

# **Factors Affecting Safety on Construction Projects**

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## **Abstract**

The construction industry is concurrently recognized as a major economic force and one of the most hazardous industries. Accidents not only result in considerable pain and suffering but marginalize productivity, quality, time, and negatively affect the environment and consequently add to the cost of construction. Unfortunately, safety and health (S&H) and the environment are often neglected on construction sites and rarely managed. Safety and health is often discussed in management meetings as a priority, while in reality safety and health takes a low priority to budget and time discussions. S&H is being identified as a parameter that should be used along with the traditional parameters: cost, quality and time, to measure the success of projects. An effective safety program may prevent many accidents on construction sites. The reasons for considering safety and health are: human factor, legislation and financial issues. Inadequate safety and health has a negative impact on both the construction and built environments resulting in fatalities, injuries and diseases. The aim of this paper is to discuss the factors influencing safety on construction projects in Palestine. The study concludes that the benefits of S&H improvements include: reduced accident costs, increased productivity, improved human relations and enhanced firms' image. S&H should be considered as a prerequisite for productivity and quality. It is recommended that management should give full safety training to all employees; good training of site managers and operatives can lead to improved safety on site.

## **Keywords**

Safety, health, cost, environment, construction.

## **1 Introduction**

Accidents at work occur either due to lack of knowledge or training, a lack of supervision or a lack of means to carry out the task safely, or due to an error of judgment and carelessness. In addition to these factors, the short term and transitory nature of the construction industry, the lack of controlled working environment and the

complexity and diversity of the size of construction firms, all have an effect on construction projects' safety. In construction and building projects, unsafe behavior is considered to be the most significant factor in the cause of site accidents and therefore provides evidence of a poor safety culture.

Traditionally, cost, quality and time have constituted the parameters within which projects have been procured and managed. However, cost quality and time can be indirectly compromised by lack of safety and health, or directly as a result of accidents. There are three reasons for considering safety and health in construction industry, these are: human factor, legislation and financial issues. Environmental concerns are often interrelated with construction health and safety issues (Coble and Kibert, 1994). Unhealthy and unsafe practices, inter alia, concrete run-off or spillage, fires, oil spillage, waste and uncontrolled sanitation impact negatively on the environment. Generation of dust, hazardous materials and the release of non-biodegradable material into the environment contribute to the impact (Smallwood, 1998).

Health and safety is vitally important, not just cost, quality and time because if a worker has been permanently disabled or killed, then a project is not a success (Hinze, 1997). Hinze maintains outstanding projects are: either a head or on schedule, within budget and reflect exemplary S&H. Total quality includes health and safety and all requirements are achievable concurrently. Levitt and Samelson (1995) stated that quality includes productivity and health and safety. The objective of this paper is to study the factors affecting safety and health on construction projects.

## **2 The cost of accidents**

The cost of accidents can be categorized as being either direct or indirect costs. The direct costs of injuries are those that are most visible and are typically referred to as insurable costs. Direct costs may include: medical cost, premiums for compensation benefits, liability, and property losses. The direct costs can generally be quantified with reasonable accuracy. Indirect costs of accidents are more difficult to measure. Indirect costs are essentially all non-insurable costs incurred as a result of an injury. The indirect costs are those which are hidden and for which no historical record is kept.

Indirect costs include: reduced productivity for both the returned workers and the crew or workforce, clean-up costs, replacement costs, stand-by costs, cost of overtime, administrative costs, replacement worker orientation, costs resulting from delays, supervision costs, costs related to rescheduling, transportation, and wages paid while the injured is idle (Hinze, 1994; Smallwood, 1998). Heinrich (1959) identified indirect costs associated with accidents as:

- Cost of lost time of injured employee.
- Cost of work stoppage of other employees.
- Lost supervisory time.
- Cost of time spent on the case by first-aid attendant.
- Cost of damage to the machinery tools, or other property.

Although Heinrich study was related to manufacturing, it describes many of the indirect costs of a construction project accident. Indirect costs are generally several times larger than the direct costs associated with an accident. Studies have shown that

the ratio of indirect costs to the direct costs can range from 4 to 1 up to 7 to 1 (Robinson, 1979). It is possible that these ratios are based on incomplete data and therefore the economic impact is underestimated.

Heinrich conducted a study of a large number of injuries and concluded that the indirect costs of injuries were approximately four times the direct costs (Heinrich, 1959). The safety profession appears to have embraced the ratio of four to one, which Heinrich postulated. However, this ratio of indirect to direct costs is not universally accepted in the construction industry. Another study indicated that the ratio of indirect to direct costs for medical-case injuries is 4 to 2 and for restricted activity or lost-workday injuries is 20 to 3 (Hinze and Appelgate, 1992). These ratios are extremely variable with injury severity being a primary influence on their magnitude.

