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Attitudes and Behaviors of Union Construction Workers and Personal Fall Arrest Systems

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There are several bodies of literature that focus on safety habits of construction workers and fall arrest systems. A constant evolution in the field of construction shows new systems being put in place with a focus on innovation of safety equipment design and use-ability. However, companies still have seen resistance with trade contractors in the field when it comes to using equipment effectively. The complexity of the issue has been addressed many times by safety workers, but little information available today has come from the worker's perspective. A critical part of knowing the "whys" of the problem may contribute to reducing worker-related accidents and improving safety standards. With this in mind, there is a clear benefit from understanding the viewpoints and attitudes of the workers using fall arrest equipment. In the body of research available today safety issues have become a popular area of study in construction. Despite improvements over the last several years, the attitudes and opinions of workers need better understanding. This study intends to shed light on the perspective of union ironworkers on personal fall arrest systems being used in the field today.

Keywords: safety, falls, behavior, ironworkers, steel construction

Introduction

The purpose of this study will be to examine the theory of negative design aspects affecting the attitudes of union ironworkers on personal fall arrest systems currently being used. This thesis in safety design is directly correlated with the negative attitudes towards using safety equipment, controlling for design of safety equipment used in the field.

The independent variable will be defined as attitudes towards personal fall arrest systems as reflected from survey data from union ironworkers in the state of California. This group was chosen for the standards of safety training and certification implemented with their apprenticeship programs. The dependent variable will be defined as safety incidences taken from union worksites in these areas. The control variable will be design, and intervening variable of convenience of the personal fall arrest system relates to the change of the independent variable to the dependent variable.

To better understand attitudes towards safety equipment, a survey was created asking union workers several questions why they may not use personal fall arrest systems. Is it convenience, lack of availability, or trusting one's judgement that stops a worker from using a system that would potentially save their life? What are other contributing factors, and how do they translate to unsafe work habits? With these questions answered companies could hope to better understand their workers, safety design systems, and safety programs that prevent fall-related accidents on the jobsite. This data may be able to influence future design of safety equipment and procedure in order to control work-related incidences.

Literature Review

Historically in the field of construction, falls, trips, and slips have been a leading cause of worker related fatalities in the field. The Bureau of Labor Statistics identifies that out of 849 fatal occupational injuries within the construction field in 2016, 384 were fall-related incidents. (U.S. Bureau of Labor Statistics, 2016) That number, up from 364 in

2015 (U.S. Bureau of Labor Statistics, 2015) and 359 in 2014 (U.S. Bureau of Labor Statistics, 2014) shows a stagnate trend in construction safety programs for efficiency in worker fall-related accidents. One component of the problem is a lack of literature towards the attitudes of working construction professionals. Previous examinations focused on, "number of safety inspections, dollars spent on safety program, and percentage of time devoted to safety issues" (Jaselskis, Anderson, & Russell, 1996) with little attention paid to the workers themselves. This study's focus is not defined on safety management, but rather on worker perspective to understand disconnect between policy and execution. The reason for these exclusions is to bring the focus on the attitudes of workers. Evaluations on behavioral-based safety, "focuses on what people do, analyzes why they do it, and then applies a research-supported intervention strategy to improve what people do." (Geller, 2001) With the review of the literature, the hope is to examine what currently exists as the focus of safety and to re-define and clarify perspective relating to the incidents occurring in the field that seem unresolvable.

The criterion for the related review was to research articles, journals, and scholarly contributions relating to fall-arrest systems, statistics, and psychology of workers in the field of construction. If systems are easy to use and the worker is willing, our hypothesis relies on a contributing attitude reducing the amount of "not tied off" situations in safety negligence. A study by Austin, Kessler, Riccobono, & Bailey, (1996) focused on positive reinforcement through, tangible reinforcers and verbal feedback, but neglected to consider environmental de-motivators in the effectiveness of their programs. Abraham and Irizary (2006) analyzed risk perception of Ironworkers and concluded "In many instances, the use of safety equipment is reduced when the worker perceives that performance will be adversely affected." The significance of understanding this outlook provides the reader with a first-person view of the usability of safety equipment.

