

Identification of Factors Influencing Accidents on Construction Sites

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Abstract. Bangladesh is facing tremendous accident issue at construction site and it get larger size every year. The statistics of accident at construction site shows us a picture that Bangladeshi construction sector is on most critical situation that need a huge and fast overcome from the current frequently accidental level. An accident leads a project delays, cost overrun and sub-standard product as well as affect economical and infrastructure development of a nation. This research focus on identifying the most crucial causes and analyzing statistical data of accident on construction site and to understand their relative importance (RII). In order to achieve this goal, a set of questionnaire was designed by a comprehensive literature review. Then a questionnaire survey conducting among various stakeholder to collect essential data. The study is found 18 crucial factors of influencing accident on construction site. The key causes of accident based on overall consideration were: lack of personal protective measures, lack of safety awareness among top management, lack of safety awareness among labour, lack of training, non-strict regulation against safety, management commitment and unskilled labour. Accident control is the major concern in the construction industry in this way any endeavor to identify and investigate any approach to prevent and control accident ought to be yell after, henceforth the requirement for the research.

Keywords: Construction Accident; Causes; Construction Safety; Statistical Analysis of Accident; Bangladesh

1. Introduction

Food, shelter, and clothing are undoubtedly the three basic needs of human being. It is therefore not surprising that the construction industry is the largest industry of the world. Construction sector is one of the most important sectors in the World. The construction industry has earned the 6% of the global GDP and growing (WEF, 2016) in 2016. Bangladesh is one of the newly born developing country. Construction sector plays a significant role on Bangladesh national economy since past few years. In 2016, this industry has earn 7.67% of growth GDP of Bangladesh (Bangladesh Bureau of Statistics, 2016). This industry has a great interaction with the other economic industries as a backward and forward linkage. But construction industry is considered as one of the most unsafe and uncertain industrial activities in the country. This is recognized as the most hazardous and uncertainty industry due to its unique nature. Construction industries are also recorded several work- related accidents and injuries for various causes in the construction site. Rate of injury to physical properties and labour in the construction industry is much greater than any other industries in Bangladesh. A great number of people fall victim to injury every year, serious harm and even death often caused by accidents on construction project sites. Construction accident as an unexpected occurrence disordering a planned sequence of a construction project which result to loss of production, injury to personnel, damage to plant and equipment (Oladiran & Sotunbo, 2009). The ILO state that there are about 60,000 fatal accidents happen in the construction sites of the world in each year. Every day about 950 people died and over 720,000 workers get hurt because of occupational accidents (Dilipkumar and Jha, 2016). According to the International Labour Association (ILO), worldwide appraisals of directly and indirectly about expenses for construction accidents are USD 2.8 trillion, comparable to 4% of the yearly worldwide GDP (Leigh, 2011).

Construction employees have three times more chances of dying and two times of getting injured than any worker of other economic activity (Sousa and Teixeira,

2004). In Bangladesh, the statistics reported that thousands of workers are being injured and killed each year due to the work related accidents, where the construction industry has recorded more than forty percent of the occupational injuries and fatalities (Safety and Rights Society report, 2015). It is necessary to understand that a high proportion of workforce come out from the construction industry that compared to other industrial arena. This indicates that a large population of global workforce is engaged in occupational injuries and fatalities. The majority of construction injury cases are simply related to poor decision making, which can be prevented through adequate safety culture (Stanley, 2010). It is necessary to determine the specific factors that are effectively important to successful implementation of safety programs to achieve desired predetermined goal. The elements of poor construction safety management find out as lack of education and training, lack of safety awareness, aversion of input safety measures and reckless operation (Tam, Zeng, & Deng, 2004). Construction accidents commonly happen on site due to lack of knowledge or training, inappropriate in judgment or carelessness and poor machineries (Coble et al, 1994). The main obstructions of safety implementation are the shortage of skilled workers, workers level, poor management commitment and nature of construction industry (Smallwood, 2000). Rough project schedule, disproportionate approval procedures, low management expertise, inappropriate planning, scarcity of skilled labour, variations and lack of coordination between projects participants are the main hazards to safety performance of a construction project. (Husin et al, 2008). Contributory factors to occur accidents are 70% is of workers, 49% is of work place issues, 56% is of equipment shortcomings, 27% is of material conditions and 84% is of risk management (Haslam et al, 2005).