### **3 Safety management**

Safety is an economic as well as humanitarian concern that requires proper management control. Benefits of safety and health may include: less injuries, less property damage, less down time, improvement in morale, enhance industrial relations, increased productivity, reduced cost and enhanced quality (Promfret, 1997). Other benefits include: less compensation insurance, fewer hidden costs, improved supervisor morale, increased efficiency, and improved marketability (Levitt and Samelson, 1995).

Most accidents on construction sites are preventable through implementation of an effective safety program. Unsafe conditions and accidents are usually a sign that something is wrong in the management system. Safety and health must be managed in the same manner that other aspects of a company are managed (Peterson, 1979). Although an effective safety program can prevent or reduce injuries, not all contracting organizations implement safety programs.

Hinze and Parker (1978) stated that good safety performance and high productivity are compatible and that safety should not be sacrificed in an endeavour to enhance productivity. Good safety performance is also related to the management style and that applying excessive pressure by any means to the workmen resulted in increased injuries. The productivity of crews may be adversely impacted by a worker injury. For instance, a crew working in the vicinity of the accident will probably work less productively as a result of the injury. Initially, these crews may simply stop work in order to observe the activities surrounding an injury. The crews may be less productive because of discussions with fellow workers concerning the accident.

### **4 Research methodology**

This research commenced by reviewing the relevant literature on construction health and safety. This was followed by exploratory interviews with five construction managers. The interview discussions were focused on the importance of health and safety, benefits of health and safety improvement, tendering system and safety, and factors affecting safety on construction projects. The outcome of the exploratory interviews has prepared the way for the main study. Thirty two construction managers were interviewed in this study. List of names and addresses were obtained from personal contacts.

## 5 Results

The results indicated that the majority of construction managers viewed safety and health to be important (Table 1). It has been observed that tidy sites may minimize accidents and provide a high level of safety performance.

**Table 1: Importance of safety and health**

<b>Importance of safety and Health</b>	<b>Response (%)</b>
Very important	45.3
Important	41.7
Fairly important	9.9
Not important	3.1
<b>Total</b>	<b>100.0</b>

The respondents stated that the benefits of S&H improvement were: reduced accident costs, increased productivity, improved human relations, and enhanced firms image (Table 2).

**Table 2: Benefits of safety and health improvement.**

<b>Nature of improvement</b>	<b>Response (%)</b>
Reduced accident costs	52.1
Increased productivity	34.8
Improved human relations	17.3
Raise firms image	14.9
Others	11.3

The results showed that 92.8% of respondents indicated that S&H process is negatively affected by competitive tendering. The construction managers mentioned that committed contractors who make an adequate allowance for safety and health may run the risk of losing the tender to a contractor who is less committed to safety and health. Owners did not consider pre-qualification of contractors on S&H.

It has been observed that there is a close relationship between the age and experience of operatives and their level of safety awareness. Operatives between 16-22 were found to be more subjected to accidents than others. The level of accidents tends to decline after the age of 30. This result suggests that the older the operative gets the more experienced he becomes, hence more aware of safety requirements. The results showed that management was more concerned with the problem of productivity rather than safety and health issue. Productivity bonuses as an incentive for higher productivity were paid without due regard to safety. Management was not concerned with safety bonuses.

Scaffolding was found to be a great source of accidents on construction site. 91.2% of the respondents believed that certain criteria such as good technical skill, training and experience should be considered as highly important to certify those who

handle scaffolding. A large number of operatives work on construction sites without adequate training. Construction managers stated that workers are reluctant to wear safety protective clothing. This is strongly related to operatives' personal attitudes towards safety protective clothing and equipment. This study indicated that management did not give enough importance to the training of operatives on how and where to use protective safety equipment and clothing.

## 6 Conclusions

This study demonstrates the importance of safety and health in construction and highlights the factors affecting safety on construction projects. The benefits of safety and health improvement include: reduced accident costs, increased productivity, improved human relations and enhanced firms image. Age and experience have an impact on the level of safety on construction sites. Safety and health should be included as a project parameter, which means it should be considered during all phases of a project.

Safety and health should be considered as a prerequisite for productivity and quality. Accidents result in increased project costs and human suffering. Legislation should be evolved that engenders prioritization of health and safety by all stakeholders. Procurement systems should be evaluated in terms of their impact on safety and health prior to their selection for projects. Prospective contractors should not be placed on tender lists unless they can show competence in the management of safety and health.

The management of safety and health should be an integral part of the management process. Developing the safety program and policies for contract document requirements should be a responsibility of the design team during the design phase. The contract documents should clearly indicate special safety provisions and identify the authority of personnel relative to safety. Managers need to give full safety training to all employees; good training of site managers and operatives can lead to improved safety on site.

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