

A Case Study on Safety and Security Assessment of Construction Project in Bangladesh

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A thesis submitted to the Department of Civil Engineering in partial fulfillment for the degree of Bachelor of Science in Civil Engineering



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DECLARATION

We hereby declare that the undergraduate research work reported in this thesis has been perform by us under the supervision of **Md. Redowan Rashid** and this work has not been submitted elsewhere for any purpose (except for publication).

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DEDICATED TO OUR PARENTS

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ABSTRACT

Construction sites are dangerous work environments. One traditional assumption prevails in the construction industry that construction safety should be the sole responsibility of the contractor. However, some safety researchers gradually begin to challenge this assumption. The elementary research in this field try to validate the existence of relationship of the owner's practices and safety performance, which indicates that the involvements of the owner have a positive impact on improvement of safety performance. Therefore, the owner can and should take a responsibility of the project safety. Some subsequent research focus on collecting and summarizing the best safety practices and procedures of the owner. Other research efforts are directed to laying out rules or principles for the owner to play a positive role in construction safety. However, relevant issues are still under-researched. Rare research is undertaken to quantify the impacts of the owner practices and procedures on safety performance. It is the responsibility of the Building Managements to ensure safety and security high rise building as well as their labors and all. Effective application of safety and security audit and engineer can minimize this risk at an optimum level.

The construction industry in Bangladesh uses labor-intensive construction methods which is relatively poor safety, and health record due its high accident and fatality rates high. We see to set in not enough Proper Safety equipment in every construction site, Fire extinguishers were not properly set and not available, No medical facilities in every construction site. There was no formal safety and security department in building construction site. Expert users of fire extinguishers and safety and security were not available at all times. There are few pure drinking water in every construction site and Sanitations system in construction site is so weak to use every labors. The extent to which workers' attitudes and perceptions and their behavior are associated with their national culture and not use all safety and security equipment

Table of Contents

Title	Page
Title of thesis	i
Declaration	ii
Acknowledgement	iv
Abstract	v
Table of Contents	vi-viii
List of Table	ix

Chapter 1: Introduction

1.1 General	2
1.2 Basic Important Terms	5
1.3 Fatality rates and construction safety culture in Bangladesh	6
1.4 Objects	10
1.5 Safety Equipment's List	11
1.6 Some Important Images	12

Chapter 2: Literature Review

2.1 Introduction / General	13
2.2 Health and Safety, Security definitions	13

2.3 Environmental protection	16
2.5 Performance costs implied within health & safety Security	18
2.6 Contractor and stakeholder strategic decisions in construction	18
2.7 Health and safety Security	19
2.8 Decision making within the construction industry	19
2.9 COVID-19 Guidance for the Construction Site	20
2.10 What is occupational health and safety security	20

Chapter 3: Methodology

3.1 General	21
3.2 Materials	21
3.3 Type of safety Audit	22
3.4 Questionnaire Design	22
3.5 Data collection and analysis	24
3.6 Site Visited for Group Member	24

Chapter -04: - Data Analysis, Results and Discussions

4.1	General	38
4.2	Data Organization	40
4.3	PPE Graph	46
4.4	Physical Survey results	47
4.5	Finding and Outcomes	54
4.6	Question for labors	55

Chapter 5: Conclusion & Recommendation

5.1	Introduction	57
5.2	Finding	58
5.3	Recommendations	59
5.3	Recommendations for Future Research	59
	Reference	62

List of Abbreviations

Acronyms	Elaboration
SU	Sonargoan University
PWD	Public Works Department
AASHTO	American Association of State Highway and Transportation Officials
BNBC	Bangladesh National Building Code
C&D	Construction and Demolition
SSD	Saturated Surface Dry
NCA	Natural Concrete Aggregate
LGED	Local Government Engineering Department
F.M	Fineness Modulus
ACV	Aggregate Crushing Value
AIV	Aggregate Impact value
F.I	Flaking Index
BBS	Bangladesh Bureau of Statistics
PSI	Pound Per Square inch
BUET	Bangladesh University of Engineering and Technology
W/C	Water Cement Ratio
Mpa	Mega Pascal
ACI	American Concrete Institute
ASTM	American Society for Testing and Materials
X	Percent of replacement of concrete.
UN	United Nations
UTM	Universal Testing Machine
SG	Specific Gravity
FA	Fine Aggregate

Chapter -1

Introduction

1.1 General

Because of the nature of construction industry, construction sites are dangerous work environments, and construction workers are usually exposed to various hazards.

According to statistics by the U.S. Department of Labor, construction frequently appears on the list of “Ten Most Dangerous Jobs” (Devanshu Pandit, 2014) .According to the Census of Fatal Occupational Injuries (Anon., 2014,april)an average of 828 workers, during the period from 2009 to 2012, lost their lives annually on construction sites. Although massive efforts have already been made to reduce the safety accident rate of construction industry, there are still many areas for improvement. Previous researchers have placed their emphasis on how to enhance the roles of designers, contractors, and subcontractors in construction safety. However, as the finance provider and ultimate user of the construction project, there has been a lack of research efforts concerning the owner’s role in construction safety. Because of the nature of construction industry, construction sites are dangerous work environments, and construction workers are usually exposed to various hazards. According to statistics by the U.S. Department of Labor, construction frequently appears on the list of “Ten Most Dangerous Jobs” (Devanshu Pandit, 2014) According to the Census of Fatal Occupational Injuries (Anon., 2014,april)), an average of 828 workers, during the period from 2009 to 2012, lost their lives annually on construction sites. Although massive efforts have already been made to reduce the safety accident rate of construction industry, there are still many areas for improvement. Previous researchers have placed their emphasis on how to enhance the roles of designers, contractors, and subcontractors in construction safety. However, as the finance provider and ultimate user of the construction project, there has been a lack of research efforts concerning the owner’s role in construction safety. Construction projects usually involve participations of owners, designers, and contractors. Every party in the project, from the subcontractor directly managing craftsmen to the owner regularly visiting the jobsite, must realize that they have an important role to play in ensuring high levels of safety performance. Most especially, the owner plays a key role in the whole

construction safety management. Most previous research on construction safety focused on contractors and designers, limited research. was conducted by looking at project participants higher in the supply chain ((Sunindijo, 2014)).

The owner is the only participant getting involved in each stage of the execution of the whole project. Safety-related processes belong to different phases that can affect each other significantly. For example, design processes in the preconstruction phase can significantly affect the safety on the jobsite. At this point, the contractor can do little to make a difference ((N D Weinstein, 2005)).

The owner should offer designers with adequate information and other necessary assistance for addressing safety in (Anderson, 2005)Nevertheless, the owner could make the designer focus on addressing safety in design. From this perspective, the owner is in the best position to take the safety performance to the next level. The owner has the authority to administrate almost every activity through the whole project. The owner is always the provider of project finance, and is in most cases the ultimate user of the final facility. Therefore, the owner has the right to propose a comprehensive set of objectives for the contractor and the designer, including safety objectives. These objectives would be deciphered by the contractor to understand the owner's emphasis on safety. Based on this, the contractor would draft different safety plans to satisfy the owner's requirement. In the light of this causation, it can be said that the owner's requirement for safety is the root cause for all actions the contractor takes to handle safety issues. In the past few decades, the owner's role in construction site safety has been increasingly recognized by governmental health & safety departments outside of the United States. In the European Union, the Council Framework Directive 92/57/EEC clearly indicates that the client is responsible for the safety at sites. And it is specially stressed that appointing a safety representative does not exempt the client from the responsibility of safety (Anon., n.d.) .Australian government also sights the owner's role as a driving force to improve safety performance in construction industry. The National Standard for Construction Work by the National Occupational Health and Safety Commission in 2005 establishes clearly OHS responsibilities for the owner. A survey was conducted by) to investigate the relationship between the owner's attitude towards health and safety on jobsite and the contractor's safety performance. The research concluded that the owner can impose a

great impact on the construction safety performance, particularly in cases of small or medium-sized contractors. Promoting or addressing the owner's attitude would make a great contribution to improvement of construction safety (Anon., 2017) In the context of Design/Build (DB) project, whether the owner explicitly evaluates safety as an important target in request for proposal or not can cause a significant difference in the safety performance. The research concluded that the owner should lead and coordinate the activities related to safety in the preconstruction stage, provide necessary resources to the contractor for implementing safety programs, and participate in safety activities on daily basis. (Anon., 2006) Another research in Australia claimed that owners should initially focus on six roles: (1) participate in site-based safety program; (2) review and analyze safety data; (3) appoint a safety team; (4) select safe contractors; (5) specify how safety is to be addressed in tenders; and (6) perform regular checks on plant/equipment (Sunindijo, 2014)

