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Identification Of Presence Of Safety Codes In On-Site Construction ProjectV.VINOTHKUMAR¹, Dr. S. KAMAL², D.KAMALANTARAJ³^{1,3}Department of Civil Engineering, Surya Group of Institutions, Vikiravandi-605652, Tamilnadu, India.²Department of Civil & Structural Engineering, Annamalai University, Annamalinagar, Tamilnadu, India.**ABSTRACT**

Construction industry is considered one of the most hazardous industries throughout the world due to its unique nature. Accidents and injuries can bring great losses to individuals, organization and society. Safety is most necessity part in construction industry. Proper maintenance of safety regulation cannot eradicate hazardous fully but it can be reduced. However, unawareness of safety is one of the major problems for accidents. Therefore, this paper is aim to identify the engineers knowledge towards safety code practice in India and implementation of safety codes in on-site construction projects. In spite of that, the critical factors are extracted through an extensive review of literatures and safety code of practice and books. Most of the literatures were concluded that the major accidents held due to scaffolds, ladders and excavation. Hence, this paper is focused on those areas to identify the lack of knowledge in engineers' and faults in implementation on site. The structured questionnaire were developed and distributed, retrieved form engineers from various construction firms. The results shows engineers' have knowledge on Scaffolding (83%) rather than Ladder (72%) and Excavation (58%). Finally the study gives the recommendation and suggestion to the firms, how to improve the knowledge on safety for their engineers'. Hence, this identification of factors can contribute to creating awareness or which may leads to the awareness about safety in future.

KEYWORDS :Construction, Safety, PPE , Safety tool**I. INTRODUCTION**

Nowadays construction industries are becoming more and more complex, because they have to meet the requirements of increased production rate, high efficiency and optimization. Huge investments are incurred. Any negligence, at any stage, from the preliminary stage of design, erection, operation, can result in disaster, loss of human lives and huge production losses, etc. therefore, Safety in construction deserves more attention because construction is widely recognized as one of the accident-prone activities. Most of the accidents are caused by inadequate planning, failure during construction/maintenance/process and design deficiencies. Accordingly, safety aspects deserves serious attempt. Today safety is an integral part of any industry. Even if a single employee neglects safety aspect, it can lead to serious problems for everybody. It is therefore essential that, fool-proof safety systems to be adequately trained by designee and incorporated people, checks and counterchecks made to ensure implementation of safety. Therefore, the objective of this paper is to identify the

presence of safety codes in on-site construction projects, the identification of these factors can contribute to creating awareness or improving of factors which may lead to the awareness about safety codes.

Background of study

"Safety is the state of being free from risk or injury. It is also a contrivance to prevent injury or avert danger". Safety is an essential resource for the life day to day. It is needed by individuals and communities to realize their aspirations. Indeed, safety must lead to a feeling of well-being and essential to the blossoming of any individual or community. The reason for accidents during construction and other activities are related to the unique nature of industry, human behavior, difficult work site condition, extended duty hours, lack of training and awareness and poor safety management. Ensuring good qualities of material, integrated maintenance of equipment, competent supervision, and compliance of standard safe engineering practices along with the use of appropriate personal

protective equipment (PPE) go a long way to bring safety

Organization	Frequency	Percent
Public	16	20.0
Contractor	30	37.5
Department		
Planning	11	13.8
Designing	11	13.8
Project	31	38.8
Overall management	27	33.8
Education		
Diploma	17	21.3
B.E	55	68.8
M.E	7	8.8
Others	1	1.3
Type of project		
Residential	22	27.5
Commercial	48	60.0
Industrial	8	10.0
Multiplex	2	2.5
Experience		
Less than 5 yrs	16	20.0
5 to 10 yrs	25	31.3
10 to 20 yrs	24	30.0
More than 20 yrs	15	18.8

into the system. Hence, an effective use of human relations would improve safety programs and make safe behavior a habit for workers and management's attitude towards worker's welfare can also play a major role in developing safe behavior among the workers and thus a safe performance in the workplace (Jannadi, 1995). The factors that influencing construction safety are historical, economical, psychological, technical, procedural, organizational environmental (Sawacha et.al, 1999), safe work behaviors, existing safety climate (Mohamed, 2002). However, the major criteria are the negligence of safety by the professionals. Architects and Engineers are in a position to make decisions about construction safety and reduce or eliminate certain identifiable risks before those risks reach the construction site (Ahmed et al.,2000).Global construction projects that involve collaboration between participants from multiple countries can often lead to conflicts and delays due to different culture perception of acceptable levels of safety among the different project participants. Identifying the root causes of construction accidents and fatalities has revealed the fact that not only contractors but designers, architectures and structural engineers are capable of influencing the safety

and health of construction workers. Provide useful perception of the history of 'Designing for construction workers' safety' concept and aims at introducing potential contribution, which could be made by designers and architectures on workers' safety.