Un-safety of different temporary structure systems are considered as the major factors of construction accidents. Construction accidents usually occur on a project site due to collapse of construction parts or elements, unsafe working condition, employee behaviours and misuse of machineries and tools. There are no doubt that the adoption of health and safety culture is an important element

needed in the construction industry. In this 21st century, the improvement in technological and social sectors have modified the steps and stage of construction works. As a result many other advanced management practices are employed to reduce and eliminating the constructional injuries and fatalities which improve efficiency and effectiveness of construction industry by reducing waste and increasing profit. The adoption of appropriate procedure in safety management can reduce and eliminate the accidents and injuries in construction site. This occurrence is also hamper the schedule, plants, equipment and related properties. Appropriate safety management technique can simplify the project success and organizational sustainability. But negligence of safety practice can result in construction accidents and injuries. These type injuries and fatalities can affect the workers output of project, therefore reducing the probability that the job will be properly executed. Several researchers have proved that the appropriate safety management can improve productivity and occupational safety and health and also reduce the massacre of cost. For all these reason the study about construction safety is important. Construction site accident statistics and data in Bangladesh are not properly and regularly published. Therefore, they are not easily available and not easy to access. However, it is expected that many fatal and non-fatal accidents would be happening everyday due to its characteristics such as unique nature and less controlled over the working environment. But there is no system recommended for aggregating and recording this statistics across the country to done in proper seriousness. This is one of the reasons for not conducting sufficient researches and literature on construction accident and safety. Therefore, this study sets the following objectives of study the existing global and national accidents factors of construction accidents in Bangladesh.

2. Methodology

The questionnaire was designed from online sources in distributed media and research papers. Then a survey was taken place to collect data. The collected data

was examined to distinguish the potential causes in the construction industry. A portion of the key data and information was taken specifically from the contextual investigations and some have been anticipated utilizing accessible information sources.

2.1 Questionnaire Design and Data collection

The nature of this study is required a quantitative methods of data collection. For questionnaire design, review through journal and conference papers, articles, media and others were found effective because of the relative ease of obtaining essential data and information appropriate for achieving the objectives of the study. From the literature scanning 18 vital number of factors were selected and used to design the data collecting sheet to determine the crucial factors of construction accident. Then a questionnaire survey was conducted for collecting essential data to determine the rank of factors. Table-1 represent the background information about the respondents.

Table 1. Demographic characteristics of respondents

Demographic Characteristics	Frequency	Percentage, %
Sex		
Male	52	73
Female	19	27
Age		
≤ 20 years old	15	21
21-30 years old	26	37
31-40 years old	17	24
≥ 40 years old	13	18
Location		
Dhaka Division	18	25
Rajshahi and Rangpur Division	11	15
Chittagong Division	13	18
Sylhet Division	8	11
Khulna and Barisal Division	21	31

Working Field		
Building	29	41
Infrastructure	20	28
Electrical and mechanical	14	20
others	8	11

To determine the rank between the factors, a data sheet was design to get the relative value of 0 to 10 based on importance by questionnaire survey among the stakeholders at construction site. Here the value 0 means the factor is not responsible for construction accident according to a specific review. Also 0 represents least important and 10 most important factor that liable the construction accident. Table 2 shows below an example of collecting data from the field personnel at construction site.

Table 2. Sample of data collection sheet for determination of relative importance index

Factors	Relative value of importance										
	0	1	2	3	4	5	6	7	8	9	10
Lack of attention from authority											x
Lack of safety awareness							x				
Errors in judgment or carelessness	x										
Lack of education and training								x			
Reckless action of authority and workers								x			
Poor equipment and their maintenance									x		
Lack of emergency measures		x									
Non-strict execution of safety						x					

regulation and operation procedure			
Non-definite organization commitments		x	
Poor safety awareness of workers			x
Lack of technical guide			x
Lack of personal protective measures			X
Overtime work for workers			x
Lack of team work or coordination		x	
Act of God or bad weathering	x		
Lack of information flow		x	
Type and nature of construction			x
Rough project schedule and variations			x

Sources: SRS annual report (2010), SRS annual report (2011), SRS annual report (2012), SRS annual report (2013), SRS annual report (2014), SRS annual report (2015), kadiri et al (2014), Amaka (2013), Abdul et al (2008), Building Standard (2013), Farida (2010), OSHE annual report (2014), Vhokto (2014), Parves et al (2015), Salma et al (2010), Fabiha et al (2016), Chowdhury and Tanim (2016), Mahbub (2015), Islam et al (2015)

2.2 Data analysis

This section is to seek the preferences of value on crucial factors responsible for occurring accidents on construction sites. Using the RELATIVE IMPORTANCE INDEX the factors resulting to accidents on construction sites can be achieved

according to importance value. To determine the relative ranking of factors the value were then transformed to importance indices based on the formula:

$$\text{RELATIVE IMPORTANCE INDEX} = (\sum M) / (HN) \quad (1)$$

In Equation (1), M represents the mean value obtain to each factor by the survey which ranging from 0 to 10, H is the highest value (i.e. 10 in the study) and N is the total number of samples of survey. Based on equation (1), the relative importance index (RII) can be calculated. And based on the relative importance index (RII) the rank of factors is arranged.

