

STUDY ON SAFETY AND LABOUR CONDITION IN CONSTRUCTION SITE

Naveen kumar.T¹, Chinnasamy.M² M.E., M.B.A , Thenmozhi.S³ Ph.D,

¹M.E-Construction Engineering and Management Student, Sree Sastha Institute of Engineering and Technology, Chennai.

²Assistant Professor, Dept. of Civil Engineering, Sree Sastha Institute of Engineering and Technology, Chennai.Tamilnadu, India.

³Professor, Head of the Department, Dept. of Civil Engineering, Sree Sastha Institute of Engineering and Technology, Chennai.

ABSTRACT - Construction is the second largest economic activity in India next to agriculture. Construction industry has recorded enormous growth world wide and particularly in last decade. Constructing safe structures and providing safe working environment to the personnel is a vital factor in successful construction business. Thus safety is an important function in the management of construction projects. The concern of safety has to start from the design stage and continues till the facilities are delivered to the owner. Construction is also a high accident prone industry employing major work force, most of them being labourers and skilled workers. Besides, construction sector is a highly unorganized sector and is a high risk Industry for clients, contractors and workers.

The term safety is difficult to define due to the inter-relationship of several factors. Safety in general can be defines as the freedom from danger of risks of personal injuries or damage to health, over a period of time, arising from both immediate and long term effects of the exposure to unhealthy working environment. Very often safety is adjudged in terms of an inverse relationship with accident rate. Low rate means high safety and vice versa. Theoretically, safety can be defines as the absence of danger at work which is made possible by eliminating hazards that create the danger. A more practical definition is that a thing is provisionally categorized as safe if its risk are deemed known and in the light of that knowledge, judged to be acceptable.

In India comprehensive and universal safety rules and regulations have not been developed. Workers are generally unskilled or semiskilled, poorly paid, temporarily employed and often migrate in a group from one place to another in search of work. Typically labourers are not trained in safe work practices and there tend to be a lack of management commitment to safety programs and procedures. Considering the safety and labour criterions that are essential for a safe worksite a questionnaire was developed. This paper presents the results of a questionnaire survey, which was distributed among the construction sites and formal interviews with the key personnel at sites.

1. INTRODUCTION

Construction Industry is an unorganized sector and it is the least researched industries even today. The system of reporting data about internal working and safety is also minimal. The manpower driven industry is facing regular accidents in daily working, which cause heavy losses in terms of men, money and time. The past studies show that on an average, 60 to 80 accidents occur per 1000 workers in the manufacturing sector while, construction sector averages around 160 to 250 per 1000 workers. In spite of all the extensive studies and efforts of various organizations working for the cause, nothing concrete has been established for the same. The main cause of the low safety standards and working conditions at the construction sites is the lack of exclusive legislations applicable to the construction industry.

Throughout the world, the construction area of civil engineering is one of the most hazardous industries. The major causes of accidents are related to the unique nature of the industry, human behavior, difficult work site conditions and poor safety management which results in unsafe work methods, equipments and procedures. However, safety is not a luxury and may be considered as an important function to be used against unnecessary loss of property, injury or death. Preventing occupational illness and injuries should be a primary concern of all employers. Especially in developing country like India, there must be an effort to raise the level of awareness among both the employers and employees of the importance of health and safety at work sites.

2. OBJECTIVES OF STUDY

This study is conducted to achieve the following objectives:

1. In construction, there are no licensing conditions or other regulations. Moreover, small capital is required to control.
2. Entry into the industry is easy and requires no special skills.
3. The small size of many undertakings
4. Contractors are less disposed towards compliance of labour laws and safety requirements.

3. SCOPE OF STUDY

The scope of the study was restricted to R.C.C. high rise buildings which fall under the residential and commercial category/ type. The construction cost of the building is not considered as the decisive factor for this study.

4. LITERATURE REVIEW

This chapter confers the review of literatures regarding the issue of construction safety in the past researches and studies. The most noteworthy of them which are relevant to the current study are being reviewed. **safety**

Tariq S. Abdelhamid and G.Everett (2000) had made a research and presented an accident root causes tracing model (ARCTM) tailored to the needs of the construction industry. ARCTM proposes that accidents occur due to three root causes,

- I. Failing to identify an unsafe condition that existed before an activity was started or that developed after an activity was started.
- II. Deciding to proceed with a work activity after the worker identifies an existing unsafe condition, and
- III. Deciding to act unsafe regardless of initial conditions of the work environment.

In addition ARCTM proposes that these unsafe conditions are due to four causes viz., (a) Management actions/inactions, (b) Unsafe acts of worker or co-worker, [c] Non-human related events and (d) An unsafe condition that is a natural part of the initial site condition.

