



# An Expert System to Rate Construction Site Based on Safety

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**Abstract:** *The number of accidents that occur in construction sites are increasing day by day. Due to that, the damages and fatality rate due to construction site failures are alarming. During construction, many accidents may occur in the site. It's the responsibility of site supervisors and Engineers to control the accidents during construction. An attempt has been made to analyse the different causes for accidents in a construction site based upon the surveys conducted at different construction sites located in Rajiv Gandhi salai, Chennai. Based upon the survey analysis, a smart system has been developed to categorize the construction of safety site based upon safety conditions adopted. This research also brings into light many effects due to improper safety management in the construction site. The research paper concludes by providing certain recommendations and strategies to all construction sites for improving their safety performance, which thereby reduces the number of accidents.*

**Keywords :** accidents; Constructions; likert rating, safety management; smart system.

## I. INTRODUCTION

Recent years, the nature of accidents caused in a construction industry is found to be more hazardous when compared to many Industries. The severity of accidents which is happening in construction sites is also increasing day by day. Due to the prevailing unsafe condition in Construction sites, it has become a very difficult task to get skilled labours this has resulted in shortage of getting skilled personals. In the recent years, need for safety awareness among construction industries is much realized. This is due to the high cost associated with work related to money spent towards labour injuries, compensation paid to the workers, premium paid for insurance, indirect costs associated with site accidents, etc., Status of construction safety at workplace is reviewed in this paper. This paper mainly focuses on creating a safe working environment for construction employees. The study was carried out by physically inspecting several construction sites located in Rajiv Gandhi Salai, collecting the data and feedback regarding number of workers, safety measures

adopted, types of accidents occurred, severity of accidents, etc., from construction site workers using questionnaires., rectification is not possible.

## II OBJECTIVES OF THE STUDY

The paper aimed at:

1. Conducting survey in construction sites and to determine the presence of hazards and then establishing procedures to overcome or meet those hazardous situations.
2. To promote safe practices at construction sites and to protect workers from hazardous situations.
3. To create a knowledge-based decision-making model to ensure safety during construction.
4. To categorize the construction sites based on the model created and to propose safety measures to be adopted.

## III METHODOLOGY

The entire project was categorized to three major phases as shown in Fig. 1.

### Phase I

During the first phase, several construction sites were inspected to determine the presence of hazards or hazardous situations. A set questionnaire were listed to measure the health and safety measured adopted in site. Due to time constraints it was decided to choose 8 construction sites for the study. The information assessed through this survey was to determine whether the chosen construction sites are competent to undertake the work safely without any major accidents.

### Phase II

Since many clients are not aware of construction, health and safety, accidents are very common in construction sites. In order to assist such clients, a decision supporting model that is knowledge assisted was created on the basis of the assessing health and safety competence and rating the sites based on safety

### Phase III

Based upon the questionnaires and with reference to the Likert scaling for rating construction site safety is a much more simple system to rate and categorize health and safety performance with respect to site conditions and standards. The taxonomy of construction sites based on Likert scale, which was considered in the survey is as given in Table 3.1. The rating of sites as per Likert scaling method is a bipolar rating method used for measuring positive or negative responses for a given statement.

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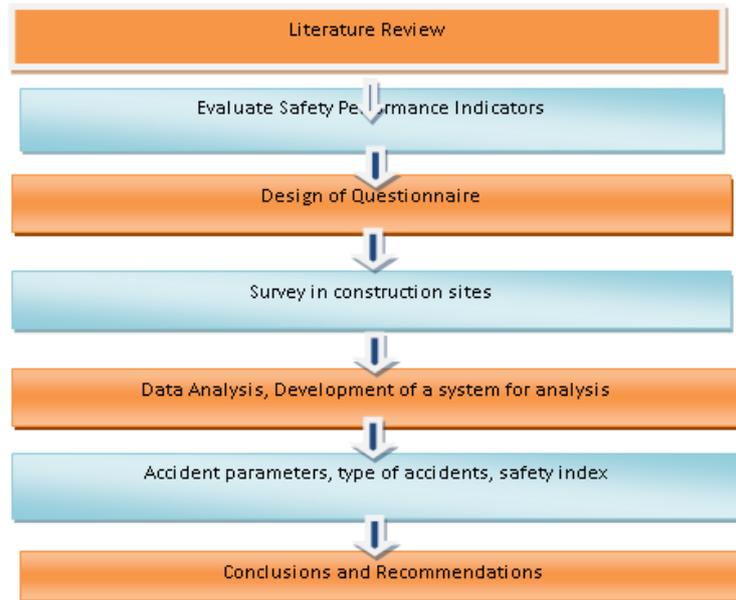
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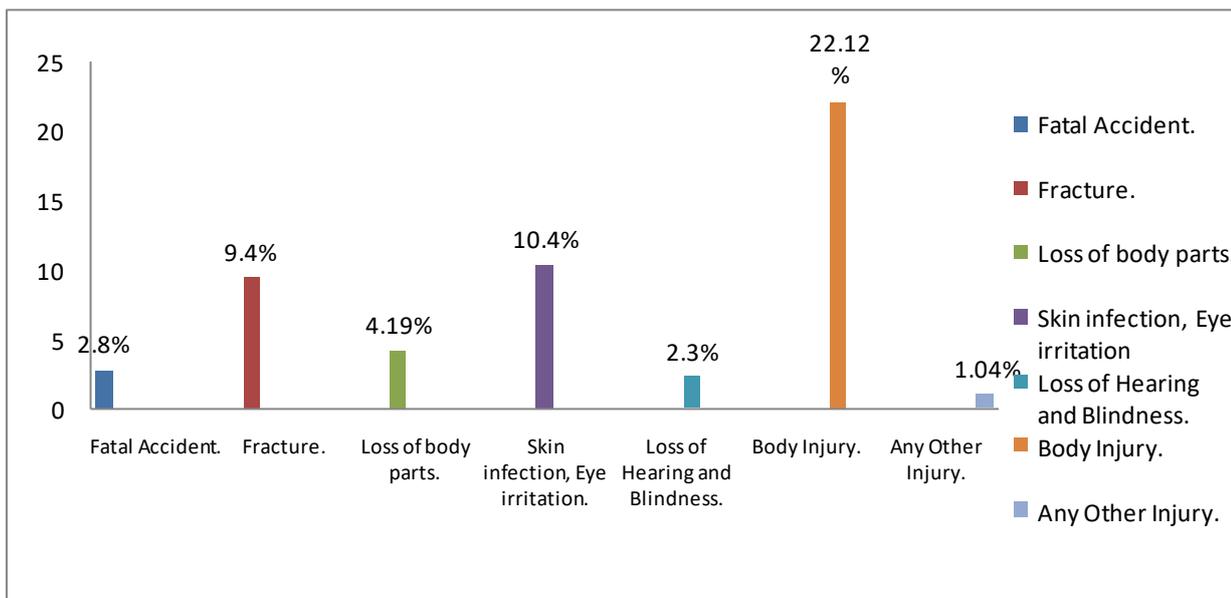
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**Fig. 1 Methodology adopted to analyse safety in construction site**

