

# Occupational Safety in Construction Projects

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## Abstract

This paper presents a research on occupational safety in construction projects, where the importance of safety management in projects was studied, including the preparation of a safety plan and program for each project and the identification of the responsibilities of each party to the contract.

The research consists of two parts:

1- Field visits: which were field visits to three construction projects, including building projects, road projects, and tower installation. The safety level of these projects was evaluated through a checklist that includes the most important safety elements in terms of the application of these items in the projects.

2- Preparation of a questionnaire: which included supervisors and engineers, and aimed to determine the level of awareness and commitment of different project categories to safety standards.

The results showed the following:

- There is a moderate occupational safety policy.
- The preparation and storage of maintenance reports are not fully complied with.
- There is a moderate level of training on occupational safety for project workers.
- The company does not impose penalties on safety violators permanently.
- There is a moderate policy for equipment and machinery safety.

- Self-injuries occur due to (fatigue, lack of attention, deliberate error, and emotional factors), with a rate of 82.4%.

**Keywords—** Management, Safety, Occupational Safety, Classification

## 1. Introduction

Occupational health and safety is an important field that has attracted the attention of many countries, researchers, and institutions for humanitarian, social, and economic reasons. The importance of occupational health and safety has been recognized as a basic function like other functions such as production, finance, etc. The main goal of the field of occupational health and safety is to protect the elements of production from work accidents and occupational diseases.

What distinguishes the construction industry from other industries is the high rate of fatal and costly accidents compared to any other industrial sector. To maintain this industry and bring it to levels commensurate with its importance, all its productive elements must be preserved, including workers, machinery and tools, and raw materials produced or manufactured. This preservation can only be achieved by applying occupational health and safety requirements during the execution of all work and activities in this industry.

The nature, conditions, and method of work performed by the worker can be a cause of work-related illnesses and injuries that affect their health, life and productivity. Therefore, the worker is the main element of production and must be protected and cared for mentally and physically from the work conditions. This protection is achieved by applying all occupational health and safety conditions and laws.

## 2. Safety concept

It is the science that aims to protect and maintain the safety and health of humans from the risks that they may be exposed to due to work performance, by providing a safe work environment that is free from the causes of accidents or occupational diseases. [1]

### 3. General objectives that occupational safety and health seeks to achieve

- Protecting human resources from injuries resulting from the risks of the work environment by preventing exposure to accidents, injuries, and occupational diseases.
- Preserving the physical elements of production, including facilities, equipment, and machinery, from damage and loss resulting from accidents.
- Providing and implementing all occupational health and safety requirements necessary for creating a safe environment and preventing risks for both human and physical resources.
- Occupational health and safety aims to establish safety and reassurance in the hearts of workers while performing their work and to reduce the risk that threatens their lives in unsafe work environments. [2]

### 4. Classification of work accidents

Workplace accidents can be classified according to their causes as follows:

- Accidents caused by human factors, where the human worker is considered a direct cause of the accident.
- Accidents caused by technical factors, where the direct cause is related to technical aspects of machinery, equipment, materials used, or the inefficiency of maintenance work.
- Accidents caused by environmental factors, which are related to working conditions such as lighting, heat, ventilation, noise, and working hours.

It can be said that most workplace accidents are caused by human factors rather than machines, with human factors accounting for 80% of the causes of workplace accidents, while material and mechanical factors such as sudden explosions and falling machinery account for between 10% and 20%. The high percentage of human factors leading to accidents emphasizes the importance and danger of the human element in causing workplace accidents and occupational injuries. [3]

### 5. Types of accidents that can occur at a worksite

There are several types of accidents that can occur at a worksite, including: [4]

- Falls
- Scaffolding collapse
- Trench collapse
- Electrical accidents, such as electric shocks and burns
- Transportation accidents, such as being struck by a vehicle
- Fires and explosions
- Asphyxiation

Table (1) illustrates the percentage of fatalities and injuries in construction projects in the United States for the year 2020, divided according to the types of accidents.

