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# Safety Management in Construction Projects

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**Abstract:** Construction work is a land-based hazardous job. In a change in countries, construction activities have been increasing over the past few years. Behavior-Based Safety (BBS) Program is a great way to change the safety cultures in the organization. Past, Behavior-Based Safety literature papers show the successful cases and also mixed effectiveness in increasing the safe behavior of workers. Data are collected by three techniques Questionnaire survey, Digital interpretation (through CCTV) and from previous case studies such as from field checklist and recorded data. The collected data are analyzed through a manual and software method. The manual method includes Root cause-effect analysis and Statistical analysis. This paper deals with the root cause-effect analysis of safety management in construction projects and also given the framework for safety activity analysis. Prevent measures are suggested after interpreting the results to obtain from the above analysis.

**Keywords:** Construction site safety, Behavior based safety, Safety planning, Root cause analysis, Preventive action.

## I. INTRODUCTION

The construction industry is the second-largest economic activity in India after agriculture and it has accounted for 40% of the development investment during the last 40 years. In August 2016, India has been ranked 35th among 160 countries for Infrastructure development. The construction sector is known as one of the most hazardous workplaces worldwide. Development wellbeing is a significant reason for worry in the working scene, as it is one of the most hazardous.

According to the Bureau of labor statistics (BLS), the fourth most dangerous profession with the second most fatal injuries. It is perhaps the second most risky land-based calling after the angling business. Providing safe working environments is a major social responsibility and challenge to every industrial sector. However, construction workers are generally illiterate and unskilled in India. They migrate temporarily to far-away cities in search of jobs. The different groups of workers employed in a project come from different cultures and speak different languages. Development mishaps cause human misery and financial misfortunes.

### A. Construction Safety Management

Development wellbeing includes any security strategy that is identified with the development business or building locales. Development wellbeing expects to guarantee that a building site or the business all in all isn't the reason for impending threat to the general population around a building site or the laborers at a building site. A security the executives framework for development is a deliberate method for recognizing dangers and overseeing dangers identifying with the development work environment.

### B. Construction Safety Management System

Basically, a security the board framework for development is a precise method for recognizing perils and overseeing dangers identifying with the development working environment. The wellbeing the board framework must incorporate the development organization strategies, techniques, frameworks, hierarchical arrangement, and accountabilities for ensuring that the vital precautionary measures have been taken and are being kept up for the security of all concerned. More than this, the security the board framework must be installed in the way of life of the organization, with the goal that it is applied by all. An appropriately performing SMS will commonly include: Recognizable proof of all security dangers identifying with the organization's exercises and evaluation of the hazard related with each risk. Hazard the board methods to hold chance from dangers down to adequate levels (which may at times mean a degree of zero).Continual observing with normal assessment of security execution. Ceaseless improvement of the adequacy of the security the executives framework. These things are much of the time oversaw in a "Plan-Do-Check-Act" cycle of constant improvement, or a PDCA cycle for short.

Plan. From the danger and hazard evaluation, the security arrangement and techniques are characterized and the assets dispensed for placing them energetically. Do. The arrangement and systems are applied. Check. Security execution is estimated, so as to keep an eye on the importance, fulfillment, adequacy, and proficiency of the usage. Act. Any suitable healing measures or enhancements

are characterized, driving go into the arranging step (1) above, to restart the cycle. A wellbeing the executives framework is a technique, as opposed to an item. The execution of a security the executives framework might be paper-based or programming based, for example. Be that as it may, the usage must be archived and auditable, implying that a wellbeing investigator (among others) can check it.

### C. Construction Accidents

Almost 60,000 deadly mishaps occur at building locales around the world (International Labor Organization, 2005). This compares to roughly one lethal development mishap at regular intervals. One in every six deadly mishaps at work happens at a building site. Mishap doesn't simply occur, they are brought about by dangerous acts, perilous conditions or both. Most mishaps result from a blend of contributing causes and at least one hazardous acts and perilous condition. So as to improve the general security execution, we have to explore the underlying drivers of development mishaps. The "Deadly Five" Accident were answerable for 62% of Construction specialist passing's in 2016

### D. Primary Causes of Accidents

The following are the primary causes of accidents in the construction sites. They are 1. Unsafe act, 2.Unsafe working condition. Unsafe act: An unsafe act is an act of doing something that has the potential to cause injury, loss or a serious accident. The human action that departs from a standard job procedure or safe practice, safety regulations or instructions Unsafe working condition: An unsafe condition is one in which the physical layout of the work location and the status of the tools, equipment and/or materials are in violation of contemporary safety standards (or) the physical or substance property of a material, machine or nature which could bring about damage to an individual, harm or obliteration to property or different types of misfortunes.

