



# Survey on Health Hazards and Causes of Accidents in the Field of Civil Engineering

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## Abstract:

Civil Engineering is a multidisciplinary field that contains a variety of domains. Out of all these domains, one inevitable specialization is 'Structural Engineering' which deals with the safety and serviceability of a structure and the population using it. As Civil/Structural Engineer, we are very much focused on the safety of residents or users of that structure but hardly anyone pays attention to the well-being of the laborers and workers building that structure. Across different countries, a lot many construction workers fall victim to accidents on a site which can pose serious threats to their health or may even cause death. This research paper reviews case studies in various publications on the causes and effects of accidents on a construction site. Methods like floating questionnaires & Google forms, analysis, RII methods, and in-person site visits were used to determine the factors responsible for the highest number of injuries. Health hazards and deaths. After carefully analyzing the data, safety tips are suggested in this paper, like bringing the safety laws into action, use of safety gears and PPE, creating a safe working environment, and following the safety guidelines to keep their health safe. Creating a safer work environment will not only save lives but will also result in increased efficiency and timely completion of the project.

**Keywords:** Construction, Accidents, Health Hazards, Civil Engineering, Injuries, Deaths, Site.

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## I. INTRODUCTION

Civil Engineering transforms hell into heaven' but in this process, a lot of lives are sacrificed. Construction is one of the most accident-prone industries out there. This review paper has been carefully drafted after going through and analyzing various papers in this domain. There are numerous factors that are considered while designing a structure and the same amount of precision goes into the construction work as well. However, when it comes to safety engineering or the safety of the laborers, there is still a considerable amount of negligence in the industry. Accidents. Health Hazards and

mishappenings are very common in Civil Engineering and after research, it has been

found that there are various factors causing injuries, deaths, and other health issues on a construction site. This paper has reviewed several other papers in which case studies of different site locations are performed e.g. Nigeria, Tamil Nadu, etc. The factors causing deaths and injuries are studied, analyzed, and presented in the form of bar graphs, tables, and pie charts. The after-effects and some of the safety measures are also suggested in this paper through review.



## II. LITERATURE REVIEW

A lot of studies have been conducted in this field and in every construction activity that has been studied has a lot of injuries and deaths involved in it. Papers discussed various factors causing accidents in construction and identified the top factors for it. A lot of different states and Union Territories were examined for the number of cases recorded for injuries and deaths during construction. Different employees including laborers, construction managers, contractors, supervisors, site Engineers, etc. were surveyed regarding the working conditions of the site and the factors causing accidents. Also, the papers discussed a variety of ways in which people working on a construction site get injured or die like electrocutions, falls from height, falling objects, etc. There were also ways of reducing the accidents and training suggested for Employees to reduce accidents on site. The usage of PPE and OSHA guidelines has also been discussed for the same purpose. [1] states that The process of maintaining safe working conditions at the site is not just about being strict with the laws and regulations but maintaining a total safety management system with the supervision of the topmost tier of the company implemented by using workshops, safety tools, and other initiatives. The forms which are adamant about creating a safer working environment at their sites must ensure a Total Quality Management system in their processes. [2] In this study, different reasons for accidents in the construction workplace are identified. According to the statistical analysis, it is found that the most common accident types in Tamil Nadu occur due to catastrophic working environment (64%), being hit by equipment, tools, and other falling objects (52%), and accidents from scaffolding (48%). [3] Lack of precautions to safety practices had led to an increased rate of accidents in the construction industry. Accidents not only cause physical injury to human or property damage, but it also has a long-term effect on a company's reputation and society. The literature also observed that lack of training, personal protective requirements, unskilled labor, safety

