

# The Status of Construction Safety in Bangladesh: Challenges, Benefits, Effects and Suggestions

Md. Mehrab Hossain, Shakil Ahmed

*Dept. of Building Engineering and Construction Management, Khulna University of Engineering & Technology,  
Khulna 9203, Bangladesh*

*Email: mehrabaopy@gmail.com; ashakilmondol@gmail.com*

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**Abstract:** Construction industry is an important part of the economy in many countries and often seen as a driver of economic growth especially in developing countries. As construction industry is less mechanized and more labor intensive, construction workers are backbone of this industry. So the major consideration is ensuring workers safety during construction. This paper is aimed to examine the current safety status, identify the main causes for not practicing safety measures which termed as challenges of construction safety, identify the benefits of considering safety measures, effects for not practicing safety measures and suggestions to overcome the challenges in the construction sites in Bangladesh. The study was conducted in three stages. Firstly the existing rules and regulations of construction safety were studied. Secondly physical survey was conducted among the ongoing construction sites. Thirdly 20 causes and 14 effects for not practicing safety measures that influence the safety performance in construction sites, 16 benefits for practicing safety measures were identified from literature review and ranked them based on Factor Index (FI) by conducting questionnaire survey. According to the physical survey data, it was obvious that workers were working without PPE and fall protective system. From the data analysis, the main causes for not practicing safety rules and measures are lack of enforcement of safety rules and regulations, lack of safety awareness among the construction stakeholder and lack of safety training respectively. The main benefits for practicing safety measures and rules are reduced administrative costs, the potential for reduced insurance and liability costs and improving safety is usually a competitive advantage, because of reduced costs respectively. The main effects for not practicing safety measures and rules are payment for settlement of injury/death claims, negative impact on reputation of firms and increase in project cost respectively. Finally significant suggestions to overcome the challenges were identified from the stakeholder of this industry. The survey results may help the authorities to increase the awareness of practicing safety measures and enforce the construction safety rules in the next project approach.

**Keywords:** Construction industry; Bangladesh; BNBC; BLA; Safety measures; PPE; Factor index.

## 1. Introduction

Construction industry is considered as one of the most dominating sources of economic growth and development of any country [1]. It also has a great contribute to the Bangladesh national economy [2]. Construction involves a little percentage of the overall workforce. But it is regarded as the most hazardous industry due to its unique nature and the safety record of building construction industry has always been poor [3-5]. Within many business developments sector construction industry is one of the largest and rapidly growing industrial sectors. This industry is considered as the most dangerous industry in recent years [6, 7]. The incidence rate for both fatal and non-fatal accidents causing death, injuries and illnesses exceeds that of numerous different enterprises. At least 108 thousand workers are killed on site every year, which represents about 30% of all occupational deaths [8]. The risks are 3 to 6 times more likely than any other occupation [9]. More than 26,000 U.S. construction workers in the past two decades have died at work. This equates that in every working day five construction workers die approximately [10]. Of these fatalities, 40% involved incidents that is related to falls from height [11, 12]. In Turkey, health and safety in construction is also considered as the primary problem [13]. Tiwari et al. [14] shows the low level of safety practice and even not appear in various Indian construction sites. Malaysian construction industry also suffers a lot for the safety issues in construction sites [15].

Being a developing country, construction industry is growing rapidly in Bangladesh. It represents 7.6 percent of Bangladesh's gross domestic product (GDP) and employs more than 3.3 million people [16, 17]. There are more than a thousand companies in Bangladesh who are involved in the construction business [18]. But in Bangladesh safety management issues are characterized as a very poor rate. From the literature review of this study it is clear

that more than 800 deaths are occurred in construction sites during the phase of 2008 to 2013 [19]. In Bangladesh more than 40% workers die due to the falling from height. In the case of accident construction industry could have been in the highest position, but the accidents occurred in Rana Plaza during 2013 had resulted in 1331 deaths [19]. As a result the fatalities rate of workers in garments sector is the highest position. An average 150 people die every year due to the construction accident in Bangladesh [20,21]. If we skip the fatalities rate in garments sector, construction industry is placed in the highest rank. A safe and constructive working environment decreases the risks of heavy accidents at work, sickness and lower costs for the total construction.

