

Statistical Analysis of Jobsite Safety Assessment in Construction

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Abstract—Construction industry is one of the most hazardous industries. Accidents may occur during construction which results in serious injuries and death to employees and also may cause severe damage to equipment. Hence it is important to prevent or minimize accidents in the construction site. Safety during construction is very important for each employee. Safety means the condition of being protected from harm or other non-desirable outcomes. This project deals with job site safety analysis in construction site by identifying the causes for accidents and implementing solutions for preventing the accident in the construction industry. For this purpose, initially twenty-five Literatures studied based on construction jobsite safety. From the literatures it was studied that statistical analysis is better way to analyze the construction jobsite safety and important factors that are affecting the safety in construction is identified from the literatures. Questionnaire regarding the factors affecting safety in construction site is also prepared. Then primary data should be collected from the various construction companies and secondary data should be collected from their clients. Then the data are ranked by two different techniques, primary data was ranked by using Relative important index method and secondary data was ranked by the Garrett's ranking technique. Then the companies which are following safe safety procedures should be found out using Statistical analysis. This data is analyzed in Statistical Package for Social Science (SPSS) software and the major factors which affect safety in construction should found out through comparison of primary and secondary data by paired sample t-test. With this approach, it is possible to evaluate the uncertainty regarding safety in construction.

I. INTRODUCTION

Construction industry is considered as one of the most hazardous industries. The development of construction industry has been plagued by the accidents or injuries that are frequently occurred. It is

estimated that there are around 60,000 construction fatalities occurred worldwide each year, which equates to one accident happen every nine minutes. Human error is a main reason for upto 80% of all incidents and accidents in high-risk industries. According to the Occupational Safety and Health Administration (OSHA), the construction industry is responsible for more than 20% of all worker fatalities, fall from elevation, struck-by objects, electrocutions, and caught- in/between are among leading causes. Also, accidents related to scaffolding account for a large proportion of the causes of the safety hazards. It is desirable that all potential safety hazards are identified in the early and planning stages and preventive actions are taken. Planning for safety typically consists of the identification of all potential hazards, as well as the decision on choosing corresponding safety measures. A job site safety analysis is a technique that focuses on job tasks as a way to identify hazards before they occur. It focuses on the relationship between the worker, the task, and the working environment.

The basic procedure for conducting job site safety assessment includes

- 1) Identifying all job steps of a given activity.
- 2) Identifying potential hazards related to these different job steps.
- 3) Proposing action procedures to eliminate, reduce, or control each hazard.

The complexity and uncertainty inherent in the nature of the construction industry requires safety planners to adopt technologies as recent and innovative as available to make sure they are covering predictable surprises as much as possible.

The aim of the project is to present a decision-making model for implementing safety by finding out the factors and comparing them by implementing those

factors in the software. This was used to avoid or minimize the adverse impacts on public health and safety of employees during the project life cycle from both routine and non-routine circumstances during the design construction and design phase.

II. LITERATURE REVIEW

Demirkesen and Ardit (2015).

The study shows that contractors are sensitive to organizational, feedback, content, process, and worker issues. Whenever they encounter language problems, they use visual aids, and provide translators and safety guidelines written in workers own language.

Anbari et al (2015)

Risk Assessment of Safety and Health RASH method for building construction has been developed with risks classified into Safety Risk and Health Risks. The overall percentages of the correct answers for the four scenarios funded by using the RASH method and the RA method. The RASH is statistically acceptable and it resulted in better response in terms of estimating the risk than the RA method.

Abueisheh et al (2020)

The results revealed that the extent of engagement in design for safety practices among the design professionals is very low despite a high awareness and positive attitude towards the concepts of design for safety. These findings suggest the presence of design for safety implementation barriers, challenges which are undermining the implementation of design for safety by the design professionals in Palestine.

Anibire et al (2019)

The study revealed that the type of accident with the highest risk score is falling objects, while the most significant cause is excessive winds on the project sit. The developed approach was applied on an on-going car park construction project. Results showed that slips, trips and falls had the best safety performance. Furthermore, based on six sigma evaluation.

Fang et al (2020)

The LCB approach has been implemented in a number of building and railway projects. Significant improvement of LCB has been observed. Safety leadership, Safety culture, and Safety behavior of the

project stakeholders at all levels were significantly improved.

Gunduz and Bappy (2018)

These 38 complete responses were received and analyzed by Frequency Adjusted importance Index, Spearman's Rank Correlation, T-Test as a result. The main contribution of this study can be summarized as the ranking the safety attributes considering both their importance and frequencies as perceived by various groups of industry professionals and identification of influential attributes affecting construction safety which have significant level of agreement among various groups in the construction industry.

Thomas et al (2004)

Evaluate the safety performance. Safety Performance Evaluation (SPE) frame work is prerequisite. The importance of SPE factor is examined through a questionnaire survey conducted. The results of the questionnaire survey are used to develop a SPE framework suitable for use in the construction industry and protocols for evaluating the safety performance at the organizational and project levels.

