

**COMPARATIVE STUDY OF SAFETY MANAGEMENT
ISSUES AMONG THE WORKERS BETWEEN
PRIVATE AND PUBLIC (GOVT. + INTERNATIONAL
FUNDING) CONSTRUCTION SITES OF DHAKA CITY**

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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

It is hereby declared that this thesis is our own work and that, to the best of our knowledge and belief, it contains no material which has been accepted or submitted for the award of any other degree.

We also declare that, to the best of our knowledge and belief, this thesis contains no material previously published or written by any other person except where due reference is made in the text of the thesis.

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Dedicated
to
“Our Parents”

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ABSTRACT

Safety measures among the workers are necessary to keep accident-free construction. This paper aimed at safety measures at private and public construction among the workers, inspection of safety knowledge and Personal Protection Equipment at the site, inspection of stressing on safety aspects to workers by the rate of employers, observation of safety training and finding out hindrances to safety measures to suggest appropriate guidelines. An appropriate suggestion is provided as per the analysis. It was observed that the rate of safety knowledge and protection equipment at the site among the workers is 78% in the case of public construction, whereas 27% is only in the case of private construction. The rate of percentage is very less in the case of private construction due to adequate safety training. Training on the safety of the workers in case of private construction is 65% whereas it is 72% for the public. The rate of supply of protection equipment by the employer is almost 77% in case of public construction whereas 18% is only in case of private construction. About the safety of the workers as well as construction works. But in the case of private construction, it is also found that stressing safety aspects to workers in private construction is very less. The rate of knowledge of safety and protection at the site among workers is higher in the case of public-private construction is not concerned regarding safety among workers as well as maintaining safety.

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CHAPTER 1

INTRODUCTION

1.1 Background and Motivation

The construction industry stands out from other employments as having one of the highest worker injury and fatality rates. Construction comprises a very small percentage of the overall workforce. Yet, the incidence rate for both fatal and non-fatal accidents causing death, injuries and illnesses exceeds that of many other industries. The construction industry has the most fatalities of any other industry sector for many countries of the world and currently for Bangladesh its fatality rate is the second largest only falling behind the garments sector. Many studies have shown that a fairly large percentage of construction accidents could have been eliminated, reduced, or avoided if simple safety techniques were applied at the sites and the workers were trained and made aware of the safety hazards present in the sites.

Construction safety (the intermediate phase between a finished design and a completed building) is largely the responsibility of the owner/developer/contractors and other site professionals. The success of a project depends on the intricate planning and decisions regarding safety measures that are made on site. Most construction accidents result from basic root causes such as lack of proper training, deficient enforcement of safety, unsafe equipment, unsafe methods or sequencing, unsafe site conditions, not using the safety equipment's that were provided, and a poor attitude towards safety (Toole 2002). Often times these safety measures are grossly neglected and safety laws are violated in the sites causing undue fatalities.

Construction is one of the world's biggest and fastest growing industrial sectors. It is, however, one of the most dangerous industries. At least 108 thousand workers are killed on site every year, which represents about 30% of all occupational deaths. The risks are 3 to 6 times more likely than any other occupation (ILO, 2009).

In Bangladesh also this industry is growing very fast. It represents 9 percent of Bangladesh's gross domestic product (GDP) and employs more than 2.6 million people.

This industry in Bangladesh is worth 900 billion Taka or US \$12 billion (BBS, 2013). There are more than a thousand companies in Bangladesh who are involved in the construction business (Dewri, 2012).

But, the safety management issue in this sector is very poor in Bangladesh characterized by high fatality rates. Though there is extensive research in this sector around the world, but in Bangladesh, studies are limited and research cannot go far due to lack of data and lack of knowledge about safety. Therefore, this subject demands further study and research, as its importance is being realized at national level to keep on track with the international standard.

In Bangladesh, the number of construction industries is increasing rapidly day by day. In the present scenario there is a trend of constructing high rise building, flyover and bridge to mitigate the people's need of shelter and transportation. Therefore, like Bangladesh all the developing countries are investing funds and workers for the development of its infrastructure, economy and urbanization. According to the estimation of International Labor Organization (ILO) nearly 110 million workers are involved worldwide in the construction sector which is almost 5-10% of the total population (Hasan et al., 2021).

In most of the cases construction workers provide their service in a very risky environment where no sufficient safety measures are taken into consideration. Therefore, workers in construction sites are victim to fatal and or non-fatal accidents which leads to death, injuries and illness. Nowadays, for this reason improving site safety is a major concern for the construction industries. An effective practice of safety culture is the key to defend accidents and all types of hazards in construction site. Safety culture can be measured by both qualitative as well as quantitative approach (Jannadi and Bu-Khamsin, 2002).

1.2 Research Objectives and Overview

The main objective of this study is to focus on the study of safety measures among the worker public and private constructions. An attempt is taken to achieve the objective through following actions:

1. To collect and analyze data on demography of the workers in private and public construction in order to identify and categorize the comparison.
2. To study of safety practice public and private construction and to inspect safety, working condition, technologies and available enforcement.
3. To find the hindrance safety practice in public and private construction hence to suggest appropriate control and measure as per situation.

1.3 Scope of the Study

The scope of this study is somewhat limited by the fact that the construction industry does not have any permanent setup. Though the construction process is always continuing but yet it is temporary in nature in the sense that it is project based i.e., when the construction of a particular structure is completed at a designated location, the concept of construction safety vanishes with it.

This study is also limited by the fact that there is no official system for recording casualty data for construction sector in Bangladesh. This was a major obstacle in assessing the nature of accidents in Bangladesh. Only newspaper reports were relied on and police records were studied but it is true that these data do not represent the actual scenario in the field as most of the incidents are neither reported to the police nor they reach the journalists. And also, currently there exist no official agency to enforce construction safety laws in Bangladesh.

1.4 Organization of the thesis

The overall thesis will be amassed with total six chapters to illustrate the methodology for achieving the aforementioned objectives coping with the scope of the study. These six chapters will be organized as follows.

Chapter 1: Introduction and Objective. Depicting contextual overview in a nutshell

Chapter 2: Literature Review. Reviewing available relevant literatures on workers safety and finally establishing the necessity of detailed study for construction workers in Bangladesh.

Chapter 3: Methodology. Describing the methodology used for the thesis sorting out the best one for fulfilling the objectives and data collection procedure for this purpose as well

Chapter 4: Data Collection. Collecting data through questionnaire survey and by photography

Chapter 5: Results and Discussion. Analyzing the data with graphical illustrates.

Chapter 6: Conclusions and Future Work. Bringing the entire thesis to an end through suggesting recommendations for the future researches

CHAPTER 2

Literature Review

2.1 Introduction

The construction industry undoubtedly plays a significant role in the economic development of a country. However, statistics have proven this field to be highly hazardous. Construction workers are backbone of this industry as this sector is less mechanized and more labor intensive. Thus, ensuring workers safety becomes a major consideration. However, little research has taken place in this field and demands extensive study to realize its importance at national level to keep on track with the international standard.

2.2 Barriers to the implementation of safety program in the developing countries construction industry

Unlike developed countries that have made considerable efforts to implement inclusive safety standards, developing countries face severe challenges on this (Bibb and Bust, 2006). In general, South Asian countries are categorized as developing countries and have similar conditions due to their geographical locations and cultures. They, therefore, have similar problems in the implementation of safety programs. There is a wealth of research that focuses on barriers to the implementation of safety programs in developing countries (Bibb and Bust, 2006). Insufficient resources are a major barrier that can have a negative impact on safety programs. In order to implement a safety program, it is the responsibility of the management to provide sufficient resources, including qualified personnel, time, money, information, safety work methods, facilities, tools and machinery (Rollenhagen and Kahlbom, 2001). Tight project schedule is another common barrier to the implementation of safety programs. Working on tight schedules adds more pressure and stress, which often leads to health and safety issues and reduces productivity (Kartam et al., 2000). Another major cause of high incidence and injury rates in the construction industry in developing countries is a low commitment to health and safety (Goh and Chua, 2013). Domestic and international disaster-related reports indicate that the workers have high risk associated with poor safety behaviour as a major cause of accidents. Those accidents resulted in inferior project performance with works delays and financial losses due to safety procedures that need to be followed, such as project stop-work orders and payment for injury

treatment cost for the workers involved (Othman and Azman, 2020). Similar work has been done before in Malaysia (Othman et al., 2018). Commitment to safety depends on the level of awareness towards safety, which in turn affects their prioritization. The low safety priority leads to a poor safety culture (Da Silva and Amaral, 2019). Similar works has been done in another projects (Yiu et al., 2019). It is also perceived that safety is only the responsibility of safety personnel. This perception implies that safety is exclusive and there is a lack of teamwork and collaboration in safety implementation (Yiu et al., 2019). Similar results were also found in previous work (Yu and Hunt, 2002). In addition, limited awareness of safety considerations at a higher management level affects understanding and strategies for managing safety and risks across the organization in Hong Kong (Yu and Hunt, 2002). Similar results were also found in other Asian countries (Kogi, 2002). Arguably, the most common problems in safety implementation are lack of safety training and lack of safety policies (Kartam et al., 2000). The safety training is essential for accident prevention and reduction (Yiu et al., 2019). Lack of skilled workers automatically results in poor safety behaviors due to poor safety awareness and inadequate knowledge on how to work safely (Sobral and Soares, 2019). Similar results were also found in previous work (Chileshe and Dzisi, 2012).

2.3 Content

The status of safety management in the construction sites in Bangladesh, particularly focusing on Dhaka, the capital city was examined (Jamal, 2015). An attempt was taken to identify the root causes of accidents, explore the risk-prone activities, and locate the factors affecting construction site safety. The study involves two phases. Firstly, fatality data were collected from the Police authorities (Dhaka Metropolitan Police) and OSHE (Bangladesh Occupational Safety, Health and Environment Foundation) to analyze and categorize the accidents occurring in this sector. From data analysis, it was found that falling from heights and electrocution were the two prime reasons for fatalities, together accounting for 71% of the total fatality count. But taking some basic safety measures could have eliminated these casualties. Secondly, thorough field survey was conducted to examine and infer on the issues of welfare facilities, safety equipment's and other factors affecting construction safety along with their relative importance. For this, people associated in this industry i.e., the workers and employers' personals were interviewed and subsequent mathematical analysis was done using rigorous statistical

tools on the basis of their responses. Analysis was carried out using Chi-square and Ranking by Importance Index method. The Chi-square was used to infer whether significant differences exist in responses from the respondents, while the Ranking by Importance Index helped in establishing their significant relative importance. The Chi-square test proved that both parties (i.e., workers and employers) agree that the safety and welfare facilities are not provided up to the standard whereas the Ranking by Importance Index identified some key factors governing the safety of the workers on a priority basis.

The number of persons evaluated whether follow construction safety or not, find out the degree of safety adoption and endorse how the safety rules can be implemented in construction practice (Islam et al., 2015). The study areas were Mirerdanga, Teliganti union and KUET at Khan Jahan Ali Thana, downtown of Khulna, Bangladesh. These areas are being developed day by day. In these areas most of the construction works are residential buildings, educational buildings, industrial buildings and horizontal and vertical extension of existing buildings. Through the study it was found that about 85% of workers do not adopt any safety measure except lame footwear in these study areas. Rest 15% of workers adopts poor safety methods. Workers and building owners follow local indigenous knowledge for construction safety. However, most of the workers do not know what types of safety should have taken and who are supposed to supply the safety equipment. It is recommended that the regional development authority must regulate safety practice in construction sector along with the owners, engineers, supervisor and contractor.

The existing studies of safety practices and discover the causes of fatalities in building construction projects in Bangladesh (Roy and Islam, 2019). To achieve these objectives, related studies were reviewed and field data collected by structured interviews with project managers, engineers and foremen. In addition, a questionnaire survey has been conducted among engineers. Data has been analyzed by using descriptive statistics. The results showed that many construction sites did not practice proper safety measures for site protection and that workers did not take personal protective measures mentioned in Bangladesh National Building Code (BNBC). Besides, the study results revealed that the leading cause of fatal accidents is falling from different heights. Furthermore, a strong positive correlation has been found

between fatal reports and survey results to find the most vulnerable age group (26-41 years) and construction floor levels (6th - 10th) for fatality. Thus, the study recommends for protecting construction sites and ensuring workers' personal safety measures the provision of better on-site safety practices to reduce fatalities. At the end, this study suggests some future studies on construction safety in Bangladesh as well as in other developing countries.

Construction safety relates to safe operation of construction works without bringing any sort of damages or casualties to its internal employees or disturbing its neighbors. The capital of Bangladesh, Dhaka is undergoing significant change due to intensive urbanization. In the last 20 years developers have been purchasing most of available plot of land to build high rise buildings. The industry now employs over three million people and is quite big fund for the developer; but it comes at a high cost for the workers. Recent study in the construction industry identifies followings as the causes of fatal accident (Daily News Paper,2004-2006).

Table 2-1. Approximate Percentage of Fatal Accident

Causes	Approximate Percentage of Fatal Accident
Falling Persons	45
Falling Materials	14
Transport	14
Lifting Equipment	7
Excavation	7
Electricity	6
Other Causes	7

Every year, an average of 150 people die and thousands get injured due to accidents in the construction projects in Bangladesh (Ahmed et al. 2018). In 2017, the Bangladeshi construction industry faced death of about 179 people due to accidents, and in 2016 and 2015, the figure of death was 145 and 172 people, respectively (Ahmed and Bashar, 2018). This scenario of accident represents a vulnerable level of construction safety practicing in the Bangladeshi construction projects.

Construction industry has encountered the highest number of fatal accidents among all other industries. Though healthy and safe environment at any construction site is the first considerable issue, adequate occupational health and safety standards are absent in developing countries like Bangladesh (Shourav et al., 2015). This performance of construction site hampers not only the country's economy but also the bottom line of construction organizations (Buniya et al., 2021).

A safety assessment framework developed for construction industry in Sri Lanka (Priyadarshani et al., 2013). According to their study, lack of commitment of management and negligence of individuals to respond to proper safety practices were the most important factors leading to accidents at sites. Occupational safety risk has been studied in Indian construction industry by (Guha and Biswas, 2013). They found that catching nets, unsafe ladders, inadequate scaffolding and personal safety measures were the major causes of construction hazards in India. Studied the safety practices in construction industry in Pakistan and applied descriptive statistics for data analysis (Hassan,2012). His study revealed that lack of using personal protection, falling from heights, lifting objects and electric shocks were the leading causes of fatal accidents.

2.4 Summary

From the study, it can be seen that safety is not adequately considered in the construction industry as proved by the statistics. Therefore, proper safety management in construction is of utmost importance. The issue of safety of workers and public during construction is a great concern to all as it affects the human life both economically and socially. In order to minimize the factors responsible for construction accidents, the workers as well as supervisor need to be properly trained about proper construction procedures and safety measures and made to be aware of the dangers of using risky construction equipments. In this connection, the worker safety must be included in the construction practices by allocating a special budget for this purpose.

CHAPTER 3

Methodology

3.1 Introduction

The methodology is designed in order to reflect the different aspects of construction sites and to reflect overall project objectives. Necessity of construction site safety of workers in Dhaka city has been discussed in the earlier chapters, which has paved the way for methodology. Therefore, available methodologies for conducting the research will be discussed in this chapter. Different methodologies will be discussed and the suitable one will be chosen which will be followed by carrying out the research. Also, the different steps of methodology will be discussed as methodology overview afterwards.

3.2 Review of potential methodologies

It was seen from the discussion in the previous chapters that in Bangladesh there is so much lacking in safety for works in construction sites. For further illustration of the site safety, different methodologies can be carried out of the available methodologies will be made and comparative analysis will be undertaken. This will indicate the appropriate technique to be carried out for this research.

3.2.1 Qualitative methodology

Qualitative method is used to understand people's beliefs, experiences, attitudes, behavior, and interactions. It generates non-numerical data. The integration of qualitative research into intervention studies is a research strategy that is gaining increased attention across disciplines. Interview questions and open-ended surveys and questionnaires are two of the most common ways to collect qualitative data.

Qualitative research aims to get a better understanding through first-hand experience, truthful reporting, and quotations of actual conversations. It aims to understand how the participants derive meaning from their surroundings, and how their meaning influences their behavior.