Table 1. Scenario

In improvement of countries' economy, the role of construction industry is irrefutable; however there are many evidences in representing construction industry as a hazardous industry. Construction accidents may lead to serious financial and humanitarian impacts such as delay project progress, increase in expenses, decreased productivity and negative psychological effects on workers, on the contrary, unessential and excessive safety measures for enhancing construction safety (Hosseinian, 2008). Moreover, the safety performance of each worker was very much related to his attitude towards his fellow employees, foreman, and employer Jannadi (1995). Now it is essential to study the Behavior-based safety on construction sites so that the Awareness were created about BBS(Behavior based safety) among the workers and measuring safety performance to improve safety on construction sites are, Implementing interventioNased on goal-setting and feedback, Way to improve construction safety for employees, An approach to improve safe behavior and to reduce unsafe behavior (M.Choudhry, 2013). In this study is to identify the knowledge about safety among the Engineers those working in the Indian construction firms.

II. Methodology

The study was conducted on the knowledge of the engineers related to safety for various construction projects. Majorly, it has found that the accidents occurring in the last few years in construction site has taken up a rise. This made a serious fall in the productivity of construction site work. However, it is found that most of the accidents were occurred in time of excavation, collapse of scaffolding, and improper laying ladder in the projects. Hence this paper is tendency to identify the knowledge of engineers towards those activities. In spite of the questionnaire were developed and issued to the engineers. The preparation questionnaire contains three parts. First part consists of demographic details of the respondents. Second is consists of the knowledge of the safety and implementation of safety system in the projects by the organization. Thirdly, survey was focused about the theoretical knowledge of engineers about the excavation, scaffolding, and ladder implementation in the project.

Respondents Profile

In this paper, the responses obtained from the engineers working in various construction organizations through questionnaire survey that were used to analysis using statistical analysis. Eighty responses were received out of one hundred sets distributed. The eightyresponsesdemographicprofiles are given below under five categories such as,i. Type of the company, ii. Department, iii.Education qualification, iv. Type of project, v. Experience in construction industry.

From Table 1 shows the demographic profile of the respondents were gone through the survey to identify the knowledge on the safety code practices and implementation in on-site.

III. Result and discussion

Knowledge Of Safety And Implementation Of Safety In Project:

In project the safety system is to implement to achieve better production, minimize the accidents, and keep workers to feel they are safe in working environment. In spite of that engineers where asked about the implementation of safety in their project through discontinuous data type. In this part totally seven factors were asked to the engineers' to answer, they are:

- Is your workplace suitable for disabled workers and visitors?

The construction industry is the most dangerous land based civilian work sector. Construction work is not only the process of building, but also involves much other type of side activities from basic construction work to management. However, the contemporary discipline of study and research were developed from the works. The study demonstrated the complexity and system coupling inherent in organizations, created by multiple process and various people working simultaneously to achieve organizational objectives, is responsible for errors ranging from small to catastrophic system failures. It also showed the importance of usage of safety code and required knowledge of engineer for safety in construction site.The engineers were tested according to their ability and by the knowledge in questionnaire survey conducted.

- Do you have safety engineer?
- Do you have a program for regular training regarding Health and Safety?
- Are Health and Safety Meetings held regularly?
- Is action taken regarding matters discussed at the Health and Safety Meetings?
- Do you have First Aiders and First Aid facility on your premises?
- Does safety training help the organization to maintain construction safety?

