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Impact of Mishaps and Hazard Evaluation Analysis of Specific Airport Development and Construction Initiatives in India Applying One Way Analysis of Variance ANOVA

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Abstract: *This research work addresses the issue of construction site accidents from the health and safety perspective. It defines the basics concerning the lack of safety procedures during work, which may lead to work-related accidents at a construction site. To set the basis, statistical data from the construction site accidents, as well as work accidents in general, are presented. Additionally, types of the most common accidents, their occurrence, and preventive measures are presented. These accidents are further discussed and analyzed to provide a comprehensive comparison of the risks concerning these accidents. By doing so, its avoidance or the reduction in occurrence is further presented. Furthermore, reasons behind the accidents are presented, including the technical preparedness of the construction site to reach the highest security as well as site management team, which might influence the accident occurrence. Current health and safety legislation is presented along with the actual requirements which are established to be kept during the construction work, in order to distinguish whether these are adhered by the site staff, or further improvement might take place to decrease the existing accidents rates and employees' awareness The investigation has discovered that principles of Occupational Health and Safety at the construction site adhere to some extent. At the same time, there is a noticeable area for an improvement as mostly communication issues were discovered, where site management did not update their employees properly regarding details of operating when in an emergency. At the same time, alignment with the OHS rules and wearing of PPE that is able to avoid accidents was satisfactory. The outcome of the study also indicated that the consequences for the workers that were involved in an accident at the construction site might often be very serious. Fortunately, the awareness of the employees at the site about this matter is rather distinctive.*

Keywords: Health, Safety, Accidents, OSHA, Construction site, PPEs, Construction work, Safety, Injury, Accidents, Workers, Analysis of Variance etc.

I. INTRODUCTION

The best estimate is that there are 38 fatal accidents every day across construction sites in India. A recent ILO study estimates that India has the highest number of fatal accidents on construction sites in the world," said labour law practitioner and senior advocate Sanjay Singhvi.12-Sept-2023. Estimated that around 48,000 people are killed in accidents at work as per British Council of India 2023. Construction in India is more labours-intensive than that in the developed countries of the world. In numerous developing countries such as India, there is a major differences between large, medium and small contractors. Most of the large firms do have a safety policy, on paper, but employees generally are not aware of its existence. Nevertheless, a number of major constructors exhibit a concern for safety and have established various safety procedures. They also provide training for workers and maintain safety personnel at the work site. Construction Industry in India is highly prone to hazards related to site activities and construction projects engage large number of contractual workers. During execution at site, these workers are exposed to various risks involved in

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construction works and other occupational diseases and health hazards which cause injuries and illnesses. As a result, the construction projects get delayed due to loss of working hours and other legal hassles. This ultimately accounts for cost and time overrun. Therefore, it is essential for any construction project to have safety guidelines and procedure to be followed for site activities and to create awareness among the workers, site supervisor and engineers Therefore, the importance of safety at construction sites is relevant more than ever not only from the perspective of the general health of the people working on sites but also due to the associated causes such as economical influences. However, even in 2020, construction site employers are often not concerned about the safety at the site more than necessary or given by the law, as they are unaware of the true consequences these bring towards them, in the form of the benefits of Health and Safety. Asian Institute for occupational safety and health conducted a case study where the prevention principles related to work accidents are presented, promoting the benefits of the investment in the preventive measures in comparison with dealing with an accident at the construction site.

There are several ways to avoid earlier mentioned consequences and costs associated with them by minimizing the occurrence of work accidents, by the complete mitigate measures system implementation into all spheres of the construction site. These aim to eliminate or reduce the risk factors that determine the occurrence of work accidents and other types of harm to the health of the people.

Based on these findings, the thesis aims to present the seriousness of the situation of those affected by an accident, and available sources for the mitigation of accidents occurrence. At the same time, consider the post-accident stage of the affected employees' return back to work and its social and work acclimatization

II. OBJECTIVES

Specifically speaking, these include the use of methods by which the risk is identified, understanding these risks and risk factors that influences them. At the same time, there is a necessity to understand the methods that can mitigate these risks. To be able to do so, there is a need for a plan preparation as well as its possible modification whenever necessary, along with the capability of finding alternatives to some most critical processes. Lastly, the presentation of the findings and results understandably and efficiently is important. Application of one way analysis of variance in selected construction project work

III. PROBLEM DESCRIPTION

As presented in the introduction, there is no doubt work accidents require special attention, especially within the construction industry, which lies within the some affected industries. At the same time, most employers representing construction companies are well aware of the consequences that bring in the financial aspects, when an accident occurs. Several duties need to be fulfilled by employers when an accident already occurred. These include sick leave, time offs, replacement of the lost employee, additional training, etc. As statistical data collected by the Construction Industry Development Council (CIDC) indicate, the number of accidents within the construction sector is still high, even though a slow decrease has been noticed in the period from 2015 to 2023. Therefore, one of the essentials is to analyze different aspects of these accidents. Investigation of what has an impact on their occurrence, but at the same time, their reduction, is necessary. With ongoing worldwide development, a rising number of people and their needs, there is an expectation that construction jobs will be occupied by more people than ever before. Based on previously mentioned, an inquiry on compliance with Occupational Health and Safety (OHS) principles at the construction site should certainly be the main point of research. At the same time, should any correlation with the occurred accidents be detected, an amendment is to be prepared

IV. PROBLEM FORMULATION

Following earlier presented, two research statements are going to be assessed and scrutinized as a part of an analysis provided further in the thesis. These are as follows:

1. Assessment of the condition of OHS at the construction site, along with detection of the weaknesses, which might serve as a guide for the OHS improvement plan
2. Assessment of the procedures taken by the management after an accident occurs at site

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V. METHODOLOGY

Collection of data

Analysis of the situation within the construction industry is based on the available literature and the latest development of the accident in construction. These data were collected from the official Asia organization, which gathered data on accidents for the recent 13-year period for all 7 Asian member states. These recent data served as a prerequisite for additional research in the matter of health and safety procedures at construction.