The government enacted the two Act/Code at the national level to ensure health and safety of workers in construction sector. The Act/Code includes BLA 2006 (Bangladesh Labour Act 2006) and BNBC 2006 (Bangladesh National Building Code 2006).

These regulatory documents have provisions to focus on the welfare of construction workers. In order to protect the rights of the workers, the following authorities are entrusted with the duty according to the provision respectively.

1) The Department of Inspection for Factories and Establishment - legal authority to enforce BLA 2006.

2) RAJUK (Rajdhani Unnayan Katripakha or the Capital Development Authority) – legal authority to enforce BNBC 2006 and to take legal actions against the violators of safety laws specifically for construction sector.

No health and safety law was applied to the construction sector as there was no existing law before November 2006. In November 2006, the Bangladesh Labour Act 2006 (BLA 2006) and the Bangladesh National Building Code 2006 (BNBC 2006) were first introduced. These rules and regulations contain health and safety provision relevant to the construction sector.

The Bangladesh Labour Act 2006 (BLA 2006) includes all types of labour that are involved in any type of work that are related to GDP of the country. On the contrary Bangladesh National Building Code 2006 (BNBC 2006) specifically deals with the labour safety of the building construction sector. So the author wants to find out what are the actual onsite scenario and what are the reasons behind the labor death or injury in construction sites in Bangladesh against BNBC and BLA.

The prime objectives of this study are as follows:

1) To investigate the current safety status in building construction in Bangladesh.

2) To analyze the safety factors those influence the safety performance in construction sites.

3) To find the benefits for practicing safety measures and effects for not practicing the safety measures and suggestions to overcome from the challenges of construction safety at construction sites in Bangladesh.

## 2. Methodology

In order to find out the actual scenario of the workers safety, a broad literature review was conducted from published and unpublished documents, newspapers, internet, journals, articles, reports, newsletters, and OSHE (Bangladesh Occupational Safety, Health and Environment Foundation) statistics. At the same time existing rules and regulations about construction safety in Bangladesh were studied. Then the questionnaire was designed from the gathered information and survey was conducted among different construction sites. After that the major causes and effects for not practicing safety measures, benefits for practicing safety measures were ranked based on factor index. At the same time the suggestions were taken from different stakeholder in construction industry so that the safety measures can be implemented on site properly.

### 2.1 Questionnaire design

There are 20 factors which may cause the fatalities in construction sites, 16 benefits for practicing safety measures, 14 effects for not practicing safety measures were identified from literature review and experts opinion. A well-structured close-ended questionnaire was designed in order to gather information from building construction sites in Bangladesh. The questionnaire was designed in such a way that there was no biasness. In these cases, the respondents (the contractor, engineers, project managers and the workers) were used to answer with respect to four points of scaling. So the conventional four points scaling were selected to design the questionnaire:

- 1) Very important or very serious effect (4 points)
- 2) Important or serious effect (3 points)
- 3) Moderate important or moderate effect (2 points)
- 4) Least important or least effect (1 point)
- 5) No effect (0 point)

### 2.2 Data collection and analysis

The engineers, contractors, project managers and labors were included in this survey. The opinion of university teachers related to construction field was also included here. The questions were thrown in separately within the

worker as well as engineer, project manager and contractor. Authors visited 17 construction sites and total 67 respondent's data were observed. Table 1 shows the demographic information of respondents. At the time of the whole survey various complications and impediments were faced. Although the worker and engineer were shown their willingness to give the answer of the question, the contractor, project manager and related person of contractors were shown unwillingness to take part in the survey. Some on-going construction sites were visited physically so that the given data from construction stakeholder could be checked in accordance with the actual evidence present in the sites.

Table 1. Demographic characteristics of respondents

Demographic Characteristics		Frequency	Percentage, %
Sex	Male	47	70
	Female	20	30
Age	≤ 20 years old	11	17
	21-30 years old	21	31
	31-40 years old	22	33
	≥ 40 years old	13	19
Location	Dhaka Division	15	22
	Rajshahi and Rangpur Division	13	15
	Chittagong Division	10	18
	Sylhet Division	8	11
	Khulna and Barisal Division	21	31

This section includes the preferences of respondents on main factors influencing safety management on construction sites. The data was analysed by using the following formula:

$$TWV = \sum_{i=1}^4 PiVi \quad (1)$$

Where,  $TWV$  is the total weight value;  $Pi$  is the number of respondents rating the safety factors;  $Vi$  is the weight assigned to each factor  $i$ .