Although since the 1980s owners have begun to gradually play an active role in craftsmen safety on the jobsite, the traditional view is still prevalent that construction site safety has been the sole concern of the contractor. Other partners in a project team, particularly the owner, do not take responsibilities of safety to a high degree. That is because the contractor, as the most professional and experienced team member, has an entirely firm control over the whole jobsite (Gambatese, 2000). However, contrary to conventional thought, owners' inactivity to perform their safety parts is one of the root causes of many construction accidents (HSE, 2003). Owners' ignorance of their roles in safety extensively exists, and up to 84% of owners never or rarely participate in construction safety audits and inspections (Musonda, 2009). Owners tend to give a high priority to other objectives such as cost and time. Therefore, decisions related to safety issues may actually not be made to create a safer workplace, but to reduce cost or accelerate progress (Sunindijo, 2014). These kinds of behaviors eventually result in overtime work, low concern for safety, and reductions in construction safety practices (Loosemore, 2007)

As aforementioned, surveys and research have demonstrated that the owner indeed plays a key role in the safety performance, but also indicated that most owners are ignorant or inactive to exert pro-active part in reducing accidents on the jobsite. There is an imperative need to thoroughly study how the owner affects the construction safety.

Nevertheless, previous research on the relationship between the owner's role and workplace safety were limited in recognizing roles that the owner can play and presenting the best practices for select. A driving force behind the owner's behaviors was largely neglected, which was the culture. The culture leads to behaviors, and behaviors reflect the culture. The effort of research should be made to improve the owner's role in both cultural and behavioral ways. Operational Excellence (OE) is an effective and practical approach to addressing safety issues, taken from the chemical processing industry. OE is defined as the performance of all tasks performed correctly every time (Anon., n.d.) OE integrates behavioral and cultural approaches to create a system whereby individuals do the right thing, the right way, every time. By creating values, beliefs, and assumptions that spawns a strong safety culture, the behaviors of individuals will improve. In the light of OE concept, improvement for the owner's role in construction safety also requires a reinforcement of behavioral and cultural executions. Therefore, the aims of this research are to investigate the owner's role in influencing safety performance, embed OE concept into the mechanism of how the owner plays a safety role, develop an effective systematic model to guide the owner to act more positively and actively in the issues of safety, and validate the effectiveness and efficiency of the model with an empirical study of cases.

1.2. Basic important terms: -

Canopy

canopy is **a roof like covering or anything that seems to cover**. An example of canopy is a thick forest that the sun doesn't shine through onto the ground below. An example of canopy is the fabric cover being held by a post at each corner above a bed.

Accident

An unfortunate incident that happens unexpectedly and unintentionally typically resulting in damage or injury.

Vulnerability

Vulnerability is **the quality of being easily hurt or attacked**. Some seniors think it's funny to pick on the ninth graders because of their vulnerability. Vulnerability comes from the Latin word for "wound," values. Vulnerability is the state of being open to injury, or appearing as if you are

Injury

hurt, damage, or loss sustained. 2 a: an act that damages or hurts: wrong. b: violation of another's rights for which the law allows an action to recover damages.

1.3. Fatality rates and construction safety culture in Bangladesh: -

Section 7 of the Bangladesh National Building Code (2006) has a section dedicated to safety measures for workers and clearly states that workers should wear helmets and safety harnesses and that temporary stairs, ladders, and scaffolds should be, substantially constructed so as not to create any unsafe situation for the workmen using them or the workmen and general public passing under, on or near them. However even casual observation would reveal that these provisions are frequently if not always violated. According to Safety and Rights Society (SRS) there were 149 deaths in the construction industry in 2012, 183 deaths in 2011, 73 in 2010, 56 in 2009 and 100 deaths in 2008.¹³ However, the actual Figure 1 is suspected to be much higher. The Dhaka Medical College morgue and its emergency department alone report receiving one or two such victims of construction site accidents every day. Unlike the export– oriented industries, the construction industry does not receive any pressure for reforms from the foreign buyers (and their consumers). Perhaps as a result, there is no enforcement body to ensure that worker safety legislation is enforced.^{14–16} In 2010, the High Court asked the government to establish a National Building Code Enforcement Authority, but no such authority has been created, leaving worker safety rules entirely unenforced (Tables 1&2).



a)



b)



c)

Figure1.1 - pictures safety and hazard scenario.



d)



e)



f)

Figure1.2 - pictures safety and hazard scenario.

1.4. Objectives

The objectives of the study are:

- To investigate the current safety status in building construction in Bangladesh.
- To analyze the safety factors those, influence the safety performance in construction sites.
- To identify some limitations in the present condition of fire- safety at building construction in Bangladesh. To make some recommendations to overcome these problems.

1.5. Safety Equipment's List: -

- Safety Papers those are signed by assign organization
- Safety Dress/Safety Vest
- Musk
- Hand Sanitizer
- Safe Water
- Fast Aid Box
- Cotton Gloves
- Surgical Gloves
- Scaffolding
- Pipe and So on/etc.
- Safety Barrier
- Safety Hale mate
- Safety Gloves
- Safety sun glass
- Safety Belt
- Safety Shoes

Some Important Figure Are Given Below:



a) Safety Rules



b) Must abide by

Fig.2.2- : Safety instruction and safety Sign at a Construction Project.



Fig.2.3: Fast Aid Box at a Construction project for Labor safety purpose

Chapter -2

Literature review

2.1. Introduction: -

The owner's role in construction safety is increasingly recognized by researchers in the recent years. The purpose of this study is to identify the critical elements influencing the role the owner plays in construction safety, and to utilize these elements to form a comprehensive rating model. By using this model, owners can find the weak areas in their safety performance and figure out an effective improvement plan to achieve a better result.

2.2. Health and Safety Security definitions:

Prior to initiating a debate and discussion regarding occupational health and safety issues, a few definitions need to be clarified, and the associated legal framework discussed. It is important towards having a clear perspective on the specific nature of the sector and the associated working conditions normally encountered within the construction sector. This would contribute towards enhancing the existing health and safety standards prevailing therein.

Health: Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity and relates to the processes employed towards protecting people from the adverse effects of all the operations concluded within a construction and work site. occupational ill health describes all health problems in the work environment. This includes health problems that workers bring to the workplace as well as health issues that are caused or made worse by work. In the construction injury, there are many hazards that can contribute to occupational ill-health. Some of these are:

- **Exposure to harmful materials**, including asbestos, lead, dusts containing silica, chemicals, sunlight, gases, and exhaust emissions. This can lead to skin problems, dermatitis, occupational asthma, occupational cancer, and lung disease, if they are not properly controlled.
- **Frequent loud noise**. In time, this may contribute to noise induced hearing loss and tinnitus.
- **Excessive use of vibrating tools**, which may lead to Hand Arm Vibration Syndrome and vibration white finger.
- **Frequent material and manual handling of heavy loads**. This may give rise to musculoskeletal disorders and upper limb disorders, particularly if you adopt incorrect manual handling procedures.
- **Stress and fatigue**. This can contribute to a range of mental health conditions, including depression and anxiety.
- **Lone working**. This presents risks such as accidents not receiving urgent assistance if nobody is nearby and if communication methods are insufficient. It may also result in accidents arising from the inability to immediately ask someone for help.
- Potential for **falls from height, electric shocks, being struck by a moving vehicle, and working in a confined space**. The dangers from these can range from a broken bone to death.
- **Inadequate working conditions**, including insufficient lighting, uncomfortable temperatures, and long working hours.