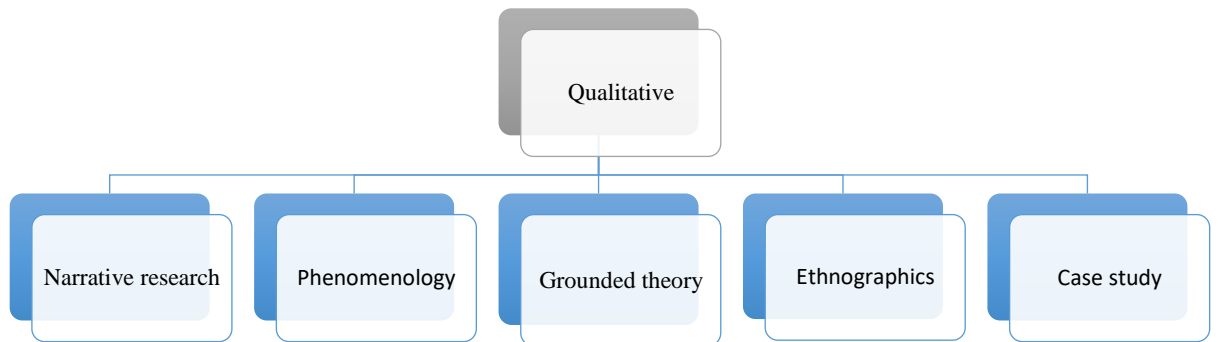


Figure 3-1. Different approaches of qualitative methodology.

3.2.2 Quantitative methodology

Quantitative data is measurable numerical data researchers collect by asking close-ended or multiple-choice questions using surveys, polls, questionnaires, and other methods. Typically, quantitative research requires a large respondent population. This is because the results of research will be representative of a larger population.

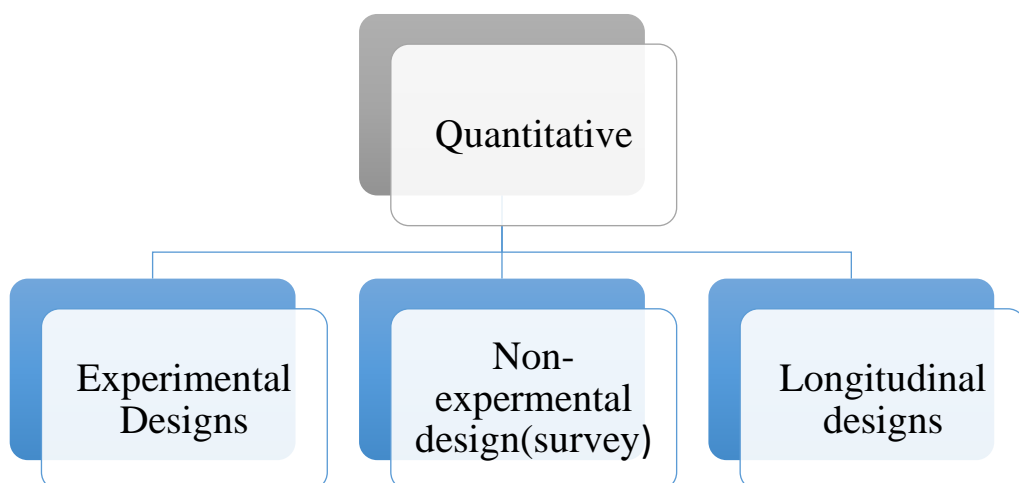


Figure 3-2. Different approaches of quantitative methodology.

3.2.3 Mixed-method methodology

A mixed methods study combines quantitative and qualitative data collection and analysis in one study. Individually, these approaches can answer different questions, so combining them can provide with more in-depth findings.

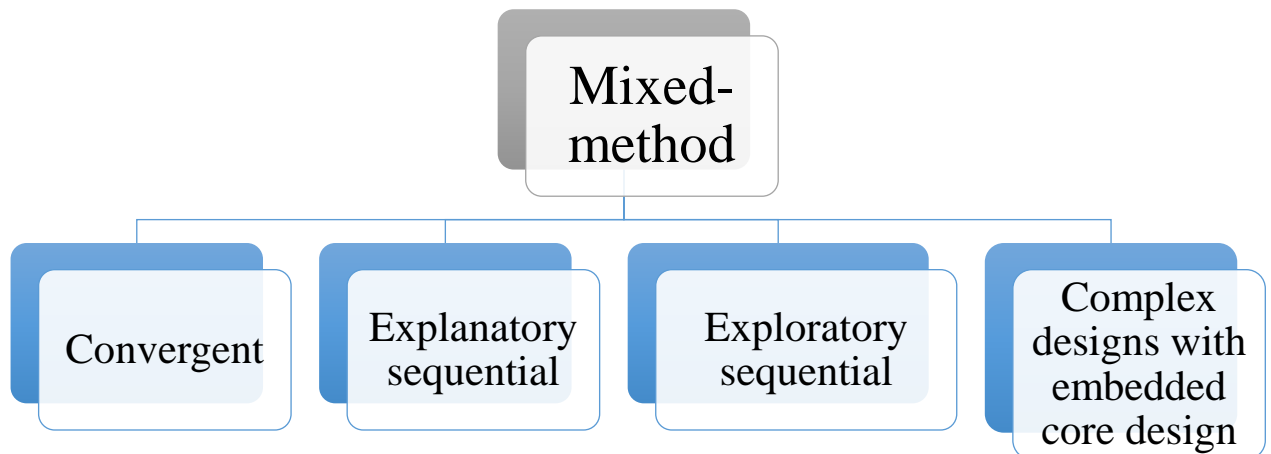


Figure 3-3. Different approaches of mixed-method methodology.

3.3 Selection of appropriate methodology

Different methodologies have already been discussed for carrying out the research. Now comparative discussion will be made here and among those the suitable one will be chosen.

Table 3-1. Comparison of different methodologies

Quantitative methods	Mixed	Qualitative methods
Pre-determined	Both pre-determined and emerging methods	Emerging methods
Closed questions	Both open and closed ended questions	Open ended questions

Attitude data Census data Observational data Performance data	Multiple forms of data drawing on all possibilities	Interview data Observation data Document data and Audio-visual data
Statistical analysis	Statistical & text analysis	Text & image analysis
Statistical interpretation	Across databases interpretation	Themes, patterns interpretation

From the comparison table 3.1 it is observed that, in safety related issues qualitative and quantitative method both are used for data collection. So mixed method is the appropriate method to use for this research. The suitable approach for the mixed method will be discussed to construct methodology overview afterwards.

3.4 Methodology Overview

For conducting the research and comparing between public and private organizations, distinguishing between these two types is required. After that, construction site selection will be made for proper planning. Next date and time selection will be done when survey could be under taken properly. During the convenient time questionnaire survey will be conducted. The survey will generate data for further analysis. Finally, analysis of data will provide result for representation.

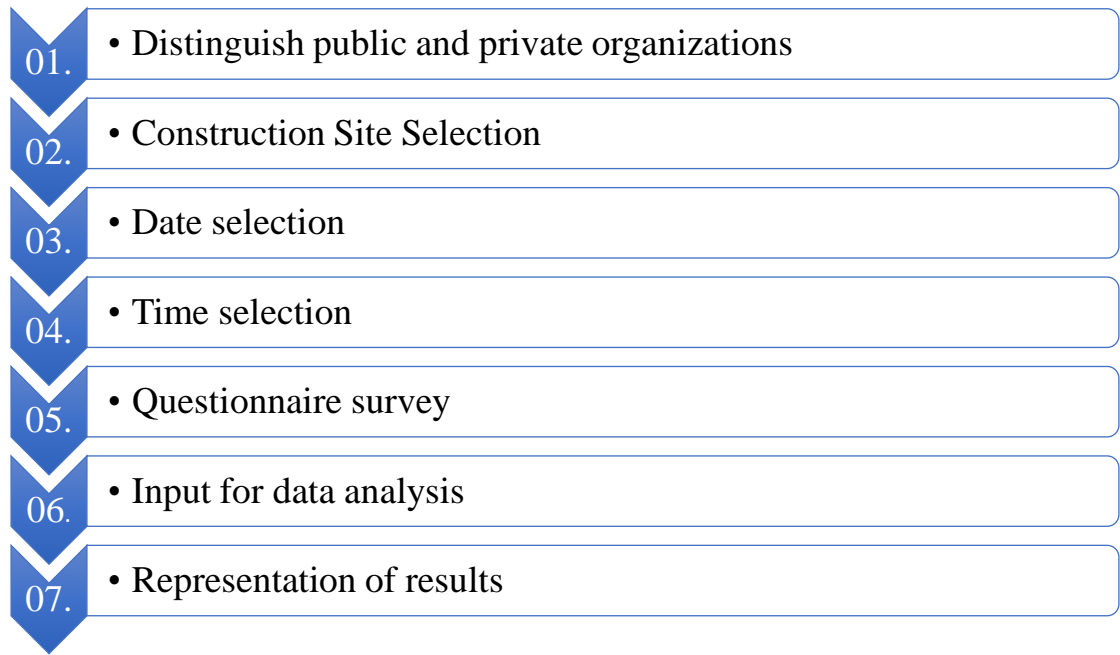


Figure 3-4. Flow chart of methodology of the research.

3.5 Summary

This chapter has presented the construction safety related research articles to discover study methodologies. Based on proper methodology, a questionnaire has been made for field survey which includes quantitative and qualitative data. Then the questionnaire is distributed and filled questionnaire is collected back from respondents. Finally, finding based on the questionnaire and interviews were used to analyze the safety performance of workers of the construction industry.

CHAPTER 4

Data Collection

4.1 Data Collection

Data is collected for 13 projects in which 3 projects include public construction (Govt+ International funding) and 10 projects include private construction. Data is collected on the basis of site inspection as well as questionnaire survey.

For data record civil construction checklist and questionnaire form is made on the basis of OSHA standard. In this regard, 13 civil construction checklists are made for the 13 projects. On the other hand, 45 questionnaire data is collected for public construction and 80 questionnaires data is recorded for private construction.

Project Type	Total Site Visited	Total Workers Surveyed
Public	3	45
Private	10	80

4.2 Field Audit and Inspection



Figure 4-1. Group instruction before going for work (Tool Box Meeting)



Figure 4-2. Working environment of the workers in the Shahjalal International Airport Terminal 3



Figure 4-3. Arrangements of cranes in the Airport Terminal 3



Figure 4-4. Bird Proofing, Netting installation (light lift) for Airport Terminal 3



Figure 4-5. Cutting with properly Hand gloves, Goggles and PPE management (Metro Rail, Line-6)



Figure 4-6. Grinding with proper safety (Line-6)



Figure 4-7. Proper PPE and Safety Harness arranged at while working in a height (Line-6)

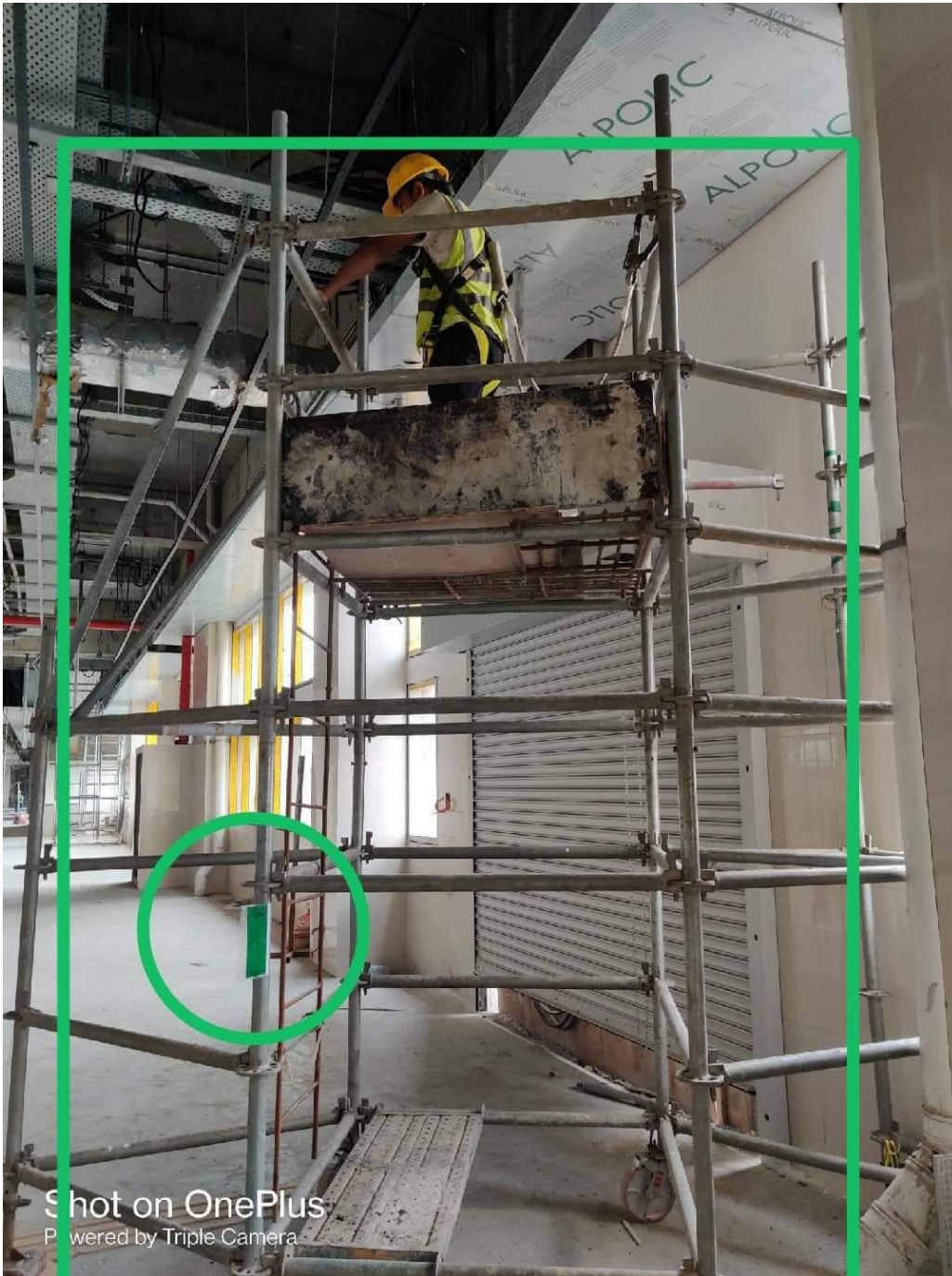


Figure 4-8. Properly safety management done. By sign green tag showing properly safe work. (Metro Rail Line-6)



Figure 4-9. Welding with proper protection at Metro rail Line-6



Figure 4-10. Sometimes workers work without proper PPE (FDEE)



Figure 4-11. Hand rails and nets are used to keep the structure safe from public inconvenience (Dhaka Elevated Expressway)



Figure 4-12. Electric machinery and wires should be kept safe and checked (Dhaka Elevated Expressway)



Figure 4-13. Weekly safety meeting between contractors and stakeholders (Dhaka Elevated Expressway)



Figure 4-14. Proper fencing is used to avoid any public loss



Figure 4-15. Proper safety should be implemented during heavy lifting

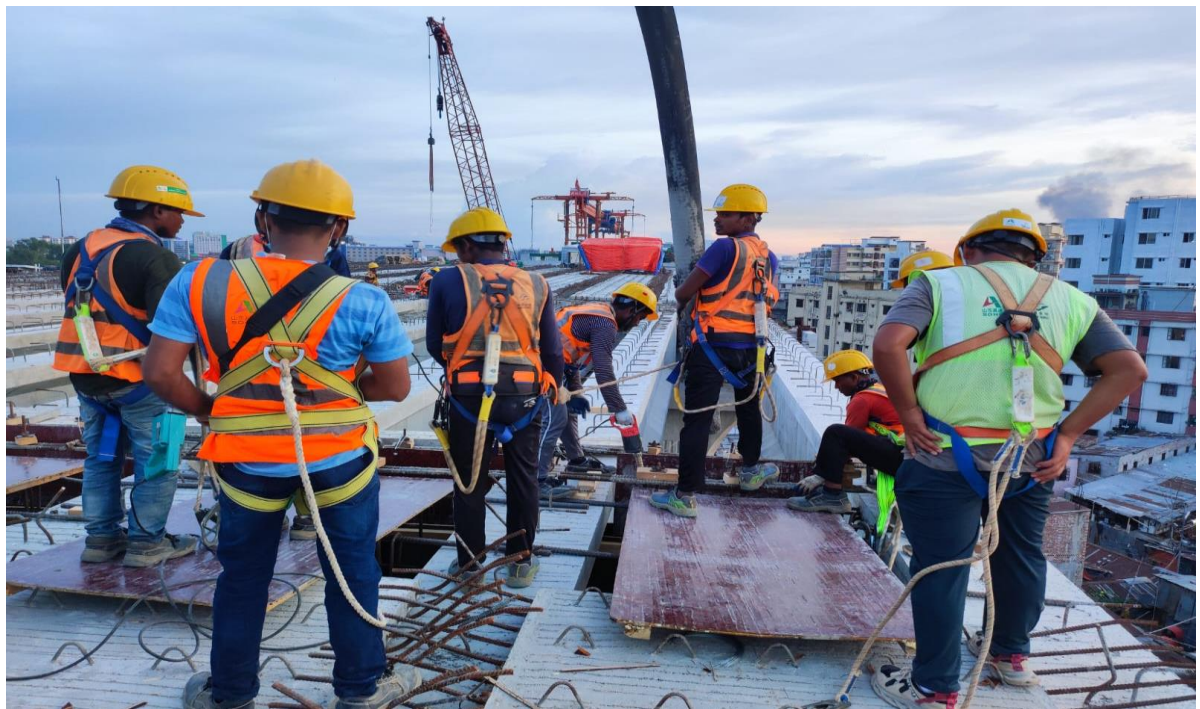


Figure 4-16. Platform and safety harness are most needed while working in height

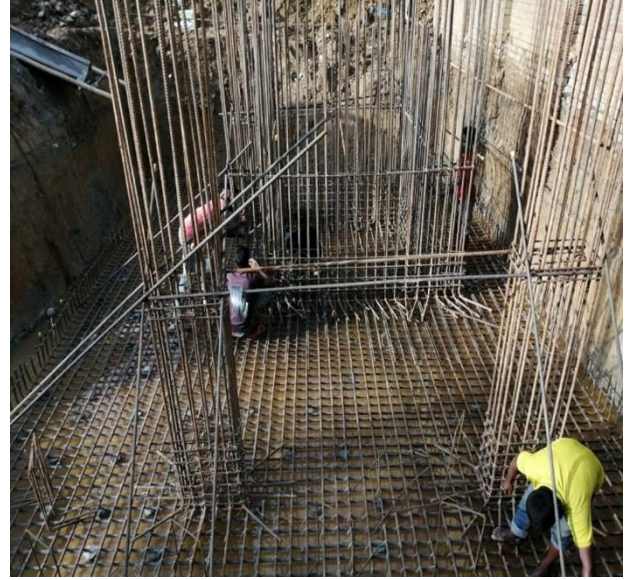


Figure 4-17. Workers working without any safety gear and PPE (Private Site)



Figure 4-18. Column Casting without safety boots, helmet.



