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A Review on Importance of Safety Management in Infrastructure Projects

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ABSTRACT: Major employment is available in construction industry, as projects are vast, fast-track and involving number of activities. Most of the unskilled & semi-skilled workmen are absorbed by construction industry. The construction industry continues to grow because the demand for infrastructure, homes, and office spaces are growing. The construction industry is so dynamic that it is vulnerable to many risks and various health issues. Safety policies and regulations are a top priority in the construction sector to ensure a healthy working environment.

The aim of this review paper is to study the safety management system in construction industry by obtaining information from past research. This review paper is the study of past research done on various factors that are responsible for the safe working conditions which minimize the risks involved for completion of the projects within the allocated cost and time without any accidents. Many studies have determined that risky behaviours cause most of the workplace injuries, and that controlling these behaviours is one of the keys to effective accident prevention and a low accident rate on construction sites. Safety practices in construction industry are one of the most important requirements of the industry.

This paper includes review of research papers related to safety practices and its implementation on construction sites, current safety practices and limitations to them, occupational health problems on construction sites, importance of hazard identification and risk assessment in infrastructure projects, risk assessment and study on how to design a questionnaire for survey and research for future studies.

KEYWORDS: Infrastructure projects, Safety policies and regulations, Occupational diseases, Hazards, Safety of workers.

I. INTRODUCTION

In recent years due to urbanisation, upcoming and ongoing major infraprojects the construction industry in India is booming. Construction sector is a major contributor to economic growth of our country. The various government flagship programs like "Smart cities", "Housing for all", "Make in India", and "Atal mission for Urban Rejuvenation and Transformation (AMRUT)" will increase the construction projects in the coming years. The expenditure on infrastructure development has increased by 20.9% by the government. The government has taken tremendous efforts to improve residential and transport infrastructure.

Construction industry employs large no of workers, most are illiterate and do not have proper trainings so are mostly prone to hazards and risks on construction sites. Construction workers come from varied trades especially from rural areas and agrarian background and have not received any proper training in construction safety. The construction workers are exposed to various unsafe conditions involved in construction works and other occupational diseases and health hazards which cause injuries and illnesses while working at site. The construction projects get delayed due to loss of work hours and other legal hassles. Therefore, all construction projects should follow proper safety policies and regulations along with proper training at regular intervals.

The construction sector has the largest number of injuries due to its nature of work compared to other industries. Thus, reducing accidents and determining construction risk is extremely an important work at hand. One of the most important steps for construction safety management is hazard identification, since the most unmanageable risks are from unidentified hazards.

II. LITERATURE REVIEW

Ahmed Senoucia, Ibrahim Al-Abbadib, Neil Eldina “Safety improvement on building construction sites in Qatar”, Procedia Engineering 123 (2015) 504 – 509

The author in his research paper have the objectives to investigate the factors affecting the safety in Qatari buildings and applies risk management process to reduce risk factors to improve the safety on Qatari building construction sites. The author achieved his objectives by studying available literature and reports. Also consulted safety experts from various construction sites and interviewed them to find the factors affecting the safety. 62 factors were initially found which were finally brought down to 38 factors. They were further grouped under five classifications: Project, Management, Personal, Government and Site conditions. A questionnaire survey was also done to collect various data about the respondents and risk management awareness. The author finds from his survey that they had a poor risk management practice, but they agreed on the importance of applying risk management techniques to analyse safety problems. The author concludes that enhancement of the practice of safety risk management by conducting more trainings, seminars and workshops to familiarise employees about the concept of safety risk management is of prime importance.

Tan Chin Keng, Nadeera Abdul Razak, “Case Studies on the safety management at construction site”, Journal of Sustainability Science and Management Volume 9 Number 2, December 2014: 90-108

The author describes about the incidents that took place in the Malaysian construction industry. The main objectives of the author were to find out the current safety practices that are implemented at the construction sites and to identify the problems in following the safety practices. Two case of studies were done of different sites through data collection by interviewing the safety officers of their respective sites. From the data collected it was found that most of the construction sites had good and well-structured safety practices. But there are many limitations to these safety practices were identified which includes ignorance of workers on work procedures, lack of financial allocation for safety management, lack of awareness among workers. Suggestions to overcome these limitations like awareness of workers, commitment of top management and allocation of resources were advised.

