International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 07 | July 2021 www.irjet.net p-ISSN: 2395-0072

DEVELOPMENT OF CONSTRUCTION SAFETY CHECKLIST FOR FALL PROTECTION

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Abstract - *This research represents the status of standards for safety used in construction and identifies areas of technical inconsistency.. Major technical sections of standards norms are compared in a checklist format to highlight the areas which vary and indicate lack of consensus. This information is analysed to develop a list of safety checklist needed for fall protection. A comprehensive understanding of the causal factors in Fall protection incidents is required. In spite of many safety checklist available in the market for different construction activities. The present study deals with the hazards arising in these construction activities.. The paper focuses on the use of survey based research technique along with macro level approach for evaluating different critical factors and proposing several mitigation techniques for avoiding hazards occurring during construction stages of project. The hazard analysis, accident analysis causes of accidents types of hazards were closely studied to achieve unsafe conditions which can be included in the checklist to avoid such falls.*

***Key Words*: Safety Checklist, Fall Protection Construction, Construction Safety, Safety Nets , Guard Rail.**

1. INTRODUCTION

Everyone can see the bigger side of this picture. But behind all this does anyone seriously do think about the life of the workers who work hard day and night to give shape and size to these high rise structures playing on their life's working at height from the ground, sometimes below the ground at low oxygen levels and in many other situations.

Does any organization worry about the safety of workers life??? This is the question for their safety. There life is equally important, they too have families, they too are having responsibilities. The life of the workers should be very prestigious for any organization. For that safety at working place is the most important point that one organization must follow. For this purpose the concept of **checklist** was introduce. running text should match with the list of references at the end of the paper.

Checklist can be used as a guide to help inspect a construction site for common problems. It is not an exhaustive list of items and will not cover all hazards on all sites.

What can be done to reduce falls?

Every site must take a three-step, systematic approach to protecting people from falls.

i) **Eliminate Fall Hazards –** The first step in this approach is to assess carefully the workplace and the work itself in the earliest design/engineering stages of project work and during the planning stages of all work. The objective is to eliminate all fall hazards. Ask "who, what, when, where, why, how, and how much" questions about each possible exposure to a fall.

ii) **Prevent fall –** The second step in continuous fall protection also requires assessing the workplace and work processes. If fall hazards cannot be completely eliminated during the first step, try to prevent falls by improving the workplace. Avoid relying on a worker's behaviour or fall-arrest equipment to prevent injuries. Early installation of stairs, guardrails, barriers, and travel restriction systems can ensure a safe work environment.

iii) **Use the Proper Fall-Arrest Equipment –** The third step is to use fall-arrest equipment. Use fall-arrest equipment, however, only after determining that potential falls cannot be eliminated by changing work procedures or the workplace. Equipment such as harnesses, lanyards, shock absorbers, fall arresters, lifelines, anchorages, and safety nets can reduce the risk of injury if a fall occurs.

2. LITERATUE REVIEW

Many researchers focused on the safety aspect of construction and tried to carve out new inferences and conclusions which would be beneficial for the academic sector as well as the industrial sector.

- A study has presented clearly that the accidents are caused due to unsafe act by victims, unsafe act by co-workers, unsafe conditions created by the worker, unsafe condition created by use or combination of the above. Unsafe acts are due to overconfidence, disregard of instructions, failure to use PPE (personal protective equipment's). [2]
- Through a study it has been established due to lack of proper planning, deficient enforcement of safety and absence of inspection, such accidents occur which may be avoided if the above causes are eliminated.[3]
- Falls are the second most common cause of injury-associated mortality after traffic accidents. They

comprise a significant percentage of blunt trauma cases and emergency department (ED) admissions as mentioned in the report by Kavya k. in her paper.[3]

- In an explanatory research on different types of accidents occurring in construction sites and measures taken to control these concludes that a focused dedication towards safety is needed and also the owners of large projects can more actively participate in construction safety management. [4]
  - In a report published by Madhu Gupta tells that ,it was found –
    - 58% deaths occurred due to fall from heights;
    - 25% deaths occurred due to a wall or building collapsing;
    - electrocution caused 14.5% deaths; and
    - 2% deaths occurred due to mudslides.[5]
  - A report by the Delhi Institute of Human Development shows that less than 30 per cent of workers have completed secondary education and that only one in ten have received training specific to their work. This lack of literacy combined with lack of inspection contributes to escalate the number of fatalities. [6]

3. METHODOLOGY

Pilot study of the questionnaire is achieved by a scouting sample, which will consist of 42 questions. These questionnaires will be distributed to experts.

The questionnaire use a Likert scale of 1 to 5 to explore the respondent's perspective on various factors

Formulate recommendations to improve performance of workers at height and prevent fall protection.

Analysing the responses on MS excel of data analysis section by **Anova: Two- Factor Without Replication.** The cumulative value obtained from this was used for determining the internal consistency (Cronbach's alpha test, also known as reliability test) value of the survey .

The scaling result obtained on MS-Excel through responses obtained from the respondents were formulated into standard formula of Cronbach alpha test and the value obtained was **0.867** which lies under the acceptable range and signifies that survey carried was reliable , acceptable and responses were good.