Figure 4-19. Workers working without lifting equipment (Shackles and Web Sling) and without helmet and no full body harness.



Figure 4-20. Worker engaged in rod cutting without safety helmet, gloves, boot and face shield.

CHAPTER 5

Results & Discussion

5.1 Introduction

The image of safety scenario prevailing in the construction industry of Bangladesh is tarnished with the burden of high fatality rate of workers. The industry also has a bad reputation in providing necessary welfare services for the workers. So, a field survey was put in action in order to find and analyze the current condition of welfare facilities and availability of safety equipment in the construction sites. In order to fulfill these objectives a well-structured questionnaire was prepared. The survey was conducted with a view in mind to cover different parts of Dhaka city.

5.2 Survey Procedure

The different steps for carrying out survey are:

- a) First step: background information collection
- b) Second step: preparation of questionnaire
- c) Third step: survey
- d) Fourth step: compiling and analysis of data

5.2.1 First step: background information collection

The background information on workers was gathered from literature and the sources of the reviewed literature were in two categories:

a) Primary source: These include field survey, both formal and informal, face to face interviews and discussions with workers on construction sites.

b) Secondary source: These include desk review of both published and unpublished material including policy documents, newspapers, internet, journals, articles, reports, bulletins, newsletters, and OSHE statistics. The information gathered from the preliminary phase helped guide the second phase of the fieldwork, which is distribution of questionnaires and collection of data from the key respondents.

5.2.2 Second step: preparation of questionnaire

In order to achieve the objectives of the study, well-structured close-ended questionnaires were designed to gather information from construction sites in Dhaka city. These questions were ethical and feasible. The wordings were without bias and the questions provided multiple choice options which gave the respondents the opportunity to present their ideas by way of selecting from the options provided. Details of questionnaire can be seen in Appendix-A

In most questions in the questionnaire, the respondents (the workers) were to use Likert scale to scale them in order of importance to assess the various factors. The conventional five-points of scaling were selected as (Danso, 2010).:

- a) Very important or very serious effect (1 point) s
- b) Important or serious effect (2 points)
- c) Neutral (3 points)
- d) Less important or less effect (4 points)
- e) Least important or least effect (5 points)

5.2.3 Third step: survey

The main emphasis was to survey sites covering different parts of Dhaka city in order to get a general scenario of the construction sites of Dhaka city. Around 13 sites were selected from both developed areas. Also, sites developed mainly by owners himself, private entrepreneurs and local contractors were selected. Selected sites were in different phases of construction. From each site, more or less one worker and one employer personnel were interviewed, thus almost 125 workers were interviewed.

In order to do survey a worker was selected among the present workers on the sites. It was tried to cover workers of different ages and work experiences in order to get a uniform response of the whole work force. As most of the workers have no formal education, the question was asked by surveyor and the questionnaire was filled by him according to the response of the worker.

5.2.4 Fourth step: compiling and analysis of data

After the survey, whole teams are compiled and arranged in a format for analysis. Then compiling data of all factors were conducted manually and data were entered in Microsoft Excel software and used in mathematical calculation. The next stage is to analyze and discuss the results obtained.

5.3 Data Analysis

Based on data collection following graphical analysis is made.

Following graphical analysis is made based on collected data for private construction.

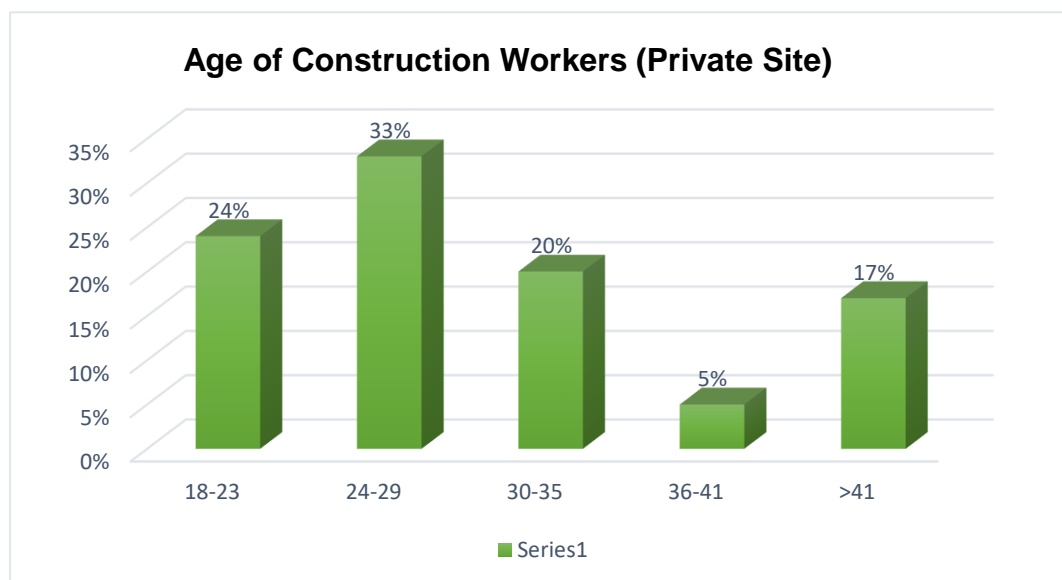


Figure 5-1. Age of construction workers at Private site

From the graph it is observed that 33% worker age is in the range 24 to 29 years which is major percentile among the workers. As the age increases workers percent is reduced. It can be said from observation that this young generation workers can give well output in case of safety if they can get proper safety training as well as adequate PPE.

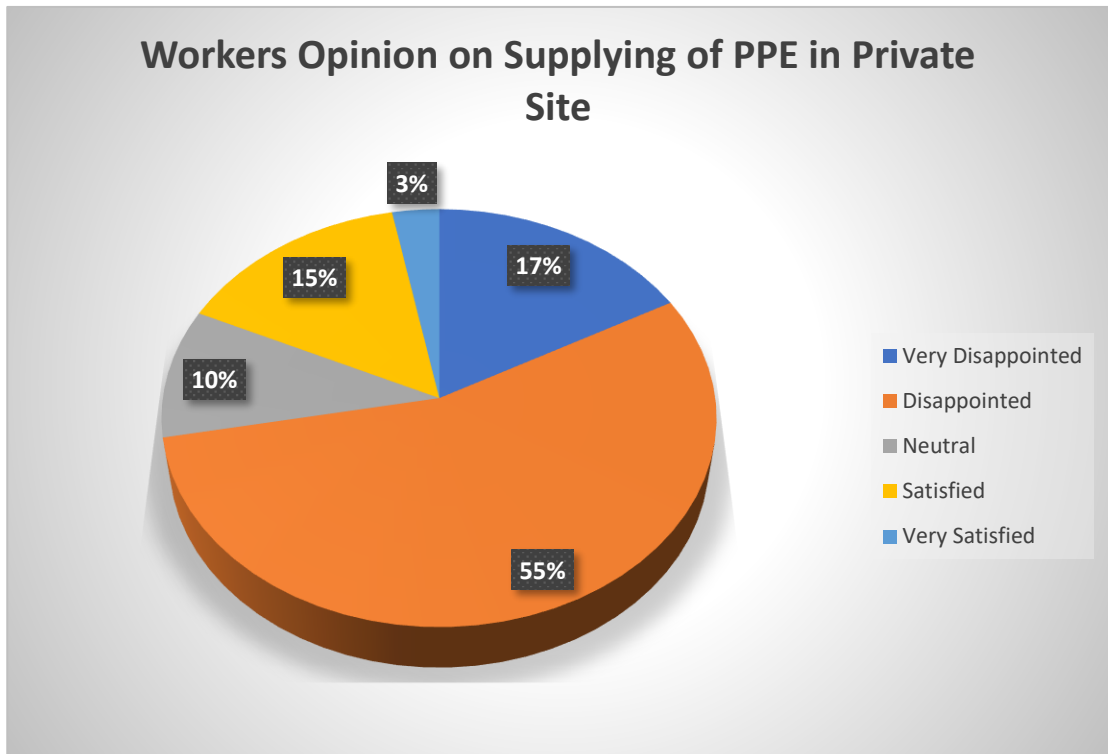


Figure 5-2. Workers Opinion on supplying of PPE at Private site

It is observed that supply of PPE equipment is not good in case of private construction as there is not enough funding as well as not maintain proper safety during construction. On the other hand, no proper PPE is found for 55% workers to do their work safely in private construction site.

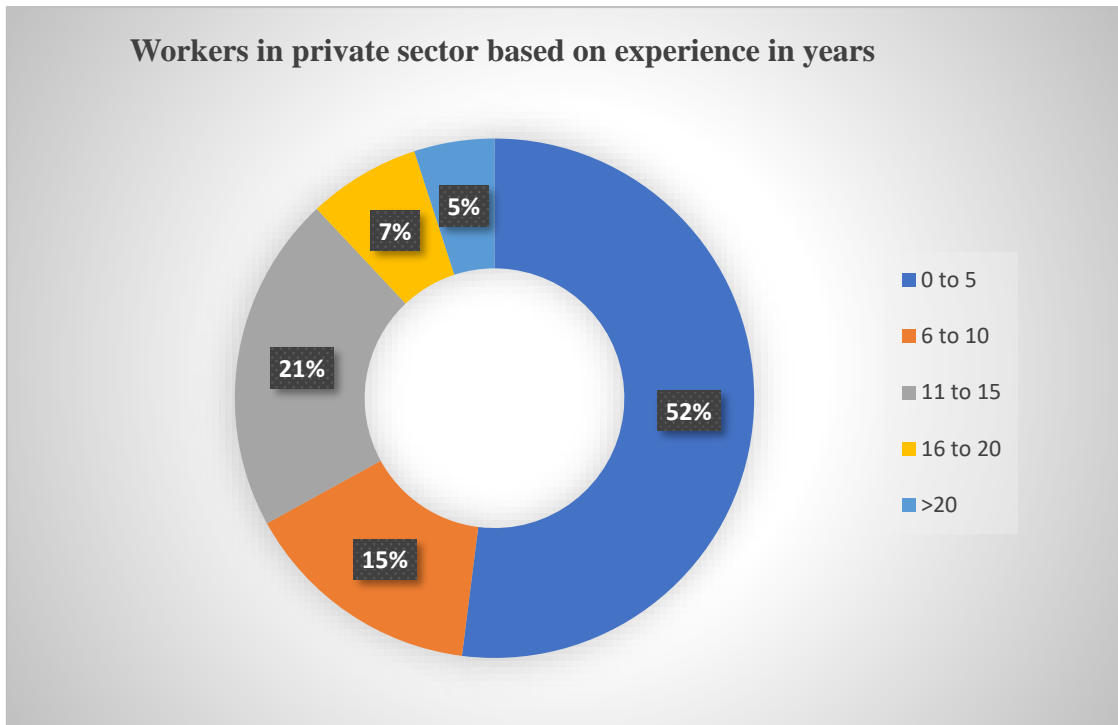


Figure 5-3. Workers in private sector based on experience in years

In case of working experience, majorly 52 % workers have 0 to 5 years. Then 21% have 11 to 15 years. Only 5% have greater working experience than 20 years. Therefore, working experience is also other criteria to maintain and obey safety rules and regulation properly. As the working experience is increased, there is possibility to work in different construction projects and also can observe and earn knowledge about safety as well as construction different activities.

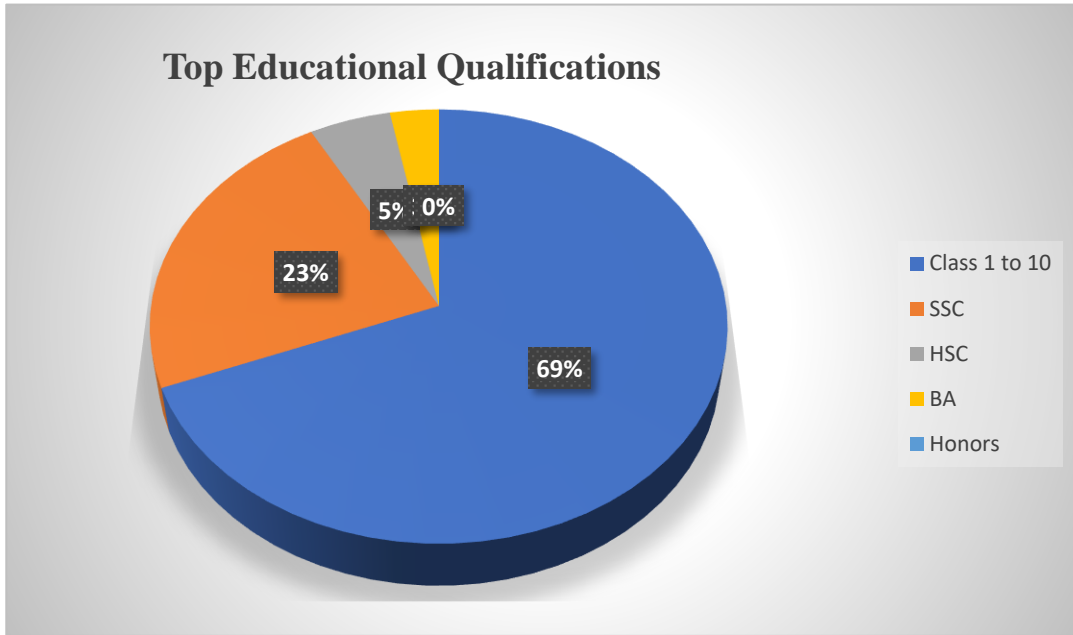


Figure 5-4. Top educational qualifications at private site

Educational background is one of the major criteria to understand regarding safety. As it is observed that 69% worker only have education in the range of class 1 to class 10. Then 23% have SSC education, 5 % of them have HSC education. To have proper training and to work as per safety rules and regulation education is very important.