Safety

Construction safety is a major cause for concern in the working world, as it is one of the most dangerous. It is, according to the Bureau of labour statistics (BLS), the fourth most dangerous profession with the second most fatal injuries. It is possibly the second most dangerous land-based profession after the fishing industry. The Occupational Safety and Health Administration (OSHA) provides health and safety regulations and standards specific to the construction industry.

Welfare

This means the provision of facilities that are necessary for the well-being of employees, such as washing, toilet, rest and changing facilities and somewhere clean to eat and drink during breaks

welfare facility requirements summary

Toilets

Toilets should be suitable and sufficient, ventilated, lit and kept in a clean and orderly condition.

Washing facilities must be provided so that workers can use them immediately after using the toilet or urinal, even if they are provided elsewhere.

Washing facilities

General washing facilities must be suitable and sufficient, kept clean and orderly and with basins or sinks large enough for people to wash their face, hands and fore arms.

The facilities should include: clean hot and cold, or warm running water; soap or other suitable means of cleaning; towels or other suitable means of drying; and showers where the nature of work is particularly dirty or there is a need to decontaminate.

Drinking water

Drinking water must be provided or made available at readily accessible and suitable places. Cups are required unless the supply is in a jet from which people can drink easily.

Changing rooms and lockers

Changing rooms are needed where workers have to wear special clothing for the purposes of their work and cannot be expected to change elsewhere.

The rooms must be provided with seating, means of drying and keeping clothing and personal effects secure.

Facilities for rest

Rest rooms or rest areas are required equipped with tables and seating (with backs) sufficient for the number of persons likely to use them at any one time.

There should be arrangements for preparing and eating meals, also for boiling water. In cold weather, heating should be provided.

2.3. Environmental protection

Relates to specific activities conducted within the workplace impacting the surrounding environment including the soil, air, flora, water and the fauna. The health and safety of the associated workers are also included herein. Activities and processes related to effluent and waste disposal are fall under the preview of this aspect. The Health and safety Executive (HSE) concludes accidents to be unplanned and un-forecasted events which end up harming individuals, groups of people or cause minor or major damage to the environment, material, plant or property within the business under consideration. The UK Health and Safety Executive (HSE) have the responsibility for the input of provisions of the Health and Safety at Work (HSW) Act that ensures all the necessary legislation implementation of the provisions therein towards the recommendations of the Health and Safety Commission (HSS). The latter is tasked with promoting the HSW Act besides providing related advisory services and conducting associated research and training. Although related authorities conclude an accident to include events and instances of specific injury, the current treatise would focus on the Health and Safety Executive definitions.

Health - is considered as a protection from processes, procedures or materials of workplace that can cause illness to the minds and bodies of people.

Safety - there is a fine line between health and safety. Therefore, in a border perspective, both the terms are causally used together for indicating the concern for the mental and

physical wellbeing of the people working in an organization. At a specific level, safety is protecting people from physical injury.

Welfare - is responsible to give facilities to the people to ensure their well-being and health at the workplace.

Environmental protection – This relates to aspects covering the fauna, flora, soil and air surrounding a workplace, and how it is impacted by activities undertaken in the course of performing a work or job within the area. Correspondingly, the impact on the overall environment is assessed. This includes atmospheric pollution and effluent disposal.

Accident – a damage or loss to property, material, plant or the environment, or injury or ill health of people, or loss of a business opportunity that is faced after any unplanned event is labeled as accident by Health and safety Executive (HSE). The proper implementation of the Health and Safety at Work (HSW) Act within the United Kingdom is assigned to the Health and Safety Executive (HSE). They are also in charge of carrying out day to day work and functions of Health and Safety Commission(HSC). The HSC is accountable for promoting health and safety at work and encourage trainings, researches and offering advisory services and information. Accident is quite narrowly defined by other authorities who do not consider those events that do not bring about any injury or ill-health. However, the Health and Safety Executive definition will be used in this study.

Hazard and Risk: Hazard can be given a rank relative to other hazards or to a possible level of danger. It is a possible activity or process that may bring about harm. They take many forms, including working from a ladder, chemicals and electricity. Hazard and risks are the two terms that are often confused with each other; construction sites that are often at high risk are usually at high hazard. Therefore, it is very important to distinguish between the two of these. A risk is a possibility of an activity, substance or process to cause harm. It can be reduced with the help of controls by good management. However, even in such cases, the probability of hazards remains high. The remaining level of risk when the controls have been adopted is called residual risk. When the control measures are inadequate and display poor health and safety, then there is high residual risk. There are various definitions of risk (Anon., n.d.)is of the perspective that risk is related to the probability of someone being harmed bodily in a work environment. According to Hertz

and Thomas (1983), it is exposure to the likelihood of loss or injury; this definition is taken from the Random House College Dictionary

Overall, the construction industry is observed to have a poor safety record;

- This necessitates instituting major reforms;
- The causes of specific accidents could be determined to be complex but should nevertheless be properly investigated;
- This ensures the safety and health of the stakeholders;
- Present safety standards have much room for improvement.

2.5. Performance costs implied within health & safety Security: -

Health and safety performance costs are an important part of the company expenses that are required for maintaining a healthy and safe work environment at the workplace. These costs include expense incurred for complying with legal laws relating to workplace health and safety, executing plans to avoid accidents during the work as well as to improve safety and work conditions in all areas of the construction work. The cost of health and safety performance is considered as an important and necessary expense by many companies.

2.6. Overview of efficiency and cost effectiveness development in the industry: -

Based on literature review, the effectiveness of project is found to be associated with project 'results' in terms of meeting core business and project objectives, user satisfaction and use of the project as identified jahid & Fajlul Haque .We have compiled and reviewed ten possible indicators that help measure project results. These include client and user satisfaction, effectiveness of project, project functionality, defect free, offer value for money, profitable, absence of legal claims, learning and exploitation and generation of positive image.

2.7. Contractor and stakeholder strategic decisions in construction health and safety Security: -

The decision making process

Contractors undertake the construction project using a team comprising of different department. Most of the contributors make decisions that affect health and safety at the worksite. In some cases, the project team consists of external members such as advocacy groups or regulatory agencies. It is important that the construction company identify health and safety issues relates to the sector during the decision making process.

2.8. Decision making within the construction industry: -

The supply chain in the construction industry is fragmented with very little communication taking place between the individuals that initiate, manufacture, design, utilize, and/or maintain the facilities. Lack of communication between different team members can prevent establishment of shared goals and objectives that will negatively affect health and safety at the organization level. Poor communication and the formal distance between the construction and the design department is especially identified as a major barrier to implementation of effective health and safety procedures within the organization. It has also been linked with higher incidence of fatalities at the construction worksite. As compared to other department, constructors have a deep understanding of the processes mainly due to specialized. Knowledge, training and expertise of the individuals. Moreover, they are directly responsible for the project outcomes. As a result, they usually have a greater interest and motivation in ensuring the work is performed safely with minimum safety and health risk for the workers. They can provide advice to the decision makers about OHS before the start of the construction process. When they fed knowledge about the construction process 'upstream' at the initial phase of the construction project, it will result in better decision making with greater chances of health and safety risks being reduced eliminated completely at the source.

2.9. COVID-19 Guidance for the Construction Site: -

- a. Encourage employees and workers to stay home if they're sick
- b. Enforce workers to wreck masks that cover mouth and nose

- c. Use personal protective equipment (PPE), to protect workers from job hazards
- d. Advise workers to avoid physical/direct contact with employees, contractors, and/or visitors.
encourage social distancing (3-feet) as much as possible.
- e. Train workers and employees how to properly wear/use/remove protective equipment and clothing
- f. Maintain wash stations with access to soap and water for hand washing

2.10 What is occupational health and safety security: -

Occupational safety and health (OSH): also commonly referred to as occupational health and safety (OHS), occupational health, or occupational safety, is a multidisciplinary field concerned with the safety, health, and welfare of people at occupation. These terms also refer to the goals of this field,^[2] so their use in the sense of this article was originally an abbreviation of occupational safety and health program/department etc.