3. Result And Discussion

In Bangladesh the incidents rate of accident on construction site is become a serious national issue and the rate of death for these types of incident is turning into horrible figure. This type of accidents not only takes life but also causes severe damages to construction products, processes and quality. The fatality rate of Bangladesh in construction site is two times than UK and three times than Singapore. Bangladesh faces those problems in few decades but not appropriately come to the media and there are no proper statistics of fatalities of construction sector that have recorded both publicly and privately. However, some of the NGO and government organization has started to collect statistics of accident ton various industries. According to annual reports of Safety and Rights Society (SRS), OHSE reports, newspapers and others documents, the construction accidental death statistics are shown in the Table 3.

Table 3. Statistics of death and injury due to construction accident from 2010-2015

Year	Death (persons)	Injured (persons)
2010	141	1355
2011	183	346
2012	149	433

2013	127	1365
2014	130	432
2015	147	234

Sources: SRS annual report (2010), SRS annual report (2011), SRS annual report (2012), SRS annual report (2013), SRS annual report (2014), SRS annual report (2015), Farida,(2010), OSHE annual report (2015), Gazi, (2015), OSHE Annual Report (2013)

In table 3, it is indicated that a huge number of fatality rate exist in the construction sector in Bangladesh. Since 2010 the death and injury rate are still stand at same amount of figure to 2015. There nothing change or improve in the safety management of construction sector.

Workers are the prime contributors and cause of accidents on construction industry. worker are 65.71% responsible for this type of accident in small scale construction project and labourers are the major group of workers that are primarily affected about 60% by these accidents (Kadiri et al, 2014). A group of workers are worked either been paid on a daily or finish and go system creates an environment in which these workers carelessly and impatiently carryout their work thereby ignoring safe and standard working practices and they are creating traditional environments in which accidents are likely to occur. In this study from literature review it has been made figure-1(data is calculated from the analysis of accident on construction site at 2010-2015 (excluding Rana Plaza and Tazner Garments) containing the statistics of accidents on construction site.

From the scan of literature review, 18 factors are selected and collect their each relative importance value from survey data. The relative importance ranking made by the relative importance index formula is shown in Table-4 below.

Table 4. Factors responsible for occurring construction accident in Bangladesh

Factors	RII	Rank
Rough project schedule and variations	1.70	9 th

Lack of safety awareness	4.47	2 nd
Errors in judgment or carelessness	3.16	5 th
Overtime work for workers	1.43	10 th
Lack of education and training	4.26	3 rd
Reckless action of authority and workers	2.04	8 th
Poor equipment and their maintenance	2.58	6 th
Lack of emergency measures	0.67	14 th
Lack of information flow	0.16	17 th
Non-strict execution of safety regulation and operation procedure	2.36	7 th
Non-definite organization commitments	0.77	13 th
Poor safety awareness of labour	4.02	4 th
Lack of technical guide	1.22	11 th
Lack of attention from authority	4.74	1 st
Lack of personal protective measures	1.09	12 th
Type and nature of construction	0.31	16 th
Lack of team work or coordination	0.44	15 th
Act of God or bad weathering	0.10	18 th

Table 4 admits the five most pivotal factors influencing safety management and liable for accidents in construction projects lack of attention from authority, lack of safety awareness, lack of education and training, poor safety awareness of labours, errors in judgment or carelessness. The results show that management authority's attention is very essential for effective safety management to reduce accident rate. Organization administrators assume an essential part in the definition and execution of safety practices in the working environment and representatives admire them for direction and demonstrating. The lack safety awareness is ranked second, the safety culture in the sector is 'much the same as some other sector. Which is helps with reducing dangers required to the workers' safety and life, in this way increasing the awareness among workers with the help of positive initiative and key arranging from the administration (Bernard, 2011).