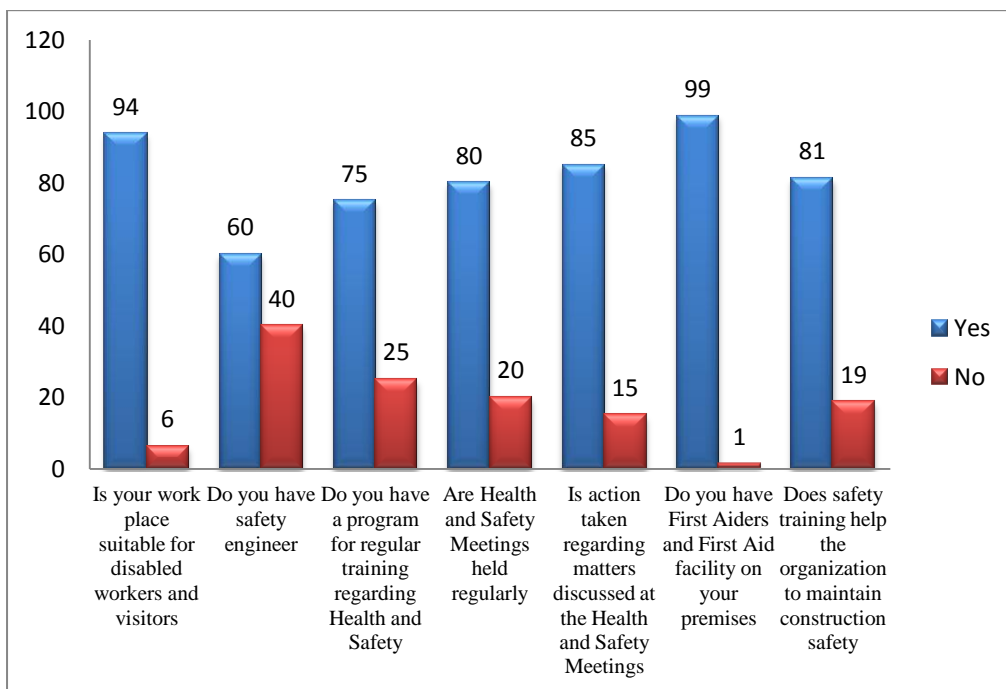


Figure 1: Percentage of Safety implementation in the project

From Figure 1 shows that thehigh percentage leads by the first aid facilities in theProject and a low percentage lead by the safety engineers in the project. Safety Engineers plays

an important role in construction industry but due to unawareness of safety and lack of knowledge about the safety engineers most of the companies are not appointing

the safety engineers. In this point itself unawareness of safety by the company is started. However, the safety engineers are need for safety; Safety is associated with a price both for compliance and non-compliance, the trade of being short term profitability or long term loyalty of workers, which translate better productivity and intangible benefits. By building in the cost of safety to the project cost the management not only communicate its intension but also ensures the accountability of the project managers in the aspects

IV. KNOWLEDGE ABOUT SCAFFOLDS BY THE ENGINEERS:

In real construction most of the accident occurred due to improper knowledge of scaffoldings. Unfortunately, thousands of employees are killed or injured every year, with many being harmed due to falls or safety hazards at construction sites. Nowadays scaffolding accidents became very common in the construction industry. The most scaffolding accidents happen because of, i. Improper equipment assembly ii. Slip-and-falls, iii. Falling objectsiv. Overloaded weight on scaffolds v. High winds or poor weathervi. Scaffold component defects. Most of these issues are avoidable and construction companies and

engineers should make sure that they have procedures in place to prevent a scaffolding accident from happening. Hence, it's necessary to identify the engineers' knowledge on scaffolding and the prevention of those accidents based on the code of practice and OSHA. However, in this part nine questions were asked out of it five where asked in the discontinuous type and one question is having sub question. Three questions are based on choose the correct answer and one question is filling the correct answer. The following are the questions were asked to engineers know about the knowledge of the scaffolding. Inspection of scaffolds carried out?

If yes means at when you do the inspection? Do you provide fall protection? Which of the following types of supports are used in building supported scaffolds? The "maximum intended load" of a scaffold includes the total weight of all workers as well as their equipment, tools and materials? When you are erecting a scaffold, it is permissible to use cinder blocks for support? You should never use a platform or a plank that has a painted walking surface? All scaffolds must be able hold its own weight plus -----times the intended load What is the distance between road and scaffolds in traffic area?