Zhang et al (2013)

An approach for defuzzification is developed in a precise way based on the representation theorem, attempting to overcome the limitations related to fuzzy linear approximations. Fuzzy importance measure is deployed for the sensitivity analysis of basic event to reveal the critical basic events for reducing the risk limit.

Awwad et al (2015)

The study revealed the existence of construction labour safety law but the absence of its enforcement, the initiation of safety programs but the lack of any monitoring or follow-up and a lack of safety education and commitment from all parties involved.

Marin et al (2019)

Results confirm that difference in overall perceptions as well as across safety climate dimensions. There was no statistically significant relationship between each group's perceptions of safety climate dimensions

SUMMARY OF LITERATURE REVIEW

- Questionnaire survey method is adopted for jobsite

safety assessments.

- Factors affecting jobsite safety in construction is identified from the journals.
- Personal protective equipment, falling objects, fire and explosion, heavy equipment's and electrical accidents are the most affecting jobsite safety.
- Likert scale is adopted for the ranking of questionnaire.
- Relative importance index is adopted for ranking of primary data.
- Garrett's ranking technique is adopted for ranking of secondary data.
- For data analyzing SPSS software is generally preferred in most of the journals.
- Paired sample t-test is adopted for comparison of primary and secondary data.

III. RESEARCH METHODOLOGY

This project comprises of Literature survey, formation of questionnaire, data collection from various construction companies, analyzing the data by using SPSS software and evaluation the data by the statistical method.

IV. DATA COLLECTION

The data collection strategy is designed to obtain comprehensive, accurate information on job-site safety performance, safety-related behaviors, and factors contributing to incidents and delays. A dual approach will be used: primary data from surveys and interviews with stakeholders, and secondary data from project safety records and documentation

Primary Data

Data is collected by means of visiting various construction sites and obtaining data from the responded. The data is collected with the help of questionnaires. A questionnaire survey is conducted with the contractors, sub-contractors, site supervisors, site engineers, and project managers.

Questionnaire Survey

questionnaire survey was conducted to analyze the safety conditions at construction job sites, focusing on workers, supervisors, engineers, and safety officers. The questionnaire consisted of both open-ended and

closed-ended questions designed to collect quantitative and qualitative data regarding safety awareness, training, and practices. It included sections covering demographic details, safety training frequency, and awareness levels, along with a five-point Likert scale to evaluate aspects such as availability and use of personal protective equipment (PPE), safety inspections, enforcement of rules, and emergency preparedness. The survey also assessed common hazards, frequency and causes of accidents, and the effectiveness of safety management practices in terms of communication, supervision, and response to incidents. The responses obtained were used for statistical analysis to identify key risk factors, measure safety performance, and suggest improvements for enhancing overall job site safety in construction projects.

Secondary Data

Secondary data was collected from the same construction company's clients. For perfect and successful data analysis ten respondents were selected for secondary data collection. Same questionnaire was distributed to the secondary respondents and it's also based on their own opinion about the construction site and their feedback about construction companies. During the secondary data collection most of the clients were less aware about the safety precautions in the construction sites was identified.

Data Analysis

Secondary data is written or collected by other researcher such as journal, academic book, newspaper and report. Secondary data is saving time to analyze as well as providing larger database and understanding to researcher before researcher plan to collect primary data. These data are basically second-hand pieces of information and are already collected. So, these are comparatively less reliable than the primary data.

Ranking of questionnaire

The ranking questions were used to identify the most critical factors affecting job site safety in construction projects by asking respondents to prioritize various safety aspects based on their importance. Respondents were required to rank factors such as use of personal protective equipment (PPE), safety training, supervision, hazard identification, emergency preparedness, and compliance with safety regulations.

In the analysis stage, an average ranking method was applied to each factor to determine its overall importance. This method involves assigning numerical values to each rank and calculating the average score for each factor based on all responses. The factor with the highest average ranking is considered the most significant in influencing job site safety. This approach helps in understanding the key areas that require immediate attention and improvement to enhance safety performance at construction sites.

V. CONCLUSION

Construction industry is considered as the back bone of the country. Its contribution in the development of the country is very crucial. This study was focused on identifying the influential safety attributes affecting the construction industry. From the data analysis, it was concluded that attributes, namely use of personal protective equipment and following of safety rules and procedures, providing safety trainings, campaign and awareness to employees by contractor, conducting safety meetings, encouraging contractors to set and achieve safety goals and selection of safe contractors with contractual safety requirements were the top five significant factors. Managing safety is the duty of its operators. After the detailed investigation the following conclusions are drawn;

- Investigation checks the provision of personal protective equipment at the job site. Also, it helps in identifying the causes that can results in accidents.
- Worker's safety and health education helps in motivating themselves. They are provided with the knowledge of safety by means of training, lecture, films, posters, etc. This lead to the safety and results in building confidence.
- Provision of safety emergency such as ambulance at site, first aid facilities, appointment of safety officers, etc.
- Periodic inspection should be given to the workplace of the workers by the safety officers and managements.
- Expenditure should be done by the company on the workers' health, maintaining the good workplace, purchasing latest personal protective equipment.

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