Williams (2008) points out, "the first step in increasing employee involvement for safety is hiring conscientious employees who care about safety." "Organizations with elite employees normally offer competitive salaries and often use an array of selection tools, such as personality tests, biodata instruments, assessment center exercises, vocation tests (when appropriate), structured interviews and cognitive ability tests" Schmidt & Hunter, (2004) and Spector (1996). While this point is accurate, it lacks a connection between attitude and actuality. Aksorn and Hadikusumo (2008) aimed, "at identifying and quantitatively prioritizing the factors contributing to the successful implementation of construction safety programs based upon the respondents' perceptions and grouping the factors into lesser dimensions by using factor analysis." This approach monitored critical success factors (CSFs) originally made popular by Rockart (1979) as direct influences on the effectiveness of a safety program. Rockart (1979) described these as "areas in which results, if they are satisfactory, will ensure success within and of the organization." Personal motivation was listed as a factor, but the research neglected the correlation between motivations and the factors that negatively affecting action.

Method

The key to this research is getting first-hand information on what aspects of personal fall arrest systems create issues. Exploratory questions in this area will look for identifying correlations between the worker experience and non-compliance. Research design for the survey encompassed understanding attitudes through a questionnaire distributed to union ironworkers around the state of California. With the audience polled, the best option for getting results seemed to be physically handing out our survey, explaining our purpose, and collecting after completion. Some notable limitations were exposed through this process. For example, there is potential that people would feel their opinions will negatively impact their job status with the union. It was important to remind respondents their participation is completely anonymous and the publication would mask the data identifiers to any traceable extent.

Data Collection Procedures and Analysis

The goal for this data is to influence the design of future equipment and help engineers and safety managers understand the viewpoints of construction workers. Data was collected through a short survey revolving around situations in which respondents chose not to use safety equipment. The survey was developed by researchers at Purdue University as well as self-identified issues by union ironworkers. After the questions were chosen, the survey was reviewed by the Institutional Review Board at Purdue University for human research protection protocol and approved for distribution. The survey asked several questions regarding ease of use, necessity of using equipment, convenience, and effectiveness of system to determine underlying factors that discourage proper use of equipment.

For an optimal response rate, the surveys were kept to thirteen questions and distributed in-person. This method of distribution yielded a high response rate, but limited the research to a smaller geographical area. Union members were given as long as they needed to fill out the survey which were then collected anonymously in envelops. The survey was also presented as a tool for respondents to voice their opinions. This is important in understanding why the response rate was so high. Respondents were willing if not eager to give voice their opinions knowing the results of the survey could have an effect on how equipment was designed, or how policies are implemented in safety programs. The survey achieved a response rate of ninety-two percent, with forty-six out of fifty surveys being answered and returned.

Research Methodology

The data was processed and categorized to observe what trends exist and identify universal thoughts and opinions union ironworkers have about the systems in use today. The study elected to survey unionized workers due to their formal apprenticeship training program which familiarized and certified them with no less than an OSHA-10 hour safety certification. Aside from gathering opinions, the survey also compared the responses to the survey questions against the number of years working in the field. The importance of this benchmark is workers with a longer history in the profession may have a bias to using new equipment or learning new policies. Other craftsmen who are newly trained in their profession may be more apt to follow safety rules that they have newly learned.

Results

Survey data was categorized by length of time in the trade versus the responses to the questions – ranging from "Strongly Disagree" to "Strongly Agree" on a seven-point Likert scale. Ranges were selected of less than ten years, ten to nineteen years, twenty to twenty-nine years, and thirty years or more to show the differences between generations. Workers with less than ten years' experience make up fifteen of the forty-six respondent pool (thirty-three percent). In the ten to nineteen years' experience and twenty to twenty-nine years' experience range, both categories represented eleven subjects each (24%) . Finally, our thirty years or more' experience range responded with nine subjects (20%), rounding out the data to what could be considered an accurate representation of the demographic.

The survey was broken into three sections. Section One of the survey proposed eleven questions which participants were able to agree or disagree on a ranged scale on reasons why they would not use fall protection in a given scenario. The goal of these questions was to identify reasons for not using safety equipment on the jobsite. Section Two was a short answer segment in which respondents were allowed to fill in their opinions on anything the survey might not have covered in section one. Section Three simply asked how long they had been in their construction career with the intent of identifying generational differences. This section had an equal variance across all age groups.