### E. Root Cause Analysis

Root-cause analysis is usually utilized in proactive management to spot the basis explanation for a drag , that is, the factor that was the most explanation for that problem. It is customary to ask the basis cause during a singular , but one or several factors may, in fact, constitute the basis cause(s) of the matter under study. A factor is taken into account the basis explanation for a drag if removing it prevents the matter from recurring. A determinant, conversely, is one that affects an event's outcome but isn't the basis cause. Although removing a determinant can benefit an outcome, it doesn't prevent its recurrence with certainty.

## II. LITERATURE REVIEW

Brian H.W.Guo et al, [1] reports a BBS program designed and implemented in the Singapore construction industry. The BBS program was planned for decreasing risky conduct in nine classifications: lifting tasks, uncovering, working at tallness, work stage and access, manual taking care of, hot work (welding/gas cutting), plant and gear, traffic the executives, and individual defensive hardware (PPE). It comprises of customary BBS components, for example, gauge perceptions, input, objective setting, and mediations. In contrast to other successful applications, the BBS program produced mixed results of safety behaviour over 36 weeks. This paper adds to the body of knowledge of behaviour safety program in terms of theoretical basis and implementation. By reviewing the BBS program holistically and reflecting upon the details of the case study, this paper offers lessons and reference for design and implementation of BBS program in the construction industry

Ibukun G. Awolusi et al., [4] this study contributes to the body of knowledge by providing a methodical and operational safety activity analysis framework that can be used to proactively monitor safety performance, set improvement targets, and provide continuous feedback to enhance safety performance on construction sites and also provides a safety activity analysis tool that is a management information system that changes a difficult and incapable manual strategy for gathering and investigating wellbeing information into an increasingly practical PC based methodology.

Xiuwen sue dong et al., [9] examined the construction face database (CFD), a quantitative database created from reports of the fatality assessment and control evaluation (FACE)program directed by the national institute for occupational safety and health (NIOSH).for 42% (325) of the 768 fatalities remembered for the CFD.individual fall capture frameworks (PFAS) were not accessible to the greater part of the fall decedents (54%); almost one of every four fall decedents (23%) approached PFAS, however Lack of access to PFAS was particularly high among residential building contractors as well as roofing, siding, and sheet metal industry sectors ( 70%). In addition to stronger enforcement, educating employers and workers about the importance and effectiveness of fall protection is crucial for compliance and fall prevention.

Dilipkumar et al., [10] attempts to estimate fatal accidents of construction sector for all states in India. These evaluations depend on solid data inferred for the development segment of National Capital Territory (NCT) Delhi district utilizing various sources. This examination further ventures the deadly mishaps for all states dependent on working populace information got from Census. The quantum of development work in all states are separated dependent on their information on concrete utilization utilizing direct entomb and extrapolation techniques. In accordance with this gauge the base number of individuals that would have kicked the bucket yearly in Indian development area from 2008 to 2012 was 11,614. The assessments introduced here would help in drawing consideration of all partners to take medicinal measures

Rafiq M. Choudhry et al., [7] receives and builds up an administration approach for wellbeing upgrades in building site conditions. A thorough conduct wellbeing framework and its mediation program was executed and sent on target building destinations. In the wake of taking half a month of wellbeing conduct estimations, the task supervisory crew actualized the planned mediation and estimations were taken. Their obligation of the wellbeing execution estimates taken by the organization's spectators was checked. An unmistakable increment in wellbeing execution level was accomplished over all classifications: individual defensive hardware; housekeeping; access to statures; Plant and gear, and framework. The exploration uncovers that scores of wellbeing execution at one anticipate improved from 86% (toward the finish of third week) to 92.9% during the ninth week. The consequences of intercession exhibited huge abatements in dangerous practices and huge increments in safe practices.