The factor index (FI) for each factor was derived by dividing  $TWV$  by the number of respondents ( $n$ ) and the mean of FI was also determined by the following equation:

$$FI = \sum_{i=1}^4 \frac{PiVi}{n} \quad (2)$$

Then the mean of factor index ( $\mu$ ) was calculated and deviation was found by using the following equation:

$$\text{Deviation} = (FI - \mu)^2 \quad (3)$$

In the case of ranking the factor index was used and the maximum value of factor index was considered as first position and gradually decreasing the rank respectively.

### 3. Results and discussions

#### 3.1 Physical survey results

To assess the real scenario of construction safety, the physical survey was conducted in different construction sites in Bangladesh and the cases below were observed.

1) The labours were working without any fall protective tools in some cases. According to the BNBC-2006, the slab must be guarded against falling. Not only the slab but also any opening in walls, slabs as well as edge of the slab and staircases must be guarded against falling. But the actual scenario during construction did not satisfy the labour safety regulations. As a result the proximity of fatalities is increasing day by day.

2) The labors were working without hand gloves, safety boots. According to the BNBC-2006, personal protective equipment such as safety boots, hand gloves, helmets, safety jackets etc. are essential during working with hazard conditions, but no uses was found during construction in some cases. The labors were asked why they were not using boots, hand gloves etc. The labor claimed against contractor for not providing the safety boots, helmets, hand gloves and other protective equipment where contractors are the main responsible person to ensure the safety of construction workers. Such kind of working environment did not satisfy the BNBC-2006. As a result the workers are facing skin diseases and other body injuries are happening. As workers are only responsible person of their family, their injury turns their family into more poverty.

3) When we conducted the physical survey, it was observed that the workers were painting and cutting tiles without eye protective equipment, gloves and respiratory protection. In spite of having the regulation for eye protection for labour, the contractor violated the rules. Impact hazards include flying objects such as chips, fragments, particles, sand and dirt. These hazards typically result from tasks like chipping, grinding, machining, masonry work, wood-working, sawing, drilling, chiselling, powered fastening, riveting and sanding. These objects or sparks are usually very small but can cause serious eye damage such as punctures, abrasions and contusions. Serious injury may be happened as workers are not provided the eye protective tools.

4) In the case of stair and lift, it is essential that the protection against falling must be needed according the BNBC-2006. But the observation resulted that there was no fall protective measurement during construction. It was observed that the safety belts were provided by contractor but workers were not using during lift installation. As a result workers and other related person of construction may experience in hazard. This was a very astonished things how safety rules were avoided in the construction project in the stair and lift core section. As a result the workers may fall from height and their life may be lost.

5) The workers are working without helmets, hand gloves which were not observed during physical survey. Eye protection system was very poor. But the BNBC says that the proper safety measurement is needed during lift installation. Physical survey showed that the contractor violated the building construction regulation. Having no skin protection, eye protection, the sparking resulting from welding may harm the skin which may lead to skin cancer. As the intensity of light was very high, the eye might be damaged due to the lack of safety. The uncovered and unprotected hazardous materials with no safety measure that is the most crucial potential factor of influencing accident and fatalities in results.

6) The electrical wires were kept randomly which might be caused the electrocution. In our country more than 40% worker die due to electrocution. On the other hand the coil spread around spark which was uncovered. As a result the proximity of happening fatalities is increasing day by day. Sometimes workers do not get any proper treatment if injury happens and workers bear their treatment cost for his own. It was told by the workers that no compensations was being provided to the workers for injury and loss of life.

### 3.2 Current construction safety status

After completing the physical survey during construction the workers were asked some question. About 67 numbers of respondents were participated in this questionnaire. They were trying to say the actual scenario but sometimes they felt afraid. They were asked about the reason of fear. They answered that the source of income of their family was only labouring and they felt afraid to loss their work if they would give the actual information. Some workers present in the onsite told that they were experienced small or large accident where they did not get the proper treatment and compensation. Even they were not allowed to take rest to recover from the injury.