The goal of an occupational safety and health program is to foster a safe and healthy occupational environment. OSH also protects all the general public who may be affected by the occupational environment.

Globally, more than 2.78 million people die as a result of workplace-related accidents or diseases, translating to one death every fifteen seconds. There are an additional 374 million non-fatal work-related injuries annually. It is estimated that the economic burden of occupational-related injury and death is nearly four per cent of the global Gross Domestic Product each year The human cost of this adversity is enormous.

In common-law jurisdictions, employers have a common law duty (also called duty of care) to take reasonable care of the safety of their employees Statute law may, in addition, impose other general duties, introduce specific duties, and create government bodies with powers to regulate occupational safety issues: details of this vary from jurisdiction to jurisdiction.

Chapter-3

Methodology

3.1 Methodology of the study

This is an exploratory type of research. The necessary information for this paper is collected from primary and secondary sources. The overall process of methodology has been given below:

Sources of Data:

a. Primary Sources of data: Data have been collected from many the high-rise building. Target population: All the high- many the high-rise building as sample. Here, high-rise means at least. Sampling method: Convenience sampling method has been used to select the sample. Primary Data Collection Method Thirty shopkeepers many the high-rise building, the questionnaire comprises three parts. The first part consists of eleven questions out of which only one question is open ended and rests of the questions are close ended. In the second part, it consists of sixteen queries which all are relevant to the reflection of the actual safety provision at the many the high-rise

b. Secondary Sources of Data: Secondary sources are summarized below:

- Different Published Report and University Journals
- Internet
- Relevant Books

3.2 Materials

In this thesis project we were used to

1. Safety Papers those are signed by assign organization.
2. Safety Barrier
3. Safety Hale mate
4. Safety Gloves
5. Safety sun glass
6. Safety Belt
7. Safety Shoes
8. Safety Dress/Safety Vest
9. Musk

10. Hand Sanitizer
11. Safe Water
12. First Aid Box
13. Cotton Gloves
14. Surgical Gloves
15. Scaffolding
16. Pipe etc.

3.3 Types of Safety Audit

Safety auditing has many definitions. Some people use a very broad definition, implying that the scope of safety auditing includes virtually all safety management activities, while others have adopted more focused technical approaches.

- a. Safety audits on specific topics, for example, human factors or hazardous substances.
- b. Plant technical audit covering special work tasks, and done by both local and special staff.
- c. The site technical audit covering special work tasks, and done by both local and special staff.
- d. Compliance audits (or verification audits) to establish whether the relevant legal requirements are met.
- e. Validation audits which deal with the scope and design of the audit.
- f. The management safety audit (or area safety audit) which covers general safety matters, and involves local staff and perhaps specialist auditing staff as well.

3.4. Questionnaire Design: -

There are 20 factors were selected from literature review and expert's opinion which may cause the fatalities in construction sites. 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 most 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:

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

3.5. 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 20 construction sites and total 47 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. This section includes the preferences of respondents on main factors influencing safety management on construction sites. The data was analyzed by using the following formula:

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

Where, TWV = the total weight value; P_i = the number of respondents rating the safety factors; V_i = the weight assigned to each factor (i)

3.5. Site Visited for Group Member: -

1. Rahim Bakaul_BCE1802014163

- A. Project name: Tanzina Naheed-Location: Baridhara, Road 5, House 19, Dhaka- Starting date: 01/06/2019 Daliy worker: Mason - 50 nos Helper - 40 -10 storage building
- B. Project build up: Apan Jewellers- Project name: Apan Rezia-Location: Block - K, Baridhara, Dhaka 1212, and Apartment Size: 3700 sft. Apan Rezia, Road # 11, and block z - K, Baridhara, and Starting date: 01/06/2018 Daily worker: Mason - 55 nos. Helper - 44 -10 storage building.

2. Md. Abdul Kader_ BCE1802014026

- A. Project Name: Friendship Tower, Proposed 10-Storeyed Residential Building (Occupancy Type: A2), Location: House No. Ka-52/B/1, Moddhapara Road, Khilkhet, Dhaka-1229_ Worker: Mason - 20 Nos. Helper - 47
- B. Project Name: Proposed 10-Storeyed Residential Building (Occupancy Type: A2), Location: Plot No. 210, Road No. - 3, Block - B, Bashundhara Residential Area. Worker: Mason - 30 Nos. Helper - 61

3. Ekbal Hossain_BCE1802014106

- A. Project name: human billa Location: Azimpur, Dhaka Starting date: 12/11/2020 Daily worker: Mason - 43 nos. Helper - 42 Storage :10
- B. Project build up: biswas builders Ltd. Project name: sky touch Location: katabon mor, Dhaka Starting date: 09/06/2021 Daily worker: Mason - 30 nos. Helper - 36 Sky touch 8 storage

4. MD. Bipul Mia_BCE1802014146

- A. Project name: PPI Girls Hostel Location: Rupganj, Narayanganj Daily workers: Mason-35 Helper: 30 Storage: 8
- B. Project name: Riverfront satellite city. Location: Z.H sikder medical college. (Rayerbagh, Dhaka). Daily workers: Mason-40 Helper: 36 Storage: 8

5. Md. Iftiaj Hossain_BCE1802014059

- A. Project Name: Asset Development Location: 91 Gulshan Avenue Daily Labour: 10 Meason: 8 Storage: G+8
- B. Project Name: Jas Holdings Ltd Location: 118/2 Matikata Dhaka Cantonment Daily Labour:



a)

Fig.3.1: Worker working without safety barrier, head protection,



b)



c)

Fig.3.2: Worker working without safety barrier, head protection,



a)
b)



Fig.3 3: Labor working without any fall protective guardrail system



a)



b)



c)

Fig 3.4: Labor working without hand gloves, eye protective tools during painting & cutting



a)



b)

Fig.3.5: Worker working with safety boots, hand gloves, head protection



c)



d)

Fig.3.6: Worker working with safety boots, hand gloves, head protection



a)



b)

Fig.3.7: Safety Meeting and Instruction among Engineer, supervisor, Labour and Security



a)



b)

Fig.3.8: Labor working with hand gloves, eye protective tools during painting & cutting



a)



b)



c)

Fig.3.9.: Construction Site visits with team members with safety equipment's.



a)



b)

Fig.3.10: Unprotected lift core and staircase



c)



d)



e)

Fig.3.11: Unprotected lift core and staircase



a)



b)



c)

Fig.3.12: Electrical wires Rup host and mixture machines equipment are kept in hazardous condition.

CHAPTER -4

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1. General:

The purpose of this study was to analyze data and presenting the results and discussion on safety and security assessment of construction project in Bangladesh

This chapter is organized into five sections: -

- (a) Demographic information,
 - (b) Data organization,
 - (c) Statistical and descriptive analyses,
 - (d) Findings, and
 - (e) Summary.
- (a) Demographic information for questionnaire methods:

The sample population consisted of 250 person's labor in grades 16 to 40 who were enrolled indifferent construction company. Responses were gathered to evaluate Labors perceptions of safety and security on a running Construction site as it related to four demographic categories: ethnicity/race, socioeconomic status, grade level, and gender (see Tables 1-3).