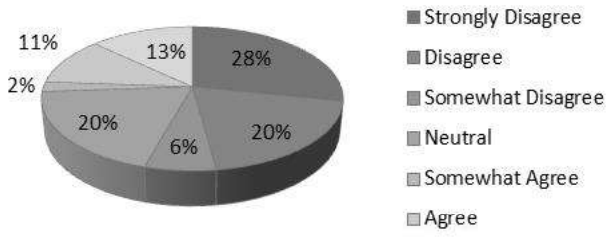

Figure 1. "Inadequate or lack of rules for my situation"

Our survey starts off with, "If a scenario exists where I do not tie off, it is because:" followed by a range of reasons in which the audience could agree or disagree. Response 1 states, "Inadequate or lack of rules for my situation." The total for responses showed that twenty-eight percent (13 respondents) strongly disagreed, twenty percent (9 respondents) disagreed, and seven percent (3 respondents) slightly disagreed with this statement. Twenty percent (9

respondents) of participants were neutral, most notably twenty-seven percent (12 respondents) in the less than ten years' experience category and twenty-two percent (10 respondents) with thirty years or more. Two percent (1 respondent) of the candidates polled slightly agreed with this statement, while eleven percent (5 respondents) and thirteen percent of participants (6 respondents) agreed or strongly agreed with this statement (respectively).

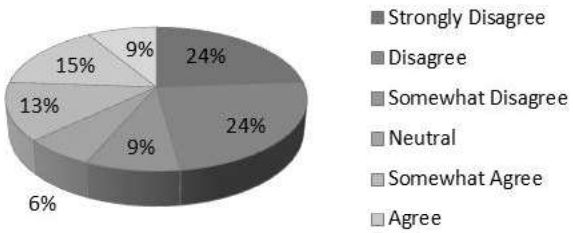

Figure 2. "Expectations and limits on tie off procedures are not clearly defined"

Question two stated, "Expectations or limits to tie-off procedure are not clearly defined." Forty-seven percent of survey takers (22 respondents) either disagreed or strongly disagreed with this statement. Another nine percent (4 respondents) somewhat disagreed with the statement. Notably, thirteen percent (6 respondents) somewhat agreed and another fifteen percent (7 respondents) agreed with this statement.

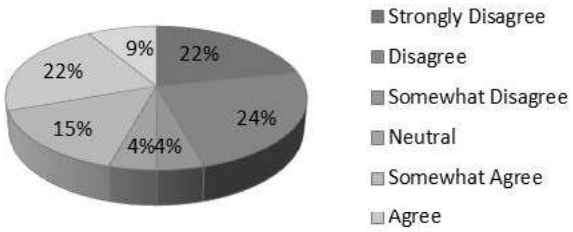

Figure 3. "Proper safety equipment is not available"

Question three read, "Proper safety equipment is not available." The responses between agreement and disagreement were almost equal. Twenty-two percent (10 respondents) strongly disagreed with this statement and another twenty-four percent (11 respondents) disagreed. Fifteen percent (7 respondents) somewhat agreed and another twenty-two percent (10 respondents) agreed with the statement. This could be for a variety of reasons – difference in safety program budget or increasingly complex architecture may lead to ambiguous safety solutions for companies.

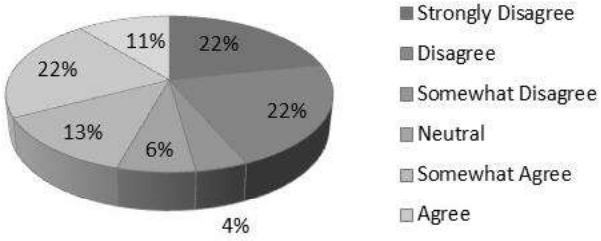

Figure 4. "Lacking enough safety equipment to do the job properly"

Question four in the survey similarly asked if the job was, "Lacking enough safety equipment to do the job properly." Many respondents had a similar answer to question three, with twenty-two percent in both strongly disagree, disagree, and agree, (10 respondents each) and thirteen percent (6 respondents) somewhat agreeing.

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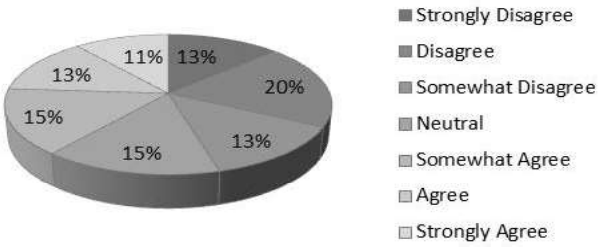

Figure 5. "Lack of safety personnel to police company policies"

Question five asked if the reason a worker would not use fall protection was due to a "lack of safety personnel to police company policies." Answers fell into the ten percent to twenty percent range with the low being eleven percent strongly agreeing (5 respondents) and twenty percent (9 respondents) disagreeing. This question shows a pretty even distribution of answers across ages and responses.

