

## **MEASUREMENT OF DEGREE OF SAFETY IMPLEMENTATION AT VARIOUS CONSTRUCTION SITES IN A DEVELOPING COUNTRY LIKE BANGLADESH**

**Md. Hamidul Islam<sup>\*1</sup>, Md. Mehrab Hossain<sup>2</sup> and Md. Nurul Islam<sup>3</sup>**

<sup>1</sup>*Assistant Professor, Department of Building Engineering and Construction Management, Khulna University of Engineering & Technology, Khulna-9203, Bangladesh, e-mail: hamidcekuet@gmail.com*

<sup>2</sup>*Lecturer, Department of Building Engineering and Construction Management, Khulna University of Engineering & Technology, Khulna-9203, Bangladesh, e-mail:mehrabaopy@gmail.com*

<sup>3</sup>*Student, Department of Building Engineering and Construction Management, Khulna University of Engineering & Technology, Khulna-9203, Bangladesh, e-mail: ikhan72929@gmail.com*

**\*Corresponding Author**

### **ABSTRACT**

Construction industry is one of the most vulnerable sectors considering degree of safety and its implementation in the site. All concerned personnel are involved in the safety policy and especially the workers more susceptible to accidents. In the world most of the developed countries have full proof law and legislation in the construction industry. Also, they have well organized safety implementation management systems which are planned to minimize or abolish accidents at workplaces. Nevertheless, in developing countries such as Bangladesh safety in the construction industry is very alarming. This study investigates the widespread safety management practices and perceptions at the construction industry at Dhaka and Khulna city in Bangladesh. The study was conducted among 45 (forty-five) construction companies, government officials and also investigated 20 (twenty) ongoing construction sites through the method of a questionnaire survey, face to face interview and focus group discussion (FGD). The results of the study revealed that there are many occupational safety problems at the construction industries in Bangladesh. The most common safety problems are the lack of safety regulations, standards, data on safety at construction sites, competent manpower, safety training, documentation and organized safety management systems. The study also proposes some recommendations for safe construction.

**Keyword:** *Construction industry, Degree of safety, Safety implementation and policy, Developing country, Sustainable construction, Questionnaire survey.*

## 1. INTRODUCTION

It is commonly known that accidents have serious implications for the construction industry both in financial and humanitarian terms. Construction accidents may cause many problems, such as demotivation of workers; disruption of site activities; delay of project progress; and adversely affecting the overall cost, productivity and reputation of the construction industry (Mohamed, 2002). In the construction industry, the risk of a fatality is five times more likely than in a manufacturing based industry; whilst the risk of a major injury is two and a half time higher (Sawacha et al., 1999). Nowadays, construction industrial accidents occur everywhere in the world at a large amount of deaths or serious injuries and the world is paying heavily for accidents in terms of both human suffering and economic losses. In spite of some progress, the safety problem is still a serious question for the human resources who involve in this sector. Safety performance and its improvement at construction sites have received a great deal of attention since the implementation of the Occupational Safety and Health Act (OSHA, 2002). A key factor in the control and improvement of any performance aspect on site is the ability to measure the performance (Laufer & Ledbetter, 1986).

The construction industry's appalling health and safety record is a worldwide problem affecting both the developed and developing countries. Very few statistics exist on the nature of accidents and injuries affecting workers in developing countries primarily due to the poor or non-existent regulatory framework (Larcher & Sohail, 1999). Considering the adverse impacts of accidents, construction safety implementation is of genuine concern to all stakeholders in the construction industry. Government, unions, and insurers have spent a great deal of time and effort attempting to evolve legislation, rules, and regulations to help the reduction of the large loss of life and limbs, and the high number of "lost-work days" (Goldsmith, 1987). In the USA, the exercise of safety in construction is delimited by administrative agencies which provide harsh guidelines and principles to enforce safety and health standards on construction sites. Bangladesh National Building Code (BNBC) describes precautionary measures to be adopted to ensure the safety of public, environment and infrastructure, property, workmen, materials, services, plant and equipment and also covers the constructional responsibilities and practices in building sites; safe storing, stacking and handling of materials, equipment's and the resources; and mostly safety of personnel during construction operations.

