

# Analyzing Factors Affecting Construction Safety Performance Through Literature Review

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**Abstract-** Construction industry is Hazardous prone industry. Every year several people killed & several injured due to unawareness of safety rule. At construction site day by day activity changes, so need to take adequate control measure to control risk at workplace. There are numerous and an enumerable cause of accidents that occurs on site. It is the duty of the site manager or supervisor to identify these causes and identify the ways of eliminating them. Because of all of this in the past few decades, need for safety awareness among construction industries was realized. This is due to the high cost associated with work related injuries, workers compensation, insurance premium, indirect costs of injuries, and litigation. Safety performance is often evaluated based on negative indicators such as accident number, days lost, injury rates and accident cost. The importance of evaluating safety performance is to gauge the effectiveness of construction firms' management in accident prevention by setting out safety objectives and targets. This paper highlights the important factors affecting construction safety performance.

## I. INTRODUCTION

Construction industry is Hazardous prone industry. Every year several people killed & several injured due to unawareness of safety rule. At construction site day by day activity changes, so need to take adequate control measure to control risk at workplace. Construction industry playing vital role to growth of country. Construction industry has positive and Negative impacts. Positive impacts are good for country development and it creates employment opportunities. Negative impacts are injury, Death of person and damage of environment that is very bad for any country. Numbers of people injured and several killed due to ineffective safety management system in construction industries. Effective safety management system always helps to create safe healthy work environment.

### 1.1 Nature of Indian Construction industry:

Construction projects in India mandate the setting up of a temporary site and the employment of huge number of

contractual labor. Typically the composition of this team keeps on changing. Even contractors that invest in training, motivating and involving this transient, highly mobile workforce in corporate safety efforts, face challenges because they carry out work that is constantly changing and where risks are generally higher.

Complex working conditions pose high risks. At Metro sites, underfoot or underground conditions, surrounding disturbances of moving traffic, paucity of space to provide adequate support, untimely working hours, pressure of completing the work and rarely, equipment failures or negligence by operating personnel or the design of the structure are contributing factors to mishap. In case of mines, uncertain geology accentuates these challenges. Also, the demolition industry in India is around 15-years behind the western world. Major activities such as excavation, blasting, material handling, fabrication work, usage of plant and machinery, gas cutting, welding and grinding, structural and equipment erection and working at height, all require stringent measures for safe execution. The construction industry in India today is very large and complex, but the rapid growth has led to a shortfall in terms of safety and health aspects of the construction workers.

### 1.2 Causes of Accidents On Construction Site:

There are numerous and an enumerable cause of accidents that occurs on site. It is the duty of the site manager or supervisor to identify these causes and identify the ways of eliminating them. The major causes of accidents were identified as:

- Lack of safety awareness
- Unsafe working condition
- Drug abuse
- Lack of provision of personal protective equipment
- Collapse of building parts and masses of earth.
- Falling of objects and pieces of work on workers.
- Falls of persons from heights, ladders and stairs.

- Loading, unloading and transportation of loads.
- Working on machines.

### **1.3 Construction Accidents Statistics:**

The construction industry is very hazardous with almost six times as many fatalities and twice as many injuries per hour worked relative to a manufacturing industry. Helander analyze 739 construction fatalities that occurred in UK. He found that fifty two per cent occurred due to falls from roofs, scaffolds and ladders. Falling objects and material were involved in 19.4 per cent of the deaths, and transportation equipment, (e.g. excavators and dumpers) were involved in 18.5 per cent. Helander also found that 5 per cent of construction accidents occur during excavation work. The categories used for classifying fatal accidents were:

- a. Falls
- b. Falling material and objects
- c. Electrical hazards
- d. Transport and mobile plants
- e. Other

Most of the accidents that involved falls occur during work on roofs, scaffolds and ladders. Moreover, collapses of structures and falling materials also contribute for a large proportion of victims.

### **1.4 Effects of Construction Accidents:**

Effects of accident in construction industry fall into three major categories, viz.

