

SITE SAFETY AND PLANNING FOR BUILDING CONSTRUCTION

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ABSTRACT-The construction industry is considered as one of the most hazardous industrial sectors wherein the construction workers are more prone to accidents. Despite recent efforts to improve site safety, construction still accounts for a disproportionate number of occupational-related fatalities. In developed countries there is strict legal enforcement of safety in the construction industry and also in the implementation of safety management systems which are designed to minimize or eliminate accidents at work places. However, occupational safety in construction industry is very poor in developing countries because lack of safety regulations and standards, low priority of safety, lack of data on safety at construction sites, lack of safety training, lack of safety promotion, and lack of documented and organized safety management systems.

The objective of present work is to study the various site safety measures at building construction sites and to compare the site safety measures with relevant safety codes. The study pertains to find out the provisions as laid down in the BIS codes for various aspects of safety measures at construction sites. The study included, physically visiting different construction sites, collecting the data regarding safety provisions adopted and feedback from site engineers by using questionnaire will help in implementing the safety measures at building sites more efficiently. So that that the present study will help out in ascertaining the proper safety planning in building construction.

Key Words: Safety, planning, construction sites.

1. INTRODUCTION

In the developed as well as developing part of the world, construction industry is considered to be one of the most significant industries in terms of its impact on health and safety of the working population. Construction industry is both economically and socially important. However, the construction industry, at the same time, is also recognized to be the most hazardous. Although dramatic improvement has taken in recent decades, the safety

record in the construction industry continues to be one of the poorest. The prevention of construction accidents usually entails predicting future accidents and their nature under given circumstances. The making of such predictions is based on knowledge about past accidents. The major causes of accidents in the construction industry are related to the unique nature of the industry, human behavior, difficult work-site conditions, and poor safety management which result in unsafe work methods and procedures. Construction safety on project sites is of utmost importance due to the nature of the construction industry. However, it is usually a secondary concern in a market-driven society where the main concern is completing projects at the required quality with minimum time and cost. Thus, safety issues are considered only after an accident occurs at a construction site with follow up measures to improve working conditions, especially in developing countries. Safety describes the surety that the environment that personnel or items are subjected to, is free from in advertent or unexpected events which may result in injury to personnel or damage to the items exposed.

Safety is a condition of being safe, freedom from danger or hazards, a keeping of oneself or others safe, especially from danger of accidents or disease. Safety is the state of being "safe", the condition of being protected against physical, social, spiritual, financial, political, emotional, occupational, psychological, educational or other types or consequences of failure, damage, error, accidents, harm or any other event which could be considered non-desirable. Safety can also be defined to be the control of recognized hazards to achieve an acceptable level of risk. This can

take the form of being protected from the event or from exposure to something that causes health or economical losses. It can include protection of people or of possessions.

2. LITERATURE REVIEW

Several authors have reported various successful safety performances at construction sites to improve safety in construction sites.

Rafiq.M.Choudhry; Dongping.Fang, Sherif .Mohamed [1] presents a robust conceptual model that has its roots firmly entrenched in pertinent academic and applied literature. This study revealed a conceptual model that recognizes human, technical, situational, and organizational elements as well as their interactions. The model is anchored in three fundamental conceptual categories, namely safety climate, behavior-based safety, and safety system. The results of this study clearly indicate that the model serves as the logical basis for determining what and how to analyze and assess the different aspects of construction safety culture. It offers the opportunity to adopt a goal-setting paradigm by pursuing multiple sub goals. This gave them the conclusion that Employee perceptions, safety behaviors, and environmental or situational features could be accessed through safety climate surveys, peer observations, and systems audits/inspections.

Keith.R.Molenaar; Jeong-II. Park; Simon.Washington [2] presents the results of a structural equation model SEM that describes and quantifies the relationships between corporate culture and safety performance. The SEM and the latent variables describe to constitute a powerful framework for defining, measuring, and improving upon corporate safety culture. The SEM is estimated using 196 individual questionnaire responses from three companies with better than average safety records. Analysis of data from the 54 measurable characteristics revealed that 19 could be used to describe a final set of five latent variables.

This gave them the result and conclusion that these five latent variables can be considered characteristics of corporate safety culture and may be used as indicators of safety performance as measured through EMR. Based on the findings from the limited sample of three companies, author proposes a list of practices that companies may consider to improve corporate safety culture and safety performance.

