge, LA 70809
69	Southern Delta Construction	P.O. Box 309 Bourg	Houma, LA 70343
70	Specialty Application Services, Inc.	P.O. Box 30	Port Allen, LA 70767
71	Specialty Industrial LLC	P.O. Box 41270	Baton Rouge, LA 70835
72	Stuart & Company General Constractors	4320 Jeffery Drive	Baton Rouge, LA 70816
73	The Lemoine Company, LLC	214 Third St. Suite 2B	Baton Rouge, LA 70801
74	The McDonnel Group	P.O. Box 7392	Metairie, LA 70010
75	Topcor	4960 BlueBonnet Blvd., Ste. B	Baton Rouge, LA 70809
76	Triad Electric	4522 Chelsea Dr.	Baton Rouge, LA 70809
77	Triad Electric & Controls	8183 West El Cajon Drive	Baton Rouge, LA 70815
78	Triad Electric and Controls	2288 Airway Dr.	Baton Rouge, LA 70815
79	Trison Constructors	3001 17th St.	Metarie, LA 70002
80	Turner Industries Group, LLC	P.O. Box 2750	Baton Rouge, LA 70821
81	Unified Recovery Group	263 Third St., Fifth Fl.	Baton Rouge, LA 70801
82	United Rentals Trench Safety	37474 Hwy 30	Gonzales, LA 70737
83	Wharton-Smith	13073 Plank Rd.	Baker, LA 70714
84	Wright & Percy Insurance	P.O. Box 3809	Baton Rouge, LA 70821

APPENDIX B: INITIAL SAFETY CLIMATE RESEARCH INSTRUMENT

Safety Climate Survey

Instructions: Please indicate your level of agreement with each statement about construction site safety by checking (✓) your response. See the sample below showing how your answer should appear.

	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Sample Statement	**1**	**2**	**3**	**4**	**5**	**6**
1 I am concerned about my safety.						✓
2 Safety is not important in my company.		✓				

Survey Begins Here

Statements	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
	1	**2**	**3**	**4**	**5**	**6**
1 Management Commitment To Safety						
1 Management clearly considers safety to be as equally as important as production.						
2 Management expresses concern if safety procedures are not followed.						
3 Management acts decisively when a safety concern is raised.						
4 Management acts quickly to correct safety problems.						
5 Management acts only after accidents have occurred.						
6 Management praises site employees for working safely.						
7 Management disciplines site employees for working unsafely.						
2 Management Communication of Safety						
1 Management clearly communicates safety issues to all levels within the organization.						
2 Management continues to bring safety information to site employees' attention.						
3 Management operates an open-door policy on safety issues.						
4 Management encourages feedback from site employees on safety issues.						
5 Management listens to and acts upon feedback from site employees.						
6 Management communicates lessons from accidents to improve safety performance.						
7 Management undertakes campaigns to promote safe working practices.						

Statements	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
	1	2	3	4	5	6
3 Safety Rules and Procedures						
1 Current safety rules and procedures are made available to protect us from accidents.						
2 Current safety rules and procedures are adequate sources of information on safety.						
3 Current safety rules and procedures are so complicated that some workers do not pay much attention to them.						
4 Current safety rules and procedures should be consulted only by new recruits.						
5 Current safety rules and procedures require us to report any malpractice by a fellow worker.						
6 Current safety rules and procedures enforce the use of personal protective equipment whenever necessary.						
7 Current safety rules and procedures require detailed work plans from subcontractors or self-employed individuals.						
4 Supportive Work Environment						
1 As a group, we adopt a no-blame approach to highlight unsafe work behavior.						
2 As a group, we often remind each other on how to work safely.						
3 As a group, we believe it is our business to maintain a safe workplace environment.						
4 As a group, we always offer help when needed to perform the job safely.						
5 As a group, we endeavor to ensure that individuals are not working by themselves under risky or hazardous conditions.						
6 As a group, we maintain good working relationships.						
7 As a group, we ensure that the workload is reasonably balanced among ourselves.						

Statements	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
	1	2	3	4	5	6
5 Supervisory Environment						
1 My supervisor/safety manager has positive safety behavior.						
2 My supervisor/safety manager believes safety is very important.						
3 My supervisor/safety manager usually engages in regular safety talks.						
4 My supervisor/safety manager welcomes reporting safety hazards/incidents.						
5 My supervisor/safety manager is a good resource for solving safety problems.						
6 My supervisor/safety manager advocates working around safety procedures to meet important deadlines.						
7 My supervisor/safety manager values my ideas about improving safety when significant changes to working practices are suggested.						
6 Employee Involvement						
1 Everyone aims to achieve high levels of safety performance.						
2 Everyone plays an active role in identifying site hazards.						
3 Everyone reports accidents, incidents, and potentially hazardous situations.						
4 Everyone participates in safety planning, according to our safety policy if being asked.						
5 Everyone has the responsibility to reflect on safety practice.						
6 Everyone avoids being involved in accident investigations.						
7 Everyone contributes to job safety analysis if being asked.						
7 Appreciation of Personal Risk						
1 I am sure that it is only a matter of time before I am involved in an accident.						
2 I am sure I can influence the level of safety performance.						
3 I am clear about what my responsibilities are for safety.						
4 I am aware that safety is the number one priority in my mind while working.						
5 I believe some rules are really necessary to get the job done safely.						
6 I believe some rules and policies are not really practical.						
7 I cannot do the job safely without following every safety procedure.						