S.H.Khahro, T.H.Ali, M.A.H.Talpur, M.A.Akhund, F.H.Siddique, “Occupational Health Problems in Construction Industry: A Case Study”, Sindh Univ. Res. Jour. (Sci. Ser.) Vol. 48 (4) 737-740 (2016)

This research paper deals with various occupational health problems and their causes in the construction industry. The author has carried out literature review of various journal papers, conference papers and reports. Professionals from different projects were also interviewed. Questionnaire was distributed among 200 respondents out of which 160 successfully responded. From the questionnaire it was found that Heat stroke, Eye strain, Lung irritation, skin diseases, noise irritation, blood poisoning, throat irritation, hearing disorder were some of the prominent health problems on the construction sites. Accordingly, some of the causes for the above health problems were Poor management, Human elements, Poor site conditions, nature of work, equipment on construction sites. The author suggests some measures to improve safety on construction sites by arranging health assessment programs and implementation of Occupational Risk Assessment (ORA).

Jayakrishnan Thayyil, Bhaskar Rao, “Occupational health problems of construction workers in India”, International Journal of medicine and public health, December 2013

The author studies that there is very little research done on the above subject in Asian countries. The aim of the study to understand the occupational health problem of the construction workers. A cross sectional study was conducted at one of the districts in Kerala, India as the part of the project “Health of migrant employees” in three construction and civil projects, semi-skilled and unskilled workers from selected projects were included from building workers and civil for the study. The study had total of 410 subjects out of which data from 387 workers were collected. The average age of the workers selected were 26.8 yrs. The prevalence of the past disease like tuberculosis (1.1%), malaria (13.7%) and jaundice (10.6), typhoid (3.4%) were higher than the general population in both groups. The condition of injury was higher among civil work group (17.2% and 6.6%). Fever, Respiratory, Eyedisease, Skin and muscles and skeleton problems were higher in the civil work groups. The author believed measures are needed to improve the work environment of the construction workers by ensuring availability of protective gears, sanitation facilities at the sites.

Vishwas H. S, Dr. G. D. Gidwani, “Hazard identification and Risk assessment in metro railway line construction project at Hyderabad”, Vol 6, Issue 08, August-2017

The author finds that hazards identification or determining construction risk are extremely important. A case study of HIRA which was applied at construction site of metro rail line projects at Hyderabad. The main motto of hazard identification is to identify the hazard and unforeseen events, which could cause accidents. The author list out 5 steps for hazard identification and risk assessment. Following are the steps explained: 1) Hazard identification 2) Risk assessment 3) Risk control 4) Implementation of risk control and 5) Monitor and review. A technique known as SREDIM principle is explained which stands for select, record, examine, develop and install. The job analysis approach is elaborated effectively with the help of job safety analysis card. The author concludes that an effective risk management process helps the construction company to identify and quantify risks, to contain risk containment and risk reduction policies.

Tingshen Zhao, Seyed Ebrahim Kazemi, Wen Liu, Miao Zhang, “The Last Mile: Safety Management Implementation in Construction Sites”, Hindawi Advances in Civil Engineering, Volume 2018, Article ID 4901707, 18 April 2018

The author studies about the construction accidents and safety management failure in china. The author identified the last mile problem that is the failure of implementation of legal and regulatory systems on the construction sites. The statistics of deaths and accidents from 2002-2015 in chinees construction industry was studied. The statistics showed that even after encouraging decline in number of accidents a gap still exist between actual safety practices and existing laws, regulations, standards of safety management. The author does the literature review classifying them into macro, micro and meso levels. The data was collected through interviews of experts and distributing questionnaire 513 questions were distributed and 447 valid questionnaires were retrieved. The data collected was analysed with the statistical package for social science (SPSS18.0) using the following techniques 1) factor analysis 2) estimation of mean value 3) rank cases 4) one-way analysis of variance (ANOVA) 5) Spearman rank correlations. The data referral test is SPSS which passed the cut off 0.5. Five factors were determined based on the factors studied which are 1) Human factor like safety attitudes of workers safety behaviours of workers, safety training received, experience and skills 2) Equipment factor 3) Environment factor 4) Management factor 5) Technical factor. The author proposed a new frame work for safety management based on his research that can transform the top-down safety management into bottom-up safety behaviour. The core of the framework is to strengthen the guidance and supervision of leaders above workers to improve the performance of workers.