Dongping Fang et al., [2] proposes a continuous BBS strategy through integrating the BBS practice into management routine. By applying the Supervisory-Based Intervention Cycle, the BBS practice has been integrated into management routine on two construction sites. With proper coaching, the site personnel are able to master the skills of intervention cycle and apply them for safety improvement on their own. Applications of the SBIC and BBSTAS are presented and discussed, indicating that the continuous BBS strategy is a potential approach to achieve persistent safety improvement in construction industry.

### III. OBJECTIVES

The objective of the study is to provide an adequate safety training conveying the latest information to workers which prevents accidents and health problems and to maintain a good working condition.

### IV. METHODOLOGY

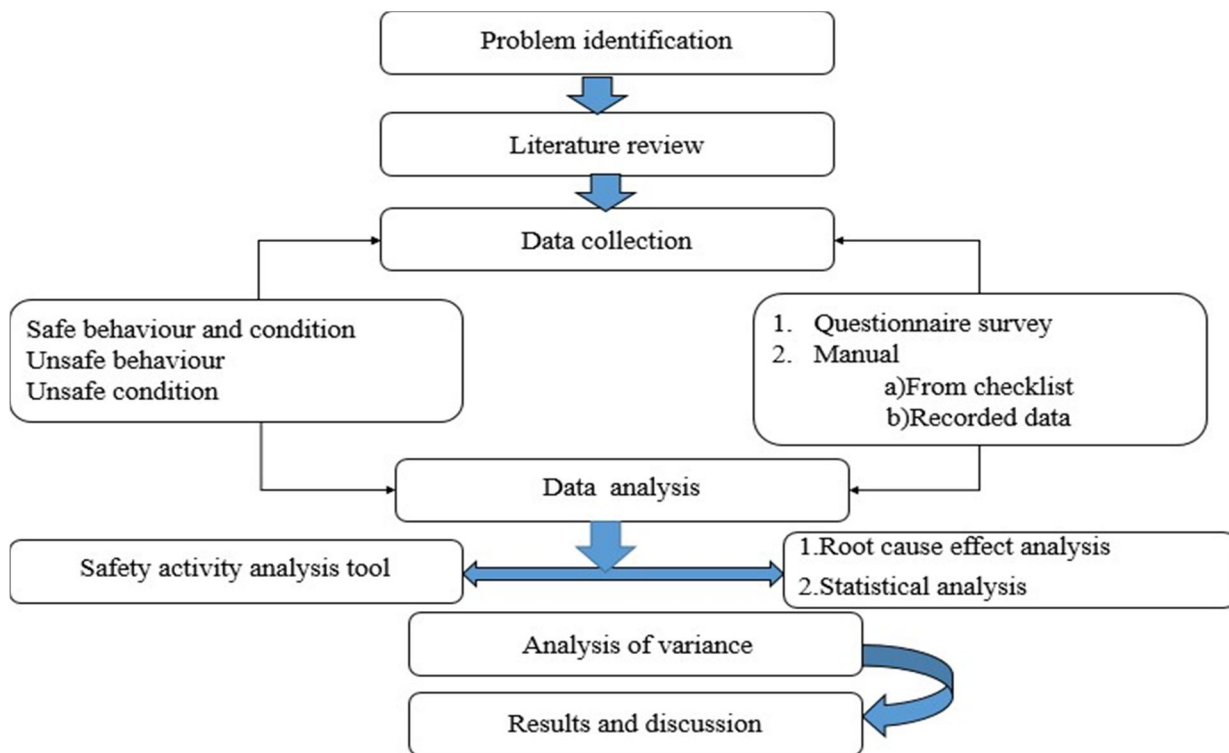


Fig 1.1 Methodology

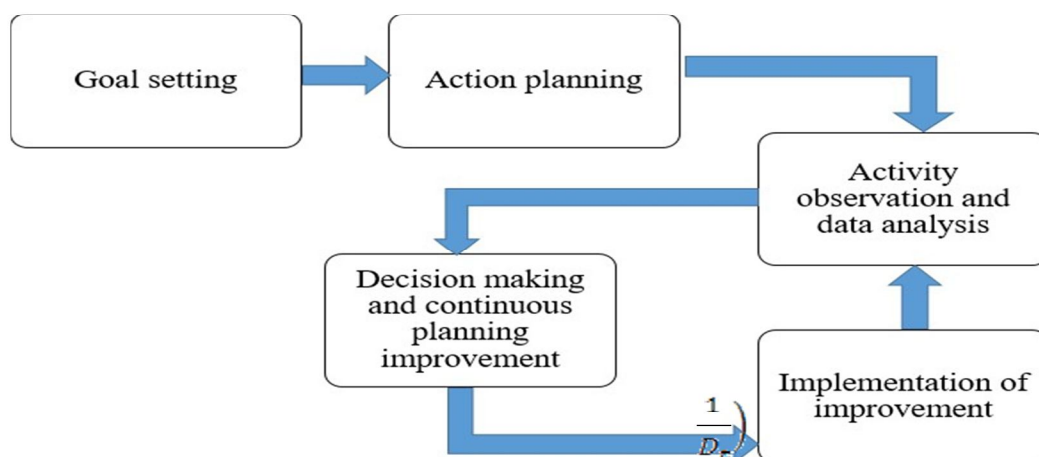


Fig 1.2 Framework for safety activity analysis

A. Collection of Data

Table 1– The Accidents Data On May 2016 To August 2109

Sl.no	Type of accidents	No of accident
1	Slips on the level	3
2	Persons fell from height	5
3	Scaffoldings	2
4	Plant machinery handling	1
5	Equipments	3

V. DATA ANALYSIS

Table 2– Cause and Effects Due To Slips on the Level

Sl.no	Causes Of Accidents	Accident Effects
1	Improper And Defective Shoes	Because of using improper defective shoes persons are injured while carrying shuttering materials. <input type="checkbox"/> 2 Knee joint injury due to improper wearing of shoes <input type="checkbox"/> 2 Foot Injuries due to prickle of nail on foot
2	Shortcut Taken	Because of taking short routes to bridge location and shortcut work to complete the task injuries occur. <input type="checkbox"/> 1 Fracture in leg of carrying over load of materials
3	Poor Lighting	Because of poor lighting at night time the work visit is not visible and at time of concreting minor injuries occur. <input type="checkbox"/> 3 minor injuries occurred due to scratching and slipping