Table 4. 1: Demographic Category: Socioeconomic Status

Socioeconomic Status.....	N
1. Eligible for free or reduced-price lunch.....	124
2. Not eligible.....	76
3. Unknown or decline to state.....	50

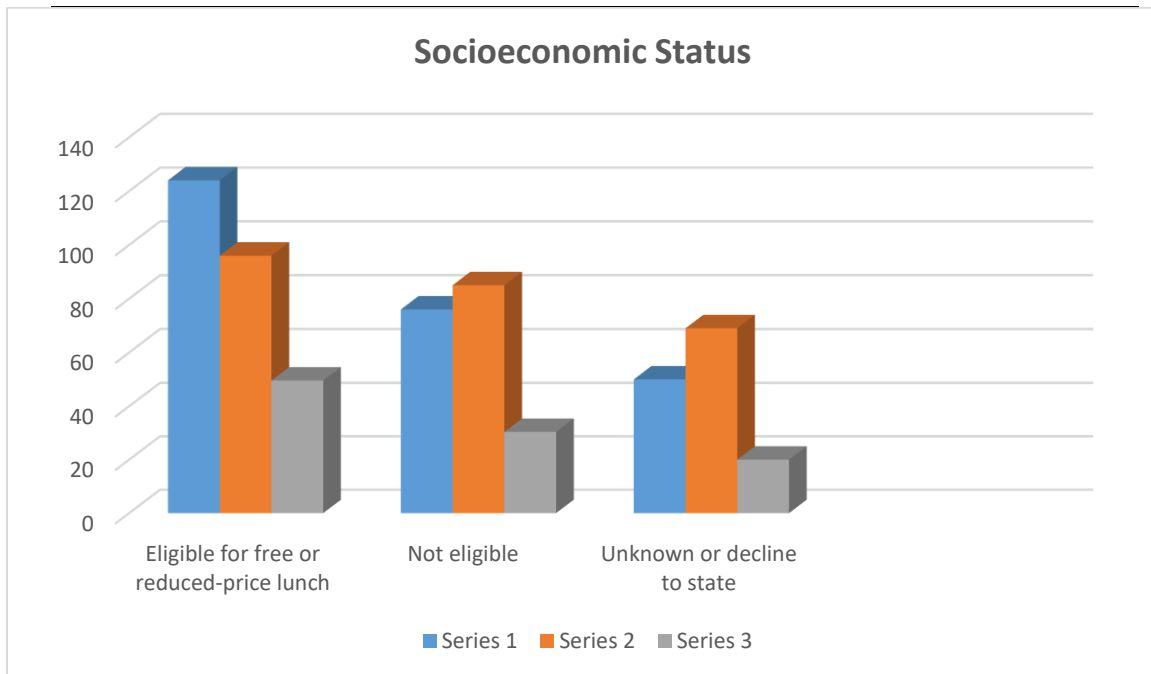


Fig.4.1 Socioeconomic Status

Table 4.2 : Demographic Category: Grade Level

Grade Level	N
9	96

10.....	85
11.....	69

Table 4.3 : **Demographic Category: Gender**

Gender.....	N
1.Male	160
2.Female	90

4.2. Data Organization: -

After evaluating the demography of the respondents who returned completed surveys, this researcher determined that certain cohorts were not large enough in terms of sample size to reliably provide results that could be generalized to a larger population. Additionally, two demographic cohorts (i.e., “two or more races” and “unknown or decline to state”) were no longer relevant and would yield insignificant data. This researcher also combined four smaller grade-level cohorts (9th-16 age to 22 age , 10th-23age to 32 age , 11th-33age to 40 age) into two larger cohorts (lowerclassmen-LC and upperclassmen-UC) to provide larger, more reliable sample sizes. Therefore, the survey data were organized into four demographic categories: ethnicity/race, socioeconomic status, grade level and gender. These categories were further disaggregated into eight cohorts: White and Hispanic, eligible and not eligible (for free or reduced-price lunch), lowerclassmen (LC) and upperclassmen (UC), and male and female. This researcher administered a survey consisting of 16 statements and six lists of safety topics requiring a total of 97 responses by each individual. In addition, respondents were provided the opportunity to insert open-ended comments. Prior to conducting the comprehensive analyses reported in this chapter, this researcher determined that certain survey statements were redundant, no longer relevant to the present study, or limited by an

inadequate response rate. These survey statements were subsequently discarded. As a result, 52 of the original 97 survey statements were used as data points for the statistical analysis. Finally, this researcher reduced the number of response cells from five to three in an attempt to simplify and streamline the massive amount of data obtained from the survey. The following cells were combined for reporting purposes only:

- (a) Strongly Agreed and Agreed, and
- (b) Strongly Disagreed and Disagreed.

Findings

Research Theme: Construction Security and Safety

Table 4.4: The ration of sex, age and location

Demographic Characteristics	Freq.	Percent. %
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

Table 4.5. The main safety and facilities for workers which are not practicing at Bangladesh

SL no.	Equipment's names	Yes	No	Percent for not practicing
01	Safety Papers those are signed by assign organization	8	2	20%
02	Safety Barrier	5	5	50%
03	Safety helmet	6	4	40%
04	Safety Gloves	0	10	100%
05	Safety sun glass	0	10	100%
06	Safety Belt	0	10	100%
07	Safety Shoes	2	8	80%
08	Safety Dress/Safety Vest	4	6	60%
09	Safety Musk	0	10	100%
10	Hand Sanitizer	10	0	0%
11	Safe Water	3	7	70%
12	Fast Aid Box	1	9	90%
13	Cotton Gloves	0	10	100%
14	Surgical Gloves	0	10	100%
15	Scaffolding	10	0	0%
16	Pipe and So on/etc.	3	7	70%
17	Gum boots	10	0	0%
18	High VIS cloth	0	10	100%
19	Welding Musk	6	4	40%
20	Safety helmet with flashlight	0	10	100%
21	Ear protection	0	10	100%
22	Caution tape	10	0	0%
23	Safety cone	8	2	20%
24	Fire bucket	0	10	100%
25	Fire Extinguisher	0	10	100%
26	Safety harness	3	7	70%
27	Welding jacket	0	10	100%
28	Eye and face protection	1	9	90%
29	Harnesses	3	7	70%
30	Disposal protective clothing	0	10	100%

Questionnaires' answers for statically:

SL	Question	9 th (16-22age)	10 th (23-32age)	11 th (33-40age)
1	what in the safety of using heavy equipment ?	26	44	30
2	How many people would take goggles before the welding?	33	50	27
3	Are you wear safety clothes properly on your site?	20	30	50
4	What training did you take on safety?	19	43	38
5	Do you use first aid box on site?	40	35	25
6	There is field meeting about safety before starting work every day ?	55	25	20
7	How many people use to helmet safety materials for self-protection ?	75	20	05
8	How many people use PPE materials for self-protection ?	25	40	35

