

Analysis of Safety Programs of 16 Large Construction Companies

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Abstract: The most recent data from the Bureau of Labor Statistics shows that as the cost of construction projects increase, the incidence rates of falls decrease. This indicates that large construction companies, who typically have large construction projects, have lower incidence rates of falls from elevations than small construction companies. One possibility is that the greater financial resources of large construction companies allow them to develop more comprehensive safety programs. The purpose of the present research was to determine whether there were common elements of the safety programs of large construction companies that could account for the lower incidences of falls from elevations. Twenty-five construction companies with average construction contracts estimated at one million dollars or greater were selected from a list of companies that sponsor internships through the Construction Engineering Management School at Purdue University. The safety directors of sixteen of those companies volunteered to answer a standardized questionnaire during a telephone interview with Purdue University researchers in the School of Health Sciences. The questionnaire consisted of twenty questions that focused on information about company safety performance, safety program structure, safety program implementation procedures, and the motivation and history behind the development of the safety program. The results indicated that the primary element that contributed to reducing falls from elevations was the commitment of upper management to support and promote safety as a top priority. The development of a “safety culture” was the cornerstone of effective safety programs. The second most important element was training line supervisors in the area of supervision. The safety directors reported that a shortcoming of most line supervisors was that they lacked the necessary supervisory skills to effectively promote safety. The third most important

element was regular onsite training from the construction superintendent. Task specific training was seen as the most important part of the onsite training.

Introduction and Literature Review

The construction industry is consistently responsible for the largest number of fatal work injuries of any industry in the United States. Of those fatal injuries, falls from elevations are the leading cause (Hinze et al., 2002). In 2000, 734 deaths due to falls were recorded (Bureau of Labor Statistics, 2001). That number is surprising when you consider the regulatory intervention imposed on the industry and the advancements in fall protection devices made over the last several years. The key question that needs to be addressed is why do these fatalities continue to occur at such a high rate.

Several factors may need to be considered as probable causes. Those factors can be broken down into three major categories. The first category has to do with possible regulatory inadequacies and whether changes in government regulation can effectively reduce the numbers of falls. The second considers the responsibilities of the construction companies and the steps that they can take to reduce the number of falls. The third category involves the workers themselves and how their actions can contribute to the reduction of falls.

Derr et al. (2001) examined how the implementation of the February 1995 29 CFR Part 1926 Subpart M OSHA fall protection regulations affected fatal fall rates. Looking at the period of 1990 through 1999, they found a significant reduction in the number of fatal falls. However, they were unable to show that the reduction in the number of fatal

falls was due to the new regulation. In part, this may have been a result of the small number of events, which diminished the statistical power of the study. Another possibility is that regulations might not have the ability to effect changes standing by themselves. Nelson et al. (1997) looked into the combination of new regulations coupled with an extensive education campaign and found results inconsistent with Derr et al. (2001) in that there was not a significant reduction of falls. It should not be construed from these results that regulation and education have no value. On the contrary, they are the foundation on which safety is built. Other factors need to be coupled with them in order to insure their effectiveness.

Enforcement is a complementary component to regulation and education that has been shown to reduce the incidence of construction falls. Nelson et al. (1997) showed from their data that construction companies that received citations after an OSHA inspection experienced a significant decline in incidence rates of falls. One problem with government enforcement is that it needs to be comprehensive in order to be effective. The sheer number of construction companies in the United States that need to be overseen makes it nearly impossible, from an economic standpoint, for OSHA to police the entire construction industry. As long as a company has a reasonable chance of being overlooked by OSHA, the benefit of being noncompliant may outweigh the risk of citation.