Statements	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
	1	2	3	4	5	6
8 Work Site Risks						
1 In our work environment safety is a primary consideration when determining site layout.						
2 In our work environment poor site layout planning is an accepted feature of the industry.						
3 In our work environment the chances of being involved in a site accident are quite large.						
4 In our work environment operating site conditions may hinder one's ability to work safely.						
5 In our work environment detecting potential hazards is not a major aim of the site planning exercise.						
6 In our work environment working with defective equipment is not allowed under any circumstances.						
7 In our work environment potential risks and consequences are identified prior to execution.						
9 Work Pressure						
1 I work under a great deal of tension.						
2 I am not given enough time to get the job done safely.						
3 It is necessary for me to depart from safety requirements for production's sake.						
4 I perceive operational targets in conflict with some safety measures.						
5 It is normal for me to take shortcuts at the expense of safety.						
6 I tolerate minor unsafe behaviors performed by coworkers.						
7 It is not acceptable to delay periodic inspection of plant and equipment.						
10 Employee Competence						
1 I received adequate training to perform my job safely.						
2 I am aware, through training, of relevant safety procedures.						
3 I do fully understand current, relevant legislation.						
4 I am skilled at avoiding the dangers of workplace hazards.						
5 I am capable of identifying potentially hazardous situations.						
6 I am proactive in removing workplace safety hazards.						
7 I am capable of using relevant protective equipment.						

Statements	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
	1	2	3	4	5	6
11 Safe Behavior						
1 Safety in my current workplace plays an effective role in preventing accidents.						
2 Safety in my current workplace reduces occupational risk.						
3 Safety in my current workplace makes it possible to get the job done.						
4 Safety in my current workplace is of high quality compared to other sites.						
5 Safety in my current workplace is not restrictive and superficial.						
6 Safety in my current workplace helps increase my productivity.						
7 Safety in my current workplace contributes to my work satisfaction.						
8 Safety in my current workplace inspires me to work more safely.						
9 Safety in my current workplace has a positive influence on morale.						
10 Safety in my current workplace makes me proud to tell others I am part of it.						
11 I follow all of the safety procedures for the jobs that I perform.						
12 My coworkers follow all of the safety procedures for the jobs that they perform.						

12 Demographic Information

Instructions: Please indicate how the following statements apply to you by checking (✓) the appropriate category or writing in the appropriate response.

1. What is your age? _____ years

2. What is your gender? ____Male _____Female (check (✓) one)

3. What is your level of education? (check (✓) one)
   _____Did not finish high school
   _____GED Diploma
   _____High School Diploma
   _____Associate Degree
   _____College Degree
   _____Master's Degree
   _____Doctoral Degree

4. I have been working in construction for _______ years.

5. My job is best described as: (check (✓) one)
   _____Construction laborer
   _____Construction manager
   _____Carpenter/Framer
   _____Roofer
   _____Electrician
   _____Equipment Operator
   _____Painter
   _____Truck Driver
   _____Plumber
   _____Other – What is your job title?____________________________

6. I was born in: (check (✓) one)
   _____U.S.
   _____Mexico
   _____Central America (Not Mexico)
   _____Canada
   _____Asia
   _____Europe
   _____Caribbean
   _____Africa
   _____Other – where were you born?___________________________

Thank you for completing the Safety Climate Survey

NOTE: THIS PAGE WILL ONLY BE ADMINISTERED TO A COMPANY REPRESENTIVE AND NOT TO ALL EMPLOYEES.

Company Information

Instructions: Only one of these forms is to be completed for each company by a representative of management. Responses will remain anonymous and cannot be traced to a company upon completion. However, this data will be tied to the employee responses from this company. Please complete the following statements writing in the appropriate response.

1. What is your company's NAICS or SIC code? ____________

2. What is your company's current Experience Modification Rate (EMR)? ________

APPENDIX C: FINAL SAFETY CLIMATE RESEARCH INSTRUMENT

Safety Climate Survey

Instructions: Please indicate your level of agreement with each statement about construction site safety by checking (✓) your response. See the sample below showing how your answer should appear.

		Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Sample Statement		1	2	3	4	5	6
1	I am concerned about my safety.						✓
2	Safety is not important in my company.		✓				

Survey Begins Here

		Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
		1	2	3	4	5	6
A. Management Commitment To Safety							
1	My boss clearly thinks safety is as important as getting the work done.						
2	My boss is concerned if safety procedures are not followed.						
3	My boss acts decisively when a safety concern is raised.						
4	My boss acts quickly to correct safety problems.						
5	My boss acts only after accidents have occurred.						
6	My boss praises employees for working safely.						
7	My boss disciplines employees for working unsafely.						
B. Management Communication of Safety							
1	My boss clearly communicates safety issues to everyone in the company.						
2	My boss continues to bring safety information to our attention.						
3	I can talk to my boss anytime about safety issues.						
4	My boss wants us to talk to him about safety issues.						
5	My boss listens to and acts upon the safety concerns we bring to him.						
6	My boss shares lessons from accidents so that everyone can learn how to work more safely on the job.						
7	My boss works hard to promote safe working practices.						