Xingu Huang and Jimmie Hinze (2003) had made a study to identify the root causes of fall accidents and to identify any additional information that might be helpful in reducing the incidence of construction worker falls in the future. While data from January 1990 through October 2001 were examined, particular emphasis was placed on fall accidents that occurred in the last 5 years of this time interval, a period when more data were accumulated and coded in the OSHA investigation reports. Results show that most fall accidents take place at elevations of less than 9.15m (30 ft), occurring primarily on new construction projects of commercial buildings and residential projects of relatively low construction cost. This paper explains about the nature of work which leads to fall accidents and also the time of occurrence of those accidents. The type of projects which involves more fall accidents, causes of fall accidents and the injuries resulting from fall accidents have been analysed. Most alarming, the results show that fall accidents account for a growing proportion of the total number of construction worker fatalities.

Osama Ahmed Jannadi and Mohammed S.Bu-khamsin (2002) had made a questionnaire survey, which was distributed among industrial contractors in the Eastern province of Saudi Arabia and formal interviews with the

contractors, officials responsible for construction safety. 72% of the companies participated in this survey were the general building construction companies. The paper identifies 20 main factors and 85 sub-factors and determines their level of importance based on the survey results and the analysis.

Enno "Ed" Koehn, Rupesh K.Kothari and Chih-shing Pan (1995) through their research discusses the approach towards safety in a developed country, the United States (OSHA 1983; zero 1993) and typical developing country, India. In addition, input from a newly developed country, Taiwan is also considered (Labor 1993). Comparisons are made and suggestions are offered for achieving safety during the construction of a project. This paper reveals the exact position of safety in Indian contractor's view. The following discussions will definitely reveals the safety in Indian construction, "In India, most large firms do have safety policy, on paper, but employees generally are not aware of its existence. Nevertheless, a number of major constructors exhibit a concern for safety and have established various safety procedures. These constructors have developed such policies and programs because they wish to maintain their excellent reputation and be able to undertake international construction work in the Persian Gulf, Africa and Russia. For majority of contractors, however, maximizing profit is the prime concern. Unsafe conditions exist on many sites, both large and small, and laborers are subjected to numerous hazards. Even large national firms who execute mega projects in different parts of India with a typical workforce consisting of 100 technical staff, 500 skilled labours and 2000 unskilled labours do not have effective safety programs." This paper further tells about the laws and regulation regarding safety and labour welfare in India and is compared with the laws and regulations of United States (OSHA).

Joe M.Wilson and Enno "Ed" Koehn (2000) presents a discussion of the methods of safety management employed on a small to medium-sized project in the North Western United States. The discussion will highlight several of the problems encountered and the solutions utilised to overcome these problems. The author discuss in this paper that responsibility for safety should be assigned at the time of preparing the safety management plan. Even though, the safety plan found effective, some obstacles may arise during the course of the project. It is concluded that the project is said to be successful in safety management aspect only when there is zero accidents. Moreover this success also depends on the willingness of the workers who are flexible and ready to try new things.

Jose L.Melia, Kathryn Mearns, Silvia A.Silva and M.Luisa Lima (2008) had analysed the safety climate from the point of view of the agent that performs the safety response question, by identifying four main agents (organisation, supervisors, co-workers and worker) and five safety climate variables: the Organisational Safety Response (OSR), the Supervisor's Safety Response (SSR), the Co-worker's Safety Response (CSR), the Worker Safety Response (WSR) and the perceived risk of accidents. The aim of the paper is to

analyse the psychosocial chain of safety influences among the safety responses and the perceived probability of accidents. Two general samples were obtained in England (N=869) and Spain (N=113) and two construction samples in China (N=99) and Spain (N=374). In both the general and construction samples, OSR and SSR are strongly related, as are CSR and WSR. Construction samples present some characteristics differences, especially in the link between the safety responses of the managerial and worker levels and the prediction of perceived risk. The results corroborate that there is a close relationship between the safety responses of organisational agents involved in management i.e. the relationship between OSR and SSR.

R.A.Haslam, S.A.Hide, A.G.F.Gibb, D.E.Gyi, T.Pavitt, S.Atkinson and A.R.Duff (2005) had overviewed and drawtogether findings from previous focus group research and studies of 100 individual construction accidents. Pursuing issues raised by the focus groups, the accident studies collected qualitative information on the circumstances of each incident and the casual influences involved. Site based data collection entailed interviews with accident involved personnel and their supervisor or manager, inspection of the accident location and review of appropriate documentation. Relevant issues from the site investigations were then followed up with off-site stack holders including designers, manufacturers and suppliers. Levels of involvement of key factors in the accidents were: problems arising from workers or the work team (70% of accidents), workplace issues (49%), shortcomings with equipment (including PPE) (56%), problems with suitability and condition of materials (27%) and deficiencies with risk management (84%). It is argued that attention to the originating influences will be necessary for sustained improvement in construction safety to be achieved.