A contrast to government regulation is worker self-regulation. Workers should have a strong interest in safety since they are the ones most adversely affected by a construction fall. Abdelhamid and Everett (2000) cite three primary reasons for occupational accidents. They are: 1) failing to identify an unsafe condition that existed

before an activity was started or that developed after an activity was started, 2) deciding to proceed with a work activity after the worker identifies an existing unsafe condition, and 3) deciding to act unsafe regardless of initial conditions of the work environment. All three reasons put the primary responsibility for safety on the worker because the worker is the person nearest and most likely to detect an unsafe situation. In the event that the worker has not been properly trained, many unsafe situations may go unnoticed. In that case, the line supervisor and ultimately, the employer also share in the burden of responsibility; however, the worker still plays the key role in the deciding what to do once an unsafe condition has been identified.

The question now becomes why would a worker wish to continue work knowing that an unsafe condition exists. The answer may lie in a workers' own assessment of risk. Ellis and Warner (1999) concluded that successful experience at heights distorts a workers perception of risk. As workers gain experience and confidence working at heights, they tend to develop a false sense of security. Their ability to self assess risk is diminished by their own self-confidence. Even if they have been unfortunate enough to know someone who has suffered a fatal fall, they can continue to justify their own safety through their own self-confidence. Holmes et al. (1999) identified another method by which workers weigh the costs and benefits of potentially unsafe situations. If the necessary safety measure is perceived to present too great a level of effort, it will be ignored. The key problem with this perception is that the worker often misidentifies the true cost being weighed. The perception may be that the cost is the extra work effort required to implement the safety procedure. In reality, the true cost is death or permanent disability because of a fall. Johnson et al. (1998) came to the same conclusion but further

showed that workers would forego personal safety if they felt that speed and comfort were more important.

Lingard and Holmes (2001) concluded that more than half of construction workers believe that their safety is the responsibility of the company or trade union. This responsibility is perceived to be in the form of better education and training. Cattledge et al. (1997) discovered that all of the claimants in their study received fall protection training but hardly any of them used fall protection devices indicating that training and education alone cannot be expected to make an impact on reducing falls from elevations. The missing component is that workers may need to have some sort of outside motivating factor that will promote the discipline necessary to keep them safe. Government regulation and enforcement have been shown to be somewhat ineffective in this regard so construction companies are left with the task of reducing falls from elevations.

Construction companies are really the most logical choice. They have the ability and opportunity to effectively train, equip, and communicate with workers. They also have the authority to promote and enforce compliance with safety procedures. This can best be demonstrated by examination of the Kuwaiti construction industry where there is little government regulation and little safety training outside of the construction companies. Kartam and Bouz (1998) evaluated injury and fatality data from the Kuwaiti construction industry and found that competent construction managers and pressure from upper management played a key role in reducing construction accidents. In the United States, another interesting trend can be shown that relates the cost of construction projects to the number of falls.

Hinze et al. (2002) have shown that as the cost of construction projects increase, the number of falls decrease. It stands to reason that larger construction companies tend to get large construction projects. In essence, large construction companies have lower incidence rates of falls from elevations than small construction companies. There are several factors that may be responsible for this trend. One possible reason is that there are greater financial resources available to large construction companies, a significant portion of which can be used for fall prevention. Another contributing factor might be increased scrutiny of large construction companies by OSHA. In contrast there are also reasons that large construction companies should have higher incidence rates of falls such as greater difficulty in managing larger groups of workers. The purpose of this study was to determine what factors were responsible for the lower incidence rates of falls experienced by large construction companies.

Methods

Twenty-five construction companies whose typical construction contracts were estimated to be in excess of \$1,000,000 were selected from a list of companies that sponsor internships through the Construction Engineering Management School at Purdue University. Letters were sent to the safety directors of each company explaining the importance of the research and indicating that they should expect a follow-up telephone call at which time a telephone interview would be conducted (an example of the letter is shown in Appendix A). A copy of the standardized questionnaire to be used during the telephone interview was enclosed with the letter to allow the safety directors time to

gather information that was not readily available (a copy of the standardized questionnaire is shown in Appendix B).