According to the BLA (Bangladesh Labour Act)-2006 and BNBC-2006, the facilities and safety which is mentioned in above for workers must be provided. But there was no application in practical field. From table 2 it is found that the personal protective equipment (PPE) is not practicing yet. This is the responsibility of contractor to provide all safety equipment to the workers in order to build up a safe construction environment. The workers told the author that when the inspector came to visit the existing condition for reporting, they are only asked if any faults found or lack of accuracy. They also added that the inspector did not ask why they were not using boots, hand gloves, helmets etc. From the conversation they thought that inspector has lack of awareness about workers safety. In the case of pure water, washing, bathing, fencing floor opening, clean and sanitary latrines, the facilities were very poor which is mentioned in above.

Table 2. The main safety and facilities for workers which are not practicing at Bangladesh.

Item	Yes	No	Percent for not practicing
Pure water supply	20	5	20%
Clean and sanitary latrines	5	20	80%
Facilities of washing and bathing	17	8	32%
Availability of first aid box	0	25	100%
Secure covering and fencing of floor opening	0	25	100%
Head protection	0	25	100%
Foot protection	0	25	100%
Hand protection	0	25	100%
Eye protection	0	25	100%
Face protection	0	25	100%
Fall protection	0	25	100%
Ear protection	0	25	100%

### 3.3 Main reasons/factors that influence the safety performance

Now what are main reasons that influence safety performance which has been mentioned in figure 1 is a main issue. In order to find out the answer of this question the survey was conducted among workers, engineers, project managers and contractors in Bangladesh. Total 67 numbers of respondents participated in this survey and question was thrown to the respondents. Some participants tried to skip the main point but they were shown the legal evidence which were found from the qualitative survey. The main reason was then ranked based on the factor index.

The table 3 and figure 2 show the factor index of each factor. The main reasons of not practicing construction safety were identified based on factor index. The higher the factors index the higher the impact. According to the table 2 it is shown that the first and main reason of not practicing construction safety is the shortage of enforcement of safety regulation. In Bangladesh the whole responsibility to enforce the construction safety regulation according to BNBC 2006 is upon RAJUK (Capital Development Authority). But the lack of enforcement of safety rules and lack of punishment of contractor and owner turns the construction sites as more hazardous.

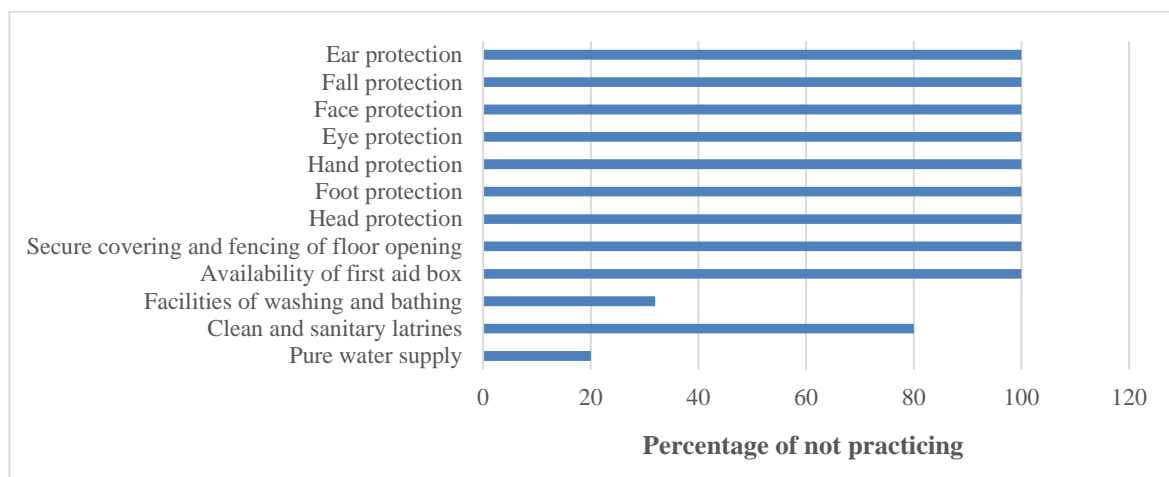


Fig 1. Current safety status in construction sites at Bangladesh.