Edward J.Jaselskis, Stuart D.Anderson and Jeffrey S.Russell (1996) through their research provides strategies for improving construction safety performance through the analysis of numerical profiles of companies and projects with varying levels of safety performance. This research perspective compliments much of the previous safety related research, which tends to be more qualitative in nature, addressing "what" factors are important for success as opposed to "how much" is appropriate to achieve successful safety outcomes. Corporate safety co-coordinators completed questionnaires that solicited quantitative data at both the company and project levels. Several safety performance measures were investigated: Occupational Safety and Health Administration (OSHA) incidence rates, experience modification rating (EMR) and a subjective project performance rating. Results from the statistical data analysis point to several company and project specific factors that are statistically significant in improving safety performance. This paper can benefit contractors, specialty contractors and owners by providing them with objective strategies to consistently achieve better safety performance.

Erkki Yranheikki and Heikki Savolainen (2000) made a research titled "Special International Report: Occupational Safety and Health in Finland" and given the following results.

In Finland, occupational safety is the responsibility of the employer, while the occupational safety and health laws are enforced by the Labour Inspection Service, an organisation of the state. The labour inspectors are mandated to verify the existence of sufficient occupational health services as prescribed by the Occupational Health Services Act for all employees. Declaring occupational accidents and disease cases is mandatory and the inspection districts examine all accidents to establish causes and consequences and to initiate prosecution in case of criminal negligence. Construction industry accounts for 25% of all fatal accidents, followed by mechanical, wood, metal, machinery and pulp and paper industry (10% each of fatal accidents). It is concluded that the Finnish occupational safety and health scene is undergoing a rapid change as it has to adapt in the situation of a diminishing and aging workforce, of European collaboration, of globalizing markets and of accelerating introduction of new technologies.

Federally mandated backup alarms and safety management have been unable to eliminate fatalities and injuries due to maneuvering trucks and mobile equipment on construction sites. Workers appear to ignore the alarms as part of the general noise level. Using human factor analysis, the problem was recognized as one of decremented vigilance, a person's natural inability to sustain attention without positive feedback.

R.B.Blackmon and A.K.Gramopadhye (1995) presents the experimental data on the use of a simulated, discriminating, personal alarm activated by a short range, directional transmitter to encourage safe behavior. It is concluded that performance specifications should be prepared for the discriminating personal alarms and transmitters. A limited number of alarms and transmitters should be produced for use in field testing. Representative samples of doppler and ultrasonic discriminating alarm systems should also be acquired. A field test program should be developed for the warning systems. Performance test should be made using various combinations of the personal and discriminating alarms. Waivers should be obtained to eliminate conventional alarm systems during the test period

5. METHODOLOGY ADOPTED FOR THE STUDY

Literature study and the study of several codes and regulations were done in order to get the parameters related to safety and labour facilities that are essential for a safe construction project. The flowchart below represents the methodology adopted for the study. After arriving the criterions related to safety and labour problems preparation of questionnaire is being done

The questionnaire prepared consists of questions regarding the general information about the site, the details of the safety policy and program, implementation of safety program, liaison with medical facilities, information about labour, wages paid to the labour, labour welfare, records of injuries and accidents and details about the contractor. Development of questionnaire along with parameter conditions for quantification of construction safety and their

weightage. This questionnaire is distributed among the construction sites and the collection of data is carried out. Finally the analysis is done for the collected questionnaire and the results are represented in graphical format. According to the response from the construction sites suggestions will be given and attentiveness regarding safety is developed. The gradual progress of the study can be represented in step by step procedure as follows,

1. Perform literature review to identify significant factors related to safety and labour facilities.
2. Develop a questionnaire considering the factors identified.
3. Collection of data.
4. Analyse the data.

Summarize the results.

6. CODAL PROVISIONS AND REGULATIONS

A large number of workmen, skilled and unskilled, are employed in the numerous construction works of big and small nature. Thus, it becomes imperative that adequate safety rules should be laid down for every phase of work and that these are meticulously followed. Some of the IS specifications and special publications regarding safety and labour laws which are relevant in our constitution and which was used during the course of this study.

6.1. LABOUR LAWS

The central and state governments have enacted a large number of laws, numbering over a hundred to regulate and improve the working conditions of labour in Provide recommendations for improving construction safety. different industrial and business establishments. Labour laws can be easily classified into the following categories:

- I. Laws concerning working conditions of labour.
- II. Laws concerning wages and other payments to labour.
- III. Laws concerning the social security of labour.