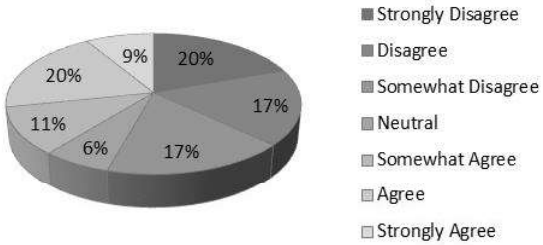

Figure 6. "Safety equipment was impossible to install properly"

"Safety equipment was impossible to install properly" marked question number six. Again, data ranged fairly even with twenty percent strongly (9 respondents) disagreeing, and thirty-five percent (16 respondents answering disagree and somewhat disagree. Eleven percent (5 respondents) somewhat agreed with the statement, while twenty percent (9 respondents) agreed, projecting that not all job sites have easy to use safety features.

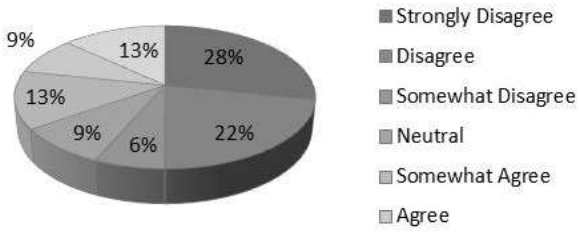

Figure 7. "Lack of training, skill, or knowledge to do the job safely"

Question seven asked if non-compliance was due to a, "lack of training, skill, or knowledge to do the job properly." Twenty eight percent of participants (13 respondents) strongly disagreed to this, with another twenty-two percent (12 respondents) disagreeing. Surprisingly, thirteen percent (6 respondents) somewhat agreed to this statement. Nine percent (4 respondents) agreed as well, and thirteen percent of total participants (6 respondents) strongly agreed. This outcome hints that there exists a gap in the knowledge base for workers in the field – either with OSHA standards, company policies, or both. With participants less than ten years, agreement to the statement was most apparent.

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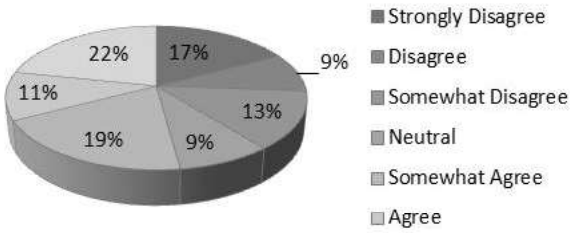

Figure 8. "It takes too much time to follow procedures set by OSHA/Company"

"It takes too much time to follow procedures set by OSHA/company" was presented as question number eight. This question marked the first time in the survey where participants agreed more than disagreed with the statement. Twenty percent (9 respondents), eleven percent (5 respondents) and twenty-two percent (10 respondents) either somewhat agreed, agreed, or strongly disagreed with the question. Seventeen percent (8 respondents) strongly disagreed this was the case. Nine percent (4 respondents) disagreed, and thirteen percent (6 respondents) somewhat disagreed with the results. An interesting trend in the data suggested less experienced workers agreed with the question and members in the "thirty years or more" category (9 of 46 of participants) very much disagreed. This may indicate a correlation between experience of the worker, and how much more willing they are to take the time to follow procedure or use time-consuming safety equipment.

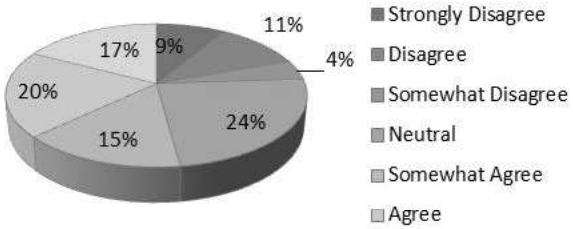

Figure 9. "I've safely done the job in the past without tying off"

Question number nine provoked a majority agreement across almost all experience levels. "I've safely done the job in the past without tying off" called into question a sense of self-trust with the ironworkers. Fifteen percent of all workers (6 respondents) somewhat agreed with the statement, with another twenty percent (9 respondents) agreeing and seventeen percent (8 respondents) strongly agreeing. The most surprising trend was in the thirty+ year experience category. Not a single survey taker in this category strongly disagreed, disagreed, or even somewhat disagreed with the question… with all of their responses being neutral or in agreement.