Table 3– Cause and Effects On Equipment Failures

Sl.no	Causes Of Accidents	Accident Effects
1	Out Of Control The Dumper	At time of travelling on steep service roads dumpers lose control due to over loading and rolled down. <input type="checkbox"/> 2 fatal Accident
2	Poor Light And Bad Road Condition	Due to poor lighting on road and bad road condition at rainy season the dumper slips in road way and accident occurs. <input type="checkbox"/> 1 Major injury

Table 4– Cause and Effects Due To Falls On Persons From Height

Sl.no	Causes Of Accidents	Accident Effects
1	Lack Of Safety Belts	While working in soil nailing areas of huge height at time of stitching of mat the tears off of belt occurred and the person falls from height. □ 2 Head injury □ 2 fatal death □ 1 Back bone injury
2	Improper And Defective Ladder Used	While grouting due to improper fixation of ladder without fixing angles and damage of clipboard in ladder occurs and the accident happened. □ 1 Elbow fracture
3	Without Fall Protection from roof top Of the Bridge	While working above bridge due to lack of fall protection accidents occurred. □ 1 major injury occurred

Table 5– Cause And Effects At Plant Machinery Handling

Sl.no	Causes Of Accidents	Accident Effects
1	Due to Miss Timing	While changing from shifts in plants the cleaning of blades happens when the next shift starts person without noticing starts the plant machinery. □ 1 Fatal Death □ 1 Major Injurie
2	Due to Belt and Machine Blade	At the time of moving of conveyer belt when the labour accidently puts ones hand on belt accident occurs. □ 1 Major Injury

Table 6– Cause And Effects On Scaffoldings Failure

Sl.no	Causes Of Accidents	Accident Effects
1	Scaffolding Frame Failure	While fixing rusted defective scaffolding frame at the work site caused instability and injury occurred.
2	Soil Condition	At placing of scaffolding in river sand area caused instability in scaffolding and soil collapses so accident occurred.