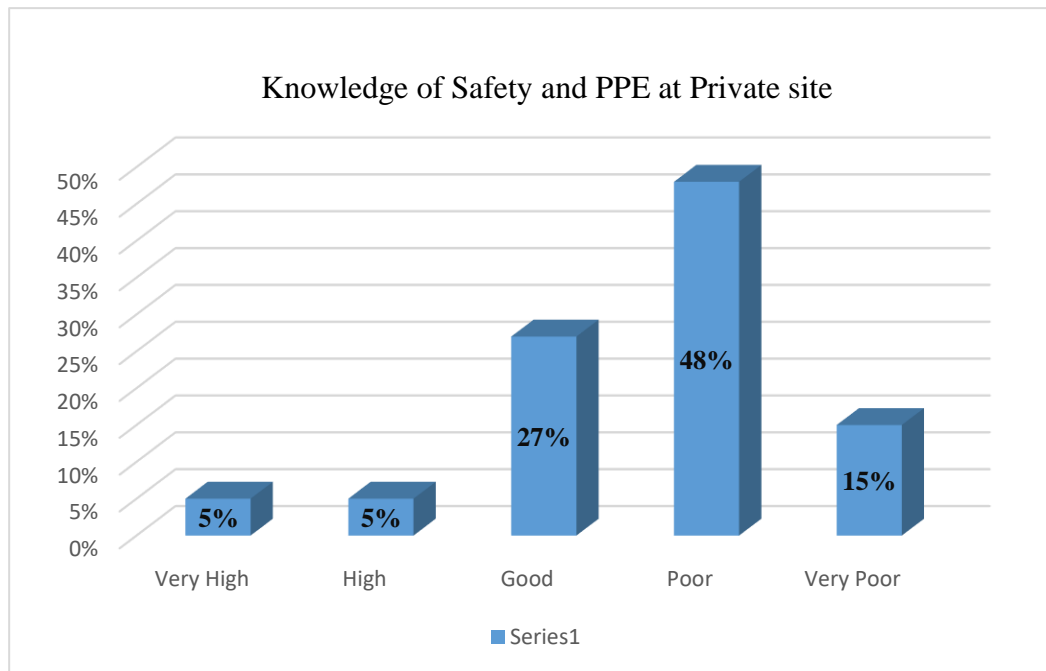


Figure 5-5. Knowledge of safety and PPE at Private site

Knowledge of safety & PPE is poor which is 48% it's called very poor knowledge of safety and PPE at site as in case of private construction. The workers do not have adequate safety training as well as tool box meeting everyday about safety and work activity. Training on safety of the workers is very less in private sector. It is seen that 50% of workers are disappointed which means they do not have proper safety training. Whereas, only 5% are very satisfied and 9% are satisfied in receiving safety training. This is very poor quantitative measure.

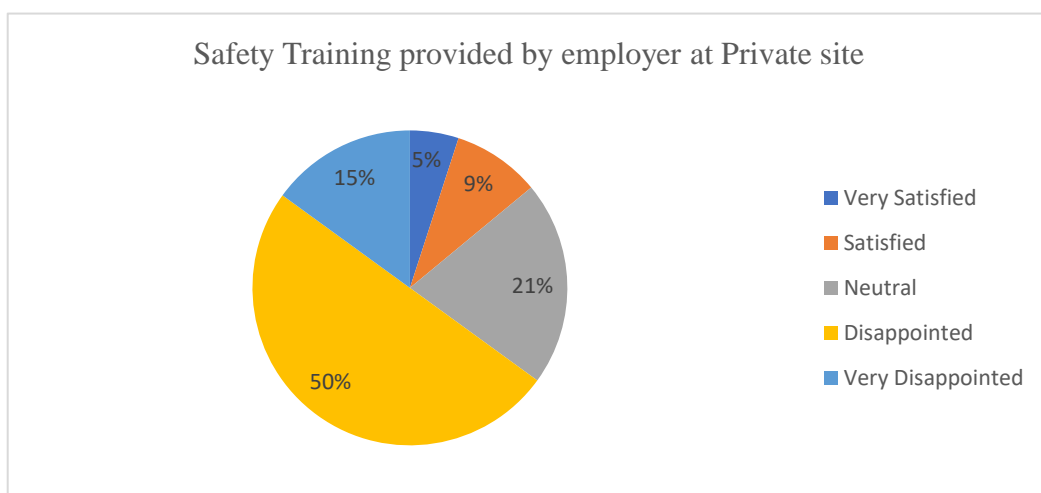


Figure 5-6. Safety training provided by employer at private site

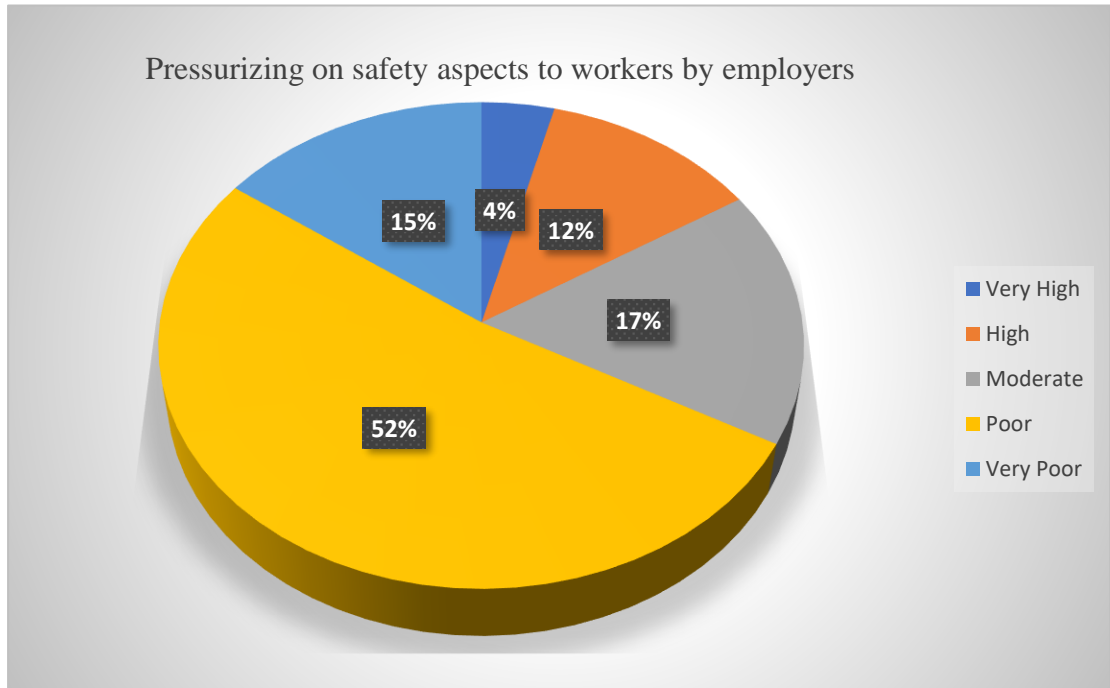


Figure 5-7. Pressurizing on safety aspects to workers by employers

Pressurizing on safety aspects to workers by employers is poor, 52%. As safety is to maintain as per project specification. Based on Pie chart above, there have 33% of respondents was positive that employer pressurizing on safety aspects while at work. Then, 52% of them indicate that the employer was ‘sometimes only’(poor) stress on safety. Lastly, 15% of them do not have any provision on safety aspects from the employer which is very poor.

Welfare Facilities:

There is a general assertion that employers do not provide the following welfare related facilities in construction site for workers. Please indicate your reaction to each statement by ticking the particular cell according to public or private site.

The following tables show the survey result of 10 private construction sites and 3 public construction sites about non-provision of welfare facilities among workers.

Public Site:

Table 5-1. Welfare facilities among the workers at public site

No.	Welfare facilities	Strongly Disagree %	Disagree %	Neutral %	Agree %	Strongly Agree %	Total %
01.	Safe drinking water	5	7.5	47.4	32.5	7.5	100
02.	Means of heating food	7.5	37.5	22.5	32.5	0	100
03.	Water for washing and cooking	7.5	42.5	17.5	27.5	5	100
04.	Suitable accommodation to rest	2.5	12.5	15	60	10	100
05.	Sanitary facilities (toilets, showers, changing room)	12.5	50	12.5	20	5	100
06.	Accommodation to change and store clothing	2.5	12.5	17.5	47.5	20	100
07	First aid equipment	0	0	0	20	80	100

a) The workers from public site admitted that among the issues, three welfare facilities that are mainly lacking on site for workers are first-aid equipment, accommodation to change and store clothing and suitable accommodation to rest.

b) With a response rate of 100%, workers demonstrate that first-aid items as a welfare item is lacking on construction site for workers. They also agreed to the items - accommodation to change and store clothing and suitable accommodation to rest with percentage of about 67.5% and 70%.

c) They only disagree on the case of sanitary facilities (toilets, showers, changing rooms) with 62.5%.

d) Mixed reaction was given in the case of safe drinking water with 40% agree with 47.4% being neutral. Similar reactions also given for means of cooking food with 32.5% agree and 45% disagree with 22.5% being neutral and for water for washing and cooking with 32.5% agree and 50% disagree with 17.5% being neutral.

In a nutshell, it is found that most of the workers are not satisfied with the welfare facilities which are provided at site.

Private Site:

Table 5-2. Welfare facilities among the workers at private site

No.	Welfare facilities	Strongly Disagree %	Disagree %	Neutral %	Agree %	Strongly Agree %	Total %
01.	Safe drinking water	10	20.6	20.4	38.5	10.5	100
02.	Means of heating food	2	18.5	18.5	52.5	8.5	100
03.	Water for washing and cooking	7.5	27.5	16.5	42.5	6	100
04.	Suitable accommodation to rest	2.5	7.5	15	55	20	100
05.	Sanitary facilities (toilets, showers, changing room)	2.5	7	17.5	65	8	100
06.	Accommodation to change and store clothing	2.5	7.5	17.5	52.5	20	100
07	First aid equipment	0	5.5	12.5	32	50	100

a) For private construction site the scenario is worst. With a response rate of 100%, workers demonstrate that first-aid items as a welfare item is lacking on construction site for workers. They also agreed to the items - accommodation to change and store clothing and suitable accommodation to rest with percentage of about 72.5% and 75%.

b) They only disagree on the case of sanitary facilities (toilets, showers, changing rooms) with 9.5%.

c) Some other reactions were given in the case of safe drinking water with 49% agree with 20.4% being neutral. Similar reactions also given for means of cooking food with 61% agree and 20.5% disagree with 18.5% being neutral and for water for washing and cooking with 48.5% agree and 35% disagree with 16.5% being neutral.

Based on data collection following graphical analysis is made.

Following graphical analysis is made based on collected data for public construction.

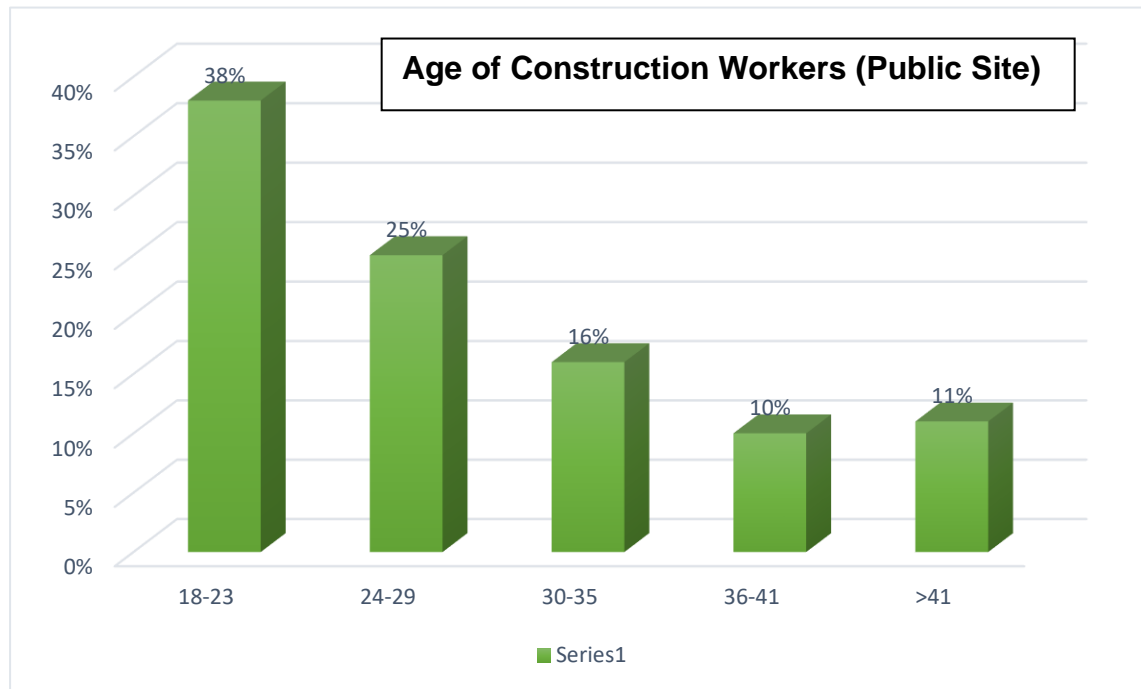


Figure 5-8. Age of construction workers at public site

From the graph it is observed that 38% worker age is in the range 18 to 23 years which is major percentile among the workers. As the age increases workers percent is reduced. It can be said from observation that this young generation workers can give well output in case of safety if they can get proper safety training as well as adequate PPE.

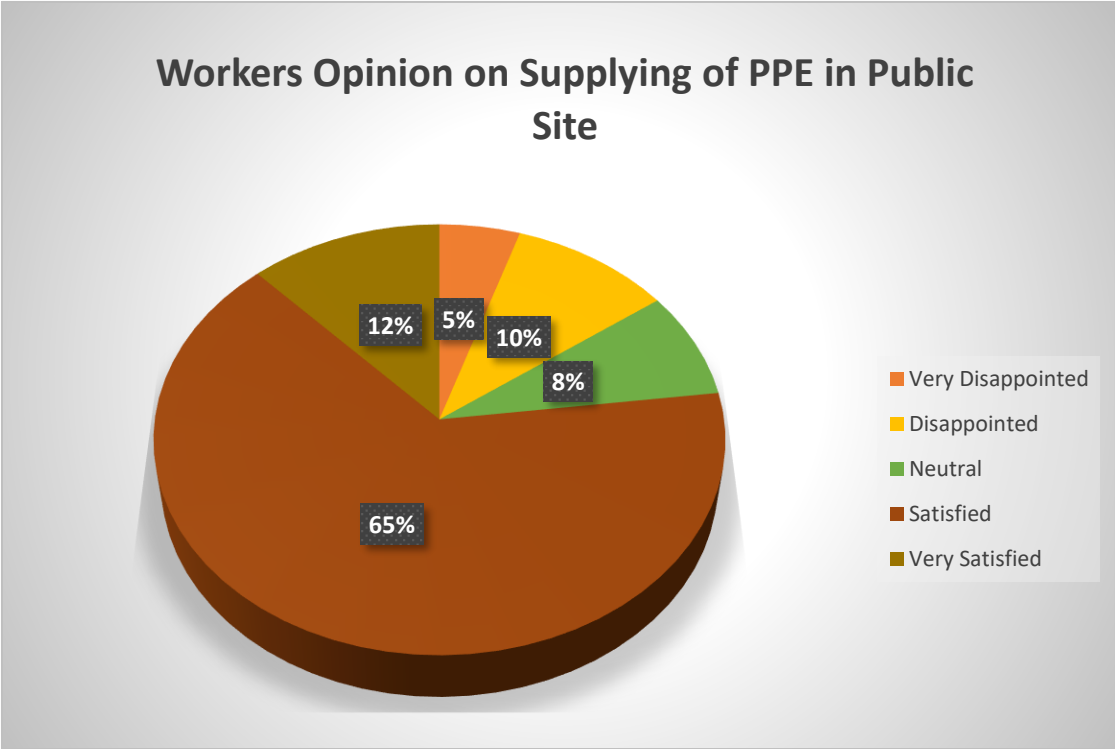


Figure 5-9. Workers opinion on supplying of PPE in public site

It is observed that supply of PPE equipment is good in case of public construction as there is govt+ international funding as well as need to maintain proper safety during construction. On the other hand, 77% worker have proper PPE to do their work properly.