6.2. LABOUR WELFARE

Construction workers may be broadly classified as skilled and unskilled. Usually couples are found to be working on the same worksite. Though child labour is prohibited, children are engaged for unskilled jobs. Most of the workers in this sector are employed on casual basis. Unstable employment, earnings and shifting of work places are the basic characteristics of work for construction workers. Employment in construction is usually interspersed with periods of unemployment of varying duration, mainly due to fluctuating requirements of labour force on each worksite. The nature of work is that there are no holidays. Though skilled workers secure jobs directly from employers, unskilled workers by and large, are engaged through intermediaries who introduce the workers to the contractors on a commission basis. The payment of wages is routed through the intermediaries who introduce the workers to contractors on a commission basis.

The temporary residential sheds put up by contractors lack even minimum facilities such as separate cooking space, drinking water, lavatories, bathing and washing places. Crèche facilities are also not available at worksites. Social security benefits are virtually non-existence because of various constraints such as lack of stable nexus between employer and employees, instability of employment, poor and uncertain earnings of workers and reliable duration of work and so on.

7. HAZARDS IN CONSTRUCTION WORK

The hazard control includes the fall of persons, materials, collapse of enabling structures, electrical and fire hazards and care in materials, machinery and equipments handling. Housekeeping is sometimes understood as "simple floor cleaning or broomstick operation". It has a wider meaning and it includes the up keep of all construction activities in an orderly manner to minimize accidents due to improper planning, placement, arrangement, handling and so on. This will not only improve the efficiency of the working system but also decreases the potential cause of accident or injury.

8. QUESTIONNAIRE SURVEY

Based on the literature study done and the codes and regulations studied, following parameters were established for study and analysis which in turn would determine the vulnerability of the sites to the sites to accidents:

1. General Information About the Site
2. Safety Program & Policy
3. Safety Program Implementation
4. Use of Personal Protective Equipment (PPE)
5. Hazards and Their Protection
6. Housekeeping
7. Emergency Compliance
8. Labour Information
9. Record of Injury / Death
10. Remarks / Special Observations

9. ANALYSIS AND RESULTS OF SURVEY

The rating of the sites for safety conditions was done based on the parameters identified earlier. From the vulnerability point of view, critical aspects were outlined under broad categories. These broad categories were further divided into factors considered most crucial and semi-crucial such as hazards, safety program and its implementation, personal protective equipments, housekeeping, emergency compliance and labour conditions. The most critical activities awarded 2 points while semi-critical were given 1 point. Table (D) shows the summary of the safety criteria and their weightages.

Each question had two options –Yes and No. The result "No" of the answer was given zero points while the "Yes" option had four levels depending on the conditions prevalent at the site. Table (E) gives the points assigned for the "Yes" option. Based on these ratings, the performance of the site was graded against each parameter.

10. COMPARISON BETWEEN BEST AND WORST SITES

The following are the observations made during the survey of the site which was the best among the surveyed.

1. The contractor had a safety policy and followed a safety program.
2. Trained and qualified personnel were appointed to ensure the implementation of the safety program.
3. Special training about safety was given to the labourers and the staff at the site on a weekly basis.
4. Signboards and posters were displayed at a number of locations to create awareness among the workers about safety.
5. A portion of the safety office was utilised for the display of personal protective equipments also showing its importance.
6. Making benchmarks over them identifying the location of the underground cables.
7. A special gang was employed exclusively for the erection of the enabling structures on site, ensuring the quality of the enabling structures.
8. Special care was taken during the monsoon season to avoid electrical hazards due to short circuit.
9. Lists of emergency phone numbers were maintained and a copy of it is stuck outside the main office site.
10. A prior arrangement had been made with one nearby hospital to deal with emergencies.
11. All the labourers employed on the site were insured under the group insurance policy.
12. Education for the labourer's children is provided.
13. Regular housekeeping was done and care was taken to see that all the materials were stacked properly after the completion of the activity.
14. Sprinkling of water was done with tankers to reduce dust on the site.
15. Proper illumination of the site was done during the night time.
16. The quality of the scaffolding and the formwork was found to be good
17. The site has a proper job layout.
18. Safety nets were provided around the structure properly

Personal protective equipments were provided to all the laborers working at the site and they were insisted to use those personal protective equipments compulsorily

11. CONCLUSIONS

- The following conclusions can be drawn from the results obtained from the analysis of the sites surveyed.
- Majority of the construction sites in Coimbatore are not having safe working environment
- 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. In particular, it can be seen 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
- 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