In most developing countries, including Bangladesh, safety consideration in construction project delivery is not given a priority, and employment of safety measures during construction is considered a burden (Mbuya & Lema, 2000). At present, the largest and fastest growing sector in Bangladesh is construction sector and this sector also contributes one of the highest national gross domestic products (GDP) next to garments sector. However, occupational safety and health in the construction industry in Bangladesh is a very lower level. The construction industry, as such, needs to assess the safety situation, and accordingly, plan and implement safe construction in Bangladesh. Currently, there is a genuine set of data on safety at construction sites in Bangladesh. Apparently, there are no systematic and organized studies conducted specifically on the safety aspects of the construction industry in Bangladesh. Therefore, this research study was aimed to assess the existing safety management practices and perception in the Bangladeshi construction industry. The assessment was useful in providing information in terms of current safety practices administered in Bangladesh. Moreover, the perception was useful in finding out what are the main reasons for accidents in construction sites and identifying factors responsible for safety management problems (Dorji & Hadikusumo, 2006). Investigations were operated various construction companies/firms, government regulatory agencies, and some ongoing projects if they perceive different opinions on safety problems, the safety policy and law might not be able to solve the problems.

## 2. METHODOLOGY

Investigations were operated in the different construction field, companies, and firms as well as with consultants, project managers and field supervisors by face to face interview and focus group discussion (FGD) at several construction projects. A form of questionnaires was designed with essential elements for safety management system and factors responsible for safety management

problem and distributed to different construction companies in Bangladesh. This questionnaire was followed up by direct interviews in 45 (forty-five) construction companies and government officials to collect information about their safety management system. Also, 20 (twenty) on-going construction project sites were visited to collect data. All the respondent companies, firms, government regulatory offices and the ongoing construction sites are at Dhaka and Khulna city in Bangladesh. The relevant government regulatory agencies were also investigated for this questionnaire survey, interviews and discussions to concern with their safety and health administration in the construction industry in Bangladesh. The data mainly in terms of safety standards, safety rules and regulations, and safety laws were collected from the government officials that are being implemented and enforced by the government to ensure safety at the construction sites. The government regulatory agencies and construction companies both were asked to give their opinions about the factors responsible for the safety problems.

An exploratory or investigative study intended to evaluate the prevalent site safety management practices and procedures of the construction companies in Bangladesh is the most important part of this research. The steps to promote safety and health in the construction sites taken by the government regulatory agencies industry is also investigated and explored. As such, the collected data were analyzed for descriptive statistics to reflect the current overall safety situations in the construction fields of Bangladesh.

The other part of the research is compared the safety management activities between different construction companies or firms and the government regulatory agencies and concerned with how they perceive the safety problems in the construction industry of Bangladesh. In order to achieve this objective, 13 factors attributable to safety problems were identified from the literature review. Respondents were then asked to rank these factors according to their importance in addressing the safety problems.

### **3. RESULTS AND DISCUSSION**

According to the Occupational Safety, Health, and Environment Foundation (OSHE) about 600 fatalities occurred in Bangladesh during the first six months of the year and 488 workers were injured in occupational accidents in 2015. At least 373 workers were killed in their workplaces in 282 separate accidents across the country in 2016, according to a survey conducted by Safety and Rights Society, a non-government organization. Safety concerns have been raised, of late, and earnest efforts are being made to promote safety and health in the Bangladeshi construction industry.

#### **3.1 General Information of the Respondent Construction Companies**

Out of the fifty-five (45) respondents of the government regulatory agencies and construction companies, about 67% of them are established, 30% are temporary and only 3% are not established as shown in Table 1. So, most of the construction companies or firms are properly established and having a permanent office building and a little number of them have not any permanent office building because of this they operate theirs activates from their residences without proper establishments. Most of the respondent construction companies work on infrastructural development. Major parts of their constructions are residential buildings, educational buildings, buildings for business purposes, high-rise buildings, roads and bridges in the country.

**Table 1:** Status of the investigated construction companies/firms.

	Establishment			Financial and Technical strength		
	Established	Temporary	Not established	High	Medium	Low
Number of Company	30	12	3	9	24	12
Percentage (%)	67	27	6	20	54	26

However, most of the respondent companies were well-based into the construction business and having work experiences of above 10 to 15 years. Approximately 20% of the respondent's companies have high technical and financial strength, about 54% have medium and 26% have low financial and technical strength as illustrated in Table 1. Maximum construction companies have 20 to 100 employee and 50 to 100 permanent workers and they also hired labor as temporary or contract worker.