4. RESULT AND DISCUSSION:

The updated checklist was developed after going through many studies:

FALL PROTECTION CHECKLIST	
Question	**Yes/No**
Anchorage Points	
Do workers know appropriate anchorage points for each task that requires a fall- arrest or restraint system?	
Are all anchorage points capable of supporting at least 2000 kilograms per person attached and supervised by a qualified person?	
Are all anchorage points for body harnesses located at shoulder height?	
Are anchorage points independent of the working surface?	
Does a worker switch from one platform to another or climb up and down without exposure to a fall?	
Attachment of lifeline, lanyard or self retracting to an anchorage point at the elevated work area is permanent or not?	
Do trained inspector perform regular inspection at regular intervals?	
Are written records are maintained on regular basis?	
Is adequate method of rescue of persons working at height worked out depending on the situation before starting of job? Is it documented?	
Are person trained at carryout identified method of rescue?	
Are names of rescuers are displayed at site and communicated to all concerned?	
Can a worker move from one station to another or climb up and down without exposure to a fall?	
Fall Arresters (Rope Grabs)	
Is installed fall arrest system is compatible with the lifeline on which it is operated?	
Is the fall arrester in proper functioning condition?	
In fall arrester equipped with changeover lever that allows it to become a stationary anchor on the lifeline?	
Is the fall arrester equipped with a locking mechanism that prevents which avoids unnecessary engagement of lifeline?	
Is the fall arrester's "up" direction marked correctly to attach equipment to the line correctly?	
Is regular periodic maintenance of fall arrester is done regularly ?	
Lanyard	
Is the lanyard length as per requirement and in no cases greater than 1.8 meters?	
Are manually adjustable lanyards available which can be used when it is required to take slack out of the lanyard?	
Tying of knots should not be done from the lanyard to the lifeline?	
Are double lanyards provided?	

Body Harnesses	
Do full-body harnesses selected for a particular job equipped with all necessary attachment points ?	
Are body harnesses deeply inspected regularly for a n y missing hardware?	
Have workers been instructed for the use and care of body harnesses/body belts?	
Other Considerations	
Is this ensured, a worker will not strike a lower surface or object before arresting the fall?	
Is there any plan of safe methods to rescue fallen workers?	
Is all of the fall-arrest equipment free from precarious of welding , chemical , corrosion, or sandblasts?	
Are all components of the system compatible manufacturer's instructions?	
Have employees been properly trained in the following issues?	
Manufacturer's recommendations,	
Location of appropriate anchorage points and attachment techniques	
Problems associated with elongation, method of use, inspection, andstorage	
Vertical Lifelines	
Does the vertical lifeline has a minimum breaking strength of 2000 kg?	
Is the lifeline protected from abrasive or cutting edges?	
Does the system provide fall protection when the worker connects to and releases from the lifeline?	
Is the lifeline arranged so workers never have to hold it for balance?	
Is the vertical segment consolidated with the horizontal segment to providecontinuous fall protection?	
Horizontal Lifelines	
Has the entire horizontal lifeline system been designed and approved by a qualified person?	
Have the anchorages to which the lifeline is attached been designed and evaluated specifically for a horizontal lifeline?	
Is the maximum number of workers for which system is designed is known to workers?	
Is the rope used free from signs of cuts, wear tear or abrasion?	
Does the rope or cable have the required initial sag?	
Have the workers been warned about possibility of falls?	
Have the clearances been checked?	
Is the hardware riding on the horizontal lifeline made of steel? (Aluminum is strictly not permitted.)	

SUPPORTS SYSTEM & PROCEDURE CHECKLIST

Anchorage / support fixing Points	
Do location of the anchoring / support fixing points inspected for proper location of the support system?	
Do the new support system for access/lifting system like winch, pulley, Climber system, rope access system, cradles/cages etc. as per manufactures EOM?	
In case of other support system, whether sketches are in line with Standard Drawings / method / procedure defined in the safety standards?	
Whether the life line posts are adequately & rigidly connected to the supports?	
Painting Work	
Whether the existing ladders /staircases are adequate and inspected a t r e g u l a r i n t e r v a l for wellness?	
Anchorage / support fixing Points	
Structural support for winch, pulleys system, lifeline supports for fall arrestor etc. are in line with the sketches shown in this standard?	
Do capacity of winches, pulleys, d-shackles & slings /steel wire ropeascertained for not less than 5000 Kg?	
Do steel wire rope / sling as life line for fall arrestor, suspended parallel to hanging cages/cradles?	
Do all sketches, drawings, photographs, pictorials, etc. of this standard have been studied for their applicability as per site needs?	

5. CONCLUSIONS

Based on the responses received and though various literature review the new checklist was developed which included all the points regarding fall protection.

The main objective was achieved by focusing on all the key points which should be included in the safety checklist of fall fall protection. While going through the comprehensive study of safety equipment specially safety net, I found that

the parameter of factor of safety was not included in IS 11507 :1984 in calculation of absorbed potential energy The present study deals with the hazards arising in these construction activities. This thesis will be useful to develop the upgraded safety checklist for fall protection as

The data used in the project was obtained after evaluating the questionnaires supplied to 100 employees of active construction companies out of which 81 active companies corresponded with answered questionnaires.

After the analysis of data obtained through Google questionnaire, I conclude that poor quality of safety equipment used on construction site result in most of the case of falling from height and most of the falls occurred from falling from scaffolds.

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