## VI. RESULTS AND DISCUSSION

Sl.no	Classification of accidents	No. of accidents In (%) percentage
1	Major injuries	37
2	Minor injuries	13
3	Fatal death	19
4	Others	31

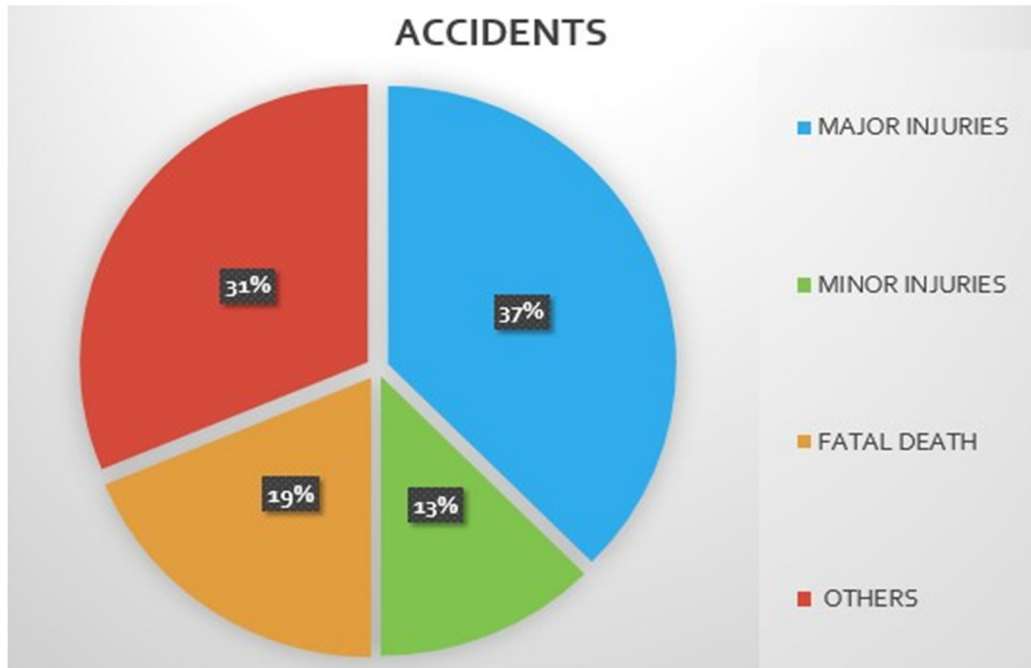


Fig 1.3 classification of accidents

To overcome from all type of accidents the follow preventive measures have to taken

*A. Falls on Persons From Height*

- 1) Temporary barricades must be provided
- 2) Workmen should not be allowed to use newly laid concrete floors
- 3) Proper Zoning has to be provided
- 4) Wear PPE (Personal Protective Equipment)

*B. Slips on The Level*

- 1) Provide and use good quality of PPE
- 2) Proper draining of water must be done
- 3) Proper slope and camber must be provided

*C. Scaffolds*

- 1) Proper planning must be done
- 2) Stability checking must be done in regular interval
- 3) Avoid defective materials
- 4) Check list

*D. Plant Machinery*

- 1) Workmen must be cautious while running machinery Check up and proper signal must be given before work start

*E. Equipment*

- 1) The maintain discipline in work premises
- 2) Avoid defective equipment
- 3) Check list
- 4) Keep proper maintenance of equipment

## VII. CONCLUSIONS

Root cause analysis has been carried out for safety management in construction projects whereas the statistical analysis and safety activity analysis will be done as future work for implementing behaviour based safety programs in construction projects behaviour based safety is designed to encourage people's actions toward safer outcomes, ideally by preventing an accident or injury before it occurs. Implementing a Behaviour-Based Safety program is the most comprehensive way for organizations to promote safety, eliminate hazards and prevent injuries. Construction safety training subsystem contains three aspects, namely, safety training process, safety training materials, and safety training implementation. Controlling is the guarantee of construction safety management. The supervision from corporation, project, and workers team can prevent accidents. All laborers are prepared to see how the program functions and how to complete the obligations appointed to them under the program. Businesses, Directors, and managers get preparing on security ideas and their duty regarding ensuring laborers' privileges and reacting to laborers' reports and concerns. All laborers are prepared to perceive working environment dangers and to comprehend the control quantifies that have been executed.

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