Purdue University researchers in the School of Health Sciences conducted the telephone interviews. The safety directors were called during normal business hours. In the event that the safety director was not available, a message was left indicating the reason for the call and providing a telephone number with which to return the call. Calls were made on a daily basis until either all of the safety directors were interviewed or the predetermined time of six weeks allotted to conduct the interviews was reached. The safety directors of sixteen companies volunteered to answer the standardized questionnaire during the telephone interview.

The questionnaire consisted of twenty questions. Five of the questions were open-ended and designed to solicit opinions with minimal interference from the interviewer or prompting from the questionnaire. The remaining questions were related to statistical information. The information collected during the interviews was entered on an Excel[®] spreadsheet.

Numerical answers were analyzed by calculating the mean and median. The qualitative answers were evaluated two ways. First, the response was assigned a number based on its order of importance to each company. For example, when the question requested the top five answers ranked from most important to least, the most important answer was assigned a one, the second most important answer was assigned a two, and so on. Second, the number of times a particular response was recorded by all of the companies was noted. The ranking of the response relative to all other responses to a particular question was based on the evaluation of both the number of times the response

was recorded and the numerical rank it received from the company who recorded it. A high ranking would indicate that a particular response received both high rankings from the companies and was recorded as a response by several companies.

Results

A summary of the questionnaire results is shown in Appendix C and the data from the questionnaires is shown in Appendix D. The companies that participated in the interviews were large in terms of their construction contract size. The median contract amount was \$9,000,000. According to Hinze et al. (2002), companies involved in construction projects of that magnitude are expected to have lower incidence rates of falls than companies involved with smaller projects. The median Experience Modification Ratio (EMR) of the companies interviewed was 0.73, which lends credibility to that study. The EMR is a tool used by insurance companies to determine premiums for workers' compensation insurance. It is the ratio of actual losses due to work-related injuries and illnesses over the expected losses. An EMR of less than one indicates that a company is suffering fewer losses than other companies in the same industry (Safety Management Group, 2002). Additional evidence of safety performance is seen in the number of years the construction companies had been practicing their current safety program. The median time was 11 years.

All of the construction companies indicated that they were affiliated with external safety organizations. The opportunity to network with other companies was listed as the primary benefit of membership. The network forum allows the sharing of information

gained through experience and provides an expert panel to explore new ideas. Rather than a beneficiary role, the construction companies that were interviewed acted mostly in an advisory capacity to safety organizations, although, some of the companies benefited from training information provided through safety organizations.

Employee turnover is a concern because of the potential inexperience of new hires. The median rate of employee turnover was 145 per year and the median duration of employment was 18 months. The turnover rate is nearly half the number of employees that work at elevations over 6 feet. The median number of employees that work over 6 feet is 320 at any given time. In spite of the high employee turnover, fall injuries were relatively scarce.

The median number of injuries due to falls in the past year was two and the median number for the past five years was five. Only one company of the sixteen interviewed reported a fatality in the past year and no other fatalities were reported in the past five years. The exception was one contractor that experienced no injuries or fatalities themselves but had subcontractors who had experienced two fatalities in the past year and seven fatalities in the past five years. The lack of compliance to safety procedures by subcontractors was a common complaint.

Safety training is likely to be one of the elements responsible for such low numbers of injuries and fatalities. The median number of employees trained per year was 500. All but one company engages in refresher training on a regular basis so most existing employees can expect to receive refresher training every 12 months. The companies were split on whether they thought the employee turnover rate affected how their safety training programs were implemented. Companies who perceived that turnover had no

effect may have been biased due to the existing level of intensity of the training program brought on by the anticipation of high turnover.

When considering training or safety equipment, cost can be an important issue. The construction companies interviewed in this study were asked to estimate their yearly expenditures for training and safety equipment per worker. The median of the estimated cost per year for training was \$800 and the median of the estimated cost per year for safety equipment was \$250. These numbers are minimal in comparison to the cost of injuries and fatalities from falls.

