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A Review on Identification of Safety Factors InConstruction Project

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Abstract-*The construction industry is concurrently recognized as a major economic force and one of the most hazardous industries. In order to improve the safety performance in construction projects the root causes of construction accidents and factors affecting them are needed to be investigated.The aim of this research is to identification factors affecting safety in construction projects in order to minimize the frequency of accident occurrence.*

KEYWORDS *– Safety, Health, construction.*

1) INTRODUCTION

The construction industry plays a vital role in social and economic development of all country. The importance and role of the construction industry in the economy of a country has been confirmed by several studies, including coble and Haupt (1999).

According to Davies and Tomasin (1996), there are number of reasons why accident records within the construction industry compare poorly with those of the manufacturing industry. There is normally a controlled working environment, with little change in the work procedure and equipment over periods; additionally, the labour force remain constant in manufacturing industry.So the labour force in the factory environment will have good knowledge on the hazards and precautionary steps to be taken for mitigates the hazards in the working environment. However, the case is quite different in the construction industry as the working environment is constantly changing and labour force s also migrating in nature

The International Labour Organization Conference of 1985 in Geneva stated that:"work should take place in a safe and healthy working environment and that conditions of work should be consistent with workers human dignity and that occupational health and safety policies must be established at both government and enterprise level."
International Labour Organization (ILO) and World health Organization (WHO) promoted occupational health of industrial globally. The word 'industrial' was replaced with 'occupational' to embrace all types of employment, instead of restricting it to factories and mines. The International Labour Organization identified the need for action for reducing in the building and adopted a convention (no.62) concerning minimum safety standard in the building industry, as back as in June1937.Thereafter; the organization adopted a comprehensive Convention (no.167) and recommendation (no.175) on safety and health on the construction industry in June 1988.

HSE manager's ultimate aim is "Zero-incident". Safety management is commonly understood as a set of principles, framework and process to prevent accident, injuries and other adverse consequences that may be caused by using a service or a product. To ensure safety in the construction process, safety manager is to be appointed to locatethe system deficiencies and mitigate it. This process is an organizational function, which ensures that all the risk associatedwithsafety have been identified, assessed and satisfactorily mitigated.HSE manager's responsibility is to fulfil the legal requirement and social responsibility,to achieve the predetermined goal of "Zero Incident", it is necessary to know about factors affecting safety.

2) OBJECTIVE

The main objective of this paper is to identify the safety factors involved in Construction projects.

3) DETAIL OVERVIEW OF VARIOUS LITERATURE REVIEWS

Dilipkumar and Kumar neeraj jha (2016):as a result, in Indian construction sector, the number of people dying in construction could be anywhere from 11,614 to 22,080. Considering the minimum estimate of fatal
Accidents, i.e. 11,614, Indian construction sector alone adds 24.20% (=11,614*100/48,000) fatality in the total 48,000 occupational accidents occurring annually in India. The fatality rate (fatal accidents/1000 workers) of UK, Singapore, UAE and Taiwan are reported to be 0.02 in 2013, 0.05 in 2012, and 0.125 in 2011 respectively in their construction sectors while fatality rate is estimated to be 0.22 in India construction sector as per this estimate.

Aksorn, T. and Hadikusumo (2008): Critical success factors influencing safety program performance in Thai Constriction Projects

Factors:
Clear and realistic goal
Good communication
Delegation of authority and responsibility
Sufficient resource allocation
Management support
Program education
Continuing participation of employees
Personal motivation
Personal competency
Teamwork
Positive group norms
Personal attitude
Effective enforcement scheme
Safety equipment acquisition and maintenance
Appropriate supervision
Appropriate safety education and training

Teo, Ling, and Chong (2005): Investigating how project managers may increase the safetylevels of construction sites

Factors:
<u>Policy aspect</u>
Understanding and implementation of safety management system.
Understanding and participation in occupational health and safety management system.
Understanding and implementation of permit-to-work system.

<u>Process aspect</u>
Quality of subcontractors.
Understanding and implementation of safety procedures.
Carrying out work in a safe manner.
Carrying out work in a professional manner.
Type and method of construction.

<u>Personnel aspect</u>
Management s attitude towards safety.
Supervisors and worker s attitude towards safety.
Contextual characteristics of workers.
Personnel aspect
Monetary incentives.
Non-monetary incentives.
Disciplinary action.

Ng, S.T., Cheng, K.P., and Skitmore R.M. (2005): Evaluating safety performance of construction contractors

Factors:
<u>At an organizational level</u>

Implementation of safety management system in accordance with legislation.
Compliance with occupational safety and health legislation, codes and standards.
Definition of safety responsibility.
Development of safety policy.

At project level
Provision of safe working environment.
Development of emergency plan and procedures.
Development of safety committee.
Definition of safety responsibility to all site personnel.

Ibrahim al-abbadi (2015): At the practice of safety risk management must be enhanced in the Qatari construction industry. Construction companies to familiarize employees about the concept of safety risk management should conduct

Factors:
More training
Seminars,
Workshops.