Lack of education and training is ranked third, this is generally accepted that it is can greatly influence the safety management in projects education and proper training of worker a crucial aspect in project implementation. It is very essential to worker that he is very well known with materials or equipment which he used his regular work. He could completed the assigned work with appropriate and safe procedure. Poor safety awareness of labour is the fourth important factor that influence the construction accident. Lack of safety awareness led a labour to indirectly discourage to take personnel safety measure and things to do with safe and healthy ways. Errors in judgment or carelessness is the fifth important factor which liable for occurring construction accident. It is referred universally as the most vital factor for affecting safety management of the project and also have the effect on project implementation greatly. The least important factor is concerned as act of God or bad weathering. It has influence on project in various ways as create risky environment for movement and transportation. The unpredictability and power of the weather can create unforeseen problems which may occur accident. It is find out from literature review that lack of information flow and nature of the work both can play little significant influence of occurring accidents on construction sites.

4. Conclusions

Construction accident is the most important fact in recent era that affect a construction project in various ways and run the project adversely. There 18 number of influencing factor are selected by literature scanning for this study. And the rank is calculated from the survey data. Lack of proper attention from authority, lack of safety awareness and lack of expertise/training are the main causes of accidents. To ensure a safe, healthy and accident free construction industry, authority must understand, undertake and implement all or some of the following measures which reduce the factors by continuous supervision and inspection by safety officials, train the workers professionally and accurate use

of safety measures and work procedures. The authority should take necessary steps to reduce the various lack of management to prevent accident on construction site. The study discloses that safety issues are the fundamental to achieve project success. More so, it has also shown the critical factors to be treated in managing safety issues and successful project completion. We analysed about 18 factors of construction accident in this study if someone will take more number of factors and analyse them it will be more effective to the treatment of construction accident in our country. It will very effective to study or review more number of sources likes journal, research paper, newspapers, reports, article, blog and website to collect the data of this paper. It will give a more accurate figure of factors as well as their importance index. The study will be more effective if more factors of accident in construction site are analysed by visiting site and take response from the workers and victims.

References

A.P.C. Chan, C. M. T. (2000). Factors affecting the quality of building projects in Hong Kong. *International Journal of Quality and Reliability Management*, 17(4/5), 423-441.

Abdul Rahim Abdul Hamid, M. Z. A. M., Bachan Singh. (2008). Causes of accidents at construction sites. *Malaysian Journal of Civil Engineering* 20(2), 242 - 259.

Ahmed, G. T. (2015, 08, March, 2015). Construction brings highest worker deaths this year: survey, *The Daily star*.

Bangladesh Occupational Safety, H. a. E. F. (2013). *OSHE's Workplace Accident Survey Report-2013*. Dhaka, Bangladesh: Bangladesh Occupational Safety, Health and Environment Foundation

Bangladesh Occupational Safety, H. a. E. F. (2015). OSHE's Workplace Accident Survey Report-2015. Dhaka, Bangladesh: Bangladesh Occupational Safety, Health and Environment Foundation

Bangladesh Occupational Safety, H. a. E. F. O. (2014). OSHE's Workplace Accident Survey Report. January 09, 2014, Dhaka, Bangladesh.

BBS. (2016). Bangladesh Bureau of Statistics annual report-2016 (Publication, Trans.). <http://www.bbs.gov.bd/>: Bangladesh Bureau of Statistics, Dhaka, Bangladesh.

Bernard, S. (2013). Importance of Safety Culture in Construction. www.essaytube.com, May 12th, 2013.

Biswas, V. K. (2014). Socio-Economic Background of Construction Workers: A Study on Dhaka City. *World Vision Research Journal*, 8(1), 82-91.

Fabiha Tasnim, I. R., Monica Sharfin Rahman and Ridwan Islam. (2016). A Review on Occupational Health Safety in Bangladesh with Respect to Asian Continent. *International Journal of Public Health & Safety*, 1(1).

G., K. Z. O. N. T. A. G. K. O. T. O. E. A. S. P. O. A. (2014). Causes and Effects of Accidents on Construction Sites (A Case Study of Some Selected Construction Firms in Abuja F.C.T Nigeria). *IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)*, 11(5 Ver. I (Sep- Oct. 2014)), 66-72.

Jama, M. U. A. M. (2015). Safety management issues in construction industry of Bangladesh. (Master in Engineering thesis programe postgraduate), Bangladesh University of Engineering And Technology, Dhaka, Bangladesh.