Sherif.Mohamed[3] discusses empirical research aimed at examining the relationship between the safety climate and safe work behavior in construction site environments. A research model was developed and tested using a survey, which contained multiple measurement items relating to each of the constructs in the model. A questionnaire survey was used in order to facilitate the collection of information from construction sites. This resulted and concluded that the empirical results indicate a significant relationship positive association between the safety climate and safe work behavior. Positive safety climates **seem to result from management's showing a committed** and non punitive approach to safety, and promoting a more open, free-flowing exchange about safety related issues. Contrary to the expectation, this study indicated that work pressure has no significant direct relationship with the safety climate. The results corroborate the importance of the role of management commitment, **communication, workers' involvement, attitudes, competence, as well as supportive and supervisory environments, in achieving a positive safety climate.**

Rafiq. M. Choudhry; Dongping .Fang; Helen. Lingard[4] determine safety climate that would enhance safety culture and positively impact perceived safety performance on construction projects. A safety climate questionnaire survey was conducted on the construction sites of a leading construction company and its subcontractors. Approximately, 1,500 hard copy questionnaires were distributed and the response rate was excellent, resulting in 1,120 valid questionnaires

being collected from 22 construction projects. From FA, two principal components were established, management commitment, employee involvement and inappropriate safety procedure and work practices. These factors have been regressed with the perceived safety performance scores to establish the causal relationship between safety climate and perceived safety performance. This finally made them to come to the conclusion that the two-factor solution explained a total of 43.9% of the variance, with factor 1 contributing 27.62% and factor 2 contributing 16.28%. During the multiple regression analysis, the two underlying factors were used as independent variables in evaluating the relationship with perceived safety performance. The study concluded that management may be warned of potential safety system failures by measuring safety climate and can assess how safety is functioning in construction site environments. The results suggest that safety climate can be used as an effective measure of assessing and improving site safety for projects under construction.

Aviad.Shapira; F.Asce, Beny Lyachin[5] presents the results of a study that identified the major factors affecting safety in tower-crane environments and evaluated the degree to which each factor influences ongoing safety on site. This study presented a list of 21 factors with an ongoing presence that affects safety in tower-crane environments. The list was generated and consolidated based on the experience and expertise of 19 senior safety managers and equipment managers from the top ten construction companies, which among them own and employ some 300 tower cranes. With a view to quantifying risk factors, the experts also assessed the influence of each of the factors, thus making it possible to distinguish between factors that exert a strong influence and those that exert a moderate influence on site safety. Overall we get to study in this paper that ,with the limited resources available for safety improvement and accident prevention, greater attention must be paid by all parties involved e.g.

construction firms, regulatory and enforcement authorities to those factors evaluated as highly affecting site safety due to tower-crane work. The study reported in this paper constitutes the first phase of a broader research plan that aims to develop quantitative indices that objectively and realistically reflect safety levels on construction sites due to the operation of tower cranes.

Alexander .Laufer; M. Asce; William B. Ledbetter;F. Asce[6]deals with the effectiveness of the various methods and the extent of their use at construction sites are examined. The study is primarily based on a sampling of medium and large construction sites. Attributes that are investigated include efficiency, reliability, and validity and diagnostic capacity of the measure in order to identify the cause for success or failure, respectively, of the safety program at a site. Data were collected through the medium of a questionnaire mailed to safety directors of the 400 largest U.S. contractors listed in the Engineering News Record. The conclusion is drawn that for the successful safety performance at construction sites, the simultaneous employment of a number of measuring methods is required. The results of this study clearly indicate that the most effective and at the same time the most widely used employed measurement methods were lost-day cases, doctor's cases, and cost of accident. No-injury cases were least effective and least in use. Process methods were found to be effective as far as their validity and diagnostic capacity extends, though their efficiency and reliability are low.

Suchismita.bhattacharjee; somik. Ghosh[7] attempt to identify the limitation of the prevailing safety approaches which reviewed the major approaches that have been implemented to improve occupational safety in construction industry. Evaluating nine major approaches in terms of techniques and effectiveness which includes personnel selection, technological intervention, behavior modification, poster campaign, quality circle, exercise and stress management, near-miss accident reporting, safety

climate, and zero injury technique, it was found that all the approaches transfer the burden of responsibility on the contractors. While the role of the contractors in the occupational safety and health risks of the workers is undeniable, yet the lack of improvement in the safety performance of construction industry in comparison to others have urged the practitioners and researchers to look for novel concepts. PtD (Prevention through Design) is such a concept, which if embraced by the construction industry and utilized properly can minimize occupational safety and health risks. This finally made them to come to the conclusion that the utilization of this concept calls for architects and engineers to participate in enhancing construction site safety. PtD concept utilizes the fact that architects and engineers are in a position to make decisions about construction safety and reduce or eliminate certain identifiable risks before those risks reach the construction site.

Qian. Chen; A.M.Asce, Ruoyu. Jin[8] presents a case study of an on-site safety management program launched by a general contractor. The initial research findings based on data analysis of incident rates (reactive measurement) and safety violations (proactive measurement) were presented to quantitatively assess the effectiveness of the program. By comparing various before and after incident rates and IRs during the 17-month study period, this research found that the Safety4Site program was effective in preventing **and reducing jobsite accidents/incidents in the GC's organization. In contrast, Subs' incident rates were not** significantly affected by the program. This gave them the conclusion that the top four most violated items, accounting for 82% of total violations, were all related to fall hazards. Besides safety, who reported around 33% of violations, project management personnel reported another 63%. This indicated strong participation and accountability among middle management personnel. Data showed that the program had a higher positive effect on

the GC (with decreased SVRs) than on Subs in reducing unsafe behaviors. A co- relational study found no any linear relationships between IRs and SVRs for the GC, two uncorrelated measurements of safety performance. A lower incident rate does not necessarily mean a safer jobsite because some unsafe behaviors may not become an accident. Which overall gives the result that both reactive and proactive measure should be used to evaluate jobsite safety performance and the effectiveness of a safety program.