The construction companies were asked to list the five key factors that influenced them to implement their current safety program. Even though this was an opinion-based question, there were not a wide variety of answers. The fourth and fifth most common answers tied for the number of responses. They were concern for the reputation of the company and compliance with OSHA regulations. The third most common answer was insurance company pressure and a high EMR. The first and second most common answers tied for the number of responses. They were concern for the well being of the employees and maintaining profitability. A common theme found in these responses was money. The safety directors felt that a negative impact on a company's bottom line was critical to the development of a proactive attitude toward safety.

The construction companies were asked to list what they considered to be the most important elements of their safety training programs with respect to making them successful at reducing falls from elevations. Since this was an opinion-based question, there were a wide variety of answers, however, there were a few that were mentioned consistently.

Two answers tied for the fifth most common element. They were daily crew meetings where supervisors go over a daily work plan and job specific safety training for those potentially exposed to falls. The fourth most common element was the promotion of safety awareness and accountability as a fundamental value. In essence, the development of a safety culture where safety was a habit rather than a chore was expressed. The third most common element was regular on-site training from the construction site superintendent. The second most common element was the training of line supervisors in the area of supervision. The safety directors felt that supervisors were too often chosen for their adeptness at their particular trade rather than their ability to exercise supervisory skills over workers. The most commonly mentioned element was unique in that half of the companies mentioned it as the most important element of their safety training program. It was upper management commitment to support and promote safety as a top priority. The safety directors felt that financial support for the safety program and the presence of upper management at key meetings was how this was best demonstrated. By making safety the first item on the agenda at management meetings, upper management displayed its commitment to safety to lower level managers. Periodically visiting jobsites and taking part in some onsite training was a way of displaying commitment to safety to line supervisors and workers.

Discussion

The results can be summed with three terms: motivation, training, and money. The primary reason for the success of large construction companies at reducing construction

falls is that upper management has made a commitment to be safe. In making that commitment, they create momentum that motivates middle managers, construction supervisors, and finally, trade workers to be safe. Without the motivation from the top, there is little chance that a successful safety program will develop and almost no chance that a safety culture will develop. As was shown by prior research (Holmes et al. (1999) and Johnson et al. (1998)), workers will perform their tasks in a manner that allows them to experience the least amount of inconvenience. Unfortunately, safety is often seen as an inconvenience.

Appropriate training must follow effective motivation. Training is the method by which motivation is focused. The most important part of that training is training line supervisors in the area of supervision. Line supervisors are the most critical link in the safety chain because of their proximity to potentially dangerous situations. To effectively promote safety, line supervisors need to understand how to effectively communicate and motivate workers so that they will comply with safety procedures. The line supervisors also need to have a good understanding of regulations concerning safety. Since line supervisors are usually regular employees, provisions need to be made to insure that they receive training on a regular basis.

Worker training is next in importance. High turnover rates put the company in a position where new employees are constantly coming onto jobsites. In order to insure that workers receive the proper training, special training for new hires, regular onsite training, and daily crew meetings where daily work plans are discussed are crucial to reducing construction falls. This type of regular training allows the supervisor to effectively dictate the expectations of the company in the area of safety.

The factor that induces the motivation that initiates the training is money. Large construction companies discovered several years ago that it was profitable to be safe. Relatively small expenditures up front as shown by the costs of training and safety equipment can prevent large costs incurred after an accident. Lost time, loss of reputation, increased insurance costs, loss of competitiveness, and potential litigation are strong reasons to invest in safety.

The primary research question was to determine what elements of the safety programs of large construction companies caused them to have lower incidence rates of falls than small construction companies. In this research we have compiled several elements common to large construction companies that appear to contribute to the success of their safety programs. The next research step should be to determine whether a lack of those common elements is responsible for the higher incidence rates of falls in small construction companies. If that hypothesis is determined to be true, then a method of incorporating those elements into the safety programs of small construction companies must be found.

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