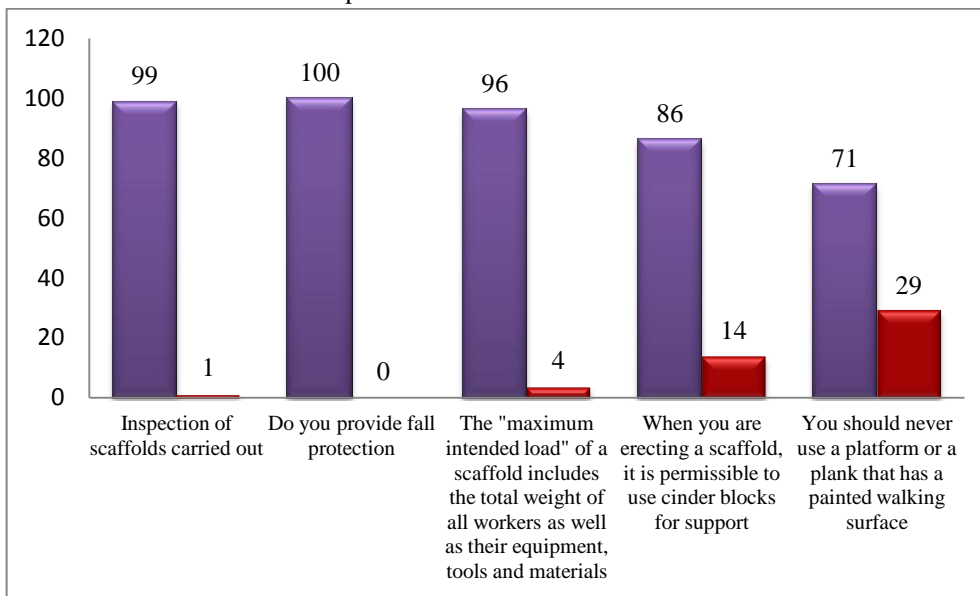
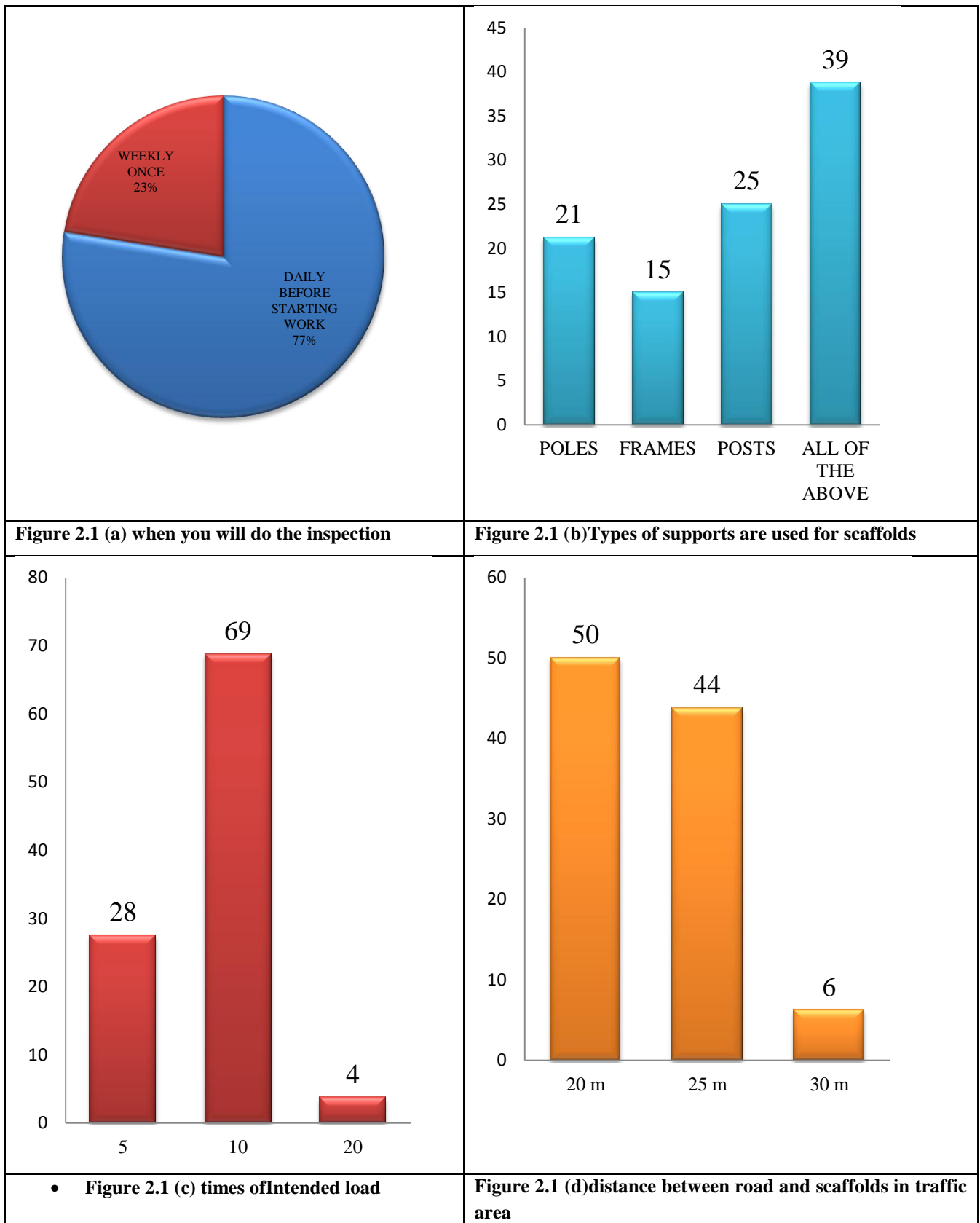