**Table 1. Scaling indicator for safety and health competence assessment based on Likert**

S.NO.	Taxonomy	Description about taxonomy
1.	Poor	Safety Standard of site is not up to the standards
2.	Fair	Partial safety standards achieved
3.	Acceptable	Construction safety is not adequate but are in standard limits
4.	Good	Site meets construction safety standards and its compliance is substantial
5.	Excellent	Exceeds standards and given the best rating



**Fig. 2 Percentage of Accidents vs. Reason for Accident**

## IV RESULTS AND DISCUSSION

The site data collected from six residential building sites and two commercial building sites are compared. Site safety survey has been conducted for a period of two months.

The construction sites reviewed in this study are located in Rajiv Gandhi salai , Chennai , India. The survey was conducted once in a week for the duration of two months in each site.

Direct survey was conducted with labors; site Engineers, safety engineers, supervisors and safety officers. Safety survey visited were randomly but once in each week. In each site safety items were checked during site visit and necessary data were collected. The site supervisors, site engineers, masons and labourers were interviewed from about eight sites and interviewed about 102 candidates

including all categories. During the survey, details of labor accidents which happened in last 2 years were collected and accident rate in each site was calculated the data collected includes, number of accidents, Injury types and reasons for accidents. From the survey results the percentage of accidents occurred during the past years in construction site along with reason for accident in each category was calculated.

**Fig. 3 Safety analysis in smart system**

From the above figure, it was found that the fatal accident was 2.8% ; Fracture 9.4%; Loss of body part 4.19%; Skin infection & Eye irritation 10.4%; Loss of hearing and blindness 2.3%; Body injury 22.12%; other injuries were 1.04%. It was estimated that the average number of accidents in construction site is 7.46%.

Based on the survey reports a smart system was developed to rate the construction sites based on Likert scale. After login, one format will appears which include the site names and site measurement which can be filled up by the user or the site engineers as shown in Figure 2. Based on the safety precautions adopted in the site the construction site will be rated.

Sl. No.	Safety Practices	S 1	S 2	S 3	S 4	S 5	S 6	S 7	S 8
.	Fall protection systems	√	√	√	√	√	√	√	√
.	Allocation of budget for safety	√	√	√	√	√	√	√	√
.	Personal protective equipment	√	√	√	√	√	√	√	√
.	Safety policy	√	X	√	√	X	√	√	√
.	Safety promotions	√	X	√	√	X	X	√	√
.	Education and training	√	X	√	√	√	√	√	√
.	Safety auditing	√	X	√	√	√	X	√	√
.	Safety meetings	√	√	√	√	√	√	√	√
.	Site safety organization	√	X	X	X	X	X	√	√
0.	Other safety practices	Safety Access available	Nil	Nil	Safety Access available	Nil	Nil	Safety Access available	Safety Access available

Table 2 summarizes the findings from the broad study performed on the practices for safety in construction sites. From the surveys conducted we found that maximum numbers of construction sites located in the study region have implemented prescribed construction safety practices. From the site survey conducted in all construction sites we found that Site 1, Site 4, Site 7 and site 8 practices a safety policy for their workers. They also provide education and training for all workers at construction sites and thereby creating an awareness among them. In addition to this, auditing ledger for safety and site inspection is maintained properly. Safety

meetings were also periodically for the laborers on and off the site explaining the safety aspects and its importances.

**V CONCLUSIONS**

From the survey studies conducted, maximum numbers of projects have implemented safety practices. From the site survey in each construction site it was found that Site 1, Site 4, Site 7 and site 8 that they adopt safety policies for their workers on site and also provides awareness and training on safety topics for all their laborers at the work place.



Also, safety inspection on tools and workers were done with proper auditing procedures regularly. Addition to the above procedures regular meetings with site stakeholders were conducted to have discussion about the safety, its importance and methods of implementation. Based on the safety practices mentioned in the above table, construction sites were rated based on a rating scale of 1 to 5. With the help of the smart system developed all sites can be checked for safety and rated depending upon the safety measures adopted. Suggestions on safety measures to be followed were also distributed to the sites.

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