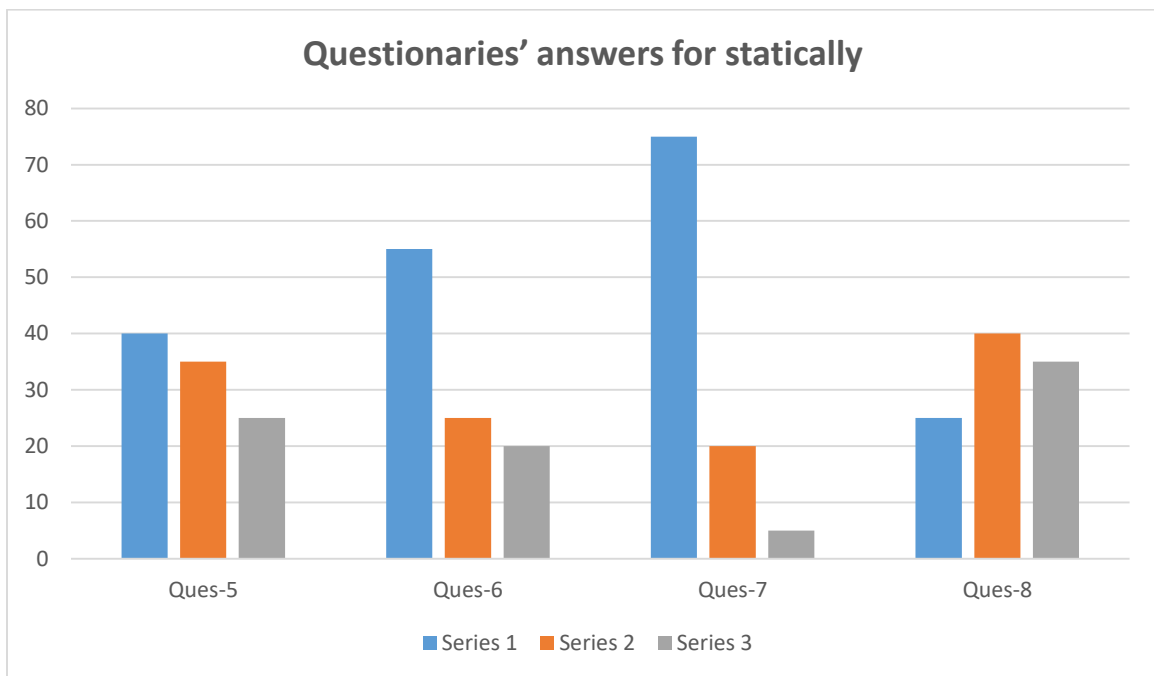
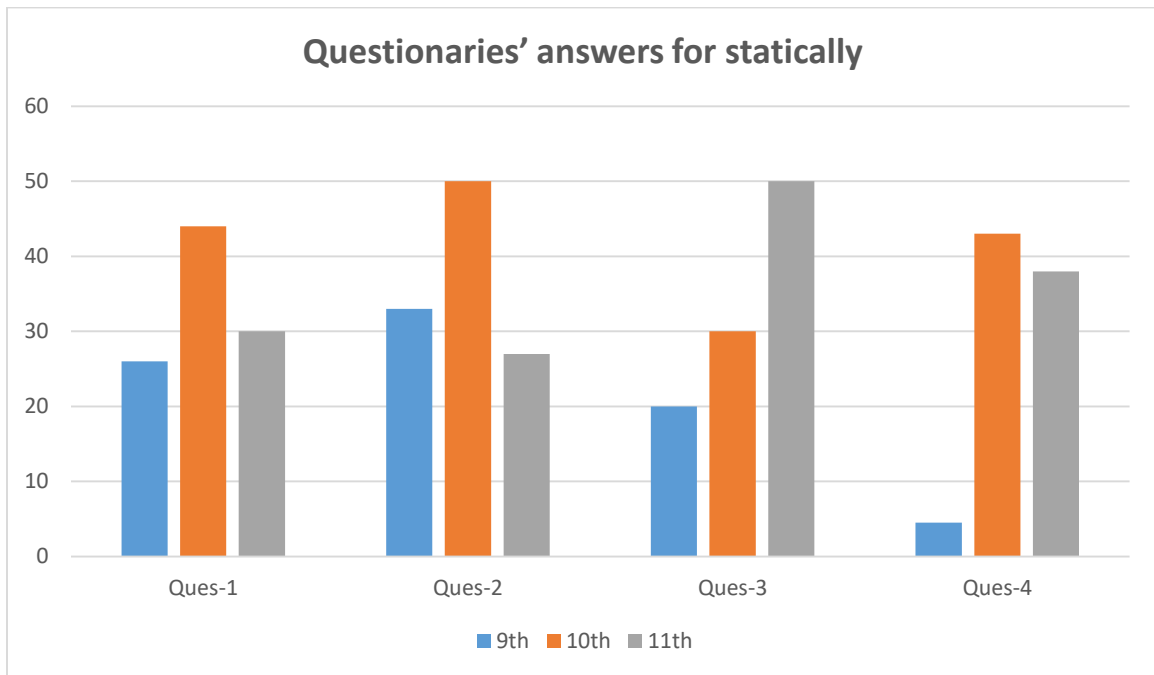


Fig4.2: Questionnaires' answers for statically

Employers must also provide practical training and information on when and how PPE will be used, and against which risks. However, Figure 8 shows that practice is quite different. Figure 8 illustrates 10 items of PPE, which are available at construction sites. Among them, a hard hat had been available in almost every project where 96% of the workers had worked, while 86% of the respondents stated that reflector vests and gloves had been mostly available. Boots/shoes were the other PPE that had generally been available at construction sites where 80% of the participants had worked. However, at most about half of the workers had had the remaining equipment, i.e., overalls (59%), rain gear (57%), goggles (52%), helmet (51%), ear plugs (39%), and harness (39%). Some workers had even never seen ear plugs (18%), helmets (13%), or goggles (10%) at construction sites.

The other important point in considering HS affairs is how frequently construction workers wear PPE. Figure shows that many workers used a hard hat (86%), reflector vest (85%), rain gear (76%), overalls (74%), gloves (71%), and boots/shoes (70%), if available. However, other equipment such as a harness (32%), goggles (27%), helmet (27%), and ear plugs (26%) was used by one third or one fourth of the respondents only. In addition, numerous workers had never worn ear plugs, helmet, harness, or goggles, even if they were available at the construction site.

personal protective equipment (PPE)

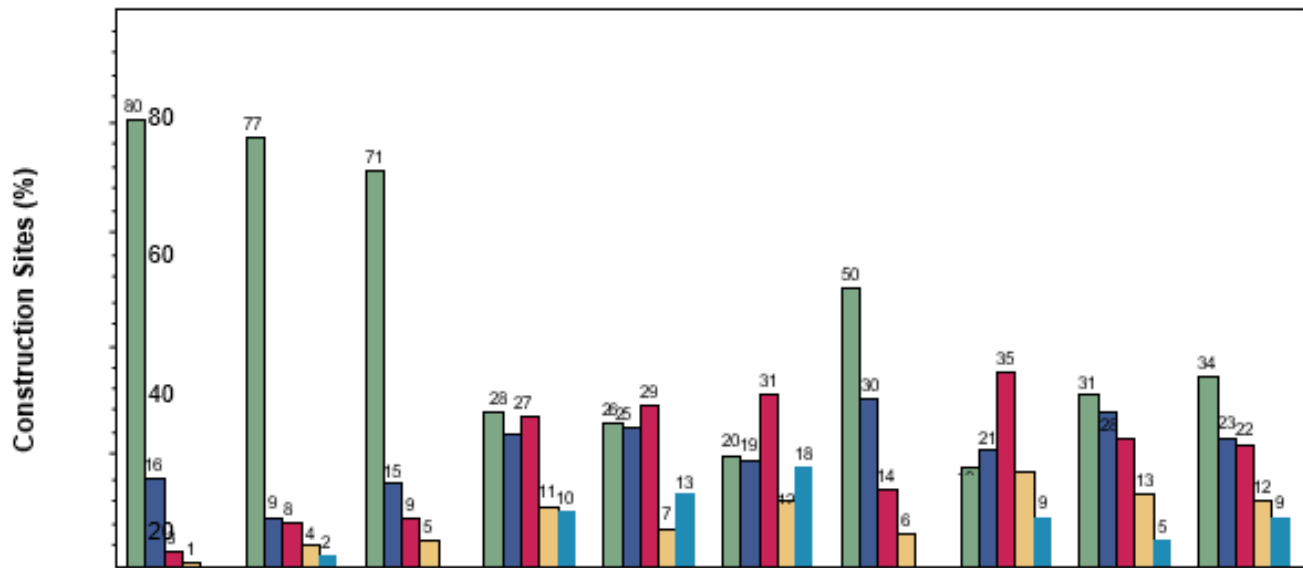


Figure 4.3: Construction sites where personal protective equipment (PPE) is available.

Physical survey results: -

To assess the real scenario of construction safety, the physical survey was conducted in different construction sites in Bangladesh. From Fig. 1 it is shown that the labors are working without any fall protective tools. 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 does not satisfy the labour safety regulations. As a result, the proximity of fatalities is increasing day by day. From the Fig. 2, it is clear that the labors are working without hand gloves, safety boots. According to the BNBC-2006, the area where personal protective equipment is necessary must be used. In this figure the necessity of boots, hand gloves are essential, but no uses were found during construction. The labors were asked why they were not using boots, hand gloves. The labor claimed against contractor for not providing the safety boots, helmets, hand gloves and other protective equipment. Contractor is the main responsible person to ensure the safety of construction workers. Fig. 2 shows such kind of working environment that does not satisfy the BNBC-2006. As a result, the workers are facing skin diseases and other body injuries happen. As workers are only responsible person of their family, their injury turn their family into more poverty. 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 which is shown in Figs. 3 and 4. In spite of having the regulation for eye protection for labor, the contractor violates 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, woodworking, sawing, drilling, chiseling, 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.