	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
	1	2	3	4	5	6
C. Safety Rules and Procedures						
1 Our safety rules and procedures are there to protect us from accidents.						
2 Our safety rules and procedures provide enough information on safety.						
3 Our safety rules and procedures are so complicated that some workers do not pay much attention to them.						
4 Our safety rules and procedures should be looked at only by new recruits.						
5 Our safety rules and procedures require us to report any unsafe acts by a fellow worker.						
6 Our safety rules and procedures enforce the use of personal protective equipment whenever necessary.						
7 Our safety rules and procedures require detailed work plans from subcontractors or self-employed individuals that work with us.						
D. Supportive Work Environment						
1 We all take a no-blame approach to pointing out unsafe work behavior.						
2 We all often remind each other on how to work safely.						
3 We all believe it is our business to maintain a safe workplace environment.						
4 We all always offer help when needed to perform the job safely.						
5 We all endeavor to ensure that individuals are not working by themselves under risky or hazardous conditions.						
6 We all maintain good working relationships.						
7 We all ensure that the workload is reasonably balanced among ourselves.						

	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
	1	2	3	4	5	6
E. Supervisory Environment						
1 My safety supervisor always acts safely themself even if they think no one is watching.						
2 My safety manager truly believes that safety is very important.						
3 My safety manager usually helps give safety talks on a regular basis.						
4 My safety manager welcomes us reporting safety hazards and accidents to them.						
5 My safety manager is a good person to ask for solving safety problems.						
6 My safety manager tells us to work around safety procedures to meet important deadlines.						
7 My safety manager values my ideas about improving safety when significant changes to working practices are suggested.						
F. Employee Involvement						
1 We all aim to achieve high levels of safety performance at work.						
2 We all take an active role in identifying job site hazards.						
3 We all report accidents, incidents, and potentially hazardous situations we see at work.						
4 We all participate in job site safety planning.						
5 We all have the responsibility to think about safety practices at work.						
6 We all try to avoid being involved in accident investigations.						
7 We all help create job safety analysis (JSA's) when asked.						
G. Appreciation of Personal Risk						
1 I am sure that it is only a matter of time before I am involved in an accident.						
2 I am sure I can influence the level of safety performance.						
3 I am clear about what my responsibilities are for safety.						
4 I am aware that safety is the number one priority in my mind while working.						
5 I believe some rules are really necessary to get the job done safely.						
6 I believe some rules and policies are not really practical.						
7 I cannot do the job safely without following every safety procedure.						

	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
	1	2	3	4	5	6
H. Work Site Risks						
1 At our job site safety is a primary consideration when determining site layout.						
2 At our job site poor site layout is an accepted part of the construction industry.						
3 At our job site the chances of being involved in an accident are quite large.						
4 At our job site working conditions may keep us from working as safely as we want.						
5 At our job site detecting potential hazards is not a major aim of the site planning exercise.						
6 At our job site working with defective equipment is not allowed under any circumstances.						
7 At our job site potential dangers and consequences are identified prior to execution.						
I. Work Pressure						
1 I work under a great deal of tension.						
2 I am not given enough time to get the job done safely.						
3 It is necessary for me to depart from safety requirements for production's sake.						
4 I perceive operational targets in conflict with some safety measures.						
5 It is normal for me to take shortcuts at the expense of safety.						
6 I tolerate minor unsafe behaviors performed by coworkers.						
7 It is not acceptable to delay periodic inspection of plant and equipment.						
J. Employee Competence						
1 I received adequate training to perform my job safely.						
2 I am aware, through training, of the safety rules procedures of my job.						
3 I fully understand current safety laws and legislation.						
4 I am skilled at avoiding the dangers of workplace hazards.						
5 I am capable of identifying potentially hazardous situations.						
6 I am proactive in removing workplace safety hazards.						
7 I am capable of using relevant protective equipment.						

		Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
		1	2	3	4	5	6
K. Safe Behavior							
1	Safety in my current workplace plays an effective role in preventing accidents.						
2	Safety in my current workplace reduces occupational risk.						
3	Safety in my current workplace makes it possible to get the job done.						
4	Safety in my current workplace is of high quality compared to other sites.						
5	Safety in my current workplace is not restrictive and superficial.						
6	Safety in my current workplace helps increase my productivity.						
7	Safety in my current workplace contributes to my work satisfaction.						
8	Safety in my current workplace inspires me to work more safely.						
9	Safety in my current workplace has a positive influence on morale.						
10	Safety in my current workplace makes me proud to tell others I am part of it.						
11	I follow all of the safety procedures for the jobs that I perform.						
12	My coworkers follow all of the safety procedures for the jobs that they perform.						

L. Demographic Information

Instructions: Please indicate how the following statements apply to you by checking (✓) the appropriate category or by writing in the appropriate response.

1. What is your age? _____ years

2. What is your gender? ____Male _____Female (check (✓) one)

3. What is your level of education? (check (✓) one)
   _____Did not finish high school
   _____GED Diploma
   _____High School Diploma
   _____Associate Degree
   _____College Degree
   _____Master's Degree
   _____Doctoral Degree

4. I have been working in construction for _______ years.

5. My job is best described as: (check (✓) one)
   _____Construction laborer
   _____Construction manager
   _____Carpenter/Framer
   _____Roofer
   _____Electrician
   _____Equipment Operator
   _____Painter
   _____Truck Driver
   _____Plumber
   _____Other – What is your job title? ____________________________

6. I was born in: (check (✓) one)
   _____U.S.
   _____Mexico
   _____Central America (Not Mexico)
   _____Canada
   _____Asia
   _____Europe
   _____Caribbean
   _____Africa
   _____Other – where were you born?___________________________

Thank you for completing the Safety Climate Survey

NOTE: THIS PAGE WILL ONLY BE ADMINISTERED TO A COMPANY REPRESENTIVE AND NOT TO ALL EMPLOYEES.