Figure 2 Percentage of Technical knowledge on scaffolding practices in project

From Figure 2 shows, the knowledge of engineers in the implementation of scaffolding in the field. However, the result shows that the engineers rated that the provision of fall protection is compulsory in the project (100%), where they are not aware of using painting symbols in the sidewalks of the scaffolding (29%). Almost all engineers

(80%) have a better knowledge on scaffolding basis but there was a difference when they are asked in depth of the implementation of scaffolding. The following are the percentage of knowledge of the implementation of scaffolding in the field.



From figure 2.1(a) shows that the percentage ratio of engineers knows “when to do the inspection of the scaffolding” in the project. Scaffolding inspection by code of practice suggested that have to do “daily before starting

the work” but around 77% of engineers where answered right, only 23% where answered wrong. However, that 23% is the higher value when consider the safety in a project. From Figure 2.1 (b) shows that the engineers knows about

the support used for the scaffoldings. However, the code of practices recommends using the “frames” for support. The results shows only 15% of engineers are aware of the support for scaffolding. It’s clearly shows that engineers don’t have much knowledge using of frames. Therefore,educatingthe engineers towards the supports is more essential,suspect that could control the collapse of supports.From figure 2.1 (c) shows the knowledge on the maximum intends load can apply on the scaffolding. The code has suggested the maximum 10 times pulse than own weight of the scaffolding. The 69% of engineers were answered correctly by around 31 % were not aware of the load. Around 28% of engineer were answered only five times, consequent of answer can say it have good factor of safety on the other flip it became as uneconomic of construction. However, 4% of engineers are around 20 times, the result seems they don’t have a better knowledge maximum load on scaffolding that could cause the overloaded weight on scaffoldswwhich generates serious collapse and produce the damage and loss of life.

Installation Of Ladder In The Site

Ladder accidents are extremely common. Ladder accidents can be classified in several categories, including falls from ladders, tipping/sliding of ladders, failure of extension ladder systems, and catastrophic failure of ladders or of ladder components. Investigation of these accidents and ladder failures are carried outmore than decades. Hence, the engineers need to have more knowledge about the ladders installation and related accidents.Instead of that the survey were consider eight factors to ask about the ladders and installation of ladders in the project and they are given below:

- If using a straight ladder to reach a roof, at least how rugs should extended beyond the roof edge for proper support?
- What is the distance b/w a ladder distance away from the wall versus its working length?
- What is the position to carry the ladder while moving from one place to another?
- When climbing a ladder, how many contact points (hands feet) should be touching the ladder at all time?
- Which two rugs of a ladder are not safe to stand on?
- At a minimum, how many rugs of an extension ladder should be overlap in the centre when it’s extended?
- Whether it is safe to put materials up the ladder by hauling?
- Can I rest a ladder against a window?

