

Safety Analysis in Construction Industry

Priyanka M K, Bhavya K

Dept. of Civil Engineering, Cochin College of Engineering and Technology, Valanchery, Kerala, India

Abstract - Safety issues have gained vital importance throughout the construction industry. The aim of this study is to identify the safety factors affecting the local construction projects and to analyze them. A typical site-specific safety plan was utilized to provide safety guidance throughout the construction project. Safety management survey was conducted to determine the status of safety in the construction sites. Ensuring Safe workplace conditions at construction sites depends on different factors including Safety policy and standards, safety organization, safety training, inspecting hazardous conditions, personal protective program, plant and equipment, safety promotion, and management behavior. The data collected through questionnaire survey was analyzed using the SPSS software method and RII manual method

Key Words: Safety management system, safety management problem, Relative important index (RII), Social package for social science (SPSS)

1. Introduction

Construction industry plays foremost role in improvement and accomplishment of the target of society. India is a developing country and most developments are going on in construction industry. Construction industry is complex in nature as it involves large number of parties such as clients, contractors, consultants, stake holders and regulators. Human life and safety is most important than anything, so systematic safety and emergency management is required at construction site. Not only construction industry but also government should take active participation in this process. As per National safety council (NSC), till day many construction companies do not have safety and emergency department. The responsibility is just given to individuals who do not possess proper knowledge and experience in this field. The safety record of construction industry is always poor. Sometimes though there are safety and emergency provision made but implementation of these provisions are not found which can prevent accidents.

1.1 Safety Management Problem

Safety means no loss of people, process, and property. The step we take and the program we put in place to avoid loss is called as safety management or Safety management is the implementation of a safety management system into a organization and safety is nothing but the condition of

being protected from the risk and injury. Emergency management is the discipline dealing with and avoiding both natural and manmade disasters. Emergency is a serious, unexpected and often dangerous situation requiring immediate action.

1.2 Safety Management System

Safety on construction sites is a complex issue in which the management team, who has the authority to allocate resources and enforce the organization's policies, plays a key role in its success. Managers must be willing to accept responsibility for the safety of their employees and must consider safety an integral part of doing business. A safety management system (SMS) aims to decrease the number of accidents, injuries, and health problems among workers at a workplace. Accidents are the major contributor to the loss of life of labours at workplace. So it is very important to tackle and deal with this major contributor of loss of life and health. This is why safety management is the apt way to rectify and stop the problems in workplaces. Safety management is the systematic process of identifying, analyzing and responding to project safety. Providing safe workplace conditions in effective construction companies. The effectiveness of the system depends on different factors, such as management commitment, effective use of resources, and worker participation, and communications. The scope and complexity of safety management systems vary according to the size and type of workplace.

The most important functions of a safety management system is to provide safe workplace conditions that significantly impact the health and productivity of workers and support the construction company's financial status. For example, poor worksite safety increases the likelihood of serious accidents in construction as compared to other sectors, such as manufacturing. There are many criteria taken to provide significantly productive and proper health of workers and to ensure companies economic and financial existence. Serious injuries and accidents, particularly fatal accidents, are more likely to occur on construction worksites than on sites in other industrial sectors. One of the most important responsibilities of an safety management system is to perform risk assessment and hazard analyses to protect people and provide a safe workplace; these processes depend on several factors, such as management commitment, safety policies, safety rules and procedures, safety training, and safe behavior. The lack of safety auditing leads to poor safety performance and a lack of improvement. The factors that affect workplace safety in

the construction industry are often not physical, as they depend on different objective factors (e.g., the number of injuries and accidents) and subjective factors (e.g., safe behavior, responsibility, and time pressure). Therefore, safety on construction sites is a complex issue. Workplace accidents can occur due to poor safety attitudes, lack of knowledge, poor training programs, and insufficient supervision even when the company provides an adequate safety policy and clear safety rules and procedures.