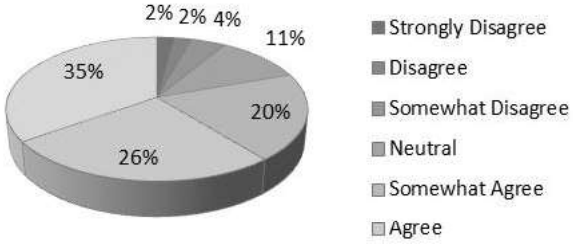

Figure 10. "Tie off equipment limits my movement"

In question ten, we saw the most agreement between all categories of experience levels. With the statement "tie-off equipment limits my movement, less than nine percent (4 out of 46 respondents) disagreed in any way with the idea. The highest response to the question was strongly agree at thirty-five percent (16 respondents), seconded by agree at twenty-six percent (12 respondents).

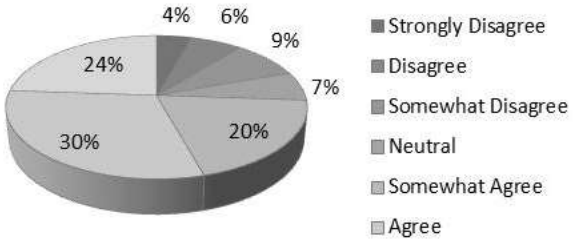

Figure 11. "Tie-off equipment pulls too much or too often on my harness D-ring"

Question number eleven noted a similar trend, with thirty percent of total participants (14 respondents) agreeing that "Tie-off equipment pulls too much or too often on a harness D-ring". This question's responses had a very similar trend across all experience levels. Here's the numbers: [Strongly Disagree: 4.35%, Disagree: 6.52%, Somewhat Disagree: 8.70%, Neutral: 6.52%, Somewhat Agree: 19.57%, Agree: 30.43%, Strongly Agree: 23.91%.] The percentage total in the agree fields is extremely relevant to safety compliant behavior.

Section Two (Question number) twelve simply asked, "Other, please explain." The intent of this question was not to be measured, but to give respondents a chance to explain in their own words the difficulties they see with following safety guidelines. Responses to the question varied widely, including attitudes, complications, and even some agreement with safety policies. Many survey takers felt time played a major factor in following safety procedures. Others pointed to the idea that equipment is fatiguing, encumbering, or add to the likelihood a fall could occur. While this was by far the majority, some respondents have had positive experiences with safety. One respondent simply wrote, "Tying off saved my life."

One of the biggest trends in the data was professionals of all experience levels trusting themselves not to fall on the job. Not all work situations are the same, but they all require the same safety solution. A worker may be less likely to fall off a long, slightly sloping roof than a structural steel I-beam, but both may require the same safety guidelines. This might be discouraging to workers to take such extreme 'one-size-fits-all' precautions to their safety plan. Another data trend showed less experienced ironworkers are not always clear on the set rules for safety. While more experienced workers possess this knowledge, they are less likely to use fall protection due to comfort or trust in their abilities. In crews compromised of various experience levels, this may lead to the less experienced individuals following suit and developing unsafe habits.

An overall theme was personal fall arrest equipment made work harder to do. This could be from being tripped up by one's own safety lanyard or being uncomfortable with the adjustment of a personal body harness. Weight of equipment or limited mobility might also play a factor. Sometimes lanyards are too short to reach the work area, or retractable brakes engage while the worker is walking too quickly.

Conclusion

In summary, workers of all ages, backgrounds, and experiences have various justifications to ignore safety guidelines. The purpose of this survey was not to illuminate the issue that guidelines are not followed, but to give honest, transparent feedback on why it happens. With experienced opinions, safety elements can evolve to mitigate issues seen in the field today. Perhaps the answer is to change OSHA 1926 Subpart R App G to mandate safety personnel are present for erection sequences to observe safety practices are in use. Safety equipment designers could also build equipment more suitable for mobility, lighter weight, or comfortable for the average worker. Safety personnel may be able to get more involved with their site knowing where potential risks of non-compliance will exist – or find ways to eliminate dangers before risk exposure. Everyone has a responsibility to create safe working conditions in construction. Those conditions go beyond day-to-day operations, and need to always focus on practical application.

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