Company Information

Instructions: Only one of these forms is to be completed for each company by a representative of management. Responses will remain anonymous and cannot be traced to a company upon completion. However, this data will be tied to the employee responses from this company. Please complete the following statements writing in the appropriate response.

1. What is your company's NAICS or SIC code? ____________

2. What is your company's current Experience Modification Rate (EMR)? ________

APPENDIX D: LOUISIANA STATE UNIVERSITY INSTITUTIONAL REVIEW BOARD IRB APPROVAL

Application for Exemption from Institutional Oversight

LSU

Institutional Review Board
Dr. Robert Mathews, Chair
131 David Boyd Hall
Baton Rouge, LA 70803
P: 225.578.8692
F: 225.578.6792
irb@lsu.edu
lsu.edu/irb

Unless qualified as meeting the specific criteria for exemption from Institutional Review Board (IRB) oversight, ALL LSU research/ projects using living humans as subjects, or samples, or data obtained from humans, directly or indirectly, with or without their consent, must be approved or exempted in advance by the LSU IRB. This Form helps the PI determine if a project may be exempted, and is used to request an exemption.

-- Applicant,Please fill out the application in its entirety and include the completed application as well as parts A-E, listed below, when submitting to the IRB. Once the application is completed, please submit two copies of the completed application to the IRB Office or to a member of the Human Subjects Screening Committee. Members of this committee can be found at http://research.lsu.edu/CompliancePoliciesProcedures/InstitutionalReviewBoard%28IRB%29/item24737.html

-- A Complete Application Includes All of the Following:

(A) Two copies of this completed form and two copies of part B thru E.
(B) A brief project description (adequate to evaluate risks to subjects and to explain your responses to Parts 1&2)
(C) Copies of all instruments to be used.
*If this proposal is part of a grant proposal, include a copy of the proposal and all recruitment material.
(D) The consent form that you will use in the study (see part 3 for more information.)
(E) Certificate of Completion of Human Subjects Protection Training for all personnel involved in the project, including students who are involved with testing or handling data, unless already on file with the IRB. Training link: (http://phrp.nihtraining.com/users/login.php)
(F) IRB Security of Data Agreement: (http://research.lsu.edu/files/item26774.pdf)

1) Principal Investigator: Charles Pecquet **Rank:** doctoral student

Dept: SHREWD **Ph:** 225-578-7790 **E-mail:** cpecqu1@lsu.edu

2) Co Investigator(s): please include department, rank, phone and e-mail for each
*If student, please identify and name supervising professor in this space

Committee Chair Dr. Joe Kotrlik, SHREWD, Professor, 225-578-5753, kotrlik@lsu.edu

IRB# E5983 LSU Proposal #
✓ Complete Application
✓ Human Subjects Training

3) Project Title: MEASURING SAFETY CLIMATE AS AN INDICATOR OF EFFECTIVE SAFETY AND HEALTH PROGRAMS IN THE CONSTRUCTION INDUSTRY

Study Exempted By:
Dr. Robert C. Mathews, Chairman
Institutional Review Board
Louisiana State University
203 B-1 David Boyd Hall
225-578-8692 | www.lsu.edu/irb
Exemption Expires: 5/17/2015

4) Proposal? (yes or no) NO **If Yes, LSU Proposal Number**

Also, if YES, either ○ **This application completely matches the scope of work in the grant**
OR ○ **More IRB Applications will be filed later**

5) Subject pool (e.g. Psychology students) construction workers

*Circle any **"vulnerable populations" to be used:** (children <18; the mentally impaired, pregnant women, the ages, other). Projects with incarcerated persons cannot be exempted.

6) PI Signature [signature] **Date** 5/8/2012 (no per signatures)

** **I certify my responses are accurate and complete.** If the project scope or design is later changes, I will resubmit for review. I will obtain written approval from the Authorized Representative of all non-LSU institutions in which the study is conducted. I also understand that it is my responsibility to maintain copies of all consent forms at LSU for three years after completion of the study. If I leave LSU before that time the consent forms should be preserved in the Departmental Office.

Screening Committee Action: Exempted ✓ Not Exempted ___ Category/Paragraph 2

Reviewer Mathews **Signature** Robert C Mathews **Date** 5/18/12

SCRIPT FOR ADMINISTERING THE SURVEY INSTRUMENT

Good Morning/Afternoon. Thank you for participating in this study. Let me take a minute to explain the purpose of it and what your role will be.

Safety is very important to all of us. No one wants to go home injured today. However, as you are probably aware, safety records are usually measured by accidents that have already occurred. By the time an accident has taken place, how many near misses have been encountered? Wouldn't it be better if we could determine what the overall safety climate was prior to an accident in order to assess if changes need to be made before someone gets hurt.

The purpose of the survey that you will be completing is to see if this safety climate can be measured. Please be completely honest in your responses. Your answers will remain completely anonymous and cannot be traced back to you. If you need assistance reading the questions, please let me know and I'll help you. If you need the questions to be in another language, please let me know.

I would also like to inform you that your participation in this study is completely voluntary. You may choose not to participate at all, or not answer certain questions, or to stop answering questions and withdraw from the study at any time without penalty or loss of any benefit to which you might otherwise be entitled.