practices, and awareness about safety were the top factors that cause accidents in site conditions. The main goal of mitigating the accident rate could be achieved by adopting safety management practices.[4] From this work, we could conclude that the most dangerous accidents in Civil Engineering include falls slipping from tall structures, scaffoldings trips, and natural demolition of buildings. OSHA statistics have helped to determine these factors. These factors include organizational, human, technical, and environmental causes. It is obvious that the act of God is inevitable, however, the laborers can be rested from work during harsh climatic conditions. Personal protective equipment (PPEs), toolbox meetings, and safety workshops for the laborers must be ensured to avoid accidents. [5]The biggest reason for accidents is laborers themselves. Negligence was the major cause of accidents on construction sites. When an accident takes place, the project gets delayed and its execution and completion take even more time. The accidents on a site can be mitigated by applying some the measures like proper use of symbols and signs, daily inspections, workshops for laborers, training programs, medical tests for drugs, tool and equipment training, etc.

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### TYPES OF ACCIDENTS

Accidents often take place on a construction site but the nature of these accidents can vary with the place and the type of work that the project demands. Some common types of accidents in Civil Engineering are as follows:

- Falling of structures
- Low height falls, trips and slips
- Crushing under heavy objects
- Getting hit by falling objects or tools
- Electrocutions
- Explosions
- Fire
- Construction vehicles accidents

### CAUSES OF ACCIDENTS

There are numerous factors that can cause an accident on a site. Definitely, the intensity of these accidents can vary with the type of work



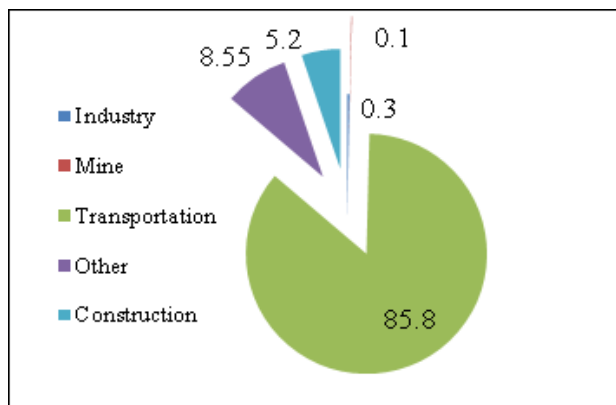
and the fate of the victims of those accidents but the factors contributing to the accidents are almost similar. The factors causing accidents on a construction site are:

- ❖ Drug Abuse
- ❖ Lack of safety awareness
  - ❖ Poor working surfaces and platforms
  - ❖ Lack of provision of personal protective equipment (PPE)
  - ❖ Insufficient lighting and blind spot
  - ❖ Unsafe working conditions
  - ❖ Step Ladder and scaffolding misuse
  - ❖ No safety Engineer on site
  - ❖ Worker’s health problems/physical fatigue

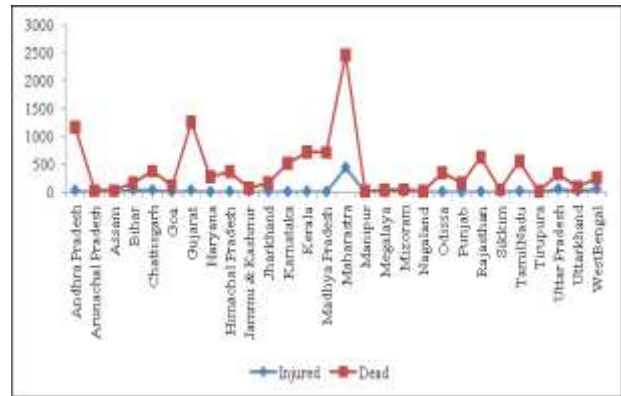
**II. STATISTICAL DATA**

A lot of research papers were studied and the statistical data was identified in the form of bar charts, graphs, excel, and charts. The most important and relevant data are analyzed and presented in this paper. Data like Types of Accidents, Number of accidents in a year, State-wise accidents in a year, etc were studied. The following data represented here have been carefully taken from various papers:

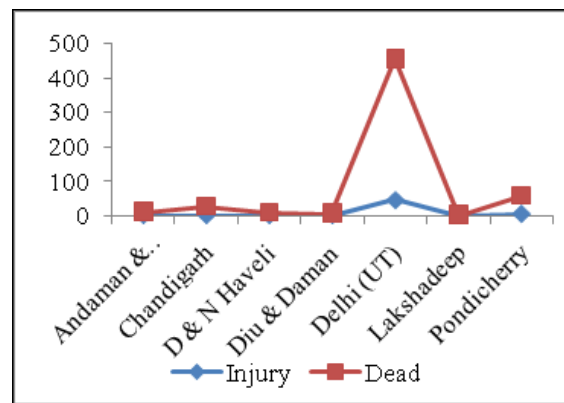
Fig 1 depicts the various sectors or industries where accidents take place. The stats show that the Transportation industry causes the maximum accidents(85.8%) which are followed by others(8.55%) and then the construction industry(5.22%).



**Fig 1: Number of fatal accidents based on sector (2012)**

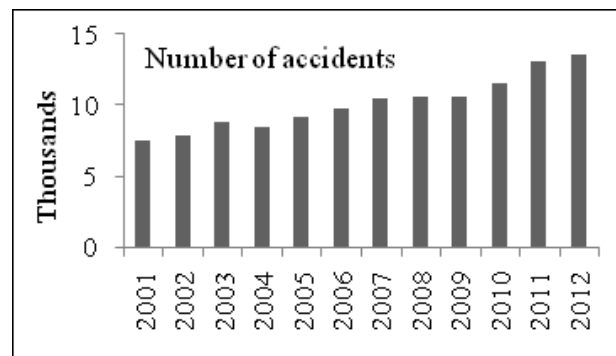


**Fig 2: State-wise fall accidents in India (2012)**



**Fig 3: Territory-wise fatal accidents in India**

Figs 2 and 3 show the state and UT-wise accidents respectively in India in the year 2012. We can observe that Andhra Pradesh, Gujarat, Maharashtra, and Delhi have a relatively higher number of accidents



**Fig 4: Number of fatal fall accidents in India (2001-2012)**



Fig 4 depicts the number of accidents from the year 2001 to 2012 we can see the surprising result that the number keeps on increasing each year whereas it should have been controlled after the previous accident-causing mistakes were identified.

**TABLE-1  
 TYPES OF ACCIDENTS IN CONSTRUCTION INDUSTRY (INDIA)**

Type of construction accidents	Years	
	2011	2012
Fall from height	10483	11052
Explosion (Boiler, Gas cylinder, etc)	481	555
Fire	1401	1432
Electrocutions	8987	8839
Fall into Pit/Manhole, etc	2638	2480
Suffocations	3209	2063
Collapse	3284	3005
Total	30324	29185

Source: Accident deaths and suicides in India 2012

In table 1, A lot of different case studies have been performed at various site locations. Personal inspection, Excels, interviews, and Questionnaires in the form of Google forms were circulated to different employees on a construction site, for example; in Abuja, the capital of Nigeria, the building industry was assessed by selecting some reputable firms including multinationals, small scale, and large scale construction industries. RII values were calculated and factors contributing to accidents were identified. Employees such as Site Engineers, Project Managers, Consultants, Laborers, Mason, surveyors, Contractors, General managers, Junior engineers, supervisors, and Executive Engineers were interviewed. All the statistical data was collected and analyzed carefully to determine the factors that contributed the most to the mishappenings at a construction site which include Fall from heights, Explosion, Fire, etc.