**Table (1) Fatality Rates by Type of Accident in Construction Projects in the United States [5]**

Type of accident	Percentage %
People fall	18%
Contact with objects and equipment	16.7%
Transportation / Mobile Machinery	3.5%
Electricity	5%
Exposure to harmful substances	36.1%
Fires / Explosions	2%
Other	3.3%

Note: The total percentages do not add up to 100% and have been included as they appear in the source.

All types of fall accidents, including falls from different levels or at the same level, as well as falling tools, equipment, and parts of the structure such as collapsing scaffolds, are considered fall accidents and are among the most common types of accidents in the workplace. 70-80% of fatal accidents and 35-40% of injuries are caused by fall accidents. [4]

#### **6. The nature of safety management in construction projects**

Safety management in a construction site is a significant challenge because every project has its own set of risks. The construction industry is considered one of the most dangerous sectors, and it is responsible for a high number of injuries. This is due to several factors, including: [6]

- The work environment in the construction sector is a wide and open environment, where the place of work changes from one project to another, and each job has a different nature in terms of size, type, activities, and stages. It

includes excavations, soil removal, water exploration, construction using concrete, stone, and prefabricated materials, road and railway works, and tunnel excavation.

- The temporary nature of construction work and the short amount of time available for work make it difficult to provide workers with the necessary skills and experience, which can lead to safety and financial problems. Contractors must choose between paying high incentives and salaries to attract qualified workers or hiring workers who lack sufficient experience to do the job, which increases the likelihood of accidents and injuries.
- The compressed work environment resulting from long working hours can cause a lack of focus due to fatigue, which poses high risk factors. Additionally, the spread of some wrong ideas and practices occurs due to the absence of a safety culture in these environments, such as considering safety as a competition to productivity, not as synonymous with it, and not using personal protective equipment due to a lack of awareness of its importance.

#### **7. Contents of a safety plan**

The safety and environment plan includes the following key points: [7]

- Basic information about the project (geographical location, total area, neighbors, equipment used, size and cost of work, owner's name, consultant, main contractor, subcontractors, etc.).
- Local legislation and laws related to safety, health, and the environment.
- Identification of safety, health, and environmental responsibilities for various levels of project implementation: project manager, execution manager, site engineers, safety and environmental manager, safety and environmental engineers, safety and environmental

supervisors, execution supervisors, and workers.

- Administrative safety and environmental procedures to be taken during project implementation, including safety and environmental teams, safety and environmental committees, accident and injury reports, accident and injury statistics, and training records.
- The location of safety and environmental responsibilities in the project's organizational structure.
- Training on safety, environment, and fire prevention.
- Identification of official and governmental bodies concerned with safety and the environment that may be referred to during implementation.
- Proper and studied scientific planning of the project site before work implementation, in accordance with safety and environmental standards and regulations.
- Preparation of engineering drawings showing the components and distribution of the site.
- Study and description of the work and activities for all project stages.
- Statement of all anticipated risks for each activity and a comprehensive evaluation of these risks.
- Identification of preventive safety and environmental requirements for each activity to control and treat risks, such as excavation works, scaffolding, welding and cutting works, electrical hazards, concrete mixers, mechanical workshops, all types of cranes, all types of warehouses, waste sorting, and disposal or recycling methods.
- Fire prevention and protection by disposing of its causes, such as smoking prohibition, using non-flammable materials for elements and facilities serving the project, preventive cleanliness, and compliance with

electrical connections to technical standards and regulations.

- Firefighting equipment: firefighting devices, the entire components of the fire extinguishing water network, and the formation of a highly trained team to deal with fires.
- Preparation of personal protective equipment and tools for workers according to the nature of each activity.
- First aid and medical care.
- Safety and environmental awareness signs and posters.

### 8. Data collection techniques

A questionnaire was prepared and distributed to construction companies in the city of Tripoli, which included workers, technicians, supervisors, and project managers. By analyzing the data collected from the questionnaire and the responses of the study sample using statistical analysis methods, the following results were obtained:

- There is an average occupational safety policy.
- Maintenance reports are not fully prepared and saved.
- There is training on occupational safety directed to project workers on average.
- The company does not impose penalties on violators of safety measures permanently.
- The presence of an average equipment and machinery safety policy.

