

FACTORS AFFECTING CONSTRUCTION SITE SAFETY MANAGEMENT: A CASE STUDY OF SURAT

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Abstract: This research presents a study that seeks an understanding of the causes of accidents in the construction industry and focuses on the role of management and the project's nature in construction accidents. The report presents an attempt to analysis of accidents along with accident causation and injuries based on accident at sites. This report then summarizes on methodologies proposed for analysis and ranks the causes of accidents in construction projects in Surat. Management-related factors, construction site and environmental & social factors and worker attribute related factors. The factors will be measured and ranked under each group by the 'Relative Importance Index' technique. Recommendations included in the questionnaire to suggest a better application of policy and management actions and procedures to improve the safety at construction sites and projects will be used to generate a list of mitigating factors to be adopted for avoiding the accidents on construction site.

Keywords: - Causes of accidents on site, Construction site, Relative importance index, Importance index.

I. INTRODUCTION

The Construction Industry in India and other developing countries faces a wide range of challenges, one of which is the frequent occurrence of accidents in the work areas. This Thesis presents results of a research that concentrated on investigating causes of accidents on construction projects in India.

Construction work is a dangerous land-based job. Some construction site jobs include: building houses, roads, workplaces and repair and maintain infrastructures. This work includes many hazardous task and conditions such as working at height, excavation, noise, dust, power tools and equipment. Construction work has been increasing in developing and undeveloped countries over the past few years. With an increase in this type of work occupational fatalities have increased. [Occupational](#) fatalities are individuals that die while on the job. Within the field of construction it is important to

have safe construction sites. The main objective is to analyze and rank the causes of accident.

II. LITERATURE REVIEW

A number of studies have been carried out to determine the causes of Accident in construction projects. According to Civil Engineering Department ,Kuwait (2002)

- The top ten most important factors the affects construction safety are :
- According to International Journal of Advances in Engineering and technology, sept 2012, The majority of accidents happens as a result of unsafe acts and unsafe conditions.
- Construction accidents, which is possible by accident investigation techniques construction accidents can be prevented just by identifying the root causes of accidents, which is possible by accidents investigation techniques.
- Accidents and incidents in construction work base are unplanned and unwanted occurrence involving movements of persons, objects or materials which may result in injury, damage or lost to property or people.
- According to HASHEM M. AL-TABTABALI, to analyse this literature objectives of accidents reporting are to: To analyse cause of accidents in construction using Numerical Ranking Techniques.
- To study the effects of projects related and safety factors, management factors and human factors on accidents in construction sites.

- (1) Lack of supervision and control on workers adherence to wear safety items
- (2) No safety engineer at site.
- (3) Altitude of construction.
- (4) Age of the worker.
- (5) Use of inappropriate ladder.
- (6) Non rigid working platform.
- (7) Inappropriate material storage arrangement.
- (8) Non-compliance to Governmental safety regulation.
- (9) Use of bad hand tool.
- (10) Bad condition of equipment.

III. RESEARCH METHODOLOGY

This section introduces the methodology which is applied in this research to achieve the research aim. Basically, this research work includes different phases. First phase of research covers review of literatures. Second phase of research includes development of framework for ranking factors affecting the contractor performance in construction work and design questionnaire to collect data. Third phase of research includes analysis of collected data. In this phase data analysis was done by “Relative Importance Index” to rank the construction site accident factor. Fourth phase covers discussion on the ranking of the important factor that affects the construction site accident different parties and finds the most appropriate factor with the help of statistical computation. Fifth stage of research covers result discussion and conclusion.

IV. DATA COLLECTION

Data was collected through questionnaire. Survey questionnaire was prepared for finding relative importance of each factor that affects construction site accident. HanyAbdElshak (March 2012) used the Relative Importance Index method to determine the relative importance of the various performance factors. The same method is adopted in this study within various groups (i.e. engineers, contractors, and developer/owner). The four-point scale ranged from 1 (less important) to 4 (extremely important) is adopted.

A questionnaire was divided into five parts;

Section A: Introduction to project

Section B: Respondent detail

Section C: Sample filling questionnaire

Section D: Main Questionnaire

Section E: Suggestion

VI. DATA ANALYSIS

The target population included civil engineering and buildings construction firms of Surat city. The architects, contractors and developers of Surat city of Gujarat were targeted for survey. The data has been collected by filling up the questionnaire sample as shown below. This topic deals with the collection of feedbacks from various stakeholders (engineer, contractor, builder, architect) and calculation of sample size. This topic deals with the analysis and discussion of information gathered from the questionnaire survey. It includes the identification and ranking of causes of various factors affecting construction site accident in residential and commercial projects of Surat city. The following method is used for the statistical analysis to find out the top ten construction site accidents causes.

VII. RII (RELATIVE IMPORTANT INDEX)

The Relative Importance Index (RII) will be used to rank (R) the different factors that affect contractor performance. These rankings make it possible to cross-compare the relative importance of the factors as perceived by the three groups of respondents (i.e. architect/engineer, contractors, and developer/owner). Each individual factor RII perceived by all respondents will be used to assess the general and overall rankings in order to give an overall picture of the factor of contractor performance in Indian construction industry.