- a) Humanitarian
- b) Economic
- c) Legal

#### **a) Humanitarian:**

This refers the effects as concerned worker on the site and these include;

- i. Suffering to individual
- ii. Hardship to the individual
- iii. Fatality
- iv. Minor injury
- v. Disabling injury
- vi. Possible loss of earning ability

#### **b) Economic:**

Economic effects of accidents in construction industry include;

- i. Production delay
- ii. Increment in insurance premium.
- iii. Legal expenses
- iv. Time loss by the employee
- v. Reduced quality
- vi. Time spent in training a temporary or permanent replacement.
- vii. Time spent by management and supervision in investigating and reporting the accident.

#### **c) Legal:**

The legal effect of accident includes;

- i. Legal liability
- ii. Failure to safeguard employee being a criminal offence leading to prosecution

Because of all of this in the past few decades, need for safety awareness among construction industries was realized. This is due to the high cost associated with work related injuries, workers compensation, insurance premium, indirect costs of injuries, and litigation. Every year, a considerable amount of time is lost due to work related health issues and site accidents.

## **II. CONSTRUCTION SAFETY MANAGEMENT**

Construction safety management is a method of controlling safety policies, procedures and practices on construction site. This consists of three phases;

- 1) Planning and Preparation
- 2) Identification and Assessment
- 3) Execution and Improvement

### **Phase1. Planning and Preparation:**

In this, construction organizations must first initiate the safety program through an effective preplanning and resource development process.

### **Phase2. Identification and Assessment Phase:**

This phase consists of developing safety goals and objectives, management training and strategic decision making on safety management techniques.

### **Phase3. Execution and Improvement Phase:**

The final phase of the CSM implementation is the execution and improvement phase. At this stage, the new culture must be incorporated in the mix, employee-training

### III. SAFETY PERFORMANCE OF CONSTRUCTION INDUSTRY

Generally, safety performance is often evaluated based on negative indicators such as accident number, days lost, injury rates and accident cost. The importance of evaluating safety performance is to gauge the effectiveness of construction firms' management in accident prevention by setting out safety objectives and targets. When a project experiences high accident rates, the contractor involved can develop a poor reputation, though the size of the company does contribute to the safety performance of construction contractors. Therefore, both large and small contractors have an obligation to maintain their reputation in health and safety by maintaining their safety performance. Construction safety performance measurement is most effective when using both 'quantitative and qualitative' safety measurements. Quantitative measures include lost time, severity rates, and Experience Modification Rating (EMR) – a method used to calculate insurance premiums for workers due to accidents; while qualitative measures consist of outstanding, average and below average performances, as determined by OHS assessors.

#### 3.1 Factors Affecting Safety Performance of Construction Project:

According to Thomas et al. (2005), there are two levels which affect safety performance in construction industries which are 'project level' and 'organizational level'.

**3.1.1 Project level:** The project level is known as the owner's decision to divide the work program with several inter-firm organizations. Safety on construction project is related with historical factors which include economy, psychology, technical, procedure, organization and environmental work issues.

- i. Implementation of safety inspection - Safety inspection is the main tool to maintain safe condition on site and monitor the unsafe practices at workplace.
- ii. Implementation of safe system of work – Safety program should be based on a policy insisting on the safety protection and safe system of work to the employees. Apart from that, serious enforcement of the written policy has to be made especially for high rise building project. It is because all the contractors and workers can aware to

the equipment and structures at workplace that hazardous to themselves or even public.

Implementation of safe plant & equipment - PPE is worn by a person at work to protect him against risk to safety and health and any additional accessory designed to protect him while performing task. It is important to provide PPE to workers at construction sites in order ensure a safe and healthy condition at the workplace.

Implementation of safe working environment - Providing a safe and healthy workplace as the most effective strategies to maintain the cost of construction project. Failure to adhere to safe working environment implementation could result in accident that may increase the project cost.

Implementation of safety officer & supervisor – In order to ensure better construction safety, an employer should appoint full-time safety and health officers (SHO) and site safety supervisors (SSS) with specific jobs such as conducting site safety tours and inspections. The appointment of both SHO and SSS is depend on the project scope that includes project value, in accordance with the legislations. Site safety supervision and the provision of a safe environment are the factors related to the implementation of safety systems at construction site.

Safety review for safety audit - A safety audit includes safety inspections, inspection of documents and interviews. Safety audit is important to check the organization's level of compliance with OSH legislations, thus provide a safe workplace.