Thank you again for your time in participating in this research. Hopefully, it will allow us all to create a more safe work environment for you and everyone else involved in construction work.

APPENDIX E: DIRECTIONS TO THE STUDENT GROUPS FOR ADMINISTERING THE SURVEY INSTRUMENT

SURVEY INSTRUCTIONS

Before you begin, read the summary of the study to familiarize yourself with the purpose of the data being collected.

Step 1: Contact the company assigned to you for permission to visit and to schedule a time. See Intro Letter for an example of what to say.

Step 2: Print the required number of surveys. Print front and back and staple.

Step 3: Visit the company at the scheduled time, read the script provided and administer the survey.

Step 4: Collect the surveys and place in an envelope. Also gather the NAICS and EMR info (see sheet in summary of study) from the company management representative and place in the envelope. Do not place other identifying marks on the surveys or envelope.

Step 5: Complete a brief report (1-2 pages typed) giving the following:

- Your group number and section number
- Names of students in your group
- Company visited
- Company Contact
- Time and date of visit
- Conditions of survey (in field, in classroom, etc.)
- Number of surveys administered (in English and Spanish)
- Questions from survey participants asking for clarification of survey
- Problems encountered such as questions you couldn't answer or took too much time, etc.
- Overall summary of experience

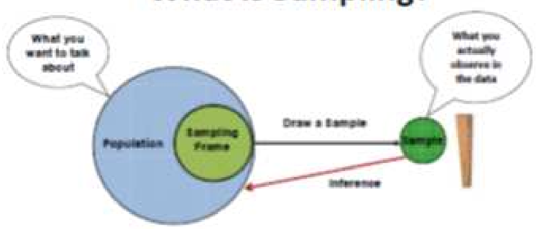
Step 6: Enter the data into the excel file template.

Step 7: Turn the envelope of surveys in and email the report and Excel file.

PLEASE ASK IF YOU HAVE ANY QUESTIONS ABOUT THE PROCEDURE.

SAMPLING AND VALIDIDTY CONCERNS PRESENTED
TO THE STUDENT GROUPS

What is Sampling?



Using data to say something (*make an inference*) with confidence, about a whole group (or population) based on the study of only a few from that group (or sample).

Safety Climate Model

Internal Validity Threats

1. **History** – is there something about the experience & history of one group that could lead to differences?
2. **Maturation** – would natural development influence the associations?
3. **Testing** – does actual participation in the study change behavior or responses?
4. **Instrumentation** – what happens if the instruments you use change during the course of a study or if different groups of participants interpret your questions differently?
5. **Regression towards the mean** – if you start with extreme groups, they are likely to be less extreme at another time point.
6. **Selection** – are participants in your study somehow different than those who are not?
7. **Mortality** – those who drop out of your study could be qualitatively different than those who remain.

Assignment

1. Assign Companies
2. Contact Companies
3. Conduct Survey and Collect Data
4. Write Report
5. Format Data

SCRIPT TO BE READ TO PARTICIPANTS

Good Morning/Afternoon. Thank you for participating in this study. Let me take a minute to explain the purpose of it and what your role will be.

Safety is very important to all of us. No one wants to go home injured today. However, as you are probably aware, safety records are usually measured by accidents that have already occurred. By the time an accident has taken place, how many near misses have been encountered? Wouldn't it be better if we could determine what the overall safety climate was prior to an accident in order to assess if changes need to be made before someone gets hurt.

The purpose of the survey that you will be completing is to see if this safety climate can be measured. Please be completely honest in your responses. Your answers will remain completely anonymous and cannot be traced back to you. If you need assistance reading the questions, please let me know and I'll help you. If you need the questions to be in another language, please let me know.

Thank you again for your time in participating in this research. Hopefully, it will allow us all to create a safer work environment for you and everyone else involved in construction work.

APPENDIX F: EMAIL NOTIFICATION TO RESEARCH SAMPLE

Dear Sirs:

I'm working on a construction safety research project for my PhD degree at LSU. I'm also an OSHA authorized instructor and teach safety courses for the Department of Construction Management at LSU. I'm hoping you would be willing to help me with my research. I want to conduct a survey of construction employees in the Baton Rouge area. All survey results would be anonymous so that the results could not be traced to an individual or company. The survey would be trying to measure the relative safety culture at each company as an indicator of effective safety management techniques. I would need your assistance by allowing me about a half hour with your employees to administer and collect a survey of questions related to safety practices. Please let me know if you have any questions or would like to discuss this by phone or in person before deciding if you would be able to help.

I look forward to hearing from you,

Charles Pecquet
Instructor of Construction Management
Louisiana State University
225-578-7790 office
225-907-3497 cell

APPENDIX G: DIRECTIONS TO CONTENT EXPERTS FOR CONTENT VALIDITY RATING

(Date)

Dear (Content Expert's Name),

Thank you for agreeing to review the Safety Climate Survey. As you read each item in the survey, please indicate your rating of the relevance of each item directly on the survey to the left of each item using the following Likert-type scale:

(1) Not Relevant (2) Fairly Relevant (3) Relevant (4) Very Relevant

I also ask and encourage you to provide any additional comments regarding any of the items directly onto the instrument. Additionally, if you feel anything has been omitted that should be part of this instrument, please note that at the end of the survey form. You may return the survey to me electronically at cpecqu1@lsu.edu.

Thanks for your time and support of this project.