1.3 Benefits of a Safety Management System

The safety system of the company follows the OHSAS 18002:2000, which are the Occupational Health and Safety Assessment Series guidelines for the implementation of OHSAS 18001. The main features of OHSAS 18001:1999 are: _1_ OH&S policy; _2_ planning; _3_ implementation and operation; _4_ checking and corrective action; _5_ management review; and _6_ continual improvement. For the company to stay competitive as argued in the following, the firm is implementing a SMS which satisfies the changing needs of the construction industry. The benefits of implementing such a systematic and effective SH&E management system could be the following:

1. Reducing the number of injuries to personnel and operatives in the workplace through the prevention and control of workplace hazards;
2. Minimizing the risk of major accidents;
3. Controlling workplace risks improve employee morale and enhance productivity;
4. Minimizing production interruptions and reducing material and equipment damage;
5. Reducing the cost of insurance as well as the cost of employee absences;
6. Minimizing legal costs of accident litigation, fines, reducing expenditures on emergency supplies;
7. Reducing accident investigation time, supervisors' time diverted, clerical efforts, and the loss of expertise and experiences.

2. Objective and Scope

The objective of the study is to find the safety factors which affect the performance of the construction projects.

1. To find the safety factors affecting the performance of construction projects.
 2. To analyze the factors and rank the factors according to the mean.
 3. To identify the critical safety factors which affecting the constraints.
 4. To give suggestions and recommendations to improve the safety performance of the construction industry.
- Safety management system, enhance and maximize the efficiency of construction management. It helps to improves project performance. Implementation of the safety management system improves clear understanding

and awareness of potential safety in project. In meeting these basic requirements, the building should not cause harm to its occupants or the environment. By achieving sustainable future in the building industry covering a number of features such as: Increased level of control over whole project, reduce the expenses, efficient problem solving process, and provides a procedure that can reduce possible and sudden surprises.

3. Methodology

The aim of this study is to identify, evaluate the factors that contribute significantly to SMS performance at construction worksites. Furthermore, the construction companies considered were ranked according to their SMS performance. Methodology selected for this research comprised of a questionnaire design, a questionnaire survey and interviews, and survey data's are analyzed by SPSS software and RII Method.

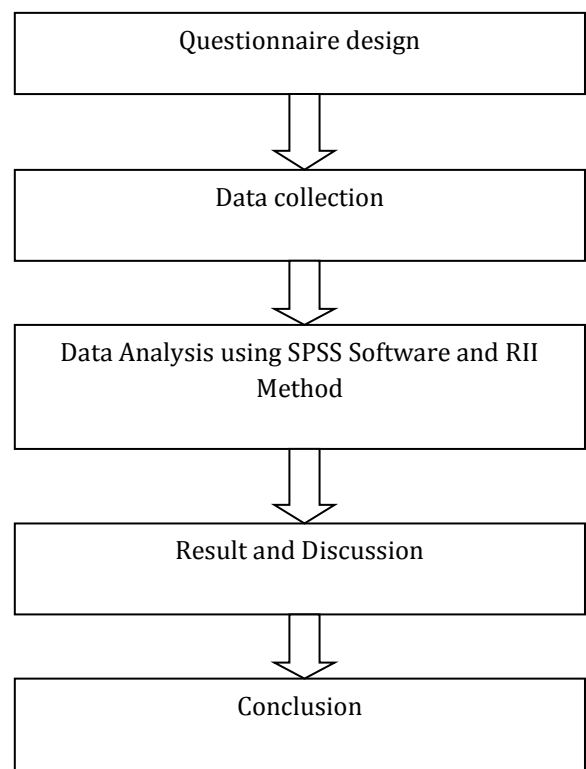


Fig-1: Research Methodology

3.1 Preparation of questionnaire & Questionnaire survey

Based on the Literature Review we are considering eight major factors i.e. Safety policy and standards, safety organization, safety training, inspecting hazardous conditions, personal protective program, plant and equipment, safety promotion, and management behavior.

Each factor contains more than 2 questions which are related to the construction oriented safety measures.

3.2 Data collection techniques

Among the many available methods in collecting data two methods were adopted, these are literature review and questionnaires. The first step involves general information collection, including both first-hand and second-hand data, in order to identify major themes from the literature. In the second step, with the literature review and unstructured interviews, important factors of safety were identified. With these factors, a questionnaire was formed and Survey was conducted. Questionnaires were used to gather information for the study.

3.3 SPSS Software

Analysis of the result was done using SPSS Software. SPSS Statistics is a software package used for statistical analysis. The software name originally stood for Statistical Package for the Social Sciences (SPSS), reflecting the original market, although the software is now popular in other fields as well, including the health sciences and marketing. All the responses obtained from the questionnaires are entered in to the software. First, the

variables or the questions are entered in the data view, then, the responses are entered into the software from the various data entered into the software, frequency can be found which is used to determine the importance factor.