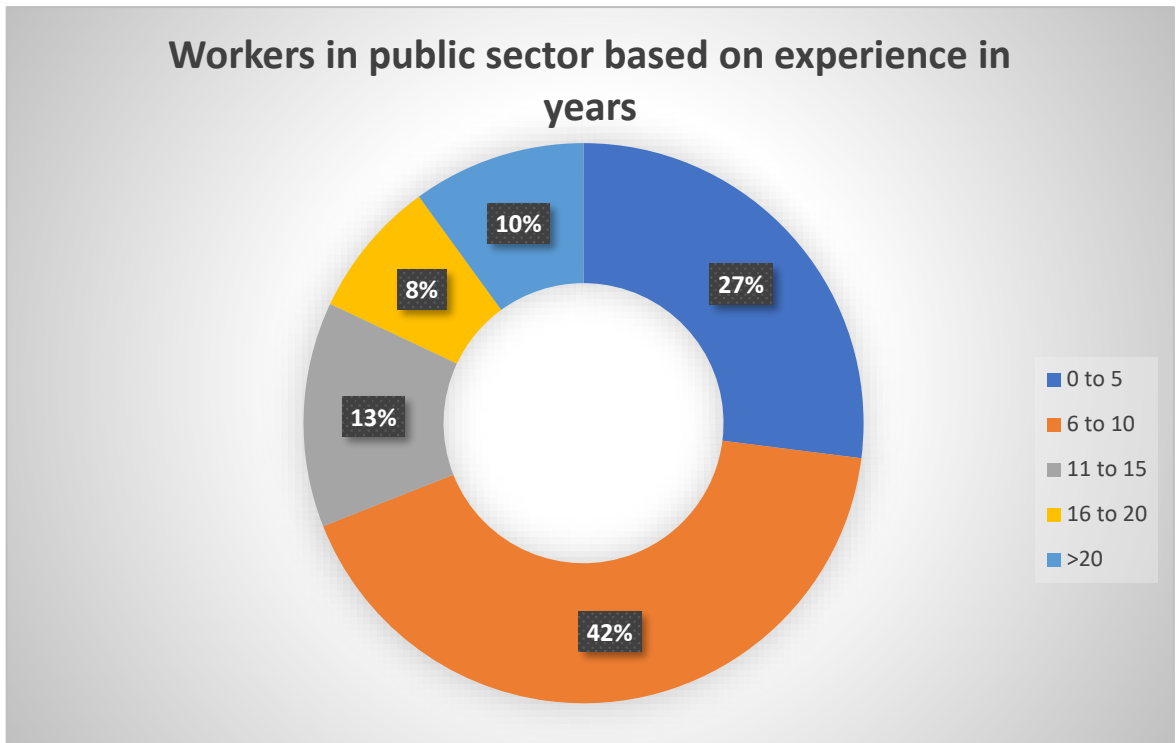


Figure 5-10. Workers in public sector based on experience in years

In case of working experience, majorly 52 % workers have 6 to 10 years. Then 27% have 0 to 5 years. Only 10% have greater working experience than 20 years. Therefore, working experience is also other criteria to maintain and obey safety rules and regulation properly. As the working experience is increased, there is possibility to work in different construction projects and also can observe and earn knowledge about safety as well as construction different activities

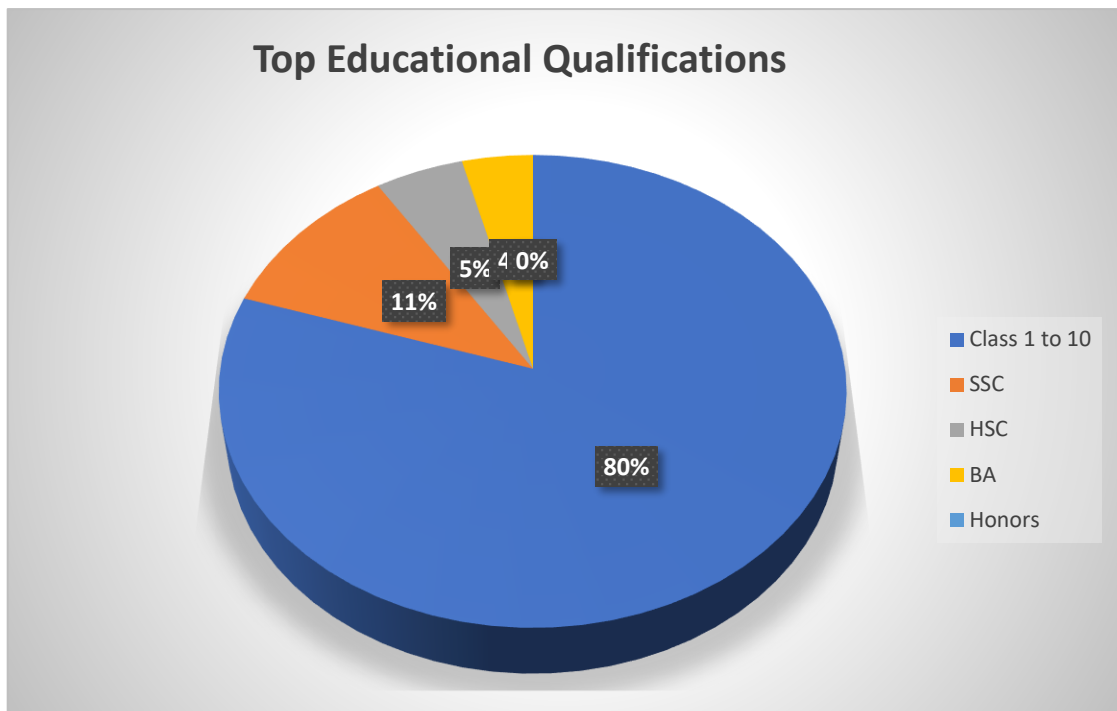


Figure 5-11. Top Educational qualification at public site

Educational background is one of the major criteria to understand regarding safety. As it is observed that 80% worker only have education in the range of class 1 to class 10. Then 11% have SSC education, 5 % of them have HSC education. To have proper training and to work as per safety rules and regulation education is very important.

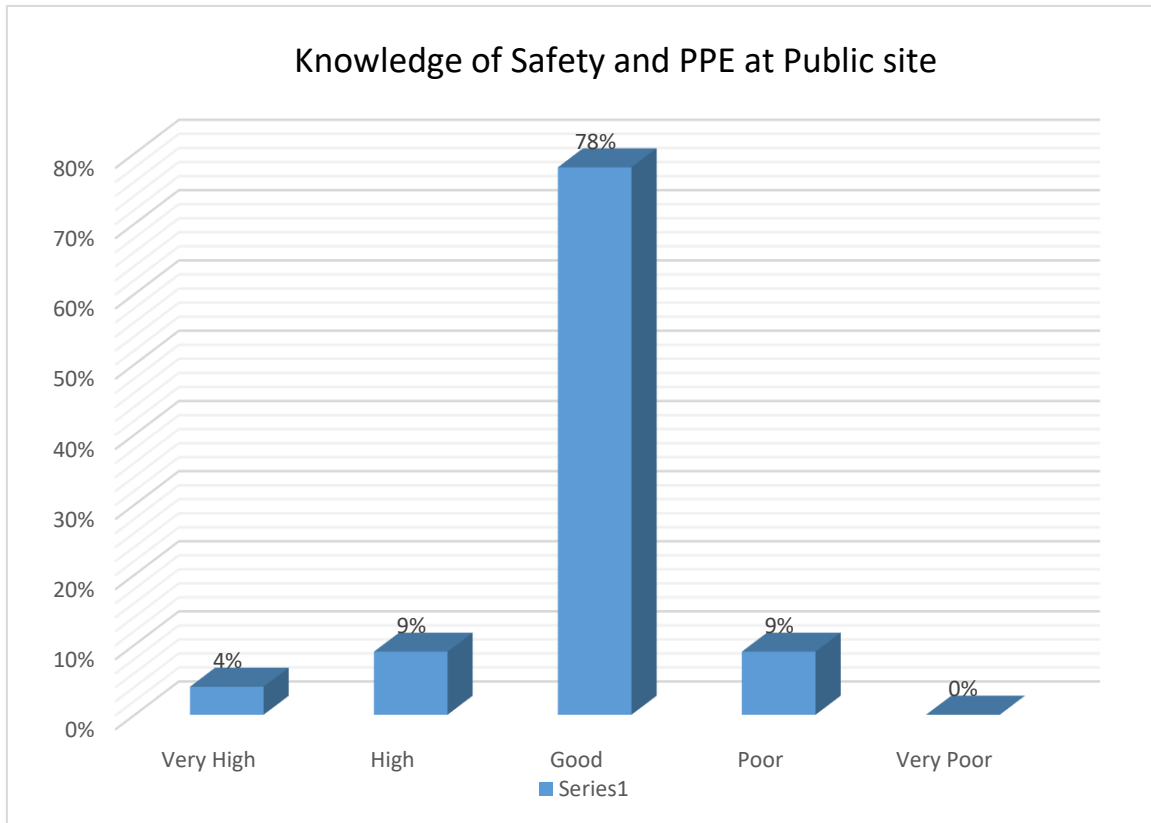


Figure 5-12. Knowledge of safety and PPE at public site

Knowledge of safety & PPE is poor which is 78% it's called moderate knowledge of safety and PPE at site as in case of public construction. The workers do not have adequate safety training as well as tool box meeting everyday about safety and work activity. Training on safety of the workers is much more, good in public sector. It is seen that 58% of workers are satisfied which means they have proper safety training. Whereas, only 13% are very disappointed and 5% are very disappointed in receiving safety training. This is overall good quantitative measure.

Safety Training provided by employer at Public site

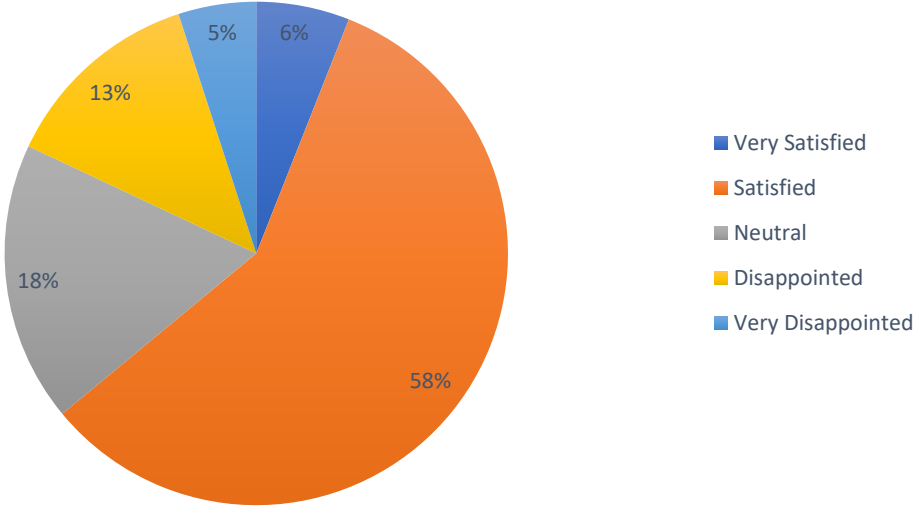


Figure 5-13. Safety training provided by employer at public site



Figure 5-14. Pressurizing on safety aspects to workers by employers at public site

Since international projects have some specifications to fulfill, the contractors are bound to take safety measures. From the pie chart it is seen that 52% sites are under proper safety management and 35% sites are in good condition.

5.4 Comparison between Public Construction (Govt+ International Funding) and Private Construction based on data collection

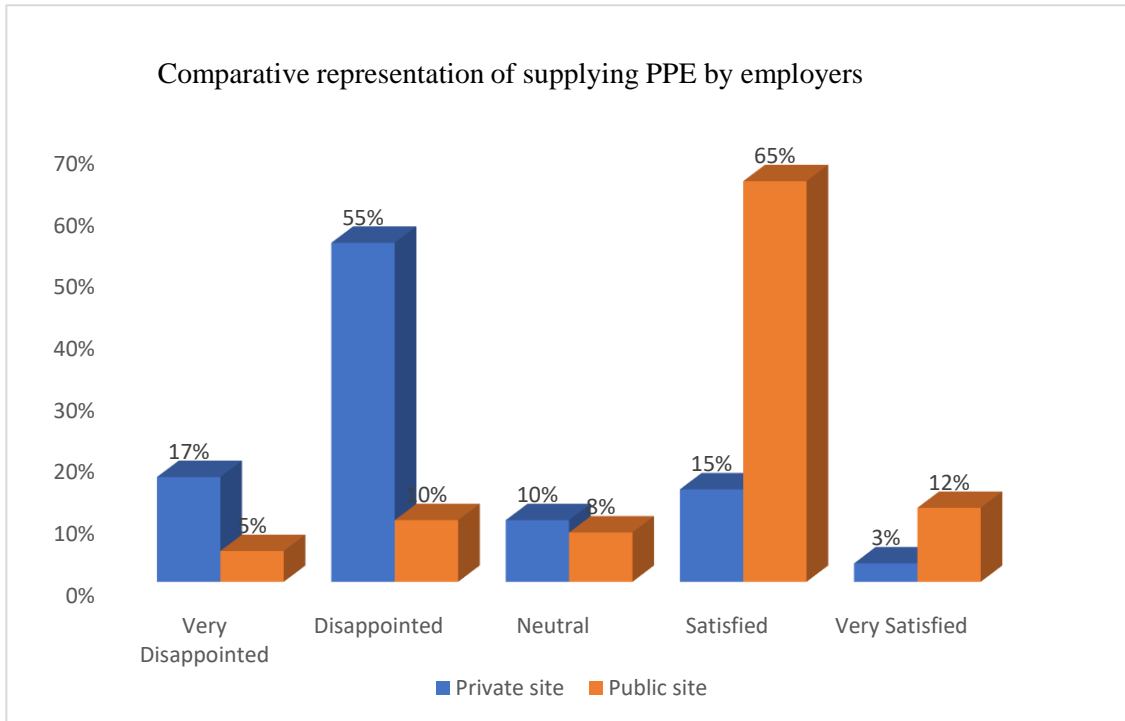


Figure 5-15. Comparative representation of supplying PPE by employers

It is obvious that contractors will provide personal protective equipment (PPE) at site to ensure safe work. From graphical comparison it is seen that this provision is quite satisfactory in public construction site whereas disappointing in private construction site. Almost 77% workers are satisfied with the supplying of PPE in public works. Again 72% are disappointed with the supplying of PPE in private works. Therefore, safety management is better for public construction sites compared to private.

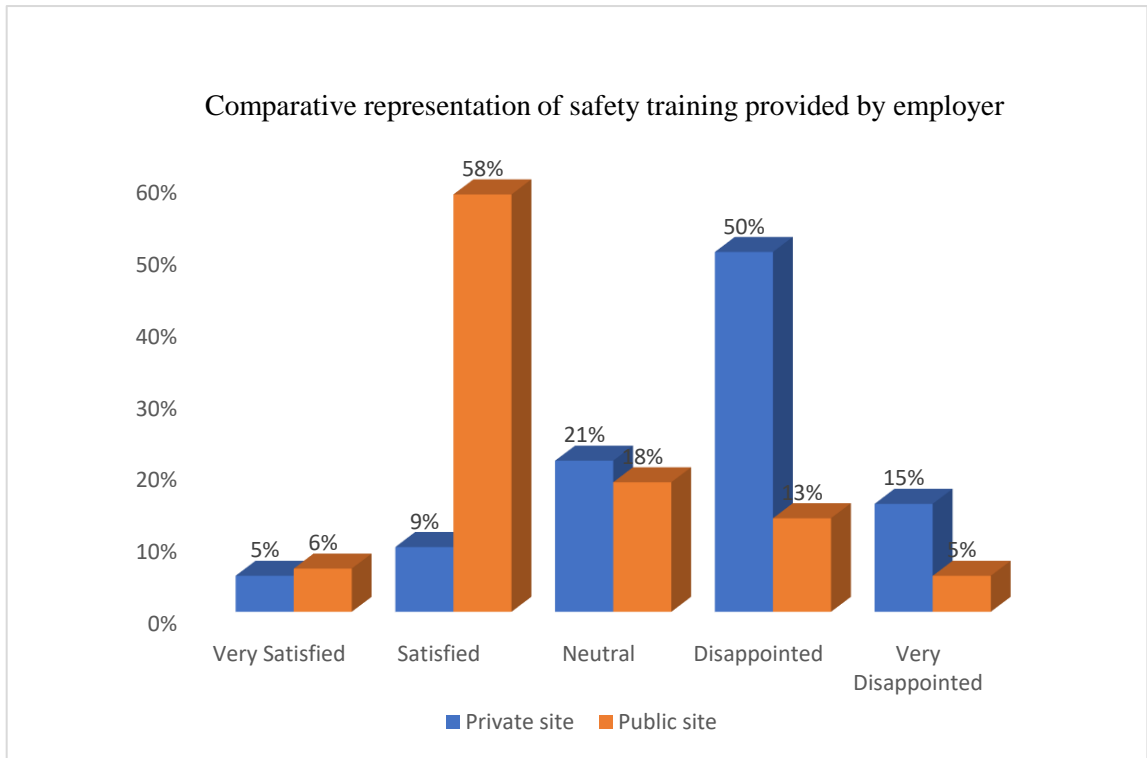


Figure 5-16. Comparative representation of safety training provided by employer

Safety training is very important for construction workers either in public or private site. Sometimes the employers are willing to provide training and sometimes try to avoid it. From above figure it is seen that in public site employers try to train their workers in a good quantitative amount, 64% while in private site it is very disappointing amount, 65%. There should be no compromise when it is related to safe works.