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 which is shown in Fig. 5. It was observed that the safety belt was 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. How safety rules are avoided in the construction project in shown in Figs. 5 and 6 in the stair and lift core section. As a result, the workers may fall from height and their life may be lost. According to the Fig. 7 it is clear that the workers are working without helmets, hand gloves which were not observed during physical survey. Eye protection system is very poor. But the BNBC says that the proper safety measurement is needed during lift installation. Physical survey showed that the contractor violates 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 may be damaged due to the lack of safety. Fig. 8 shows the uncovered and unprotected hazardous materials with no safety measure that is the most crucial potential factor of influencing accident and fatalities in results. The Fig. 8 shows that the electrical wires are kept randomly which may cause the electrocution. In our country more than 40% worker die due to electrocution. On the other hand, the coil spreads 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. No compensations are provided to the workers for injury and loss of life.

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 laboring and they felt 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 the all safety equipment to the workers in order

to build up a safe construction environment. The workers said 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 asked why they were not using boots, hand gloves, helmets etc. From the conversation they thought that inspector has lack of awareness about worker's 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.

Main reasons/factors that influence the safety performance:

Now which are main reasons that influence safety performance which has been mentioned in Fig. 9 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 Fig. 10 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. 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 about 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.

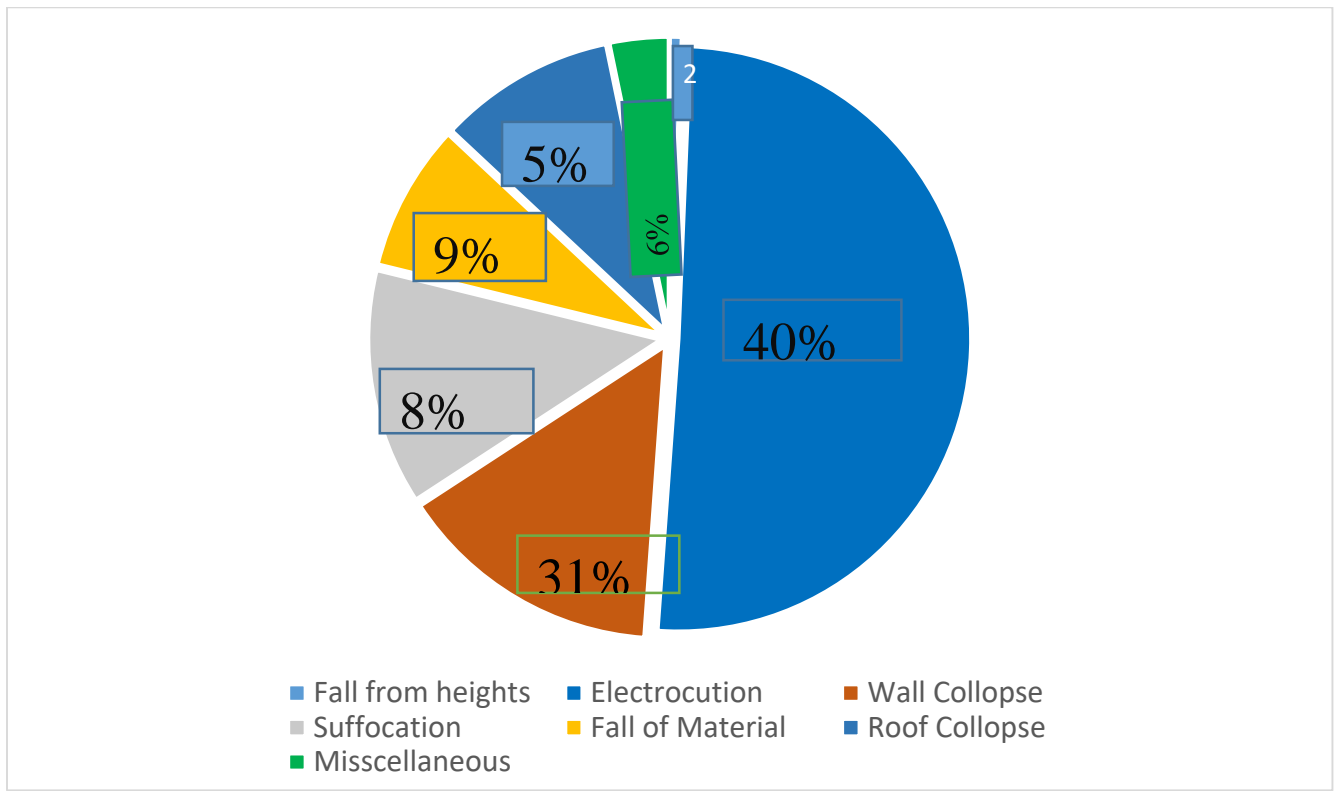
Table 4.2. The main safety and facilities for workers which are not practicing at Bangladesh

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%

Table 4.6. The main factors that influence construction safety performance at Bangladesh

Type of Safety Factors	TWVFI	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



Source: <https://medcraveonline.com/MOJCE/MOJCE-05-00149.pdf>

Figure4.4: Percentage distribution of different causes of fatalities.

Findings and outcomes

It explains the result of findings, reasons, logic of findings of construction safety in Bangladesh. It also describes site visit inspection and construction safety in workplace. On the other hand, worker's safety knowledge and applications also describes here to provide few ideas of prevention. This study was done on 42 construction workers, 15 were unskilled (36%), and 27 were skilled (64%) and 30 of them are uneducated whose don't have primary education and other 12 have primary education. Most of them have an experience about construction that more or less of 3 years but less than 1-year experience in those individual sites. Interestingly, they don't have any training on the work of construction industry.

Few major facts

I. In Bangladesh (Especially in Dhaka), there is no any construction work is being run with 100% concern and facility about safety.

II. Contractors are unwilling to give the equipment's to the worker.

III. High risk hazards are few specific in general (20% more or less) and little amounts of item but most dangerous.

IV. Illiteracy doing a huge bad role in this case with a specific perspective.

Overall, it can be said that the scenario of Bangladesh about construction safety in construction workplace is absolutely not good enough and not in an acceptable range.

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Question for labors with Group Member: -

1. what in the safety of using heavy equipment?

Ans: yes, sir. sometimes we use helmet, safety shoe and hand gloves.

2. Are the accommodation and drinking water provided to you healthy?

Ans: yes, Sir, we are in this project to say that our living quarters, drinking water is healthy.

3. Why don't you want to wear safety clothes properly on your site?

Ans: Safety clothing is safe to wear. But we can't wear it because we don't have enough safety clothing on our site.

4. What training did you take on safety?

Ans: Safety training refers to learning programs designed to train employees on precautionary processes and procedures to mitigate risk or the chance of injury or fatality on the job. Safety training is a form of compliance training delivered to protect the organization and its people.

5. Do you have a first aid box on your site?

Ans: First aid refers to the immediate treatment of an individual(s) that is injured or ill. First aid is not a full medical treatment, but something that can be done to stabilize a person so they can be moved to a hospital for regular medical treatment, or to preserve life while waiting for medical professionals.

6. There is field meeting about safety before starting work every day?

Ans: no sir. there is no safety meeting before starting work in project

7. This site has any safety materials for self-protection?

Ans: no sir. there are no safety self-protection materials for using my self

8. what in the safety of using heavy equipment?

Ans: yes, sir. sometimes we use helmet, safety shoe and hand gloves

9. What you know about PPE?

Ans: Yes, everyone knows about PPE.

10. What kind of safety do you use when building high rise?

Ans: Be Prepared for a High-Rise Fire Emergency

Never lock fire exits, doorways, halls or stairways. Fire doors provide a way out during a fire and slow the spread of fire and smoke. Never prop stairway or other fire doors open. Learn your building's evacuation plan.

11. What is the maximum and minimum age of the workers?

Ans: Minimum ages of the workers are 18 and maximum ages are no limit.

12. What safety do you carry while doing scaffolding work?

Ans: When you're climbing a scaffold, always maintain a three-point grip. That means that one hand and two feet, or one foot and two hands, should stay in contact with the scaffold at all times. Keep your body as close to the frame as possible. Leaning way out could cause the whole works to tip over right on top of you.