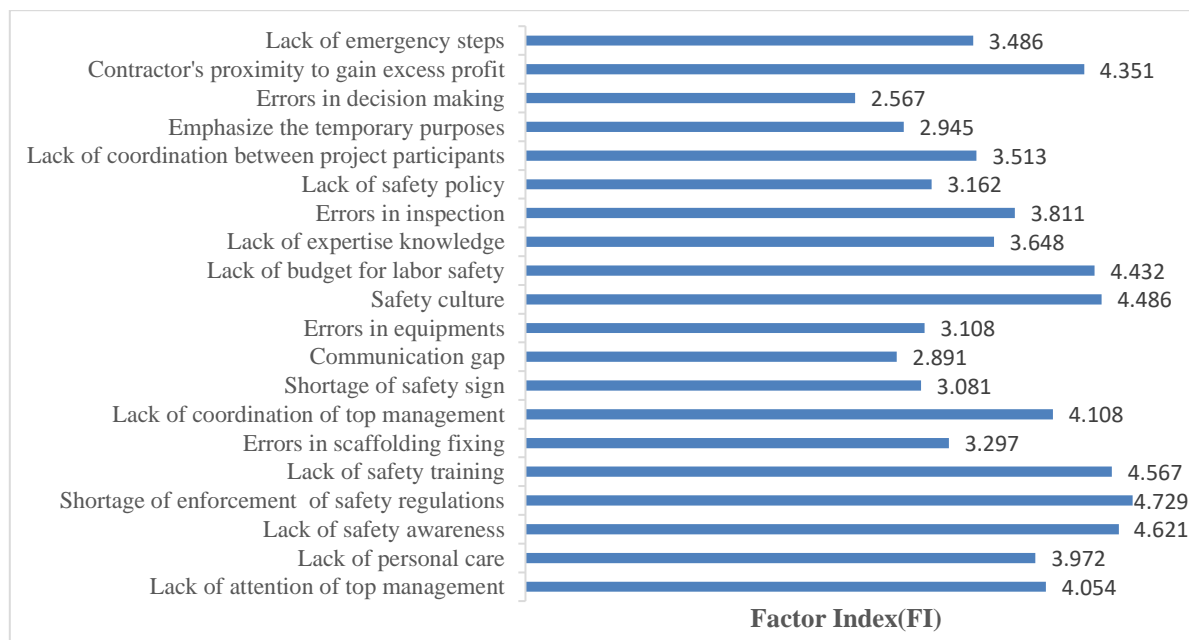


Fig 2. Reasons for not practicing construction safety at Bangladesh.

The second main reason is the lack of safety awareness among the top management, contractor as well as workers. Workers do not feel the necessity of safety for their own. They do not aware what happen if the construction safety is absent. They do not understand about the fatalities in construction. As a result the number of fatalities is increasing tremendously. Not only the workers but also the contractor and top management are not aware of construction safety. The third main reason is the lack of safety training among the site manager,

contractor's agent and workers. There is no safety policy, safety program and lack of onsite safety training. As a result workers cannot know the serious impact of accident and rate of construction fatalities is increasing.

Table 3. The main factors that influence construction safety performance at Bangladesh

Type of Safety Factors	TWV	FI	Rank	Mean Deviation	$(FI-\mu)^2$
Lack of attention of top management	150	4.054	8	0.345	0.119
Lack of personal care	147	3.972	9	0.263	0.069
Lack of safety awareness	171	4.621	2	0.912	0.831
Shortage of enforcement of safety regulations	175	4.729	1	1.02	1.04
Lack of safety training	169	4.567	3	0.858	0.736
Errors in scaffolding fixing	122	3.297	14	-0.412	0.169
Lack of coordination of top management	152	4.108	7	0.399	0.159
Shortage of safety sign	114	3.081	17	-0.628	0.394
Communication gap	107	2.891	19	-0.818	0.669
Errors in equipment	115	3.108	16	-0.601	0.361
Safety culture	166	4.486	4	0.777	0.603
Lack of budget for labor safety	164	4.432	5	0.723	0.522
Lack of expertise knowledge	135	3.648	11	-0.061	0.003
Errors in inspection	141	3.811	10	0.101	0.01
Lack of safety policy	117	3.162	15	-0.547	0.299
Lack of coordination between project participants	130	3.513	12	-0.196	0.038
Emphasize the temporary purposes	109	2.945	18	-0.764	0.583
Errors in decision making	95	2.567	20	-1.142	1.304
Contractor's proximity to gain excess profit	161	4.351	6	0.642	0.412
Lack of emergency steps	129	3.486	13	-0.223	0.049