### **3.2 Safety Policy**

Bangladesh is one of the developing countries where construction techniques and safety policy implemented is basically labor base with little mechanization. A few years ago traditional construction techniques have been used in Bangladesh but now a days, some of the companies used high mechanization and heavy machinery in the construction field. About 33.33% construction companies use labor base techniques, 54.33% companies use little mechanization and about 13.33% construction companies' use highly mechanized construction techniques out of the total respondents in Bangladesh as shown in Table 2.

Table 2: Safety policy of the investigated construction companies/firms.

<b>Content</b>	<b>Number of Company/Firm</b>	
Types	Traditional	None
	Labor base	15
	High mechanization	6
	Little mechanization	24
	No mechanization	None
Written Safety Policy	Yes	15
	No	9
	Sometimes	21
Level of Safety Priority	Highest priority	21
	Medium priority	15
	Lowest priority	9

Here about 30% of the construction firms use written safety policy, about 50% of construction firms use it sometimes and 20% do not use written safety policy in Bangladesh as shown in Table 2. Respondents were also asked to rank the level of priority of their safety policy that they implemented in their construction fields.

### **3.3 Safety Operating**

One of the essential elements of the safety management is the designation of an individual with responsibilities and accountabilities in the implementation of the construction safety programme and plan (Dorji & Hadikusumo, 2006). Safety department or committee operates how safety policy implementation is to be monitored, how safety budgets are fixed, determines the activities of how safety committees and safety representatives and how individual job descriptions should safety responsibilities and reflect health.

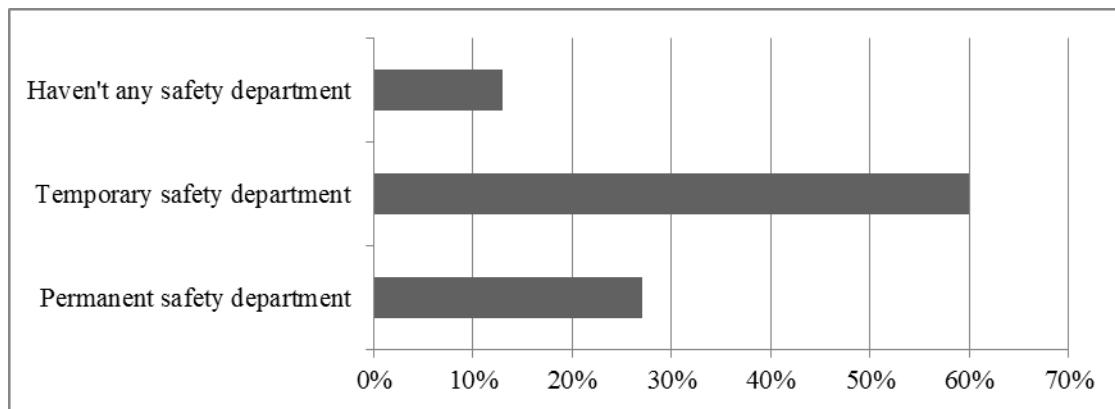


Figure 1: Percentage of safety department having in the investigated firms.

Out of the respondent's companies, about 27% and 60% have permanent and temporary safety department or committee respectively and about 13% have not any safety department or committee as shown in Figure 1 in Bangladesh.

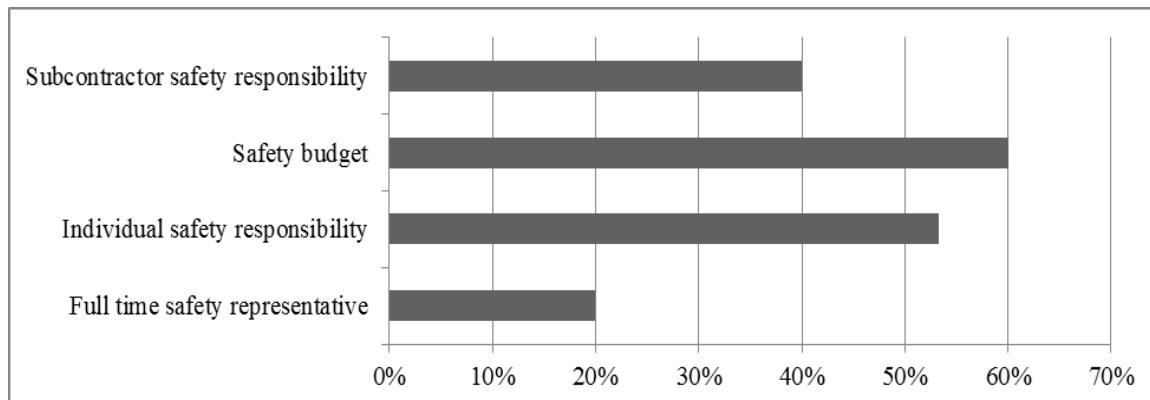


Figure 2: Degree of implementation of safety management of the investigated firms.