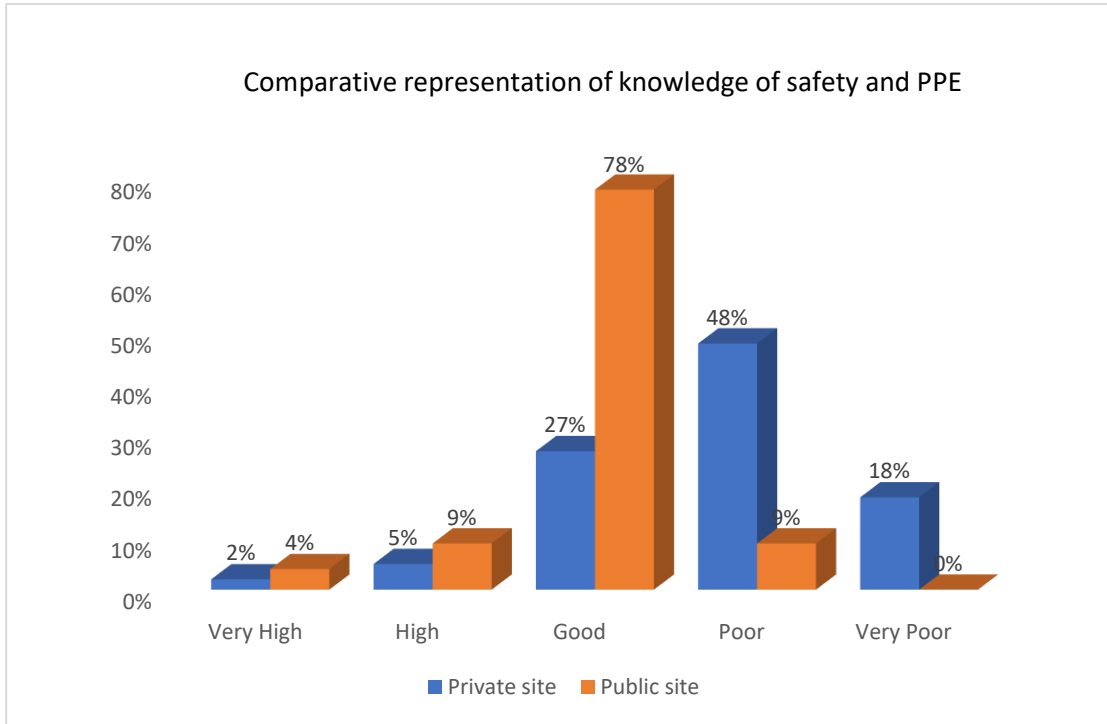


Figure 5-17. Comparative representation of knowledge of safety and PPE

From the graph it is found that most of the works from public site are familiar with safety knowledge whereas workers are less experienced in private projects. Generally, in public projects employers hire people based on real experience. Besides employers hire people based on low cost. This results less experienced people are recruited in private works. Almost 91% workers bear good knowledge about safety in public site and 66% workers have poor knowledge.

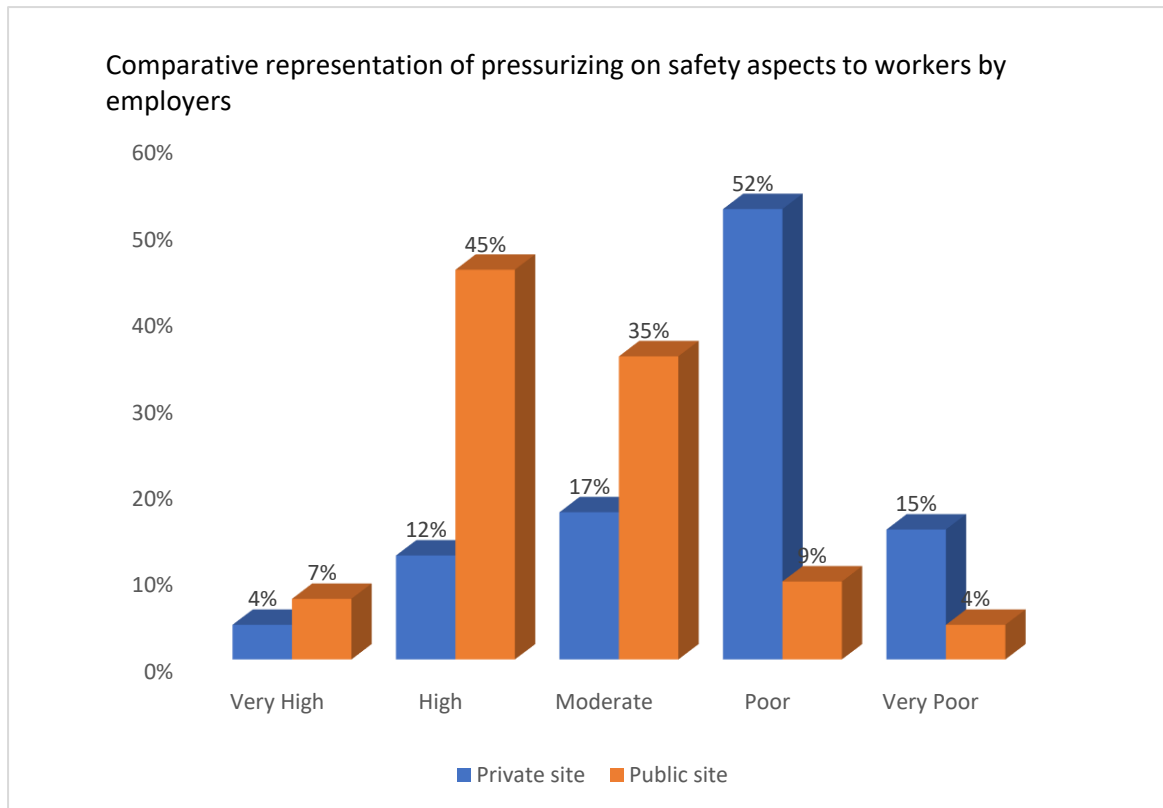


Figure 5-18. Comparative representation of pressurizing on safety aspects to workers by employers

Pressurizing on safety aspects to workers by employers is 80% in case of public construction whereas only 29% in case of private construction. From the graphical analysis it is seen that private construction is not concerned about safety so pressurizing on safety aspects to workers is very less.

5.5 Summary

This chapter has presented the analysis and the discussions of the results obtained from the collected data. The demography of the respondents has been analyzed using descriptive statistics. Almost all the respondents were experienced in their work and capable of exercising sound judgement and that their responses could be relied on for the study. From the comparison it has been seen that private construction is not concerned regarding safety among the workers as well as maintaining safety for their projects. The budget is not enough for private construction. Government should adopt proper policy and take appropriate action to improve and ensure safety practices in construction sites.

CHAPTER 6

Conclusions and Future Works

6.1 Conclusions

Implementing safety programs in the construction industry is a way of minimizing safety hazards, reducing injuries and deaths, eliminating costs associated with poor safety performance, and protecting construction organization's reputation.

Further research revealed some more facts regarding safety management issues in Dhaka city:

- Rate of knowledge of safety and PPE at site among worker is higher in case of public construction (Govt+ International Funding) than private construction as worker have continuous safety training, PPE supplied by the employer as project requirement.
- Stressing on safety aspects to workers by employer is higher in case of public construction (Govt+ International Funding) than public construction as there exist project specification from the client.
- It is found that adequate funding is available in case of public construction (Govt+ International Funding). On the other hand, there is not enough budget in case of private construction.
- Private construction is not concerned regarding safety among workers as well as maintaining safety for their projects.
- Private construction should allocate a minimum budget to provide PPE among workers and proper training for workers to maintain safety during construction.
- Government rules and regulation should be stressed strictly to private construction to maintain safety and to provide PPE among workers during construction.
- The use of PPE should become the main priority to protect workers and prevent from serious accident. Therefore, all parties should take the lead collaborate in achieving the objectives to ensure PPE application among workers in worksite
- If all public and private parties follow and implement safety among workers as well as safety for their project, safety issue can be overcome and the number of accidents in our country can be reduced specially in case of both public and private construction.

6.2 Limitations and Recommendations for Future Works

Based on the study of existing conditions at the construction sites following recommendations can be made to improve the safety scenario.

- This work is based on considering the construction safety inside Dhaka city. Further research about safety of workers can be done outside of Dhaka city.
- This survey was conducted in Dhaka city in around 13 construction sites. The more geographical area can be surveyed, the more appropriate the result will be obtained. For more appropriate results, sample size should be increased.
- Safety comparison can be done between revenue and foreign aided funded projects.
- Comparison of site safety among Bangladesh and other similar countries of the world can be performed for getting more accurate results.
- Site safety tools price can be compared among Bangladesh and foreign countries.
- Research can also be done on how much project management is concerned about workers safety in Bangladesh.
- The co-relation between knowledge about occupational accidents and safe-work tendency among workers of Bangladesh and other countries can be research.
- Schedule pressure from client should be avoided by proper management and that should be kept in mind as a mandatory matter during contractual procedure.
- The supervision of project manager is very much important that the workers properly use the safety equipment. Nothing but some supervision and awareness can reduce accidents to great extent.
- More welfare facilities, safety equipment and various factors affecting safety can be added for survey and subsequent analysis. The more parameters will be added, the more accurate and extensive result can be obtained
- Adoption and adaptation of innovative and advanced management techniques such as lean construction, BIM, automation, total safety management and cloud-based facilities should be carried out. This idea may bring several benefits to the construction industry, especially in terms of implementing safety policy and culture and detecting, avoiding, and eliminating accident in construction projects.

- Laborers are recommended to work with consciousness in relation to equipment, materials and other construction elements, safety measure (PPE), collaboration and teamwork. Laborer should avoid reckless attitude, freaky behavior and interference with other roles in the construction sites. Additionally, laborers are suggested to show interest to get training and follow safety policy.

REFERENCES

- Ahmed, S., and Bashar, I., *Analysis of accident on construction site in Bangladesh: A construction safety management issue part-I*, B. Sc Eng. Thesis, Department of Civil Engineering, Khulna University of Engineering and Technology, 2018.
- Ahmed, S., Sobuz, Md. H. R., and Haque, Md. I., "Accidents on Construction Sites In Bangladesh: A Review," in *4th International Conference on Civil Engineering for Sustainable Development*, (ICCESD 2018), pp. 1-8, 2018.
- Buniya, M. K., Othman, I., Sunindijo, R. Y., Kineber, A. F., Mussi, E and Ahmad, H., "Barriers to safety program implementation in the construction industry," *Ain Shams Engineering Journal*, Vol. 12, pp. 65-72, 2021.
- Bibb, A., and Bust, P., *Construction health and safety in developing countries*, Loughborough University, European Construction Institute, 2006.
- Bangladesh Occupational Safety, Health and Environment Foundation (OSHE). (2009). Occupational Safety and Health Profile of Construction Sector, Dhaka.
- Chileshe, N., and Dzisi, E., "Benefits and Barriers of Construction Health and Safety Management (HSM)," *Journal of Engineering, Design and Technology*, Vol. 10, pp. 276-298, 2012
- Danso, F.O., *Occupational health and safety issues involving casual workers on building construction sites in Ghana, a Kumasi study.*" M. Sc. Thesis, Kwame Nkrumah University of Science and Technology, Ghana, 2010.
- Da Silva, S. L. C., and Amaral, F. G., "Critical Factors of Success and Barriers of the Implementation of Occupational Health and Safety Management Systems: A Systematic Review of Literature," *Safety Science*, Vol. 117, pp. 123-132, 2019.
- Dewri, L.V., (2012). "A Comprehensive Study on the Real Estate Sector of Bangladesh," *Real Estate and Housing Association of Bangladesh.*, 2012.
- Goh, Y. M., and Chua, D., "Neural network analysis of construction safety management systems: a case study in Singapore," *Construction Management and Economics*, Vol. 31, pp. 460-470, 2013.
- Guha, H., and Biswas, P.P., "Measuring construction site safety," *International Journal Scientific and Engineering Research*, Vol. 4, pp. 2138-2143, 2013.

- Hasan, M., Sharmin, S., Chowdhury, S. A., Islam, A., and Shuvo, A. K., “A Study of Safety Culture Practice in Running Construction Project of Bangladesh,” *Journal of Civil and Construction Engineering*, Vol. 7, pp. 47-56, 2021.
- Hassan, S. A., *Health, safety and environmental practices in the construction sector of Pakistan*, M. Sc. Eng. Thesis, Uppsala University, Sweden.
- Islam, M. H., Morshed, S. Y., and Karim, M. R., “Construction Safety Practice in Bangladesh: A Case Study in KUET, Mirerdanga and Teliganti Union,” in *International Conference on Recent Innovation in Civil Engineering for Sustainable Development*, Vol. 041, 2015, pp. 134-138, 2015.
- International Labour Organization,
<https://www.ilo.org/safework/areasofwork/hazardous-work/lang--en/index.htm>
 [Accessed on 2 Aug. 2022].
- Jamal, M. U. A. M., *Safety Management Issues in Construction Industry of Bangladesh*, M. Sc. Eng. Thesis, Department of Civil Engineering, Bangladesh University of Engineering and Technology, 2015.
- Jannadi, O. A., and Bu-Khamsin, M. S., “Safety factors considered by industrial contractors in Saudi Arabia,” *Building and Environment*, Vol. 37, pp.539-547, 2002.
- Kartam, N. A., Flood, I., and Koushki, P., “Construction safety in Kuwait: issues, procedures, problems and recommendation,” *Safety Science*, Vol. 36, pp. 163-184, 2000.
- Kogi, K., “Work Improvement and Occupational Safety and Health Management Systems: Common Features and Research Needs,” *Industrial Health*, Vol. 40, pp. 121-133, 2002.
- Othman, I., and Azman, A., “Safety misbehavior and its effect towards safety performance of construction projects,” in *International Conference on Architecture and Civil Engineering*, Vol. 59, pp. 193-200, Springer, 2020.
- Othman, I., Mohamad, H., Sapari, N., Shafiq, N., Ibrahim, F., and Kamil, M. S., “HSE management system at high elevation in shipbuilding project,” *International Journal of Engineering Technologies and Management Research*, vol. 5, pp. 117-127, 2018.
- Priyadarshani, K., Gayani, K., and Sajani, J., “Construction safety assessment framework for developing countries: a case study of Sri Lanka,” *Journal of Construction in Developing Countries*, Vol. 18, pp. 33-51, 2013.

- Roy, C., and Islam, M. S., "Hazards and Safety Issues at Construction Sites in Bangladesh," *MOJ Civil Engineering*, Vol. 5, pp. 52-56, 2019.
Report Published on Daily News Papers between 2004-2006.
- Rollenhagen, C., and Kahlbom, U., "Towards a model for the assessment of safety activities and their associated organization context," in *Proceedings of the 4th international workshop on human error, safety and system development*, pp. 11–12, 2001.
- Shourav, S. A., Shahid, S. and Yahya, S. M., "Assessment of Occupational Safety Conditions in the Construction Industry of Bangladesh," in *Malaysian Research Conference and Innovation Exhibition*, pp. 1-6, 2015.
- Sobral, J., and Soares, C. G., "Assessment of the Adequacy of safety barriers to hazards," *Safety Science*, Vol. 114, pp. 40-48, 2019.
- Toole, T. M., "Construction Site Safety Roles," *Journal of Construction Engineering and Management*, Vol. 128, pp. 203-210, 2000.
- Yiu, N. S. N., Chan, D. W. M., Shan, M., and Sze, N.N., "Implementation of Safety Management System in Managing Construction Projects: Benefits and Obstacles," *Safety Science*, Vol. 117, pp. 23-32, 2019.
- Yu, S. C. K., and Hunt, B., "Safety management systems in Hong Kong: is there anything wrong with the implementation? ," *Managerial Auditing Journal*, Vol. 17, pp. 588-592, 2002.

Appendix A

Survey Questionnaire

Section A: Respondent's and Construction site's Demography

Please tick (√) in the appropriate space below.

1. Location of the Construction Site

Dhaka North City Corporation Dhaka South City Corporation

2. Type of Construction

Government Private

3. Position at the Construction Site

Contractor Project manager

Site engineer Worker

If others please specify.....