Safety review for site safety policy review - Safety policy is nothing but published statement reflecting the organization's vision and mission in relation to the management of health and safety matters.

Emergency plan and procedures - Emergency drill should be conducted once in every three months which all the workers will be given a briefing on emergency procedures. Attendance of the workers at the designated assembly area should be also recorded.

Safety training - Safety training is the most effective tool to mitigate hazards since training helps to improve worker's skills and abilities to identify hazards. One way to encourage employee safety is to involve all employees at various times in safety training through regular sessions with supervisors, managers, and employees which should often coordinated by HR staff members.

**3.1.2 Organisational Level:** The organisation's commitment to safety has a significant influence on cultivating a positive OHS culture, with the most influential factor driving safety performance in the construction industry being the organisational safety policy. Improvements in organisational structure, organisational importance of safety, safety

responsibility and accountability, communication, management behaviour, employee involvement, and employee responses and behaviour can help improve safety performance. This would involve the development of more detailed written safety programmes, greater expenditure on safety programmes, additional training to part time safety coordinators, and better indoctrination of new staff on company policies and guidelines. Safety systems, written safety policies and measurable safety targets, safety committees at company level, communication of safety policies to the various concerned parties are also said to be essential to construction safety, while safety awards or incentive schemes, safety training schemes, safety committees and level of subcontracting are also recommended for consideration.

Durdyev et al. (2017) after in depth review of relevant literatures, enlisted 30 different factors affecting safety performance in Cambodia as follows:

**Table1: Factors affecting construction safety performance**

Sr. No.	Factors affecting construction safety performance
01	Lack of training
02	Reckless operations
03	Lack of skilled labour
04	Poor equipment
05	Low educated workers
06	Lack of personal protective equipment
07	Lack of technical guidance
08	Lack of experienced project managers
09	Excessive overtime work
10	Insufficient promotion of safety awareness
11	Ineffectiveness of current safety policies
12	Tight schedule
13	Workers’ physical fatigue
14	Financial pressure
15	Lack of management commitment to safety programs
16	Lack of inspection procedures onsite
17	Lack of safe construction site environment
18	Lack of safety supervisor onsite
19	Lack of worker compensation insurance
20	Poor safety awareness among top management
21	Poor selection and control of subcontractors
22	Poor legislation, codes and standards
23	Lack of emergency plan and procedures
24	Poor weather conditions
25	Lack of monitoring the compliance of safety measures
26	Insufficient safety budget

27	Lack of protection in material transportation
28	Reluctance to input resources for safety
29	Poor accident record keeping and reporting system
30	Overlapping activities

So at the end for questionnaire design we can summarize all above factors affecting safety performance as given below:

Sr. No.	Category	Factors affecting construction safety performance
01	Plant (Site) Level Category	Lack of safe construction site environment
		Lack of safety supervisor onsite
		Lack of technical guidance
		Lack of inspection procedures onsite
		Poor accident record keeping and reporting system
		Poor weather conditions
02	Organisation Level Category	Poor selection and control of subcontractors
		Insufficient promotion of safety awareness
		Lack of training
		Lack of monitoring the compliance of safety measures
		Reluctance to input resources for safety
		Lack of emergency plan and procedures
03	Management Level Category	Poor safety awareness among top management
		Lack of management commitment to safety programs
		Tight schedule
		Overlapping Activities
04	Workforce Level Category	Reckless operations
		Excessive overtime work
		Workers’ physical fatigue
		Lack of skilled labour
05	Resources Category	Low educated workers
		Poor equipment
		Lack of PPE
		Lack of experienced project managers
		Financial pressure

		Insufficient safety budget
06	Legislation Category	Ineffectiveness of current safety policies
		Lack of worker compensation insurance
		Poor legislation, codes and standards

#### IV. CONCLUSION

Through literature review, there are several identified factors that can affect the safety performance of construction project. There are many advantages by implementing these safety factors, such as reduce the number of accident on the construction project, increase productivity, project complete on time, and decrease compensation cost and increase morals among employees. The good safety performance in site level and organisation level category can lead to better improvement of safety performance in construction industry.

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