Sincerely,

Charles Pecquet
225-907-3497 cell
cpecqu1@lsu.edu

APPENDIX H: PERMISSIONS FROM AUTHORS AND PUBLISHERS FOR WORKS CITED

Permission from Sherif Mohamed to use his survey instrument

Charles Pecquet <cpecqu1@tigers.lsu.edu> **Tue, Oct 25, 2011 at 12:21 PM**
To: Sherif Mohamed <s.mohamed@griffith.edu.au>

Dear Dr. Mohamed,

I am currently working towards my PhD and my study is focusing on measuring safety climate on residential construction. I have read your work, particularly your 2002 study entitled "Safety Climate in Construction Site Environments" and am hoping to base my study on continuing some of your research. I am hoping to use the instrument you used in your study with some modifications. I wanted to see if you would mind me using your instrument and if you might be willing to provide some input on the changes I'm considering.

Thanks,
Charles Pecquet
Louisiana State University
Baton Rouge, Louisiana, United States

Charles Pecquet <cpecqu1@tigers.lsu.edu> **Mon, Nov 14, 2011 at 8:23 AM**
To: Charles Pecquet <cpecqu1@tigers.lsu.edu>

[Quoted text hidden]

Charles Pecquet <cpecqu1@tigers.lsu.edu> **Mon, Nov 14, 2011 at 8:24 AM**
To: Charles Pecquet <cpecqu1@tigers.lsu.edu>

On Mon, Oct 24, 2011 at 11:10 AM, Charles Pecquet <cpecqu1@tigers.lsu.edu> wrote:

> http://www.griffith.edu.au/engineering-information-technology/griffith-school-engineering/staff/professor-sherif-mohamed
> http://www.griffith.edu.au/cgi-bin/phone_search.pl?email=S.Mohamed@griffith.edu.au&format=search

[Quoted text hidden]

Sherif Mohamed <s.mohamed@griffith.edu.au> **Sun, Jan 29, 2012 at 8:30 PM**
To: Charles Pecquet <cpecqu1@tigers.lsu.edu>

Dear Charles,

Thank you for your e-mail message. By all means, you can use the safety climate instrument with some modifications which I would be happy to view in its final form.

Best Regards,

Sherif
****
Prof. Sherif Mohamed
Griffith School of Engineering
Centre for Infrastructure Engineering & Management
Griffith University, Gold Coast campus
QLD 4222

Permission from Academy of Management to use Figure 3

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ACADEMY OF Management

Title: WHAT IS THE DIFFERENCE BETWEEN ORGANIZATIONAL CULTURE AND ORGANIZATIONAL CLIMATE? A NATIVE'S POINT OF VIEW ON A DECADE OF PARADIGM WARS.

Author: Daniel R. Denison

Publication: The Academy of Management Review

Publisher: Academy of Management

Date: Jul 1, 1996

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APPENDIX I: FACTOR ANALYSIS TABLES FOR SURVEY ITEMS INCLUDED

Table A25. Factor Analyses of Included Items in Safety Climate Variable

Item number in survey	**Scale**/Statement	Factor loading
A.	**Management Commitment To Safety**	
3.	My boss acts decisively when a safety concern is raised.	.798
2.	My boss is concerned if safety procedures are not followed.	.765
1.	My boss clearly thinks safety is as important as getting the work done.	.653
4.	My boss acts quickly to correct safety problems.	.534
7.	My boss disciplines employees for working unsafely.	.430
6.	My boss praises employees for working safely.	.425
B.	**Management Communication of Safety**	
5.	My boss listens to and acts upon the safety concerns we bring to him.	.774
4.	My boss wants us to talk to him about safety issues.	.770
2.	My boss continues to bring safety information to our attention.	.754
7.	My boss works hard to promote safe working practices.	.745
3.	I can talk to my boss anytime about safety issues.	.728
1.	My boss clearly communicates safety issues to everyone in the company.	.676
6.	My boss shares lessons from accidents so that everyone can learn how to work more safely on the job.	.533
C.	**Safety Rules and Procedures**	
1.	Our safety rules and procedures are there to protect us from accidents.	.716
7.	Our safety rules and procedures require detailed work plans from subcontractors or self-employed individuals that work with us.	.644
2.	Our safety rules and procedures provide enough information on safety.	.643
6.	Our safety rules and procedures enforce the use of personal protective equipment whenever necessary.	.586
5.	Our safety rules and procedures require us to report any unsafe acts by a fellow worker.	.374
D.	**Supportive Work Environment**	
5.	We all endeavor to ensure that individuals are not working by themselves under risky or hazardous conditions.	.747
7.	We all ensure that the workload is reasonably balanced among ourselves.	.696
4.	We all always offer help when needed to perform the job safely.	.681
6.	We all maintain good working relationships.	.653
2.	We all often remind each other on how to work safely.	.653
3.	We all believe it is our business to maintain a safe workplace environment.	.637
E.	**Supervisory Environment**	
4.	My safety manager welcomes us reporting safety hazards and accidents to them.	.824

(table continues)

Table A25 (continued)