PRACTICE OF EXCAVATION ACTIVITIES IN THE FIELD

Site excavation is a necessary part of all construction projects, but can be an extremely dangerous job for poorly trained workers, safety regulations not followed,

construction company employer or supervisor are negligent the safety norms. Unfortunately, when engineers or supervisors are negligent or fail to provide a safe working environment for their employees, the consequences can be devastating.The following are common causes of excavation accidents on construction sites are i. Failure of excavation machinery, ii. Failure to properly shore an excavation site, iii.Poor training of construction workers, iv. Failure to adhere to OSHA safety regulations, v. Explosion of underground utilities and, vi. Excavation site collapse. There is necessity to avoid these then the engineers have the good knowledge about the accidents precautions and prevention suggested by the code of practice. To evaluate the knowledge and the regular practice of the engineers were account in this survey. Therefore, Ten factors been asked from the engineers to understand about the knowledge on excavation safety practice in site. The following are the factor for excavation safety.

- Thedigging depth at which trenching becomes a particular safety concern is ____ feet.
- The two naturally occurring hazards that affect soil stability include
- The average weight of one cubic yard of dirt is _____ pounds.
- Loss of soil stability is caused by
- The angle of repose for average soil conditions is
- To safely get into and out of a sloped trench you should
- The large metal or wood box used in shielding is called a
- The purpose of shielding is to
- The shoring component used to provide support against the vertical and horizontal shoring members is the
- To keep water out of the trench, install

V. Conclusions

The survey and questionnaire were analyze and the engineers were tested on their basic knowledge about the accidents occurring, safety and codes used for it. Scaffolding is also used in adapted forms for formwork and shoring, grandstand seating, concert stages, access/viewing towers, exhibition stands, ski ramps, half pipes and art projects.Some common sense and some basic safety practices can help prevent accidents and injuries caused by the improper or unsafe use of ladders, or the use of defective ladders. Also, don’t forget that there are excellent alternatives to using ladders, which can be quicker and safer. There are federal regulations in place to protect workers who are performing excavations on a job site, including extensive bracing and shoring requirements to prevent collapse. There are also provisions in place to protect those working in and around excavation machinery

like bulldozers, backhoes, excavators, and other heavy machinery, to prevent unnecessary accident and injury.

REFERENCE

1. Janet K. Yates and Edward E. Lockely (2002), "Documenting and Analyzing Construction Failures", Journal of Construction Engineering and Management, January/February 2002. DOI: 10.1061/(ASCE) 0733-9364(2002) 128:1(8).
2. John A. Gambatese Michael Behm Jimmie W. Hinze, "Viability of Designing for Construction Worker Safety", Journal of Construction Engineering and Management (ASCE)/September 2009. DOI:
3. International LabourOrganization (I.L.O, 1995), "Safety, health and welfare on construction sites: A training manual", International LabourOffice 1995, Geneva, ISBN 92-2-109182-1.
4. International LabourOrganization (I.L.O, 2005), "Prevention: A Global Strategy Promoting Safety and Health at Work. The ILO Report for World Day for Safety and Health at Work", International Labour Office 2005, Geneva, ISBN 92-2-117108-6.
5. Indian Standard Falsework for Concrete Structures Guidelines, IS 14687: 1999, Bureau of Indian standard, September 1999, New Delhi.
6. 10.1061/(ASCE) 0733-9364(2005) 131:9(1029)
7. DayangNailulMunnaAbang Abdullah and Gloria Chai Mei Wern (2010), "An Analysis of Accidents Statistics in Malaysian Construction Sector", 2010 International Conference on E-business, Management and Economics, IPEDR vol.3, IACSIT Press, Hong Kong.
8. Indian Standard Glossary of TermsRelating to Cement Concrete, Part V Formwork for Concrete, IS 6461 (Part V): 1972, Bureau of Indian standard, July 1972, New Delhi.
9. Indian StandardSafety Code forScaffolds and Ladders,PartI Scaffolds, IS3696 (Part I): 1987, Bureau of Indian standard, March 1988, New Delhi.
10. Indian StandardScaffolds and Ladders - Code of Safety,Part2 Ladders, IS3696 (Part 2): 1991, Bureau of Indian standard, August 1991, New Delhi.
11. NareshFernandes, Samir Patil, Jennifer O'Brien, ShivamVij (2015), "Across India 2600 people die every year in building and other structural collapses", scroll.in, article no. 668636.

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