Tan chin keng* and Nadeera abdul razak (2014):
From the research findings,it is concluded that generally the construction site has good and structured safety practices namely

Factors:
Safety policy
Education and training
Site safety inspection, safety auditing and safety meeting
Site safety organization,
Personal protective equipment,
Safety measuring devices
Fall protective systems and safety promotions.

T.Subramani,R.Lordsonmillar (2014):
The work environment 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. Owners of large projects can more actively participate in construction safety management in each stage of project execution including project design contract selection, contract development, the construction phase, selecting safe contractors, and developing the safety culture on the projects through

Factors:
Safety training
Safely recognition programs.

Tam, C.M., Zing, S.X., and Deng, Z.M (2004): Identifying Elements of PoorConstruction Safety Management in China

Factors:
Poor safety awareness of top management.
Lack of training.
Poor safety awareness of project managers.
Reluctance to input resources to safety.
Reckless operations.

Sawacha, E., Naoum S., and Fong, D. (1999): Identify factors influencing safety performance on construction sites.

Factors:
Management talks on safety.
Provision of safety booklets.
Provision of safety equipment.
Providing safety environment.

Appointing a trained safety representative on site.

Fang. D. P., Xie, F., Huang, X. Y., and Li, H. (2004): Discussing an empirical research on workplace safety management performance on construction sites in China

Factors:
Foremen related factors
Frequency of a crew's receiving safety inspection.
Frequency of a foreman's presence in safety meeting.
Frequency of a foreman's reporting safety related matters to manager.
Frequency of a foreman's announcing safety related matters to workers.
Frequency of a foreman's correcting workers unsafe actions.

Worker related factors
Frequency of a worker's smoking on the site.
Frequency of a worker's breaking safety regulations.
Hours of safety, education per year a worker receives.
Frequency of a worker's partners reminding him of personal safety.

Crew related factors
Frequency of a crew s receiving notices of hazard removal.
Frequency of a crew s breaking safety regulations.
Frequency of a crew is suffering safety penalty.

Manger related factors
Frequency of a project manager s presence in safety meeting.
Frequency of a project manager is hearing safety reports.
Frequency of a project manager's discussing safety matters with subcontractors.

Safety training related factors
Days of safety, education per year a safety officer receives.
Hours of safety, education per year a foreman receives.
Frequency of a foreman's reminding new workers of safety regulations.
Ratio of workers whose occupational experience is less than 1 year to total workers on site.

4) Major Outcome to Identify Safety Factor:

A) PLAN
-To do conceptual study about
Management system overview, Company system and standard
Regulatory requirement and Safety design concept
OSHA recognized, generally accepted good engineeringpractice, and BAST (best available and safest Technology) consideration.

Safety induction-It isan initial phase; Responsibility of HSE department is to provide an overview about the project and give formal orientation about safety to the newly joined Employee.

Content to be included in the formal orientation

Policy and Mission,Vision of project	Respond inEmergency	Toolbox-talk, Handling of power tools
Safety Regulation and Rules	Permit for work	Height work, Electrical work.
Fire Safety, Material Handling	First-Aid area, Handling of power tool	Environment condition, Reporting of incidents.
Personal Protective Equipment	Provide Detail to HSE Staff	General Utility and Welfare

ER no	Name	Designation	Nationality	Pp/id no	Date	sign

After orientation, record the detail as per thebelow Given format;

B) Do

Review of Activity and Method Statement-Prior tomaking assessment, HSE department has to know detail of activity and refer the method statement of concern activity so they can make adequate changes to mitigate the risk.

Method Statement content format

Purpose	Why Carry out work
Scope	In which Area work Carry out
Reference standard	Approval Drawing by DM and Specification and standard
Control Measure	Ensure All require Permission and an approval Status of work
Methodology	Follow the method as per define
Job Responsibility	Who responsible person for concern work
Resources	Required equipment/material

C) Check

Documentation reviews: Review of project plans, prior project files and initial step taken by project team

Gathering information:
Brainstorming: Brainstorming is the most frequently used identification technique. The goal is to obtain list of safety affecting factors that can be addressed later in qualitative and quantitative safety analysis processes.

Checklists: Checklists for the identification can be developed based on past information and knowledge that has been accumulated from previous similar projects. Advantage of using checklists is that safety affecting factors identification is quick and simple.

For physical Evidence:
Position of injured workers
Equipment being used

Material being used
Safety device in use
Damage of equipment
Housekeeping of area
Weather Condition
Lighting and noise level

For Ensure Safety in work:
Risk Assessment-After gathering detailed information about the activity frommethod statement, HSE manager carries out the risk assessment based on the knowledge and experience.

TRA (Task Risk Assessment)-Prior toassessing risk, HSE manager identifies the risk involved in theactivity by makingthe S* P (Severity * Probability) = Risk rank and Risk value. If the ranking and risk value is not acceptable then HSE manager reassess all the condition and make a fresh new assessment plan to reduce and mitigate the risk in such a way that the ranking and risk value drops down to acceptable limits.
Risk rank and risk value is decided by HSE manager based on his past experience and vast knowledge in the field of construction.