Moreover, approximately 20% companies have full-time safety representative, 53.33% companies have individual safety responsibility, 60% companies ensure safety budget and 40% companies have subcontractor safety responsibility from the respondent's construction companies and government regulatory agencies in Bangladesh as shown in Figure 2.

### 3.4 Planning and Implementation

Planning is the preliminary and critical step of the control and enforcement of a safety management program. It is a process that prepares, creates, implements and monitors the safety programmed, thereby addressing the workplace health and safety through an organized, step-by-step strategy (CSAO, 1993). In this study, about 18 (eighteen) respondent company out of 45 (forty-five) organize the meeting on planning and implementation of safety management before starting construction for every project in Bangladesh.

**Table 3:** Information about safety meeting and safety auditing of the investigated construction companies/firms.

Meeting on Safety Planning & Implementation	Safety Auditing
Number of Company	18 out of 45

Moreover, from the respondents about 36 (thirty-six) construction companies out of 45 (forty-five) operate auditing on an implementation of safety in the site in each project in Bangladesh. Some of their activities are safety inspection, safety training, job hazard analysis and control, accident investigation and reporting, safety promotion, and personal protective equipment (PPE) etc.

### 3.5 Safety Equipment

According to Bangladesh National Building Code (BNBC) data collected on 7 (seven) types of construction personal protective equipment from 20 (twenty) ongoing construction site in a different region in Bangladesh. Results of this analysis are following:

#### 3.5.1 Eye and face protection

Safety glasses or face shields are worn any time of work operations can cause foreign objects to get in the eye (OSHA, 2002). For example: during welding, cutting, grinding, nailing (or when working with concrete and/or harmful chemicals or when exposed to flying particles). From the investigations of the construction site, it marked that about 10% of workers use eye and face protector during construction in Bangladesh as shown in Figure 3. That is very poor and risk for the workers.

#### 3.5.2 Foot protection

Construction workers should wear work shoes or boots with slip-resistant and puncture-resistant soles. Safety-toed footwear is worn to prevent crushed toes when working with heavy equipment or falling objects (OSHA, 2002). From the investigations of construction site, it marked that about 45% of workers use foot protector during construction in Bangladesh as shown in Figure 3.

#### 3.5.3 Hand protection

According to OSHA workers should wear the right gloves for the job (examples: heavy-duty rubber gloves for concrete work; welding gloves for welding; insulated gloves and sleeves when exposed to electrical hazards). A very little number of workers (11% approximately) use hand protection equipment during construction as shown in Figure 3.