Xinyu .Huang; Jimmie. Hinze[9] presents the results of a **study on the owner's role in construction safety** which was demonstrated through the project characteristics, the selection of safe contractors, the inclusion of safety **requirements in the contract, and the owner's active** participation in safety during project execution. Through analysis of the project interview data, it can be concluded that owners can positively influence project safety performances. Several practices of owners that were associated with better safety performances were identified. This study also found that petrochemical owners are among the most proactive owners in construction safety. They help to explain why the safety performances of petrochemical projects are better than other types of projects. This finally made them to come to the conclusion that by identifying practices of owners that are associated with good project safety performances, guidance is provided on how owners directly impact safety performance.

P.S.Sathish.Kumar; M.Logesh. Kumar[10] presents the results of a questionnaire survey, which was distributed among the construction sites and formal interviews with the key personnel at sites. The criteria considered for survey are safety programs and policy, safety program implementation, use of personal protective equipment, hazards and their protection, housekeeping, emergency compliance. This study revealed that Safety is a management initiative, which was found completely

lacking on all most all the sites surveyed. Generally, all aspects of safety are neglected at construction sites. The results of this study clearly indicate that the most critical factors like safety policy, awareness among the workers and falling hazards are neglected. Even though personal protective equipment are being used at many sites, hand glove are widely used mainly for concreting operations. Also in some sites helmets were found to be used for carrying water and storing oil which is used for applying to the formwork. This gave them the conclusion that Barricading, handrails and signage are not provided, to safe guard the person from falling, in most of the sites. Proper stacking of material is not done. Majority of the sites do not have their access ways clear from obstruction. In most of the sites trained operators were not used for operating the machineries and there is lack of manual of maintenance at the site. Site engineer/ Site-in-charge did not know the capacities of the equipments present at the site. Traffic signage and flagging was completely absent in all most all of the sites. There was complete ignorance about the laws and rights of labourers. Also there were no labour unions to fight for the labour rights. No contractor has been given notice regarding unsafe working conditions by any government department.

T. 11Subramani¹; R. Lordsonmillar^[11] examine the safety management in the construction industry. The study will collect data from general contractors, who are involved in major types of construction. Collected data include information regarding organizational safety policy, safety training, safety meetings, safety equipment, safety inspections, safety incentives and penalties, workers' attitude towards safety, labour turnover rates and compliance with safety legislation. This gave them the conclusion that the work environments in construction activities are generally more hazardous, than other industries due to the use of heavy equipment, dangerous tools, and hazardous materials, all of which increase the potential for serious accidents and injuries. Therefore, it is

evident that a focused dedication inwards safety is needed from construction at all levels. It can be inferred from the survey data that safety managers have the opportunity to influence and enhance the sense of safety and the quality of the work environment. Thus the paper will conclude by providing a set of recommendations and strategies to contractors for improving their safety performance.

S. Thomas Ng; Kam Pong Cheng, R. Martin Skitmore^[12] examined the importance of Safety Performance Evaluation (SPE) factors through a questionnaire survey conducted in Hong Kong. A questionnaire survey was conducted with clients, contractors and consultants in HK in order to establish the importance of the factors. The analyses were carried out by examining the MS and MR. The results clearly indicate that the most important SPE factors at an **organizational level** to be **"implementation of safety management system in accordance with legislation"** and **"compliance with occupational safety and health legislation, codes and standards"**. **At project level, the most important SPE factor was "provision of safe working environment"**. This gave them the conclusion that having reviewed different existing SPE methods, a more comprehensive framework for evaluating construction safety performance was developed. This provides a comprehensive analysis approach on contractor's safety performance at both organizational and project levels that are not found in any existing systems. The safety performance scores can be used to form a league table of **contractors' safety performance**. This benchmarking system could be applied at tendering stage, or for determining insurance premium and award in order to **enhance contractor's motivation and awareness in construction site safety**.

3. DISCUSSION

Based on various researchers, it is observed that safety managers have the opportunity to influence and enhance the sense of safety and the quality of the work environment. It is also been observed that a set of

recommendations and strategies is to be provide to contractors for improving their safety performance.

4. CONCLUSION

Based on above literature review it could be concluded that Safety climate can be used as an effective measure of assessing and improving site safety for projects under construction. Employee perceptions, safety behaviors, and environmental or situational features could be accessed through safety climate surveys, peer observations, and systems audits/inspections. Work pressure has no significant direct relationship with the safety climate. It corroborates the importance of the role of management commitment, communication, workers' involvement, attitudes, competence, as well as supportive and supervisory environments, in achieving a positive safety climate.

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BIOGRAPHIES



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