Study of Ergonomics & Safety in high rise buildings

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***Abstract*- High rise structure are also called vertical cities or high rise means tallest buildings and structure whose height minimum 70feet (21m) and above. The construction industry is one of the major industries in world. It gives tremendous boost to countries economy. It have registered significant amount of growth recent years. In India construction sector employees second best after agriculture. Thus the rate of fatal accident is very high as unorganized labour exposed to serious OHS hazards. The aim of this paper is to study the attitude of our construction companies towards the awareness of safety on construction site, and to establish whether there is any relationship between safety provision for worker and worker productivity on site**

Index Terms- Safety, Construction, High-Rise, Hazards, Worker

1. INTRODUCTION

Presently our country is witnessing the higher growth in infrastructure development mainly in urban areas and there is disproportionate transit of population towards cities, which has generated the need of vertical extension of offices/residential/commercial buildings looking to constraints of land and commutation from far locations to city hub. In addition environment is also affected with the destruction of God gifts such as mountains, forests, trees, rivers, potable water, and agriculture land etc. in its original shape/form. Therefore to maintain fast growth of development along with ecological balance, there is need of High Rise Building.

Construction sector is the largest contributor to central exchequer and it is the 2nd largest employer in the country. It creates more than 45 million jobs either directly or indirectly among various classes of individuals in the country. [1]Every construction work is unique and includes various activities which are depending on labor force. In India total 32% are labor and from that 30% are working on construction sites. [2]

With the construction of high rise buildings issue of safety at the time of construction, access control, resource management with high level protection with human comforts and modern look arises and in turn it is a challenge to engineers to give their best with zero hazards and accidents.

Construction safety and health is often considered as an issue supported by everyone. Unfortunately, when it comes to spending money on health and safety, many people do not feel it is vital to the success of projects. Thus, it is not normally a cost code item, and it is subject to cutbacks if budgetary constraints develop. This stems from the failure of many to recognize that an effective construction safety and health program can reduce job accidents and directly or indirectly reduce project costs.

2. LITERATURE REVIEW

There have been various studies performed on the Safety & Ergonomics in the field of construction, some of them are studied & presented in the following literature review.

Boatman et al. (2012) has been did the study related attitudes and awareness that contractors, unions and workers have about ergonomics and what its status is in practice. They did survey in many construction sites with questionnaire and discussed with those persons who was actually working and facing the muscles problem. Study has been showed that around 40% workers were unaware related that. [5]

Everett (1994) has been presented seven risk factors by overexertion injuries such as static exertion, Repetitive exertion, forceful exertion, posture stresses, vibration, low temperature and localized mechanical stresses. Those factors have been rated by 1 to 3 such as 1 for insignificant, 2 for moderate and 3 for high. This analysis could be used where pre-planned and repetitive activity has been going on. For

that we will be use automation and robotics to avoid over exertion. [6]

Devi and Kiran (2015) has been presented workers musculoskeletal disorders who were working in various industries like Gold Smith, Sewing Machine Operator, Printing press, Brick kilns, Super market cashiers, Taxi Drivers and Sanitation. Result was the problem of upper extremity which includes the problems of pain in neck, shoulders, wrist, elbow, back is 80,20,45,75% found to be is highest among the gold smith workers preceded by problem of upper extremity among the brick kilns workers is (73 %). The workers of sewing machine operators and newspaper printers have less level of discomfort as only 16, 41 present. [7]

Ayat Al swaity, AdnanEnshassi (2012)the aim of this paper is to assess and understand the level of ergonomics awareness in the construction industry and to recognized current safety practices. The method used in collecting the data was by sites interpretations, its remarks and discussions with safety engineers, contractors and labours. The findings of study indicate that strains and sprains are the most prevalent types of injury resulting in the back being the part of the body mainly affected. The majority of these injuries are due to overexertion in lifting and carrying heavy materials. Safety and ergonomics measurements in Gaza are not applied in construction firms; ignoring safety rules by the employers and lack of their knowledge of ergonomics principle are the main causes of real and fatal injury and illness. Ergonomics, work related musculoskeletal disorder, workplace, construction ergonomics, and good practices. Overall, the findings of this study could still provide helpful direction and insights into ergonomic work practices. [8]

PanchalVarsha G., DodiyaParth I. (2013)the aim of this study is to study the attitude of construction companies towards the awareness of safety on construction site, and to establish whether there is any relationship between safety provisions for worker and worker productivity on site. Objectives like investigate construction companies' attitude towards safety provision for their workers on site, create awareness on safety programmers in order to reduce the number of workers compensation claims and cost due to accident, examine government safety regulations on construction companies and their compliance for the benefit of their workers were focused during study. The mode of study is based on the site observations and operatives 'questionnaire. Factors such as safety at workplace, types and causes of accidents, economic impact of accidents were basically focused during study by author. [9]

3.0 METHODOLOGY

1. The survey technique is significant in gathering information from site supervisors and the workers on the construction sites by use of interviews.
2. Descriptive research is used for this study since it helps to identify the nature of the health and safety measures used on the construction sites and evaluate their enforcement mechanisms on construction sites as practiced.
3. Implementation of preventive measures to reduce the risk of accident on current site by case study.
4. Conducting field research using questionnaire
5. Survey.

4. DATA COLLECTION

4.1 Health & Safety Risks in Construction:

The construction industry accident casualty rate stands at more than double that of the all sector average – more minor accidents are almost incalculably more. Put simply, construction sites are a health and safety nightmare – almost every possible hazard exists within this constantly changing working environment.

Working at Height: The construction of buildings – or indeed, demolition works – frequently requires tradesmen to work at height. The risks associated with working at a height are often increased by added access and mobility restrictions. Training, including safety awareness training is essential for employees required to work at height.

Moving Objects: A construction site is an ever changing environment; hazards are inherent to this industry and only increase as a construction project progress, as things rise and expand.

Slips and fall: When you consider the diverse range of activities going on at a construction site at any one time it seems hardly surprising slips and falls happen on an almost daily basis.

Noise: Noise is a major hazard within theconstruction industry. Repetitive, excessive noise causes long term

hearing problems and can be a dangerous distraction, the cause of accidents.

Material & Manual Handling: Materials and equipment is being constantly lifted and moved around on a construction site, whether manually or by the use of lifting equipment. Different trades will involve greater demands, but all may involve some degree of risk.

Where employee's duties involve manual handling, then adequate training must be carried out.

Collapse: Not exactly a hazard, more a risk – an accident in waiting.

Every year excavations and trenches collapse bury and seriously injure people working in them – precautions need to be planned before the work starts.

Airborne Fibers & Materials – Respiratory

Diseases: Construction sites are a throng of activity and kick up a lot of dust an often invisible, fine, toxic mixture of hazardous materials and fibers that can damage the lungs, leading to diseases such as chronic obstructive pulmonary, asthma and silicosis.

Electricity: On an average, three construction industry workers are electrocuted each year during refurbishment work on commercial and domestic buildings. People working near overhead power lines and cables are also at risk.

4.2 Hazards & Solutions:

1. Scaffolding:

Hazard: When scaffolds are not erected or used properly, fall hazards can occur. About 2.3 million construction workers frequently work on scaffolds. Protecting these workers from scaffold-related accidents would prevent an estimated 4,500 injuries and 50 fatalities each year.

Solutions:

1) Scaffold must be sound, rigid and sufficient to carry its own weight plus four times the maximum intended load without settling or displacement. It must be erected on solid footing.
2) Unstable objects, such as barrels, boxes, loose bricks or concrete blocks must not be used to support scaffolds or planks.
3) Scaffold must not be erected, moved, dismantled or altered except under the supervision of a competent person.

2. Fall Protection:

Hazard: Each year, falls consistently account for the greatest number of fatalities in the construction industry. A number of factors are often involved in falls, including unstable working surfaces, misuse or failure to use fall protection equipment and human error. Studies have shown that using guardrails, fall arrest systems, safety nets, covers and restraint systems can prevent many deaths and injuries from falls.

Solutions:

1) Consider using aerial lifts or elevated platforms to provide safer elevated working surfaces;
2) Erect guardrail systems with toe boards and warning lines or install control line systems to protect workers near the edges of floors and roofs

3. Ladders:

Hazard: Ladders and stairways are another source of injuries and fatalities among construction workers. OSHA estimates that there are 24,882 injuries and as many as 36 fatalities per year due to falls on stairways and ladders used in construction. Nearly half of these injuries were serious enough to require time off the job.

Solutions:

1) Use the correct ladder for the task.
2) Make sure that ladders are long enough to safely reach the work area.
3) Mark or tag ("Do Not Use") damaged or defective ladders for repair or replacement, or destroy them immediately.

4. Stairways:

Hazard: Slips, trips and falls on stairways are a major source of injuries and fatalities among construction workers.

Solutions:

1) Stairway treads and walkways must be free of dangerous objects, debris and materials.
2) Slippery conditions on stairways and walkways must be corrected immediately.
3) make sure that treads cover the entire step and landing.

5. Trenching:

Hazard: Trench collapses cause dozens of fatalities and hundreds of injuries each year. Trenching deaths rose in 2003.

Solutions:
1) Never enter an unprotected trench.
2) Always use a protective system for trenches feet deep or greater.
3) Employ a registered professional engineer to design a protective system for trenches 20 feet deep or greater.

6. Cranes:
Hazard: Significant and serious injuries may occur if cranes are not inspected before use and if they are not used properly. Often these injuries occur when a worker is struck by an overhead load or caught within the crane's swing radius. Many crane fatalities occur when the boom of a crane or its load line contact an overhead power line.
Solutions:
1) Check all crane controls to insure proper operation before use.
2) Inspect wire rope, chains and hook for any damage.
3) Know the weight of the load that the crane is to lift.
4) Ensure that the load does not exceed the crane's rated capacity.

7. Hazard Communication:
Hazard: Failure to recognize the hazards associated with chemicals can cause chemical burns, respiratory problems, fires and explosions.
Solutions:
1) Maintain a Material Safety Data Sheet (MSDS) for each chemical in the facility.
2) make this information accessible to employees at all times in a language or formats that are clearly understood by all affected personnel.
3) Train employees on how to read and use the MSDS.

8. Forklifts:
Hazard: Approximately 100 employees are fatally injured and approximately 95,000 employees are injured every year while operating powered industrial trucks. Forklift turnover accounts for a significant number of these fatalities.
Solutions:
1) Train and certify all operators to ensure that they operate forklifts safely.
2) Do not allow any employee under 18 years old to operate a forklift.
3) Properly maintain haulage equipment, including tires.

9. Head Protection:
Hazard: Serious head injuries can result from blows to the head.
Solution:
Be sure that workers wear hard hats where there is a potential for objects falling from above, bumps to their heads from fixed objects, or accidental head contact with electrical hazards

4.3 Safety Checklists
The following checklists may help you take steps to avoid hazards that cause injuries, illnesses and fatalities. As always, be cautious and seek help if you are concerned about a potential hazard.
Personal Protective Equipment (PPE)

Eye and Face Protection:
a) Safety glasses or face shields are worn anytime work operations can cause foreign objects getting into the eye such as during welding, cutting, grinding, nailing (or when working with concrete and/or harmful chemicals or when exposed to flying particles).
b) Eye and face protectors are selected based on anticipated hazards.

Foot Protection:
a) Construction workers should wear work shoes or boots with slip-resistant and puncture-resistant soles.
b) Safety-toed footwear is worn to prevent crushed toes when working around heavy equipment or falling objects

Hand Protection:
a) Gloves should fit snugly.
b) Workers wear the right gloves for the job (for example, heavy-duty rubber gloves for concrete work, welding gloves for welding, insulated gloves and sleeves when exposed to electrical hazards).

Head Protection:

a) Workers shall wear hard hats where there is a potential for objects falling from above, bumps to their heads from fixed objects, or of accidental head contact with electrical hazards.
b) Hard hats are routinely inspected for dents, cracks or deterioration.

Electrical Safety:

a) Work on new and existing energized (hot) electrical circuits is prohibited until all power is shut off and grounds are attached.
b) An effective Lockout/Tag out system is in place.
c) Frayed, damaged or worn electrical cords or cables are promptly replaced.
d) All extension cords have grounding prongs.
e) Protect flexible cords and cables from damage. Sharp corners and projections should be avoided.

Floor and Wall Openings:

a) Floor openings (12 inches or more) are guarded by a secured cover, a guardrail or equivalent on all sides (except at entrances to stairways).
b) Toe boards are installed around the edges of permanent floor openings (where persons may pass below the opening).

Elevated Surfaces:

a) Signs are posted, when appropriate, showing the elevated surface load capacity.
b) Surfaces elevated more than 48 inches above the floor or ground have standard guardrails.
c) All elevated surfaces (beneath which people or machinery could be exposed to falling objects) have standard 4-inch toe boards.
d) A permanent means of entry and exit with handrails is provided to elevated storage and work surfaces.

5.EXPERIMENTATION:

We prepare case study on residential high rise project which Bagad Properties Nasik. 2 stages high rise project namely natures pride & natures bliss respectively stage one i.e. natures pride which is 70% completed and another one is natures bliss which is 10% completed or foundation level both the stages are now yet to complete we arrange case study on both the projects what hazards or accidents labors has face on first stage or site after this we prepare safety awareness, audits ,interviews ,seminars etc at first time of visit we found ratio of safety was negligible for ex. During high rise construction project safety belt and kit use of 20 labors actually use only 2 to 5 labors at site then we found increases percentage of awareness towards employers are aware of their duty of care to employees, visitors, and those that may be affected by their activities, and will manage the site effectively, implementing appropriate accident prevention measures. Risk assessments are carried out by management to identify hazards and risks posed.

safety through checking of daily worksheet program which updated day by day all of this charts survey increasing percentage shows graphically and systematically which is yet to come in final presentation report and seminar now we are studying and research on safety work towards conclusion.

6.CONCLUSION

This paper concluded that consideration of Safety, Health and Environment leads to healthy and safe working environment and safety work practices. The various types of accidents that exits on construction site and their respective control measures revel in this study. Awareness about safety, health and environment can be created in every individual associated with the project. It can be also concluded that there are several control factors that significant to be taken into consideration in order to improve the implementation of ergonomics and reduced the ergonomics risk factors. More research work is still required in this field, so great scope of research is accessible for new researchers in this

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