By applying the Relative Importance Index, the most critical factors causing accidents on a construction site could be identified. The people

who filled the form whether from, small scale, large scale, or multinational companies were asked to give scores from 1 to 5 to the factors affecting Civil construction site safety by representing the least important as 1 and 5 as the most important. Then the relative ranking was found by converting scores into importance indices based on the formula  
 Relative importance/difficulty index

$$= \sum w_i / AN$$

w denotes the mean weighting given to every factor by participants, lying between 1 to 5, A being the maximum weight (i.e. 5 in this case) and N denotes the total number of samples (i.e. 20 samples). Based on the equation written above, the relative importance index (RII) can be determined. The table below depicts the relative importance index of each factor affecting safety on a construction site.

**Table 2: RII values for the causes of accidents**

Ranking	Factors affecting site safety	Relative importance index
1	Lack of attention from leaders	0.92
2	Reckless action	0.90
3	Poor safety consciousness of managers	0.88
4	Non-certified skill labor	0.87
5	Lack of emergency measure	0.87
6	Poor equipment	0.85
7	Lack of training	0.80
8	Poor equipment maintenance	0.80
9	Non-strict enforcement of safety regulations	0.76
10	Non-definite organization commitment	0.75
11	Lack of experience of managers	0.75
12	Non-effective operation on safety regulation	0.75
13	Poor of education of laborers	0.74
14	Poor safety consciousness of laborers	0.73
15	Not-strict operation procedures	0.70
16	Lack of technique guide	0.70
17	Lack of personal protective equipment	0.68
18	Non-perfect of safety and regulations	0.67
19	Overtime work for labor	0.65
20	Lack of protection in material carrying	0.65
21	Lack of protection in material storage	0.64
22	Lack of teamwork	0.63
23	Shortage of safety management	0.60
24	Poor information flow	0.60
25	Lack of innovation technology	0.55

**Table 3: RII values for the causes of accidents**

FACTORS	RII VALUE	RANK
The drug abuse cause accident in the site	0.82667	1
Drug abuse cause accident in site	0.82	2
Lack of safety awareness	0.8	3
The poor working surface and platforms cause accident	0.79	4
The lack of provision of personal protective equipment (PPE)	0.79	4
Insufficient lightening and blind spot	0.75	5



Tables 1 and 2 show the number of factors that contribute to accidents is immense and each of them has been assigned a different RII value based on the survey. We can notice that drug abuse, lack of awareness, and lack of attention from the juniors and seniors are some of the top factors that can cause accidents on a site.

#### **SAFETY TIPS**

1. Employees should be strictly advised to avoid drugs or alcohol during work.
2. Work should be executed with proper safety standards.
3. All Engineers, Contractors, and workers must be aware of the safety standards in the workplace.
4. PPE or personal protective requirements should be mandatory during site activities.
5. Proper records should be maintained at a construction site.
6. Safety audits should always take place twice or thrice a year to maintain the proper level of safety.
7. A Safety Engineer is in a lot of demand these days in order to enforce safety in the construction work

#### **TASK DEMAND ASSESSMENT (TDA)**

One of the recent methods is based on experimentation and analysis and determines the 'task demands' of execution or construction operations. It is based on the exposure to dangers, the availability, and tier of task demand factors, like the hazards factor that can turn into a deadly accident. Also, this method can identify 2 different incidents and determine the effect of production factors on the probability of an accident taking place.

#### **III. CONCLUSIONS**

We know that our construction industry is one of the most inevitable industries out there but

this industry also has its own flaws which we cannot ignore and a lengthy discussion has been done in this paper about the accidents in the field of Civil Engineering. There have been plenty of accidents in India and abroad as well which are depicted in this paper using bar graphs, line graphs, pie charts, and tables. A lot of statistical data has also been presented which determines the top factors causing accidents on a construction site and eventually leading to deaths. We can conclude that Drug abuse and lack of awareness on site are the top factors for any accident. Also, some safety tips have been discussed in this paper after surveying other papers which can prevent or reduce accidents on a construction site due to which various health hazards or even deaths are caused. It can be inferred that usage of PPE kits and the inclusion of strict safety standards at the site are the top measures to avoid accidents.

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