Khanom, M. F. (2010). Occupational Accident Statistics in Bangladesh: Reality, problems and challenges. Dhaka, Bangladesh: Bangladesh Occupational Safety, Health and Environment Foundation.

Leigh, J. P., Waehrer, G, Miller, T R and McCurdy, S A. (2006). Costs differences across demographic groups and types of occupational injuries and illnesses. *American Journal of Industrial Medicine*, 49(10), (845-853).

M. H. Islam, S. Y. M. a. M. R. K. (2015). Construction Safety Practice in Bangladesh: A Case Study in KUET, Mirerdanga and Teliganti Union. Paper presented at the International Conference on Recent Innovation in Civil Engineering for Sustainable Development, DUET - Gazipur, Bangladesh.

N.H. Husin, H. A., K. Jusoff. (2008). Management of Safety for Quality Construction. *Journal of Sustainable Development*, 1(3), 41-47.

Ogwueleka, A. C. (2013). A review of safety and quality issues in the construction industry. *Journal of Construction Engineering and Project Management*, 3(3), 42-48.

Parvez Ahmed Sharif, M. E. I. a. R. A. K. (2015). The international journal of business & management. *The International Journal of Business & Management*, 3(5), 214-226.

Patel, D. A. J., Kumar Neeraj. (2016). AN ESTIMATE OF FATAL ACCIDENTS IN INDIAN CONSTRUCTION. Paper presented at the Proceedings of the 32nd Annual ARCOM Conference, 5-7 September 2016, Manchester, UK.

R. a. Haslam, S. A. H., A. G. F. Gibb, D. E. Gyi, T. Pavitt, S. Atkinson, and A. R. Duff. (2005). Contributing factors in construction accidents. *Appl. Ergon.*, 36, 401-415.

R.I. Coble, C. J. K. (1994). The environment as a construction Safety Concern. Paper presented at the Proceedings of the 5th Annual Rinker International Conference focusing on Construction Safety and Loss Control, Florida.

S. Sousa, J. T. (2004). Prevention measures to reduce risk of falling from heights. Paper presented at the IX National Symposium of ISMAI, Porto, Portugal.

Salma A. Iqbal, M. I., Md. Zubair Taufiq and Md. Shamim Ahmed. (2010). Identification of occupational injury among the workers of selected cement industries in Bangladesh: a case study. *Journal of Chemical Engineering, IEB*, 25(1), 22-28.

Smallwood, J. J. (2000). The holistic influence of design on construction health and safety (H&S): General contractor (GC) perceptions. Paper presented at the Proceedings of the Designing for Safety and Health Conference, London, UK.

SRS. (2010). Safety and Rights Society Annual report: Workplace deaths in Bangladesh in 2010. Dhaka, Bangladesh: Safety and Rights Society.

SRS. (2011). Safety and Rights Society Annual report: Workplace deaths in Bangladesh in 2011. Dhaka, Bangladesh: Safety and Rights Society.

SRS. (2012). Safety and Rights Society Annual report: Workplace deaths in Bangladesh in 2011. Dhaka, Bangladesh: Safety and Rights Society.

SRS. (2013). Safety and Rights Society Annual report: Workplace deaths in Bangladesh in 2013. Dhaka, Bangladesh: Safety and Rights Society.

SRS. (2014). Safety and Rights Society Annual report: Workplace deaths in Bangladesh in 2014. Dhaka, Bangladesh: Safety and Rights Society.

SRS. (2015). Safety and Rights Society Annual report: Workplace deaths in Bangladesh in 2015. Dhaka, Bangladesh: Safety and Rights Society.

Stanley, J. (2010). The causes of construction accidents and what to do about them: Workplace Safety Blog.

Tanim, M. F. C. a. T. R. (2016). Industrial Accidents in Bangladesh Apparel Manufacturing Sector: An Analysis of the Two Most Deadliest Accidents In Histor. *Asian Journal of Social Sciences and Management Studies*, 3(2), 115-126.

WEF. (2016). Industry Agenda Shaping the Future of Construction: A Breakthrough in Mindset and Technology. www.Weforum.org.

Oladiran, O., & Sotunbo, A. (2009). Accidents on building sites: rate of occurrence and causes. *The Professional Builders*, July.

Smallwood, J. (2000). Ergonomics in Construction: Management and Worker Perceptions. Paper presented at the Proceedings of the Human Factors and Ergonomics Society Annual Meeting.

Tam, C., Zeng, S., & Deng, Z. (2004). Identifying elements of poor construction safety management in China. *Safety Science*, 42(7), 569-586.