Item number in survey	**Scale**/Statement	Factor loading
2.	My safety manager truly believes that safety is very important.	.717
1.	My safety supervisor always acts safely themself even if they think no one is watching.	.667
5.	My safety manager is a good person to ask for solving safety problems.	.621
3.	My safety manager usually helps give safety talks on a regular basis.	.620
7.	My safety manager values my ideas about improving safety when significant changes to working practices are suggested.	.534
F.	**Employee Involvement**	
1.	We all aim to achieve high levels of safety performance at work.	.728
3.	We all report accidents, incidents, and potentially hazardous situations we see at work.	.689
5.	We all have the responsibility to think about safety practices at work.	.610
7.	We all help create job safety analysis (JSA's) when asked.	.604
4.	We all participate in job site safety planning.	.596
2.	We all take an active role in identifying job site hazards.	.594
G.	**Appreciation of Personal Risk**	
3.	I am clear about what my responsibilities are for safety.	.714
4.	I am aware that safety is the number one priority in my mind while working.	.669
5.	I believe some rules are really necessary to get the job done safely.	.562
2.	I am sure I can influence the level of safety performance.	.480
H.	**Work Site Risks**	
3.	At our job site the chances of being involved in an accident are quite large.	.797
2.	At our job site poor site layout is an accepted part of the construction industry.	.764
4.	At our job site working conditions may keep us from working as safely as we want.	.724
5.	At our job site detecting potential hazards is not a major aim of the site planning exercise.	.692
I.	**Work Pressure**	
3.	It is necessary for me to depart from safety requirements for production's sake.	.878
2.	I am not given enough time to get the job done safely.	.816
5.	It is normal for me to take shortcuts at the expense of safety.	.808
4.	I perceive operational targets in conflict with some safety measures.	.798
6.	I tolerate minor unsafe behaviors performed by coworkers.	.682
1.	I work under a great deal of tension.	.515
J.	**Employee Competence**	
5.	I am capable of identifying potentially hazardous situations.	.791
2.	I am aware, through training, of the safety rules procedures of my job.	.774

(table continues)

Table A25 (continued)

Item number in survey	**Scale**/Statement	Factor loading
1.	I received adequate training to perform my job safely.	.762
6.	I am proactive in removing workplace safety hazards.	.682
4.	I am skilled at avoiding the dangers of workplace hazards.	.663
7.	I am capable of using relevant protective equipment.	.637
3.	I fully understand current safety laws and legislation.	.591

Note. Factor analysis conducted using Varimax rotation.

Table A26. Factor Analyses of Included Items in Safety Behavior Variable

Item number in survey	**Scale**/Statement	Factor loading
K.	**Safe Behavior**	
10.	Safety in my current workplace makes me proud to tell others I am part of it.	.788
8.	Safety in my current workplace inspires me to work more safely.	.757
12.	My coworkers follow all of the safety procedures for the jobs that they perform.	.638
4.	Safety in my current workplace is of high quality compared to other sites.	.631
7.	Safety in my current workplace contributes to my work satisfaction.	.612
9.	Safety in my current workplace has a positive influence on morale.	.603
11.	I follow all of the safety procedures for the jobs that I perform.	.599
2.	Safety in my current workplace reduces occupational risk.	.594
3.	Safety in my current workplace makes it possible to get the job done.	.585
1.	Safety in my current workplace plays an effective role in preventing accidents.	.546
6.	Safety in my current workplace helps increase my productivity.	.501

Note. Factor analysis conducted using Varimax rotation.