3.4 RII Manual method

The sample for this study is relatively small. As a result, the analysis had combined all groups of respondents (clients, consultants, contractors and regulatory boards) in order to obtain significant results. Data was analyzed by calculating frequencies and Relative Importance Index (RII). The data analysis was carried out using SPSS. SPSS was used to generate the frequency (fi) of the response category index for the cause and effect factors. The relative importance index (RII) for each factor was calculated using the frequency data for each response categories generated from SPSS. The Relative Importance Index (RII) is calculated as follows:

$$RII = \Sigma W/A * N$$

Where, W = weight given to each factor by respondents A = highest weight and N = total number of respondents.

4. Result and Discussion

SPSS Method

Table - 1

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Construction safety requirements	30	1.00	4.00	2.200	0.887
Policy to new employees	30	1.00	5.00	3.333	1.124
Feedback from employees	30	1.00	4.00	2.167	0.791
Policy familiar with project management personal	30	1.00	4.00	2.267	0.907
Organization chart	30	1.00	4.00	2.200	0.997
Safety responsibilities	30	1.00	5.00	2.367	0.890
Arrangements to collect feedback	30	1.00	5.00	2.200	1.064
Sufficient safety officers and supervisors	30	1.00	5.00	2.533	1.137
Safety training plan	30	1.00	5.00	2.800	1.349
Basic general safety training	30	1.00	5.00	3.367	1.098
Site specific safety training	30	1.00	5.00	2.867	1.167
Tool box training	30	1.00	5.00	3.167	1.053
Appropriate arrangements	30	1.00	5.00	2.833	0.986
Safety inspection at regular intervals	30	2.00	5.00	3.233	0.858
Analyse the result of safety inspection	30	1.00	5.00	3.067	1.112

Sufficient stock of PPE	30	1.00	5.00	2.900	1.094
Effective system for Issuance recording and inspection of PPE	30	1.00	5.00	3.633	1.245
Proper use of PPE	30	1.00	5.00	3.333	1.213
Monitoring PPE	30	1.00	5.00	2.667	0.994
Training of plant operator	30	1.00	4.00	2.600	0.932
Suitable plant and equipment	30	2.00	5.00	3.400	0.894
Safety bulletin board	30	2.00	5.00	3.567	0.971
Safety signs and posters	30	2.00	5.00	3.933	0.980
Safety performance by individual	30	1.00	5.00	2.200	1.031
Safety talks	30	1.00	4.00	2.500	1.042
Pre task meetings	30	1.00	4.00	2.533	0.819
Safety meeting	30	1.00	5.00	2.667	1.093
Valid N (list wise)	30				

RII Method

Table - 2

No	Factors	RII
1	Safety signs and posters prominently displayed onsite	0.787
2	An effective system for the issuance, recording, and inspection of PPE and its replacement been established	0.727
3	The individual health and safety responsibilities of all employees been clearly defined	0.720
4	Safety bulletin boards provided and located so that every employee will see them during working days	0.713
5	All plant and equipment used on site suitable for the job and are their user's properly trained	0.680
6	All workers received basic general safety training	0.673
7	The policy explained to new employees as part of their training and orientation before entry to and work on-site	0.667
8	There are procedures to ensure the proper use of PPE as well as training and instruction in this area	0.667
9	Safety officers and safety supervisors carry out safety inspections at regular intervals	0.647
10	All workers received toolbox training related to their tasks	0.633
11	Here are appropriate arrangements to collate and analyze the results of safety inspections	0.613