13. For construction work what kinds of equipment name you know for personal safety?

Ans: PPE includes gloves, gowns, laboratory coats, face shields or masks, eye protection, resuscitation masks, and other protective gear such as hats and booties

Chapter -5

Finding, Recommendation & Conclusion

5.1: Introduction

It is the responsibility of the Building Managements to ensure safety and security high rise building as well as their labors and all. Effective application of safety and security audit can minimize this risk at an optimum level.

The construction industry in Bangladesh uses labor-intensive construction methods which is relatively poor safety, and health record due its high accident and fatality rates. This is due in part to the unique nature of the industry, human behavior, difficult work site condition, minimum use of equipment, shortage of adequately trained worker, and lack of adequate infrastructure such as roads, bridges, power generation facilities and poor construction management.

Finding:

From the questionnaire survey, the opinions of the respondents regarding safety were found. The major findings are listed below:

1. Expert users of fire extinguishers were not available at all times.
2. Fire extinguishers were not properly maintained.
3. The extent to which workers' attitudes and perceptions and their behavior are associated with their national culture.
4. No medical facilities in every construction site
5. There was no formal safety and security department in building construction site.
6. Underground reservoirs were mostly undersized for holding adequate water for fire fighting
7. Not enough Proper Safety equipment in every construction site.
8. There are few pure drinking water in every construction site.

9. Sanitation system in construction site is so weak to use every laborer.

Recommendation

To develop the safety rate in construction site co-related with hazard some process can be applied, which are:

Improve maintain the hazards

Hazards are set on roof or slab or ground of each floor, we can use small spaces on each of the floor and notice by high visible reflected sign board on place to put materials which seems as hazard. That will be noticed to people to be aware from accident.

Proper use of safe guard

Just not enough safety equipment, they need to be well trained for using this properly.

Safety campaign

For safety concern they can take campaigns for safe in work.

Develop the safety culture

In Bangladesh construction workers are not well educated and not proper trained up. After long time experience, they can use to on this work. Fresh workers can learn from senior or experienced one. It will be costly to take every worker totally trained up. But we can train those workers for experience.

Worker psychology

We need to know about worker psychology, some entertained or some mentally relaxed treat they also need. Maximum workers work like reckless, irresponsible that's why maximum accident occurs. They are mostly simple people. This can be explained to them the importance of the emotional and life, they will be concern about safety. It will reduce probability of accident.

Create Safety environment in every site

Every construction site need also awareness poster that show with picture, some rhythmic gnome, and bill board can use entry way of the gate and living place of workers, it will help also to aware of worker to safe. At a Construction Site the Construction Project Manager is responsible for the Safety and Health of the employees on behalf of the Owner while still having to complete the project as per the approved design plans, scope of works and specifications. The Project Manager faces challenges from the grass-roots level since he is responsible for the overall success of delivering the owner's physical development within the constraints of project cost, time, quality, environmental and safety requirements with the increase in complexity of projects and consequently of the construction processes ensuring awareness of Safety, Health and Security is extremely important. The processes and practices must be adhered to in spite of increasing nuisance from non-stakeholders since Owners demand accountability and proper guidance during the entire planning and construction process, all as approved by an authority. The Project Manager must be technically competent and be able to adapt to the changing requirements of the built environment by relying on the knowledge and skills acquired through training, education, and hands-on experiences. The Project Manager needs to also have skills to meet play the roles and bear the responsibilities to create wisdom, distribute the wisdom, and identify hindrances to knowledge acquisition with PMI defining project management as "the application of knowledge, skills, tools, and techniques to a broad range of activities in order to meet the requirements of a particular project." HSE covers all phases of a project. In today's competitive environment, the construction technological aspects need to be designed for timely information to enable preparation of engineering works, procure the required materials from the market and deploy the necessary labor, plant and equipment so that productivity remains high. The processes discussed earlier provide an essential compendium in the construction industry for securing safety for all practicing engineers, designers, planners and other practitioners since Safety, Security and Health encompass all the phases of planning, design, and construction from start to finish.

5.3. Recommendations for Future Research:

This study focused on safety climate in the Bangladeshi construction industry and to what extent Bangladeshi national culture can influence that safety climate. However, no attempt was made to do any sort of comparative study either with any other developed country or developing country. Therefore, further research is recommended in this area; especially a comparative study could be carried out on the same pattern in any developed country like Australia, so as to compare the results within these two countries. Another

comparison can be undertaken by utilizing the same questionnaires for safety climate and for national culture from this doctoral study for any other developing country which reflects similar construction operations environment. Further research can also be recommended in the area of safety climate within Pakistan, but this time to include Pakistani construction managers for their safety attitudes and perceptions and then to compare the results of perceptions and attitudes of construction workers and managers on safety climate and managers' safety practices. This research did not attempt to develop a cause and effect model of relationship between national cultural dimensions and worker's attitudes, perceptions and managers' safety practices. Therefore, it is recommended to study the cause and effect between worker's attitudes perceptions factors, managers' safety practices and national cultural dimensions by using structural equation modeling (SEM). This study will help in-depth understanding the behavior of each variable and its direct/indirect link with other variables. For further future research it is recommended, to test the direct or indirect influence of safety climate factors, that could be relevant to Bangladesh construction industry (i.e. regulatory environment, management characteristics, worker characteristics, physical work environment and work pressure) on safety climate. A conceptual model for safety climate for Pakistan's construction industry could then be proposed, and statistically tested. Raising the standard of living of people is related to the development of a country. Without building infrastructures such as modern commercial and residential centers, this is not possible and hence construction industry has 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:

- Workers are not provided personal protective equipment (PPE) according to the data analysis and from physical survey. 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.
- The main reason for not practicing safety rules are lack of enforcement of safety laws, lack of safety awareness among the construction stakeholder and lack of safety training respectively.

The recommendations that help the future studies are as follows: this survey was conducted at Bangladesh around nine construction sites. The additional geographical area can be surveyed so that the result will be obtained more accurately. The correlation between construction stakeholder and causes of not practicing safety rules can be added as additional parameter. Other statistical tools such as SPSS can be tried for analysis to get a comparison of the results.

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Project details and visited date

1. Project name: Tanzina Naheed-Location: Baridhara, Road 5, House 19, Dhaka-Starting date: 01/06/2019 Daily worker: Mason - 50 nos Helper - 40 - 10 storage building
2. Project build up: Apan Jewellers- Project name: Apan Rezia-Location: Block - K, Baridhara, Dhaka 1212, and Apartment Size: 3700 sft. Apan Rezia, Road # 11, and block z - K, Baridhara, and Starting date: 01/06/2018 Daily worker: Mason - 55 nos. Helper - 44 -10 storage building.
3. Project Name: Friendship Tower, Proposed 10-Storeyed Residential Building (Occupancy Type: A2), Location: House No. Ka-52/B/1, Moddhapara Road, Khilkhet, Dhaka-1229_ Worker: Mason - 20 Nos. Helper - 47
4. Project Name: Proposed 10-Storeyed Residential Building (Occupancy Type: A2), Location: Plot No. 210, Road No. - 3, Block - B, Bashundhara Residential Area. Worker: Mason - 30 Nos. Helper - 61
5. Project name: human billa Location: Azimpur, Dhaka Starting date: 12/11/2020 Daily worker: Mason - 43 nos. Helper - 42 Storage :10
6. Project build up: biswas builders Ltd. Project name: sky touch Location: katabon mor, Dhaka Starting date: 09/06/2021 Daily worker: Mason - 30 nos. Helper - 36 Sky touch 8 storage
7. Project name: PPI Girls Hostel Location: Rupganj, Narayanganj Daily workers: Mason-35 Helper: 30 Storage: 8
8. Project name: Riverfront satellite city. Location: Z.H sikder medical college. (Rayerbagh, Dhaka). Daily workers: Mason-40 Helper: 36 Storage: 8
9. Project Name: Asset Development Location: 91 Gulshan Avenue Daily Labour: 10 Meason: 8 Storage: G+8
10. 2.Project Name: Jas Holdings Ltd Location: 118/2 Matikata Dhaka Cantonment Daily Labour: