"Review Paper on Worker's Safety in Highway Work zone"

Pooja Gohil[1], Akash Parekh[2],Deep Patel[3]

[1]Assistant Professor, Civil Department, Indus Institute of Technology& Engineering,Rancharda, Thaltej, Ahmedabad, Gujarat 382115.

[2]M.Tech. in Construction Project Management student (2016-2018), Indus Institute of Technology& Engineering Rancharada, Thaltej, Ahmedabad, Gujarat 382115.

[3]Assistant Project Manager, Tata Consulting Engineers, Ahmedabad, Gujarat

[1]poojagohil.cvl@indusuni.ac.in, [2]akashparekh541@gmail.com,

Abstract

In this paper author presents workers' safety circumstances in highway work zone. There is no workers' safety awareness shown during highway construction. So many accidents occur at highway work zone. This paper shows the importance of safety for workers who work at highway work zone. It also shows the general duties and privileges of workers. In this paper it is found that higher rate of accidents occurs at highway work zone during past years and there is less improvement of worker's safety at work zone. This paper shows the common causes of injury at highway work zone. Hence there is a higher requirement of safety awareness for workers at work zone.

Key words: safety in highway construction, important of safety in highway construction, important of worker safety, duties and privileges of worker.

Introduction

Construction work is a hazardous based job. Some construction site jobs include: building houses, roads, tree forts, workplaces and repair and maintain infrastructures. This work includes many hazardous task and conditions such as working with height, excavation, noise, dust, power tools and equipment. The most common fatalities are caused by the fatal four: falls, being struck by an object, electrocutions, and being caught in between two objects.

History

The National Institute for Occupational Safety and Health (NIOSH) reports that roughly 20,000 construction workers are injured each year in highway and street construction accidents. According to the Bureau of Labour and Statistics, approximately 100 construction workers are killed each year – 101 in 2008, 116 in 2009, 106 in 2010, 122 in 2011, 133 in 2012 and 105 in 2013. Census of Fatal Occupational Injuries (CFOI) data indicates that 55% of fatalities occur within the work zone itself.[7].

According to the Bureau of Labour and Statistics, transportation incidents accounted for 66% of fatal roadway worksite incidents. In most of these occurrences, a worker was hit by a moving vehicle. Incidentally, backing vehicles accounted for 27 of the 48 pedestrian vehicular incidents. 60% of cases involving workers hit by backing vehicles involved dump trucks.[7].

Fortunately, fatalities have fallen significantly since the 1960s, with 1.37 fatalities for every 100 million miles of travel, as opposed to 5.5 fatalities in 1966[7].

Need for Study

The construction industry has historically encountered far more injuries and fatalities than it statistically should. According to the 2005 Bureau of Labour Statistics Report for Kentucky, the construction industry represented 4.58% of the state-wide employment, while it accounted for 11.48% of the state-wide fatalities. (Bureau of Labour Statistics, 2005) In theory, a represented industry should produce equal proportions of fatalities with respect to its relative market size; however, this is not true because some industries contain more risk than others [8].

Objective

- Objective of author is to study the importance of safety in highway construction work zone.
- To Study Basic Safety Structures Required In Highway Construction For Workers.
- Purpose A Crash Prediction Model For Workers In Highway Work Zone.

Hazards to Construction Worker

The leading safety hazards on construction sites include falls, being caught between objects, electrocutions, and being struck by objects. These hazards have caused injuries and deaths on construction sites throughout the world. Failures in hazard identification are often due to limited or improper training and supervision of workers.Areas where there is limited training include tasks in design for safety, safety inspection, and monitoring safety.[9].

Failure in any of these areas can result in an increased risk in exposing workers to harm in the construction environment. Falls are the leading cause of injury in the construction industry, in particularly for elder and untrained construction workers. In the Occupational Safety and Health Administration (OSHA) Handbook (29 CFR) used by the United States, fall protection is needed in areas including but not limited to ramps, runways, and other walkways; excavations; hoist areas; holes; form-work; leading edge work; unprotected sides and edges; overhand bricklaying and related work; roofing; precast erection; wall openings; floor openings such as holes; residential construction; and other walking/working surfaces. Other countries have regulations and guidelines for fall protections to prevent injuries and deaths [9].

Type of Hazards

- Working at Height
- Moving Objects
- Slips, Trips, & Falls
- Noise
- Hand Arm Vibration Syndrome
- Material & Manual Handling
- Collapse, Electricity
- Asbestos, Airborne Fibers & Materials – Respiratory Diseases

How to Improve Safety

Construction Industry in India has changed drastically during the last few decades. It is the second largest employing sector next to agricultural sector, but first in terms of accidents close to the road accidents. It is observed that many of the Construction projects are not working with respect to safety and emergency management which is the primary cause of a major number of accidents. By using safety and emergency management model (SEM) these accidents may be reduced up to a large extent. SEM model is helpful for motivating towards the safety and it increases the company's profit due to fewer accidents[1].

Road safety signs are a simple tool used in influencing drivers on orientation and information waits ahead. New evolutionary road safety signs by using electronics devices in assisting road users are widely in practice, yet the conventional vertical road signs which are strategically placed along roads will be part of the road environment for many years to come. The modernization of safety signs on road construction site are foresee for generations by various authorizes in ensuring both public and contractors safety. It is important when designing and installing a system to ensure it is visible at all times and to minimize fatal incidents. Although many authorities understand the road safety regulations as a tool to minimize fatal accidents in road construction sites, few have actually put it into practice [2].

Truck-related crashes contribute to a significant percentage of vehicle crashes, which often result in injuries and fatalities. There was a significant increase in crash severity when a truck crash occurred in work zones. Due to the difference of driving patterns between passenger car drivers and truck drivers, there was a need to study the truck speed profile and passenger car speed profile in order to determine the effective location of utilizing a PCMS in the upstream of work zones. In this paper, the truck and passenger car speed profile models were developed for three situations: (1) a PCMS at 750ft away from the W20-1 Sign; (2) a PCMS at 575ft away from the W20-1 Sign; and (3) a PCMS at 400ft away from the W20-1 Sign. Compared with the Situations One and Three [3].

From the study it is found that if proper attention and safety management strategies are not applied at the highway construction projects there will be higher accident rate and loss of life, property etc. The study also concludes that safety management is essential for highway construction activities in curtailing losses and improving efficiency. The supplementary commendations can be provided as safety management strategies founded on this study and from other sources: 1. including safety management as an important part of every highway construction projects. 2. Developing code of practices, manual on safety, poster presentation and public workshop for every highway construction projects (DPW, 1965). 3. Improved traffic control is the most direct method to reduce highway work zone fatalities [4].

Through the analysis of the influence that Transition Area Length and Speed Limit Value on work zone safety and mobility can get a conclusion as follows. Gain the influence model that Transition Area Length and Speed Limit Value on the work zone safety and mobility that bring a quantitative method for factors influence on safety and mobility, and provide basis for choosing maintenance projects and reliable means for optimizing it.For limiting knowledge and time, there are some contents need to be further studied, for example, this paper only studies highway maintenance on four-lane, two-way highways closing kerb lanes, further studies can spread this method to other types[5].

Construction incidents have numerous root causes, but one of the most frequent is worker behavior. Therefore, construction safety management systems should be designed to maximize the number of safe behaviors by workers, and focus on the execution of construction safety management to achieve excellent safety performance. Operational excellence, a safety concept from the chemical processing industry, is defined as doing the right thing, the right way, every time – even when no one is watching[6].

Construction industry has accomplished extensive growth worldwide particularly in past few decades. For a construction project to be successful, safety of the structures as well as that of the workers is of extreme importance. The safety issues are to be considered right from the

design stage till the completion and handing over of the structure. Construction industry employs skilled and unskilled labors subject to construction site accidents and health risks[7].

Construction workers need to be properly trained and educated on the task or job before working, which will assist in preventing injuries and deaths. There are many methods of training construction workers. One method is coaching construction site foremen to include safety in their daily verbal exchanges with workers to reduce work-related accidents. It is important that the workers use the same language to assure the best communication. In recent years, apart from traditional face to face safety knowledge sharing, mobile apps also make knowledge sharing possible. [10].

Another method is ensuring that all workers know how to properly use electronics, conveyors, skid-steer, trucks, and other equipment on the construction site. Equipment on the job site must be properly maintained and inspected regularly before and after each shift. The equipment inspection system will help the operator make sure that a machine is mechanically sound and in safe operating conditions. An employee should be assigned to inspect equipment to insure proper safety. Equipment should have lights and reflectors if intended for night use. [10].

Each construction site should have a construction site manager. This is an occupational health and safety specialist who designs and implements safety regulations to minimize injuries and accidents. He or she also is in charge of conducting daily safety audits and inspections to ensure compliance with government regulations. Most construction site managers have an entry level experience or higher degree.[10].

Access and egress are also important parts of excavation safety. Ramps used by equipment must be designed by a person qualified in structural design. No person is allowed to cross underneath or stand underneath any loading or digging equipment. Employees are to remain at a safe distance from all equipment while it is operational. Employees who have training and education in the above areas will benefit their co-workers and themselves on the construction site[10].

Common Causes of Highway Construction Injuries

The leading cause of roadside worker injuries and fatalities is contact with construction vehicles and equipment. Workers operating construction equipment are most likely to be injured by collisions or overturning equipment. They might also be caught in equipment while it is left running.[11].

Injuries between 2003 and 2008 broke down roughly as follows:

- Contact with equipment or falling objects – 35%
- Slips and falls – 20%
- Overexertion – 15%
- General transportation – 12%
- Exposure to harmful substances (i.e. asbestos and solvents) – 12%

Causes of fatalities between 2005 and 2010 were as follows:

- Run-overs/back-overs (mostly by dump truck) – 48%
- Collisions between vehicles and mobile equipment – 14%

More than half of fatalities caused by run-overs or back-overs involved construction vehicles. Such collisions have been attributed to limited visibility around equipment, with statistics concluding that 29% of workers were cleaning or repairing, 28% walking along the road and 18% directing traffic. NIOSH provides blind area diagrams to assist in visualizing areas that can't be seen by equipment operators.[11].

According to the Associated General Contractors of America (AGC of America) Highway Worker Safety Program, there are four basic hazards known as the Focus Four Hazards. [11]. These include:

- Falls, due to improperly constructed surfaces and unprotected edges
- Struck-byes, due to vehicle strikes and falling or flying objects
- Caught-in-betweens, due to rotating equipment and unguarded parts
- Electrocutions, due to contact with utility lines and live circuits

The following conditions increase dangers for all construction workers:

- Constricted work sites
- Inclement weather
- Low light
- Reduced visibility
- Vehicle congestion

Flaggers, who signal drivers to drive cautiously while passing through a work site, run the risk of being struck by vehicles or construction equipment. It's especially dangerous when flaggers can't be seen by motorists or equipment operators [11].

Motor Vehicle Crash Deaths Collapsed

The Federal Highway Administration reports say that number of deaths in crashes that occur in construction and maintenance work zones.[12].

From 1982 through 2014, 24,745 individuals (about 750 per year) lost their lives in work zone crashes.[12].

Since the peak year of 2002 – when 1,186 died in construction and maintenance zones – the number of deaths declined steadily to an average of 591 from 2008-2014[12].

Worker Fatal Injuries collapsed

The Bureau of Labor Statistics reports fatal injuries to workers at road construction sites. From 2003-2015, 1,571 workers lost their lives at road construction sites. The number of fatal work-related injuries at road construction sites averaged 121 per year. Over the 13 years from 2003-2015, Texas ranked as the state with the most worker deaths at road construction sites (171), followed by Florida (104), Pennsylvania (85), Illinois (69), California (69), and Tennessee (62) [13].

Worker Fatal Injuries by Incident Event and Source collapsed

The Bureau of Labor Statistics revised the system used to code event and source data in 2010, resulting in a break in series; the data presented here are for 2011-2015.[14].

Transportation events accounted for 73 percent of roadway work zone fatal occupational injuries during the 5-year period. In 61 percent of these transportation events, the worker was struck by a vehicle in the work zone.[14].

Backing vehicles accounted for 64 of the 240 worker deaths in a work zone for which the direction of travel was recorded.[14].

Pickup trucks and SUVs accounted for 95 worker deaths at road construction sites from 2011-2015, followed by semi-trucks (91), automobiles (88), machinery (87), and dump trucks (62).[14].

General Rights and Duties of Workers

- Workers should have the right and the duty at any workplace to participate in ensuring safe working conditions to the extent of their control over the equipment and methods of work and to express views on working procedures adopted as they may affect safety and health processes. This information should be presented in forms and languages which the workers easily understand.
- Workers should have the right to obtain proper information from the employer regarding safety and health risks and safety and health measures related to the work processes. This information should be presented in forms and languages which the workers easily understand.

- Workers should have the right to remove themselves from danger when they have good reason to believe that there is an imminent and serious danger to their safety or health. They should have the duty so to inform their supervisor immediately. [15].

In accordance with national legislation, workers should:

- Co-operate as closely as possible with their employer in the application of the prescribed safety and health measures;
- Take reasonable care for their own safety and health and that of other persons who may be affected by their acts or omissions at work;
- Use and take care of personal protective equipment, protective clothing and facilities placed at their disposal and not misuse anything provided for their own protection or the protection of others;
- Report forthwith to their immediate supervisor, and to the workers' safety representative where one exists, any situation which they believe could present a risk and which they cannot properly deal with themselves; [15].

Conclusion

There is not much safety awareness for workers in construction area. Due to that higher accidentsoccur in work zone. Owner must understand that safety is important for workers. From this paper it's clearly shown that there is less improvement of safety for workers at work zone. There is so much improvement in technology found in construction but there is less research for workers' safety. There are many reasons of accident of labor at work zone. It is duty of site engineer, project manager, and also owner to give proper safety guidelines, safety equipment etc. to workers at work zone. There isnecessity of safety engineer at work zone. Government should give strict guidelines of safety for workers before work is given to owner. Due to injury there are not only physical effects to workers there are also economically, mental effects that happen to laborers. There are also timely, economical damages that happen with owner. So safety is not onlyimportant for workers but it is also important for whole site due to other reasons. Workers also need to know the privileges about safety. It is also shown that some accidents occur due to less knowledge of work. Hence it is also the duty of workers to give importance of safety and health for themselves.

Reference

1.1 PAPERS

[1] Makarand P. Garole JSPM's Imperial College Of Engineering & Research, Wagholi, Pune , UdayPhatak JSPM's Imperial College Of Engineering & Research, Wagholi, Pune

[2] Risk Factors In A Road Construction Site By V.R. Gannapathy Technical University Of Malaysia Malacca S.K. Subramaniam Technical University Of Malaysia Malacca

[3] Risk Factors In A Road Construction Site By V.R. Gannapathy Technical University Of Malaysia Malacca S.K. Subramaniam Technical University Of Malaysia Malacca

[4] Key Factors Analysis Of Work Zone Safety And Mobility Based On Micro-Simulation Meng-Hua Dinga, Chi Zhanga*, Jiao Yana, James Tsaia,B

[5] Accidental Risk Analysis Of Highway Construction Sites And Its Safety Management Strategies By UpendraNathTripathi, Anjelo F. Denis, Ehsan Ali* And Franklin E. Kujur Dept. Of Civil Engineering, Sam Higginbottom Institute Of Agriculture, Technology

[6] Enhancing Safety And Health Management Techniques In Indian Construction Industry Er. ShrishailShirur, Dr. SuwarnaTorgal

[7] Studies On Labour Safety In Construction Sites By S. Kanchana, P. Sivaprakash, And Sebastian Joseph

1.2 Web site

[8] https://www.dbkrieginc.com/onsite-work-safety.php 25/9/2017

[9] http://uknowledge.uky.edu/cgi/viewcontent.cgi?article=1152&context=ktc_researchreports date- 25/9/2017

[10] https://en.wikipedia.org/wiki/Construction_site_safety date- 25/9/2017

[11] https://en.wikipedia.org/wiki/Construction_site_safety date- 25/9/2017

[12] https://www.dbkrieginc.com/onsite-work-safety.php date- 25/9/2017

[13] https://www.cdc.gov/niosh/topics/highwayworkzones/default.html date- 3/10

[14] https://www.cdc.gov/niosh/topics/highwayworkzones/default.html 3/10

[15] https://www.cdc.gov/niosh/topics/highwayworkzones/default.html 3/10