Manvinder Singh, Debasis Sarkar, H. B. Raghavendra, “Comparative study of EVM and Fuzzy EVM methods for risk analysis of Infrastructure Projects” IJAIE, Volume 6, Issue 7, July 2017

This research is an attempt to compute risk severity of the elevated corridor metro rail project using expected value method and Fuzzy EVM (expected value method) and compare both methods risk assessment was carried out by both EVM and Fuzzy EVM. Case study considered for the research was Ahmedabad elevated corridor for metro rail construction. The methodology was formulating questionnaire and responses of the respondents from the officials of metro rail were used as inputs for computing risk severity and ranking of all major activity. Both qualitative and quantitative assessment was done. The final quantitative and qualitative risk severity values with ranking of all the major risk identified of the project were tabulated using EVM and FuzzyEVM methods. The author after his research concludes the Fuzzy EVM methods is better for defining risk severity ranking and for risk mitigation.

Vishal Kumar Gupta, Jitesh J Thakkar, “A quantitative risk assessment methodology for construction project”, 26 June 2018

This paper highlights that present risk management tools and techniques do not provide adequate basis for response selection in managing critical risk that are specific to infrastructure projects. The author proposes a risk quantification methodology and demonstrates its application for the industrial construction projects. He studies that most of the projects are failing to achieve the planned objectives in terms of cost and time. The author through literature survey of various standards like PMBOK, British Standard Institute, Office of Government Commerce, UK Association of Project Management studies that there are two general approaches widely used in project risk analysis, they are qualitative risk analysis and quantitative risk analysis. The author has mainly focused on the development of conceptual framework because he thinks that the major problem in the quantification of risk and developing risk response strategy is the intangibility associated with some of the risk an individual subjective preference in choosing risk response strategy.

The research proposes the methodology that integrates GTOPSIS (Group Technique for Order Preference by Similarity to Ideal Solution), JRAP (Judgemental Risk Analysis Process) and Mont-Carlo simulation that takes project schedule as well as cost and time escalation into account. The data collection and case study were done on an ongoing industrial project in Bangalore. Through review of literature identification of 19 most appropriate and relevant risk that may occur in a construction project was found. For carrying out qualitative risk analysis three criteria were selected 1) probability of occurrence 2) impact on duration 3) impact on cost. 100 professionals were contacted through email, with the help of the results achieved the author proposes the methodology for reduction in cost and time escalation of the project.

Yousif.S.Saeed, "Safety management in construction projects", Journal of University of Duhok, Vol. 20, No. 1, 2017.

The author through this research tries to evaluate the safety management in construction projects. Questionnaire was used to collect opinions from professionals working in different construction sites. Literature review provided a background to design questionnaire. Statistics of accidents and causes of accidents were found out from literature studies. According to the author the design of questionnaire as described in (CRS 2015) pointed out that designs a survey should include the following steps 1) Establishing the aim and objective of the project 2) Determining the sample 3) Choose survey methodology 4) Create questionnaire, test the questionnaire if practical and conduct the survey and analyse the data. The results were plotted on graphs as per responses. The author concludes that the construction industry has a high number of fatalities and long-term injuries. The result of this study suggests that organisation should take more steps towards safety management to minimise the construction risk.

III. CONCLUSION

From the above review it is learnt that many construction sites have safety management policies and plans, but the implementation is poor therefore awareness of safety policies must be done by conducting trainings, seminars and workshops to familiarise the workers with the safety risks associated with their jobs. The study also reveals that ignorance of workers on safe work procedures, lack of financial allocation from management for safety and lack of awareness were some of the limitations found on construction site. Many construction sites have safety policies and plans, but they are not strictly followed. Occupational diseases are one of the challenges in construction industry which are mostly neglected. Health assessment programs and occupational risk assessment (ORA) should be implemented at workplaces to reduce occupational health risks. Work environment of construction workers should be improved to reduce occupational health problems.

Hazard identification and risk assessment are important to evaluate the risks and draw safety policies to reduce the unsafe conditions which in turn will reduce time and cost of the projects. Various methods can be used for risk assessment on sites. A study on questionnaire design was also done in order to perform future research.

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