This RII technique is used by many researchers like, Desai Megha, HanyAbdElshakour (March 2012) to rank the various performances

$$RII = \frac{\sum w}{A * N}$$

Where, W = Weighting given to each factor by the respondents (ranging from 1 to 4), A = Highest weight (i.e. 4 in this case), N = Total Number of respondent.

VIII. RESULT & DISCUSSION

The all ranking indices explained earlier were used to rank the accident causes from viewpoints of the four parties (Engineer, Architect, Contractors and Builder). Total 100 respondents participated in this survey. These respondents included 35 engineer, 35 contractors and 15 architects, 15 builders.

The relative importance index, RII, was computed for each cause to identify the most critical causes. The causes were ranked based on RII values. From the ranking assigned to each cause of accidents, it was possible to identify the most important factors or causes of accidents in Indian construction industry as shown in table 1.

Table 1: Top 10 causes ranked by Relative Importance Index (RII) Technique:

Sr.No	FACTORS	TOTAL RII
1	Lack of supervision and control on workers adherence to wear safety items	0.855

2	No safety engineer at site	0.844
3	Altitude of construction	0.832
4	Age of the worker	0.801
5	Use of in appropriate ladder	0.788
6	Non rigid working platform	0.753
7	Inappropriate material storage arrangement	0.705
8	Noncompliance to Governmental safety regulation	0.685
9	Use of bad hand tool	0.655
10	Bad condition of equipment	0.611

IX. CONCLUSION

On the basis of survey conducted within the scope of study area we come to the following conclusions are drawn: Based on the ranking, the most important causes of construction accidents were: Lack of supervision and control on workers adherence to wear safety items, No safety engineer at site, Altitude of construction, Age of the worker, Use of in appropriate ladder, Non rigid working platform, Inappropriate material storage arrangement, Non-compliance to Governmental safety regulation, Use of bad hand tool, Bad condition of equipment. Analysing the responses from each party separately it was found that maximum of the above mentioned factors were responsible for the construction site accident as per their prospective.

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APPENDIX-A

Sr.No	FACTORS	DECRPTION
Management Related Factors		
1	Appropriate personal safety	Safety equipment like helmet, hand glozed, net, and

	procedure were not specified	safety shoes are not provided to the workers which may results in accidents
2	Correct tools/equipment were not used for specific task	Equipment/tools which is used for work is faulty, old or they are not used for specific work
3	Lack of supervision and control on workers adherence to wear safety items	Site supervisor may not be present on the site or site supervisor is not doing their job well.
4	No safety engineer at site	Due to absence of safety engineer, there is no one to give directions to the worker for doing the work properly.
5	The management is pushing the work regardless of worker's ability	Management gives more work to the workers.
6	No training program for the worker implement the job	No training programes were arrange for the workers for doing particular job
7	Non-compliance to governmental safety regulation	Contractor or builder is not obeying the rules and regulations of government related to the safety
8	Use of in appropriate ladder	Ladder used at the construction site may be damaged, old, or may not be designed for the proper height
9	Use of bad hand tool	Hand tools by the workers used are old and not properly maintained.
10	Risky sitting and sleeping place	Workers sometimes sitting or sleeping below the equipment may lead to accidents
11	Imporper material handling	Method of handling materials is faulty or incorrect
12	Bad condition of equipment	Equipment used by the workers used are old and not properly maintained or repaired
13	Limitation of working area	Some tools/ equipment are interrupted due to insufficient working area which results in accidents.
14	Contact with hazardous chemicals	Hazardous chemicals are not stored in proper place. Due to such contact serious injury may occur.
15	Inappropriate material storage capacity	Materials are not arranged in a systematic manner or badly arranged
16	Poor ventilation	Due to improper ventilation, workers cannot work properly
17	Non Rigid working platform	Working platform cannot take major loads due to improper design
18	Interior quality Of material	Materials required for the construction are of poor quality and hence leads to bad construction
19	Altitude of construction	<u>I</u> f the height of the construction is too high, workers may fall from the height
20	Poor illumination	Due to improper illumination, workers may fall from height, even they may fall in the excavation, hence proper illumination is an important factor

Environmental and Social		
21	Weather conditions	In monsoon season, due to heavy rainfall, workers may slip and in summer season, due to high temperature, accident takes place
22	Uncomfortable social life	Due to mentally disturbance, worker gets disturbed while doing the work, which may leads to accidents
23	Living and housing facilities	Due to poor living and housing facility conditions, accidents take place
Work Attribute		
24	Worker suffering from mental and physical fatigue at the job	Mental and physical worker's fatigue, can leads to the accident
25	Age of the worker	Old aged worker cannot perform the task properly, and hence accident takes place
26	Negligiance or lack of knowledge regarding wearing personal protection items	Due to lack of knowledge, training, and having no habit of wearing protection items while performing the work, accidents takes place.
27	The workers are always taking overtime	Due to overtime, excessive fatigue, stress on worker results in accident
28	Worker rushing for the job	Workers may slip or fall due to rushing for the doing work