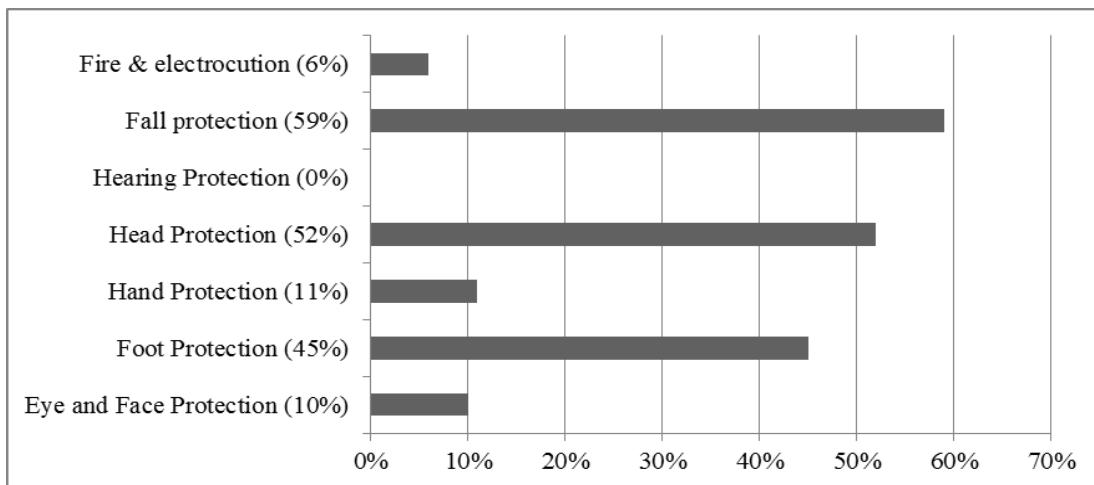


Figure 3: Approximate percentage of workers who use personal protective equipment during construction.

#### 3.5.4 Head protection

Wear hard hats where there is a potential for objects falling from above, bumps to the head from fixed objects, or of accidental head contact with electrical hazards (OSHA, 2002). About 52% workers use head protector in the field during construction in the surveyed construction site in Bangladesh as shown in Figure 3.

### **3.5.5 Hearing protection**

Use earplugs/earmuffs for workers in high noise work areas where chainsaws or heavy equipment are used; clean or replace earplugs regularly. It is not surprising to note that there is no worker (0%) who uses hearing protector equipment during construction in the field as shown in Figure 3. Unfortunately, that is very harmful to the worker's health and makes out-of-temper.

### **3.5.6 Fall protection**

Previously, falls are the foremost cause of fatalities in construction, considering for about one-third of all fatalities in the industry. For example, the Bureau of Labor Statistics reported that there were 291 fatal falls to a lower level in construction in 2013, out of 828 total fatalities (OSHA, 2002). From the investigations of the construction site, it marked that about 59% of workers use fall protector equipment and fall restraint system during construction on the site as shown in Figure 3.

### **3.5.7 Fire and electrocution protection**

From this study a very little number of workers (about 6%) use fire and electrocution protector in their working field. That indicates a very poor safety implementation system in this field in Bangladesh.

### **3.5.8 Factors Affecting Safety Problems**

Safety at construction site is a multifaceted fact, and the theme of safety attitudes and safety performance in the construction industry is even more so. In the construction industry, the risk of a fatality is 5 (five) times more likely than in a manufacturing based industry; whilst the risk of a major injury is two and a half time higher (Sawacha et al., 1999). Respondents from the construction companies as well as the officials in the relevant government regulatory agencies were asked directly about the important factors attributable to the site safety management problems in the Bangladeshi construction industry. In this study identified 12 (twelve) factors that are more responsible for safety management problem. They are following: (i) Lack of safety regulations and standards, and their enforcement; (ii) Lack of safety awareness and understanding of safety benefits in the construction industry; (iii) Lack of safety training facilities; (iv) Finance/budgetary constraint; (v) Lack of formal labor union organization; (vi) Lack of certified skilled labor; (vii) Extensive use of subcontractors; (viii) Poor safety consciousness of workers; (ix) Lack of personal protective equipment (PPE); (x) Poor mechanization; (xi) Lack of safety professionals and (xii) Lack of knowledge about safety management system.

## **4. CONCLUSIONS**

A survey has been conducted with 45 (forty-five) construction companies and the government regulatory agencies relevant to the construction industry in Bangladesh to better understand their safety management practices. Also investigated 20 (twenty) ongoing construction sites to identify the percentage of using safety equipment by the workers during construction in various regions in Dhaka and Khulna city. In terms of safety policy, most of the companies did not have written safety policy and they had poor safety awareness. In terms of organizing, most of them did not have safety department, safety representative, and safety committee. Less than 40% of them did not have safety budget. In terms of preparation and execution, most of them were conscious of the safety regulation and claimed to have insurance schemes for the workers depending on the clients' necessities. Most of them also claimed that they provided PPE to workers although some of the workers did not want to use the PPE because they felt uncomfortable. However, in terms of measuring and reviewing safety performance, many of the companies did not have proper records to give the indication on the number of any kind of accidents occurring at their construction project sites. In addition, many did not employ safety audits. This study also concludes main factors for why the application of safety management system was not adequate. We identify that the five top most reasons were (i) lack of safety training facilities, (ii) lack of safety awareness and understanding of safety benefits, (iii) lack of safety professionals, (iv) lack of knowledge about safety management, and (v) lack of safety regulation enforcement.

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