### 3.4 Benefits for practicing safety measures in construction sites

Health and safety at construction sites deals with both physical and psychological well-being of workers on construction sites and other persons whose health is likely to be adversely affected by construction activities. Practicing safety measures and safety rules bring the benefits. These benefits are ranked based on factor index shown in the following table 4.

Table 4 shows the benefits for practicing construction safety measures and safety rules. Reduction of administrative costs ranks as the highest effect with the total weight value rating of 163 containing factor index 4.398, followed by the potential for reduced insurance and liability costs with the total weight value rating of 159 containing factor index 4.298, then by improving safety is usually a competitive advantage, because of reduced costs, with the total weight value rating of 157 containing factor index 4.247. Banks and investors will be more willing to finance to the company was the least effect with total weight value rating of 101 containing factor index 2.739. All of the benefits can be achieved if construction safety measures are taken properly according to the OSHA regulations and national rules.

### 3.5 Effects for not practicing safety measures in construction sites

When accidents happen on site, they cause many human tragedies, de-motivate workers, disrupt site activities, delay project progress, and affect overall project cost, productivity and reputation of the firms concerned. For this reason the importance of safety on construction sites and safety of construction workers can never be over emphasized. The effects of not practicing safety measures are ranked based on factor index shown in the following table 5.

Table 5 shows the effect for not practicing construction safety measures and safety rules. Payment for settlement of injury/death claims ranks as the highest effect with the total weight value rating of 203 containing factor index 5.486, followed by negative impact on reputation of firms with the total weight value rating of 198 containing factor index 5.360, then by increase in project cost, with the total weight value rating of 196 containing factor index 5.298. Cost of cases/litigation was the least effect with total weight value rating of 133 containing factor index 3.605.

### 3.6 Suggestions to overcome from the challenges

When the survey was conducted, the stakeholder related to construction industry was told to give suggestions to overcome the challenges of construction safety. The following suggestions are remarked below.

1) To ensure the health and safety of workers, suitable programmes should be provided by the employers and contractors that are consistent with national Laws and Regulations. This includes maintaining a workplace that has minimal risks and accidents that can result in injury or death. To ensure safety guidelines a competent person has to be selected to inspect the construction project site at suitable intervals.

Table 4. The benefits for practicing construction safety measures and safety rules

Benefits	TWV	FI	Rank	Mean Deviation	$(FI-\mu)^2$
Reduced administrative costs	163	4.398	1	0.321	0.111
The potential for reduced insurance and liability costs	159	4.298	2	0.245	0.064
Improving Safety is usually a competitive advantage, because of reduced costs	157	4.247	3	0.848	0.773
Improved relations with OSHA and other associated agencies	154	4.172	4	0.949	0.967
Reduced costs from injuries and illnesses	153	4.122	5	0.798	0.684
Improved employee performance	141	3.820	6	-0.383	0.157
Improve regulatory compliance	140	3.770	7	0.371	0.148
Positive employee impacts and protection of worker health	137	3.694	8	-0.584	0.366
Enhanced image within your company for employees, the community, clients and customers, and stakeholders	131	3.544	9	-0.761	0.622
Provide early notice of potential problems	126	3.393	10	-0.559	0.336
Better employee relations within the company. Everyone is on the same page with regard to safety.	121	3.267	11	0.723	0.561
Other businesses similar to yours may learn how they can do better	113	3.066	12	0.672	0.485
Savings of avoiding fines associated with non-compliance	109	2.941	13	-0.057	0.003
Enhance the ability to set realistic action plans	107	2.890	14	0.094	0.009
Provide the possibilities of more acceptance to changes/development	106	2.865	15	-0.509	0.278
Banks and investors will be more willing to finance to the company	101	2.739	16	-0.182	0.035