Risk assessment format

A	H & C	Harm	S	P	RISK	S*P	Con mesa,	R	Rasp

Full Forms of Above listed words.

(A) Activity
(H &C)Hazard and Consequences
(Harm)Who will be harm?
(S) Severity
(P)Probability
(S*P)Risk Rank = Severity * Probability
(Con mesa) Control Measure
(R)Residual Risk
(Rasp) Responsible person

HSE department of company prepares risk matrix

Probability	Consequences				
	Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
Rare 1	1	2	3	4	5
Possible 2	2	4	6	8	10
Likely 3	3	6	9	12	15
Often 4	4	8	12	16	20
Frequent 5	5	10	15	20	25

Risk influences
1-10 - Low
10-20 - Medium
20-25 - High risk

D) Act

For constantly improve the safety affecting factor performance in construction work, it's necessary to follow below steps

Toolbox Talk-Guide all the labour/employ about safety.in concern work. Itis conductedevery morning before starting the work at assembly point and the labours are guided about the risk associated and the safety measures to be taken to prevent the risk.

SOP(Safe operating procedure-Detailed instruction about the activity are given by the assistant officer of the HSEdepartment.

Monthly inspection- The safety tools are inspected periodically by the officer and the inspection report is marked by attaching a tag to it. Usually the colour code for the tag is changed every three months.

Permit to Work - Major activity in which risk rank and risk value is high, can only be carried out after taking necessary permission from the HSE department. For example,

- Firework,
- Height work
- Excavation work

Audit –Audit is carried out to review the actual work carried out on the site with the standard procedure and safety rules to ensure that all the necessary steps are being effectively followed. If any deficiency of malpractice is observed it should be brought in notice to the management and also inform it to the employee

Make-Report (Violence) -If any major issue is found during audit by the HSE officer it is brought in notice to the concerned department to take corrective action in a defined period of time. If the same issue prevails after the defined time interval, the HSE officer may then make violence report against the concerned department.

Receive Respond-On receiving the violence report, the concerned department has to take the necessary action and respond to the HSE department. If the received respond is correct then move for close out phase.

Closeout–If receive respond is correct then close the report and respond the concern department, but if the respond is not at par with the requirement then such an incident is brought in notice to Project Manager and is considered a serious offence.

Data Record-Maintain the record and data in the form ofDPR (daily progress report)and WPR (weekly progress report). The data are further used to analyse and avoid future risk.

5) IDENTIFIED FACTORS

It is more important to identify specific factors that are significantly important towards building successful safety programs leading to satisfactory outcomes and safety performance. Furthermore, many factors needed to be desirably classified so that few and essential critical safety factors representing a main root of wide variety of issues can be revealed. Accordingly, to improve project safety, safety factors must be considered in the construction lifecycle form beginning of project to its end. In this paper, on the basis of previous researches to find out critical safety factors in construction project are reviewed

No	Risk Factor
A	**Project Nature**
1	Arrangement of site
2	Application of new technology in construction in construction project
3	Lighting the site during night work.
B	**Emergency planning and implementation**
4	Make a plan to respond in Emergency
5	Provide Training to workers regarding respond in emergency
C	**Signs and Barricades**
6	Use danger signs
7	Use caution and instruction signs
8	Use barricades to close the working area

D	**Worker perception**
9	Worker safety awareness and knowledge
10	Worker safety training received
11	Relation with other workers and management
12	Workers education and Experience
E	**Management Commitment**
13	Availability of standard safety policy
14	Management attitude towards works
15	Safety Awareness of company's top management
16	Liable Persons of Sites (Foreman, site manager) always inform me on safety work.
17	Likelihood and Severity of risk in site are identified and included in Training.
D	**Safety Inspection**
18	Periodically safety inspection by government authorities
19	Periodically Safety inspection by management
E	**Safety Meetings**
20	Conduct Tool box talk before each activity Start
21	Attend Safety meeting by Top management
F	**Economic Investment**
22	Allocate Sufficient Budget for safety
23	Insuring with insurance Firm
G	**Safety Training and Educating**
24	Proper Guidance and Training of workers Regard Safety
25	Safety Poster
26	Management held safety Seminar
27	Guide and Train of workers for First-aid
H	**Welfare Facilities**
28	Provide Sufficient rest and Food eating Area
29	First Aid Facility
30	Provide Hygiene lavatories and washing area.
31	Food and drinking water Facility
I	**Disposal of waste materials and Hazardous materials**
32	Establish Risk management plan
33	Establish a Waste management plan
34	Quick Remove the waste out of the site.
J	**Perception About Equipment and Tools**
35	Provide Suitable equipment to perform the task safely
36	Use of PPE(Personal protective equipment)

6) Conclusion

In Construction Project achieving "Safe man Hour" (with no Fatality or no major Injury) continues improvement in Safety affecting factors are necessary. However, by taking adequate action and timely precaution it can be improve to some extent. This review analyzing and finding the possible measures to the construction projects in order to boost the performance for identified factors in the future projects. In this paper, various safety affecting factors in every construction project has been analyzed to avoid this in the future construction projects.

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