Section B: Civil Construction Safety Checklist

Project Type:

Date:

Location:

<p>HOUSEKEEPING</p> <ul style="list-style-type: none"> <input type="checkbox"/> Storage of materials <input type="checkbox"/> Disposable of wastes <input type="checkbox"/> Tripping, Slipping <input type="checkbox"/> Others..... <p>TEMPORARY POWER</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lights <input type="checkbox"/> GECI outlets <input type="checkbox"/> Extension cords <input type="checkbox"/> Panel covers <input type="checkbox"/> Exposed live parts <input type="checkbox"/> Others..... <p>LADDERS</p> <ul style="list-style-type: none"> <input type="checkbox"/> Safety feet <input type="checkbox"/> Tied off <input type="checkbox"/> Electrical exposures <input type="checkbox"/> Rungs recessed/broken <input type="checkbox"/> Rails <input type="checkbox"/> Safety lines and Harness <input type="checkbox"/> Extended 36° above landing <input type="checkbox"/> Others..... <p>GANG BOX</p> <ul style="list-style-type: none"> <input type="checkbox"/> Medical Kit <input type="checkbox"/> OSHA posters <input type="checkbox"/> Emergency posted <input type="checkbox"/> MSDS <input type="checkbox"/> Others..... <p>WALKING WORKING SURFACES</p> <ul style="list-style-type: none"> <input type="checkbox"/> Handrails <input type="checkbox"/> Barricade <input type="checkbox"/> Oil, water <input type="checkbox"/> Scrap, Rubbish <input type="checkbox"/> Others..... <p>Source: OSHA Website</p>	<p>SCAFFOLDS</p> <ul style="list-style-type: none"> <input type="checkbox"/> Footing <input type="checkbox"/> Handrails <input type="checkbox"/> Fall protection <input type="checkbox"/> Properly erected <input type="checkbox"/> Properly supported <input type="checkbox"/> Others..... <p>FIRE PROTECTION</p> <ul style="list-style-type: none"> <input type="checkbox"/> Extinguisher(s) charged <input type="checkbox"/> Extinguisher tagged <input type="checkbox"/> Others..... <p>PERSIONAL PROTECTIVE EQUIPMENT</p> <ul style="list-style-type: none"> <input type="checkbox"/> Safety glasses W/side shields <input type="checkbox"/> Full body harness <input type="checkbox"/> Goggles <input type="checkbox"/> Still toed shoes <input type="checkbox"/> Hard hats <input type="checkbox"/> Hearing protection <input type="checkbox"/> Gloves <input type="checkbox"/> Respirators <input type="checkbox"/> Long sleeve shirts <input type="checkbox"/> Others..... <p>LIFTS</p> <ul style="list-style-type: none"> <input type="checkbox"/> Emergency stops <input type="checkbox"/> Safety chain <input type="checkbox"/> Clear pathway <input type="checkbox"/> Others..... <p>EQUIPMENT</p> <ul style="list-style-type: none"> <input type="checkbox"/> Hoses wired <input type="checkbox"/> Good condition <input type="checkbox"/> Warning signs <input type="checkbox"/> Grounding required <input type="checkbox"/> Electrical cords <input type="checkbox"/> Power Tools <input type="checkbox"/> Barricades <input type="checkbox"/> Others..... <p>Signature:</p>
--	---

Section C: Questionnaire Form for Worker's Safety

Project Type:
Location:

Date:

Job

Name of the worker :
Designation :

The following are the topics which should be focused in the construction site to analyze safety condition. Please rank these to indicate the extent to which they show the safety condition at site according to construction workers by ticking the appropriate cell:

- a) Age (years):
5. >41, 4. 36-41 3. 30-35, 2. 24-29, 1. 18-23
- b) Education:
5. Honors , 4. BA, 3. HSC, 2. SSC, 1. 1-10
- c) Working Experience:
5. >20, 4. 16-20, 3. 11-15, 2. 6-10, 1. 0-5 years
- d) Knowledge of Safety and PPE at Site:
5. Very Poor, 4. Poor, 3. Good, 2. High, 1. Very High
- e) Stressing on Safety aspects to workers by employers:
5. Very poor/Never, 4. Poor, 3. Moderate, 2. High, 1. Very High
- f) Supply of PPE Equipment by Employer
5. Very Disappointed, 4. Disappointed, 3. Neutral, 2. Satisfied, 1. Very Satisfied
- g) Training on Safety by Employer:
5. Very Disappointed, 4. Disappointed, 3. Neutral, 2. Satisfied, 1. Very Satisfied
- h) Opinion about safety of the worker:
5. Very Disappointed, 4. Disappointed, 3. Neutral, 2. Satisfied, 1. Very Satisfied

Section D: Health and Safety Related Issues-

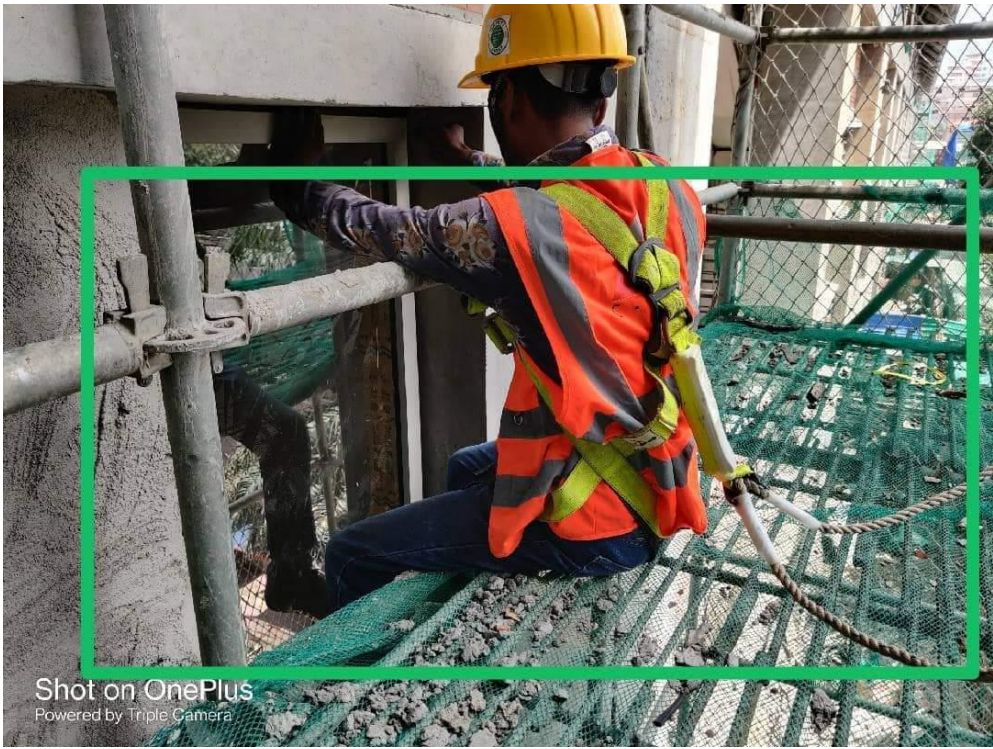
There is a general assertion that employers do not provide the following welfare related facilities in construction site for workers. Please indicate your reaction to each statement by ticking the particular cell according to public or private site. Using the scale below, please choose and circle the relative items to indicate your answer on workers safety management of the construction sites, ranging from 5= Strongly Disagree to 1= Strongly Agree.

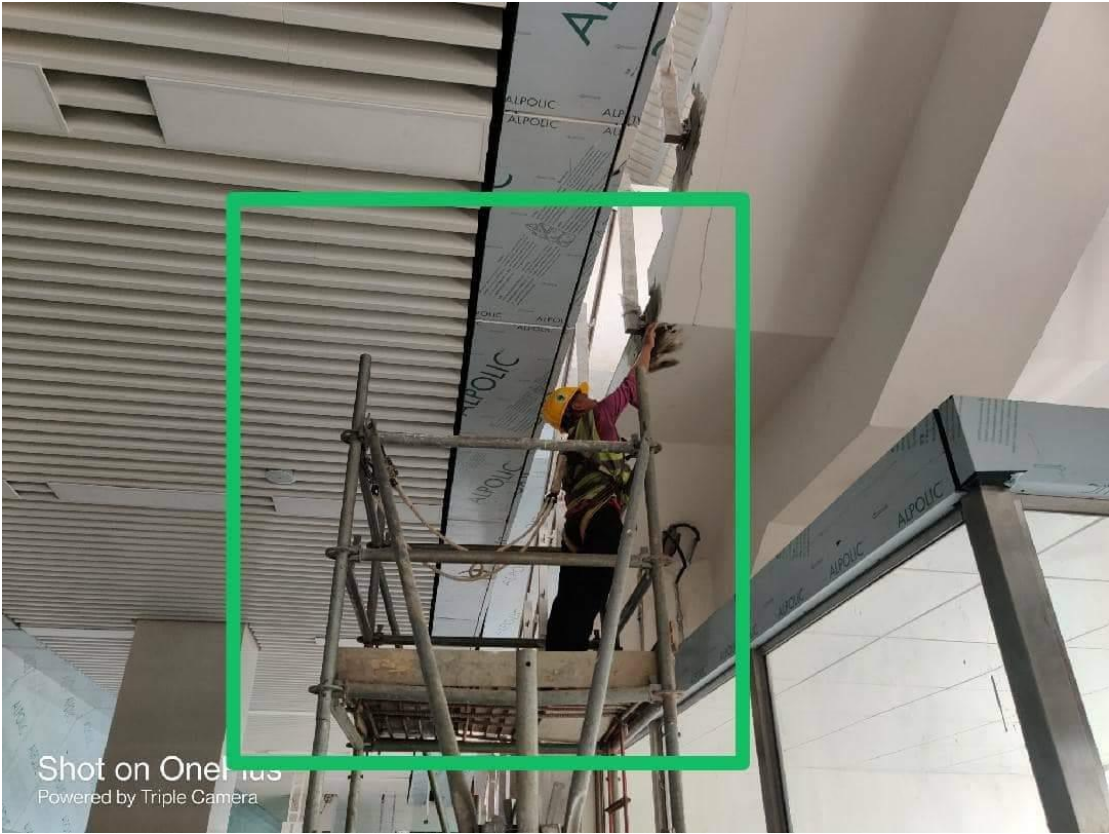
No.	Welfare facilities	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
		5	4	3	2	1
01.	Safe drinking water					
02.	Means of heating food					
03.	Water for washing and cooking					
04.	Suitable accommodation to rest					
05.	Sanitary facilities (toilets, showers, changing room)					
06.	Accommodation to change and store clothing					
07	First aid equipment					

Appendix B

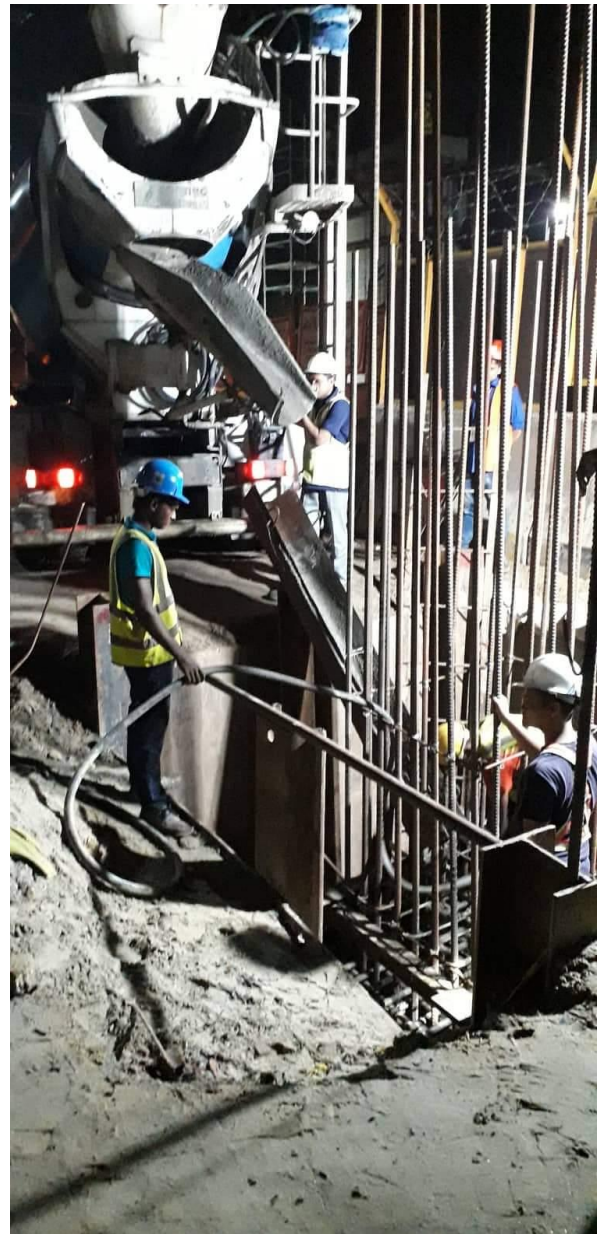
Scenario of Surveyed Construction Project around Dhaka city