APPENDIX J: DATA ANALYSIS SYNTAX USED IN SPSS FOR STUDY

```
TITLE "Charles Pecquet Safety Climate Study" .
USE ALL.
RECODE A1 TO A7 B1 TO B7 C1 TO C7 D1 TO D7 E1 TO E7 F1 TO F7 G1 TO G7 H1 TO
H7 I1 TO I7 J1 TO J7 K1 T K12  (SYSMIS=9).
RECODE Born (1=1) (ELSE=0) INTO BornUS.
RECODE Born (2=1) (ELSE=0) INTO BornMex.
RECODE Born (3=1) (ELSE=0) INTO BornCent.

RECODE Job (1=1) (ELSE=0) INTO Labor.
RECODE Job (2=1) (ELSE=0) INTO Manager.
RECODE Job (3=1) (ELSE=0) INTO Framer.
RECODE Job (5=1) (ELSE=0) INTO Electric.
RECODE Job (5=1) (ELSE=0) INTO Operator.
RECODE Job (8=1) (ELSE=0) INTO Driver.
RECODE Job (10=1) (7=1) (9=1) (ELSE=0) INTO Other.
RECODE Job (11=1) (ELSE=0) INTO Pipe.
RECODE Job (12=1) (ELSE=0) INTO Super.
RECODE Job (13=1) (ELSE=0) INTO Estimate.
RECODE Job (14=1) (ELSE=0) INTO Safety.

COMMENT RECODE A5 (1=6) (2=5) (3=4) (4=3) (5=2) (6=1) (SYSMIS=SYSMIS) INTO
A55.

COMPUTE M1 = (A1+A2+A3+A4+A6+a7)/6.
COMPUTE M2 = (B1+B2+B3+B4+B5+B6+B7)/7.
COMPUTE M3 = (C1+C2+C5+C6+C7)/5.
COMPUTE M4 = (D2+D3+D4+D5+D6+D7)/6.
COMPUTE M5 = (E1+E2+E3+E4+E5+E7)/6.
COMPUTE M6 = (F1+F2+F3+F4+F5+F7)/6.
COMPUTE M7 = (G2+G3+G4+G5)/4.
COMPUTE M8 = (H2+H3+H4+H5)/4.
COMPUTE M9 = (I1+I2+I3+I4+I5+I6)/6.
COMPUTE M10= (J1+J2+J3+J4+J5+J6+J7)/7.
COMPUTE Behavior = (K1+K2+K3+K5+K6+K7+K8+K9+K10+K11+K12)/11.
COMPUTE Manage = (M1+M2+M3+M4+M5+M6+M7+M8+M9+M10).

FREQUENCIES VARIABLES = ALL.
DESCRIPTIVE VARIABLE = ALL.
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  /Format=NOLABELS
  /SCALE(M1)=All/MODEL=ALPHA
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  /SUMMARY=TOTAL .
RELIABILITY
```

```
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  /STATISTICS=DESCRIPTIVE SCALE
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RELIABILITY
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  /Format=NOLABELS
  /SCALE(Behavior)=All/MODEL=ALPHA
  /STATISTICS=DESCRIPTIVE SCALE
  /SUMMARY=TOTAL .
FACTOR
 /VARIABLES A1 TO A4 A6 TO A7
 /MISSING LISTWISE
 /ANALYSIS  A1  TO A4 A6 TO A7
 /PRINT UNIVARIATE INITIAL KMO AIC EXTRACTION ROTATION
 /FORMAT SORT BLANK(.30)
 /PLOT EIGEN
 /CRITERIA  FACTORS(1) ITERATE(25)
 /EXTRACTION PAF
  /ROTATION VARIMAX
 /METHOD=CORRELATION .
FACTOR
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 /ANALYSIS  B1 TO B7
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 /FORMAT SORT BLANK(.30)
 /PLOT EIGEN
 /CRITERIA  FACTORS(1) ITERATE(25)
 /EXTRACTION PAF
  /ROTATION VARIMAX
 /METHOD=CORRELATION .
FACTOR
 /VARIABLES C1 C2 C5 TO C7
 /MISSING LISTWISE
 /ANALYSIS  C1 C2 C5 TO C7
 /PRINT UNIVARIATE INITIAL KMO AIC EXTRACTION ROTATION
 /FORMAT SORT BLANK(.30)
 /PLOT EIGEN
 /CRITERIA  ITERATE(25)
 /EXTRACTION PAF
  /ROTATION VARIMAX
 /METHOD=CORRELATION .
```

```
FACTOR
 /VARIABLES D2 TO D7
 /MISSING LISTWISE
 /ANALYSIS  D2 TO D7
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 /FORMAT SORT BLANK(.30)
 /PLOT EIGEN
 /CRITERIA  FACTORS(1) ITERATE(25)
 /EXTRACTION PAF
  /ROTATION VARIMAX
 /METHOD=CORRELATION .
FACTOR
 /VARIABLES E1 TO E5 E7
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 /ANALYSIS  E1 TO E5 E7
 /PRINT UNIVARIATE INITIAL KMO AIC EXTRACTION ROTATION
 /FORMAT SORT BLANK(.30)
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 /CRITERIA  FACTORS(1) ITERATE(25)
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  /ROTATION VARIMAX
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FACTOR
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```

```
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FACTOR
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Framer Electric Operator Driver Pipe Super Estimate Safety Other with Behavior EMR
  /PRINT=TWOTAIL NOSIG
```

```
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NONPAR CORR
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NONPAR CORR
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REGRESSION
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  /MISSING LISTWISE
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VITA

Charles Francis Pecquet was born in Baton Rouge, Louisiana in 1966. He grew up in the Baton Rouge area with his parents, the late Philip N. Pecquet and Janis M. Pecquet, and siblings, Beth, Philip, Andrew, and Kelli. His father was a city judge in Port Allen, Louisiana and his mother is a retired teacher.

Charles graduated from Catholic High School in Baton Rouge in 1985. In 1991, he graduated from Louisiana State University in Shreveport in 1991 with a Bachelor of Arts degree in history. During his undergraduate career, he enlisted in a combat engineer battalion in the Louisiana National Guard. In 1992, he completed the LSU Summer Drafting Institute and began a career in the field of drafting and design working for mechanical engineering and architectural firms in the Baton Rouge area designing houses and mechanical seal assemblies.

In 1997, he was offered the opportunity to begin a teaching career in higher education by taking a position teaching drafting and design technology at Louisiana Technical College in Baton Rouge, Louisiana, and began working towards a Master's of Science degree in Human Resource Education and Workforce Development. In 2001, he was offered the position of program director of drafting and design at Nunez Community College in Chalmette, Louisiana. He was promoted to the rank of assistant professor and earned national American Design Drafting Association (ADDA) certification. He taught there until 2005 when Hurricane Katrina caused Charles to leave Chalmette and return to Baton Rouge. In 2006, he was offered an instructor position in the construction management program at Louisiana State University and completed a Master's of Science degree in Human Resource Education and Workforce Development in 2007, and immediately began working towards his doctoral degree.

During his career at LSU, Charles was named a service-learning faculty scholar in 2008. In 2009, he received OSHA authorization as a safety outreach trainer and became a Certified

Occupational Safety Specialist (COSS). He was certified as a COSS Instructor in 2010. In 2011, he received a Tiger Athletic Foundation Michael R. Mangham College of Engineering Memorial Teaching Award. In 2011, he began serving as a visiting team member for the national accreditation of construction education programs in higher education with the American Council for Construction Education (ACCE). He currently serves as a vice-chair of the Midsouth Education Center Advisory Board (MECAB) to the OSHA's newest region VI Outreach Training Institute (OTI) and was recently appointed as the LSU CM OTI Coordinator.