### Questionnaire Scale

Likert triple scale has been used to answer paragraphs of this questionnaire, limiting the answers to: (High effect or impact- average impact- no impact), the directions of the sample have been identified according to the Likert scale as shown in table (1) where the length of the period used is (2 / 3), or about

(0.66). The length of the period was calculated on the basis of the weights of the three responses (1-2-3), then two spaces been confined between them as shown in table (2).

Table (2) Trends in accordance with Likert triple scale according to weighted average

The weighted average	Level
1 to 1.67	Low
1.68 to 2.34	Medium
2.35 to 3	High

### Statistical Methods Used in Data Analysis

- The reliability test was conducted and the study relied on the alpha-Cronbach equation.
- The statistical package used for data analysis was SPSS (Statistical Package for the Social Sciences).

### Results of the study's data analysis

After the questionnaire was administered and the study data was analyzed, the following table shows the ranking of the causes of accidents according to the responses of the study sample.

Table (3) shows the percentages of the causes of accidents according to the responses of the study sample

Causes	Number	Percentage
Administrative: due to (lack of training, lack of monitoring, unavailability of protective equipment)	3	8.8%
Personal: due to (fatigue, inattention, deliberate error, emotional reaction)	28	82.4%
Technical: due to (lack of maintenance, quality of machines)	3	8.8%
<b>Total</b>	<b>34</b>	<b>100%</b>

The following table shows the common injuries and accidents at the workplace.

Table (4) shows the common injuries and accidents at the workplace.

Injuries	Number	Percentage
Wounds	12	35.3%
Wounds, Burns	1	2.9%
Wounds, Burns, Deaths	1	2.9%
Wounds, Fractures	10	29.4%
Wounds, Fractures, Burns	3	8.8%
Wounds, Fractures, Deaths	1	2.9%
Burns	1	2.9%
Fractures	4	11.8%
Total	34	100%

## 9. Conclusions

The following conclusions were reached through the study:

- There are deficiencies in safety management in projects in terms of planning, awareness, and training.
- There are no specific safety specifications for construction projects, while there are specific safety specifications for the oil industry.
- There are no records of accidents and injuries.
- Negligence, inattention, lack of experience, and lack of personal protective equipment, along with the availability of an unsafe environment, are the most common causes of accidents and injuries.

## 10. Recommendations

Based on the results obtained, a number of recommendations will be presented aimed at increasing attention to occupational health and safety. The most important recommendations reached by the study are as follows:

- Issuing laws and regulations specific to occupational health and safety, particularly compensation laws, if any, and activating these laws and giving

their importance for their economic and social value.

- The regulatory institutions must carry out their work at construction sites periodically without interruption to ensure the application of systems, regulations, and laws related to occupational health and safety. It is necessary to take the necessary measures if employers violate these laws to protect the lives of workers at the site.
- Senior management in construction companies and institutions must provide protective clothing and equipment for workers to emphasize the importance of raising awareness and training workers to ensure the necessary protection from work hazards. It is also necessary to develop and implement training programs continuously to enhance their practical experience and increase their health awareness.
- Cooperation and coordination between the three parties involved in the work (government agencies, employers, and workers) in the field of preventing work accidents are necessary due to the joint responsibility.
- It is necessary to promote awareness of occupational health and safety through the media, issuing periodic bulletins and scientific magazines by centers specialized in preventing work accidents with the aim of transferring knowledge and exchanging information in this field.
- Restricting and complying with general and specific specifications when designing and implementing any work,

and conducting laboratory tests of samples with sufficient monitoring.

- Reducing the number of workers who do not have the necessary skills and experience for the job.
- Establishing a safety program specific to each project.
- Reporting imminent injuries and accidents and preparing special reports on accidents.
- Compelling sites to have a certain number of safety technicians and supervisors according to the number of workers.

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