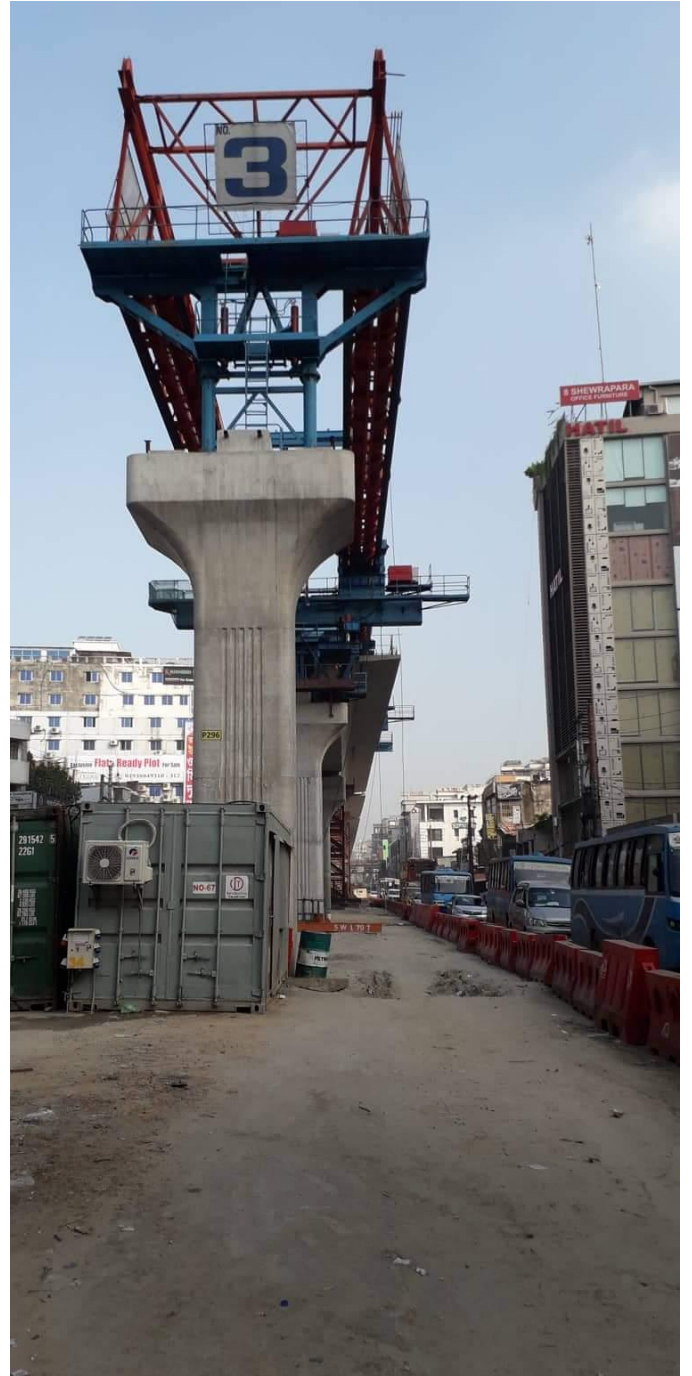


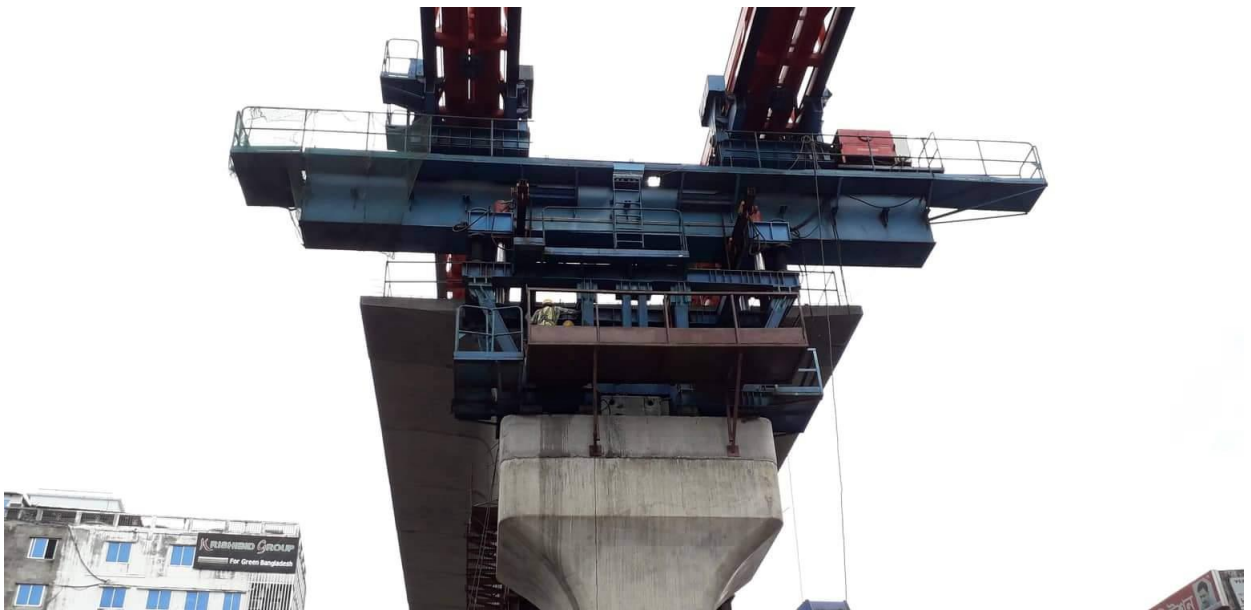






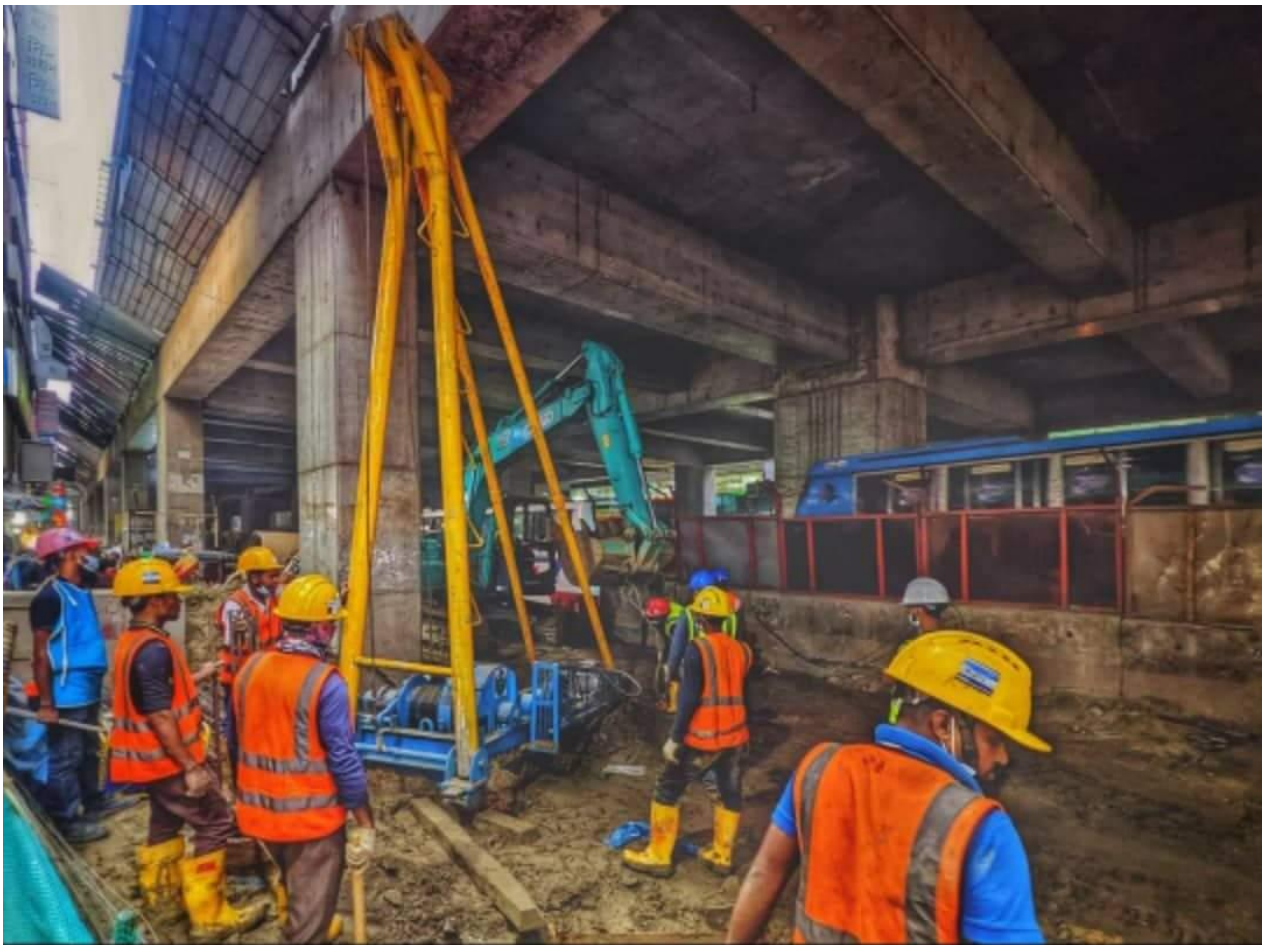
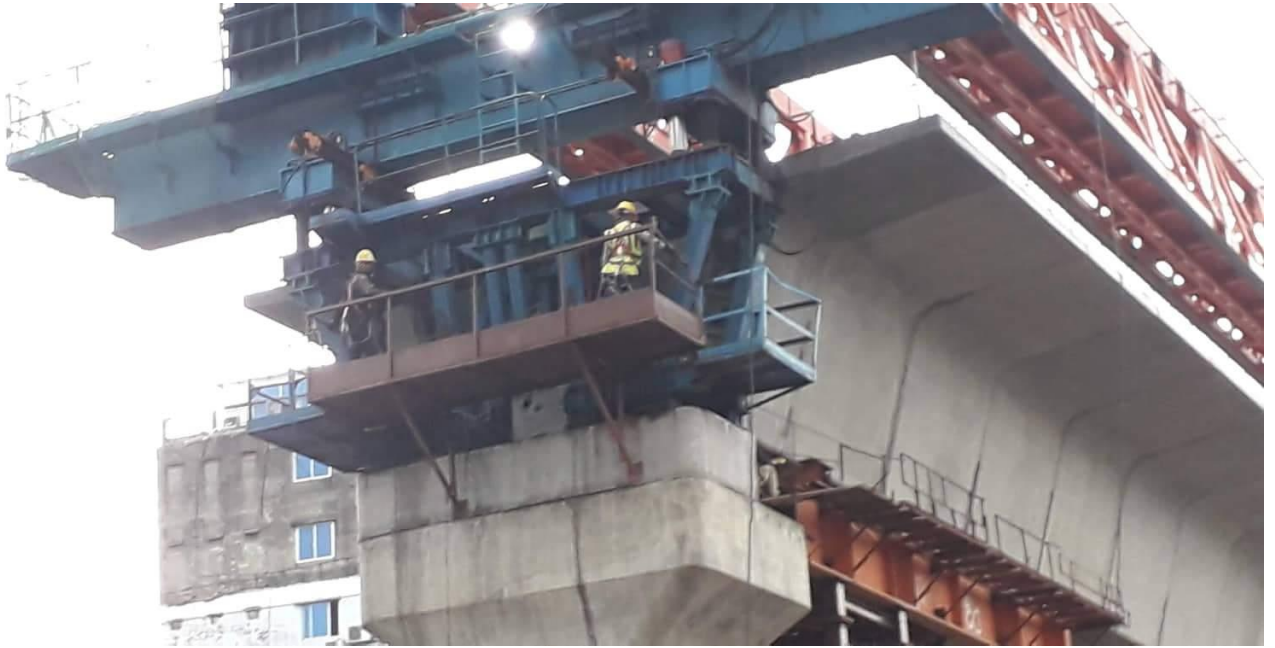
















Joint venture SDRB & SINOHYDRO

Date: 16.05.2022

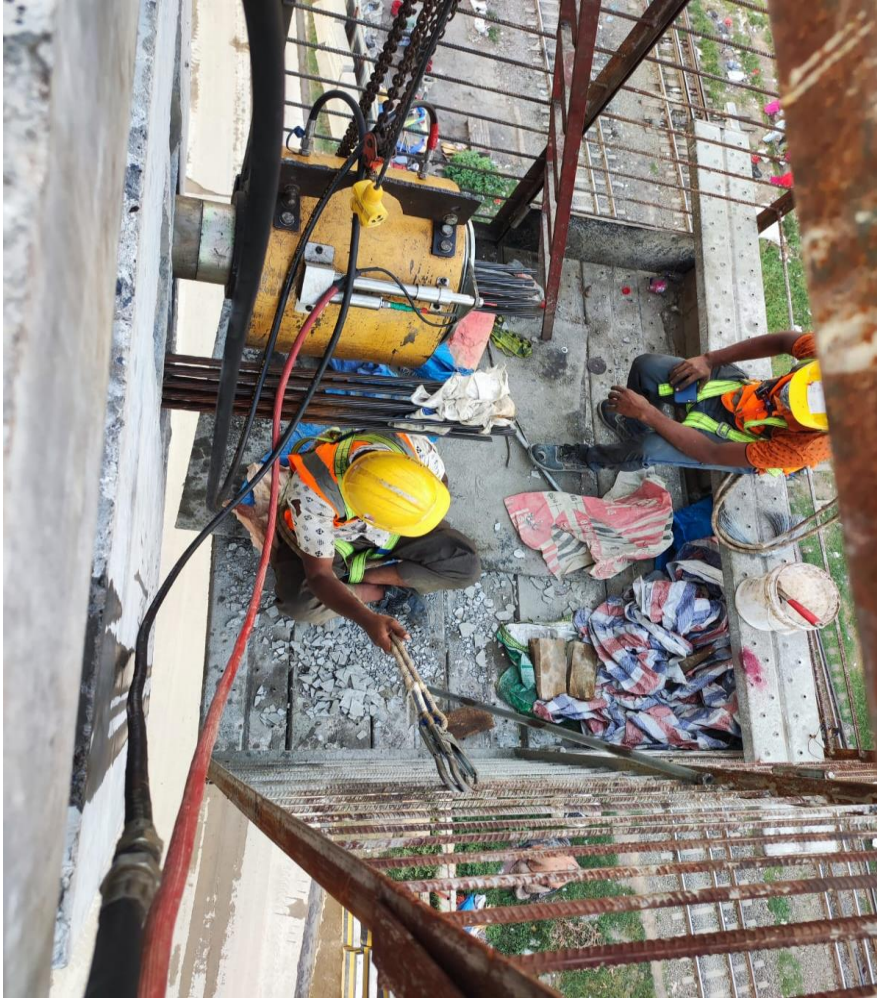
Site: Lapangan Location: Spring Hill

Training/Meeting Attendance Topics: Incident investigation at site or accident by first incident or health & safety & discussion about improvement about Health & Safety culture within the organization. PPE, safety, PTN, system & factor, and follow the instruction/activity by the organization.

No.	Name	Company Name	Position	Signature
1	Ustzul Hassan	JV	HSE MANAGER	[Signature]
2	Al Hafidhan Huda	JV	HR	[Signature]
3	Karim Ahmad	"	HSE Asst	[Signature]
4	Ma. Sahas	"	Officer	[Signature]
5	Ma. Zahid Huda	JV	HR Coordinator	[Signature]
6	M. M. M. M. M.	JV	HRD Supervisor	[Signature]
7	M. M. M. M. M.	"	Officer	[Signature]
8	MD. Razaul Karim	"	HSE officer	[Signature]
9	M. M. M. M. M.	JV	HSE Asst.	[Signature]
10	Mohammed Razaul	JV	HSE Asst	[Signature]
11	Mohammed Razaul	JV	HSE Asst	[Signature]
12	MD. Imran Huda	"	"	[Signature]
13	MD. Imran Huda	JV	HSE officer	[Signature]
14	MD. Imran Huda	"	"	[Signature]
15	MD. Imran Huda	"	"	[Signature]
16	MD. Imran Huda	"	"	[Signature]
17	MD. Imran Huda	"	"	[Signature]
18	MD. Imran Huda	"	"	[Signature]
19	MD. Imran Huda	"	"	[Signature]
20	MD. Imran Huda	"	"	[Signature]

No.	Name	Company Name	Position	Signature
18	Ma. Razaul Karim	JV	HSE Officer	[Signature]
19	Ma. M. M. M.	JV	"	[Signature]
20	Mohammed Razaul	JV	"	[Signature]
21	Zahin Rahman	JV	"	[Signature]
22	RABIB	JV	Inspector	[Signature]
23	M. M. M. M. M.	JV	safety Inspector	[Signature]
24	MD. Imran Huda	JV	HSE-Inspector	[Signature]





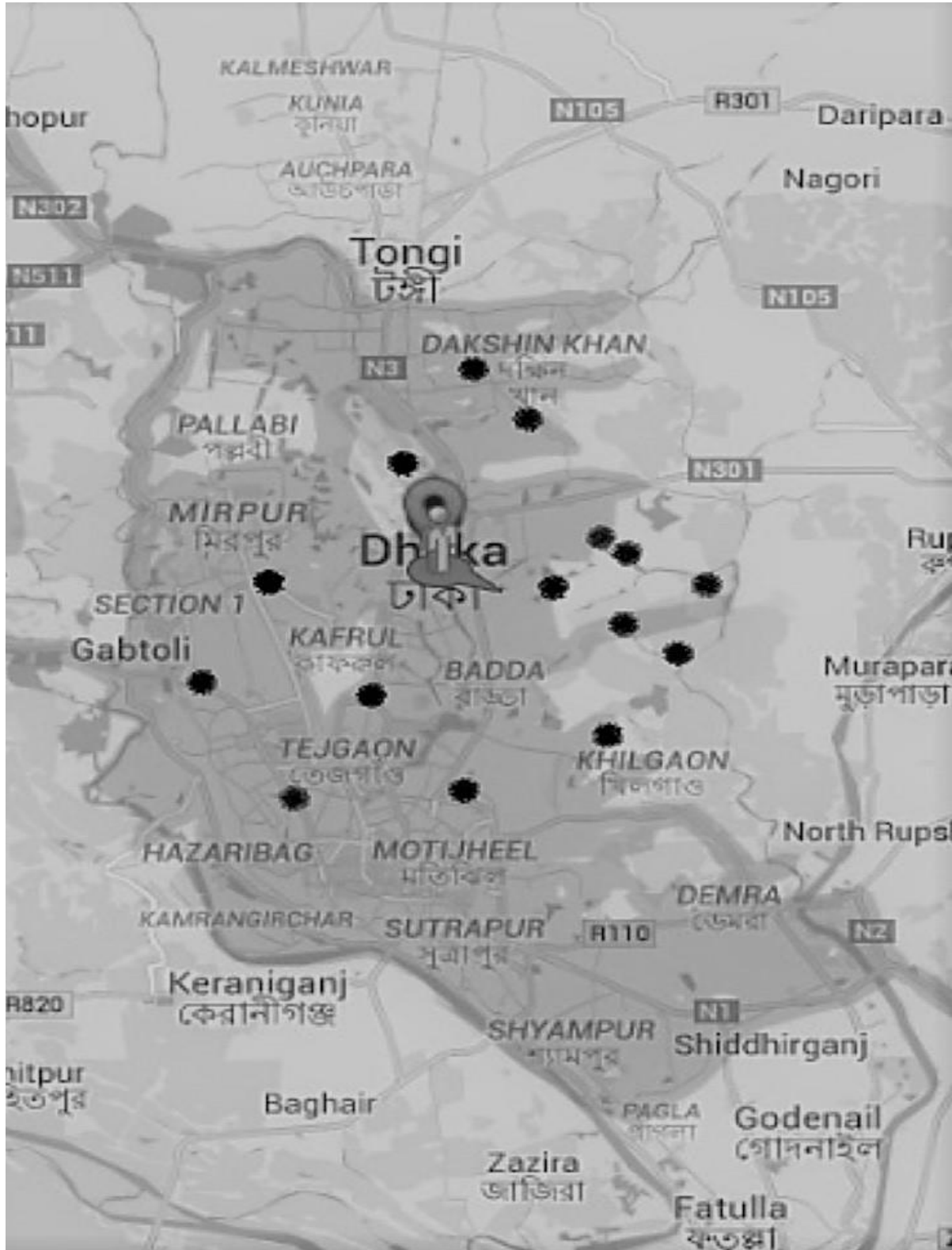


Appendix C

DB Box



Appendix D Area surveyed in Dhaka city (approximate location)



Source: Wikipedia

(Black dots indicate the approximate location of the survey sites)