12	A sufficient stock of carefully selected and appropriate PPE been obtained	0.580
13	All workers received site-specific safety training	0.573
14	There appropriate arrangements to monitor the effectiveness thoroughness of the inspection	0.567
15	There a safety training plan and is it reviewed regularly	0.560
16	There is a procedure to monitor the PPE brought on-site by subcontractors or workers	0.533
17	There is a policy of training of plant operators	0.520
18	Sufficient competent safety officers and safety supervisors been appointed and engaged for the site	0.507
19	There are pre-task meetings before executing an activity	0.507
20	Site managers and supervisors involved in regular safety talks with workers	0.500
21	A policy that skilled and experienced supervisors become familiar with the project management personnel, the company's policies, and other project-specific safety matters	0.453
22	The policy clearly states that decisions on other priorities should give due regard to construction safety requirements	0.440
23	There is an organization chart showing the names and positions with responsibility lines for safety performance management	0.440
24	There are arrangements to collect and review feedback on safety matters	0.440
25	Safety awards meted out on a regular basis with recognition given for good safety performance by individuals	0.440
26	Subcontractors hold regular safety meetings	0.440
27	The review arrangement includes feedback from employees at all levels	0.433

Based on the questionnaire the first factor affecting of improper safety management in construction is safety promotion. It indicates that safety promotion play a very important role in safety management in construction. Personal protection program is graded the second. The results are a clear indication of poor obedience by construction team project. Safety training, Inspecting hazardous condition, plant and equipments is ranked the third, fourth and fifth respectively. As for the rest of the factors it is ranked the sixth, seventh and eighth.

5. Conclusion

Based on the research done, it can be concluded that safety management in construction project needs to be further improved and monitored frequently for its effectiveness. While achieving the set objectives, this work provoked many aspects of education, training, and engineer's obligations toward managing safety in the construction industry. The core elements of a safety, health, and environmental management system have

been identified for improving site safety on construction projects. Numerous best practices were explored in the research and one such example is that safety management has been integrated into project management. The work investigated eight aspects of safety management, which included safety policy and standards, safety organization, safety training, inspecting hazardous conditions, personal protective program, plant and equipment, safety promotion, and management behavior. The responses indicate that the company considers the safety and health of its employees as equally important to any other business function. Company management is committed to comply with safety, health, and environmental protection legislation and all contractual requirements at an absolute minimum goal. As the recommendation, the management of the company has to realize the performance of the company in safety management as they play a big role in this matter. One of the ways is by restructuring the safety management team. This is to ensure that safety matters are taken cared by a responsible person. Besides that, the government should give the privilege to small construction company in order to set up a systematic construction safety management system. In addition, government should provide free Green Book Training to the workers. Thus, this will enhance the capability of the company to control safety matters in the construction site.

6. References

1. Ganapathi Bhat, Y.S.Sidde Gowda (2013) „Safety Management System of Construction Activities in UAE Infrastructure Project“ ISSN: 2249 – 8958 international journal of Engineering. Vol-2 Issue-6
2. Gregory Carter and Simon D. Smith, “Safety Hazard Identification on Construction.” journal of construction Engineering and Management,” vol 132, pp.197-205
3. Jimmie Hinze, xCaroline Pedersen and John Fredley, “Identifying root causes of construction injuries”, journal of construction Engineering and Management 1998 vol.124 , pp.67-71
4. R. Navon, M.ASCE and O. Kolton, “Model for Automated Monitoring of Fall Hazards in Building Construction”, journal of construction Engineering and Management Vol. 2, 2006 pp.733-740
5. S. Chockalingam and T. Sornakumar, “A Study on identifying hazard, aspect and risk in the activities involved at construction site”, journal of construction Engineering and Management. Vol.3.no.1.pp.11-31.
6. Dağdeviren, M. &Yüksel, İ., (2008) Developing A Fuzzy Analytic Hierarchy Process (AHP) Model For Behavior-Based Safety Management. *Information Science*, **178**(6), Pp. 1717–1733.
7. Zou, P.X.W. & Sunindijo, R.Y., (2013) Skills For Managing Safety Risk, Implementing Safety Task, And Developing Positive Safety Climate In Construction Project. *Automation In Construction*, **34**, Pp. 92–100.
8. Zhou, Z., Goh, Y.M. & Li, Q., (2015) Overview And Analysis Of Safety Management Studies In The Construction Industry. *Safety Science*, **72**, Pp. 337–350.
9. Ismail, Z., Doostdar, S. & Harun, Z., (2012) Factors Influencing The Implementation Of A Safety Management System For Construction Sites. *Safety Science*, **50**(3), Pp. 418–423.
10. Elyas Jazayeri, Gabriel B. Dadi, (2017) Construction Safety Management Systems And Methods Of Safety Performance Measurement: A Review, *Journal Of Safety Engineering*, 6(2): 15-28.