Table 5. The effects for not practicing construction safety measures and safety rules

Effects	TWV	FI	Rank	Mean Deviation	$(FI-\mu)^2$
Payment for settlement of injury/death claims	203	5.486	1	0.400	0.138
Negative impact on reputation of firms	198	5.360	2	0.305	0.080
Increase in project cost	196	5.298	3	1.058	0.964
Loss of human lives	193	5.204	4	1.183	1.206
Loss of productivity	190	5.141	5	0.995	0.854
Damages to plant/equipment	176	4.765	6	-0.478	0.196
Delay in work progress	174	4.703	7	0.463	0.184
Demotivation of workers/reduce morale	171	4.608	8	-0.728	0.457
Injuries	164	4.421	9	-0.949	0.776
Cost of rework/repair	157	4.232	10	-0.697	0.419
Cost of workman compensation	151	4.075	11	0.901	0.699
Loss of opportunity to qualify for future tender	142	3.825	12	0.839	0.606
Damages to completed work	136	3.668	13	-0.071	0.003
Cost of cases/litigation	133	3.605	14	0.117	0.012

2) Employers must make an assessment of the health and safety risks to which employees and others are exposed on construction sites. They need to do risk assessment to find out about the risks, and to put sensible measures in place to control them since managing health and safety is different from managing any other aspect in construction.

3) Contractors must keep accident registers at sites, and make record of all kinds of accidents from minor bruises to major and fatal accidents, and submit reports to Directorate of Occupational Health and safety services. Health and safety induction training must be given to all employees when they start to work, which should cover basics such as first aid and fire safety. If risks change, and refresher training when skills are not frequently used, training must also be provided.

4) When bid package is prepared, contractors should make provision for construction safety. In order to compete with other bidders and to avoid a monetary loss, the provision for safety and health must be made competitive with the aim.

5) Site supervisory staff should be sensitized and should share knowledge with co-workers regarding with Occupational Health and Safety. Safety officers must be incorporated to make rules, warning signs and other measures governing the sites.

6) Workers have a right before commencement of a project to proper information regarding their safety at a construction site. This information should be presented in such a language that they can understand.

7) Workers must wear their personal protective equipment properly according to the direction of their employer or the person in control of the site. They should take care of the equipment, not misuse them and report any defects and problems to the supervisors.

8) It must be ensured by the Directorate of Occupational Health and Safety services that the construction sites are inspected regularly for health and construction safety as provided in OSHA.

9) Contractors should be compelled to draw up safety responsibilities and authority structure which should be available in every site to inform all parties as to their responsibilities as far as health and safety is concerned.

10) Finally all parties in construction project must have contribution for making construction sites healthy and safe from their own rightful parts.

#### 4. Conclusions & recommendations

Raising the standard of living of people is related to the development of a country. Without building infrastructures such as modern commercial and residential centres, this is not possible and hence construction industry has been considered as a very dominating sector. The safety condition in the construction sites is comparatively poor which was found by the survey and this industry is experienced by high fatality rates due to negligence of safety issues.

The summary of results and discussion are as follows:

1) Workers are not provided personal protective equipment (PPE) according to the data analysis and from physical survey.

2) In the case of fall from height, there is no protective measurement for the workers. But the working environment is running in this way from the beginning.

3) The main reasons for not practicing safety rules are lack of enforcement of safety laws, lack of safety awareness among the construction stakeholders and lack of safety training respectively.

4) If the safety measures are taken properly the administrative cost and liability cost are reduced and reputation of the company is never lost. As a result, bank shows their willingness to finance.

5) Workers fall in demotivation and cost of compensation is given as a result of accident caused by not practicing safety rules.

6) Finally, all parties in construction project must contribute towards making construction sites healthy and safe from their own rightful parts.

The recommendations that help the future studies are as follows:

1) More construction sites can be surveyed so that the result will be obtained more accurately.

2) The correlation between construction stakeholder and causes of not practicing safety rules can be added as additional parameter.

3) Other statistical tools such as SPSS can be tried for analysis to get a comparison of the results.

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