At the same time, data on the actual condition of the OHS within construction sites were obtained from a survey that was handed out to fifteen construction site employees.

Data validity

The collection of data was followed by its validity. That was done mainly in selecting only renowned sources such as national or international organizations covering the sphere of OHS at construction sites. These data were used in connection with the thesis aim and re-evaluated whether they correspond to prepared content and may cooperate in the formation of this research's outcome.

Survey methods

Information regarding the survey used in other chapter is presented. Survey participants are construction site workers at L&T, and this is where the survey was conducted. They participated in constructing an administrative dwelling at the time. The selection of the workers and construction site is purely random, but dependent on a fact, there was a connection to workers due to the previous employment of a student at this specific construction site and therefore, it was possible to ask them to participate in a survey. Otherwise, it might be challenging to get any access to any construction at all. The actual situation of Covid-19 has participated in this matter of forbidden construction site visits. There was one representative selected from the management, which was able to hand out the papers to workers. and return them after fill in. This request with undergoing a survey and sharing a personal experience on OHS at the site addressed to fifteen site workers as this was the available number that was personally known and could be contacted. All these persons received a paper with survey questions they needed to fill in. Nine of them actually participated and returned these papers– 60% feedback rate. The age, gender, education, or working experience of the participants was not specifically set due to the shortage of construction workers being able to take the survey. As there are several subcontractors at this large site, these workers were reviewed on the OHS provided by the construction company they were employed in or hired by. The survey consisted of 11 questions. Their role was to analyze used OHS within their company, its downsides, and its benefits. The survey was anonymous and options were about to be circled. Received answers were analyzed further in chapter 7.1 based on the method of descriptive statistics. The intention was to summarize common signs of the collected data set, from the selected sample. As a part of the descriptive statistics, along with the presentation of the collected results, the characteristics of the answers were examined. This was done to make a judgment based on received replies and relate them to questions that were prepared in the first place.

VI. APPLICATION

To provide a better understanding of the topic, this problem analysis is prepared. Within this chapter, construction at sites is going to be analyzed in order to refer to the issue of the accident in general. Therefore, the below-listed sub-topics are discussed:

1. Introduction to the construction industry
2. Occupational Health and Safety principles
   - OHS Legislation
   - OHSAS 18001:2009
   - Personal Protective Equipment
3. Overview of the types of accidents
4. Explanation of the risk factors
5. Preventive measures available to avoid accidents

At the same time of conducted a data collection for the last decade, where the decreasing trend is visible for the construction industry. As it can be seen in the graph underneath, while in 2015 the number of non-fatal accidents within the member countries was reaching towards 500,000, in 2023 was this number just about 350,000 for the construction

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industry. It can be considered that with more sticker politics regarding OHS promoted by the beginning of the decade, the decreased number of accidents might have benefited directly from the promotions.

Year	Incidents
2013	90
2014	92
2015	109
2016	100
2017	120
2018	89
2019	69
2020	62
2021	55
2022	67
2023	138

Figure 2 Non-fatal accidents in India construction in 2013-20123

A similar trend is present for the same period of the gathered data from 2013 until 2023 for fatal accidents in countries. Data show that 1,000 construction workers have died at work in 2016 which decreased by 300 persons to 700 fatalities from 2020 to 2023. Unfortunately, the construction sector is the leader among the top five sectors with the highest risk levels, showingthe highest number of fatalities in all 8 years researched.

Situations associated with hazards at the construction site occur in almost every kind of this industry. General hazardous factors can be divided into three categories

Psychosocial

- Workplace relations among colleagues

Physical

- Climate (pressure, humidity, temperature)
- Dustiness
- Radiation (electromagnetic) and optical (lighting)
- Vibration-acoustic (chemical preparations)

Biological factors

- Harmful fauna and flora

These are hazards present at the construction site; however, it is possible to identify various risk factors that interfere with the construction process and whose direct effect comes from the earlier presented hazards. Yet, it is necessary to take these risks into account so that such risks can be eliminated in the future. For several years a great effort has been devoted to the study of risk as such, due to the new developing situations which occur, and that the entire industry can learn something from

Most common accidents

- Fall
- Struck by objects
- Electrocutions
- Caught-in/between

VII. CONSTRUCTION SITE ANALYSIS

Results shared in this chapter are based on the replies collected from the survey that was filled by the construction site employees. As 9 out of 15 surveys returned, it might be considered that the overall interest in OHS might not be that high from the perspective of the employees. However, it must be considered that there might be several other aspects that stopped papers from returning, such as loss, damage, being not present at work when the collection took place, and so on. Further, the question from the survey is going to be analyzed below by showing the actual question and number

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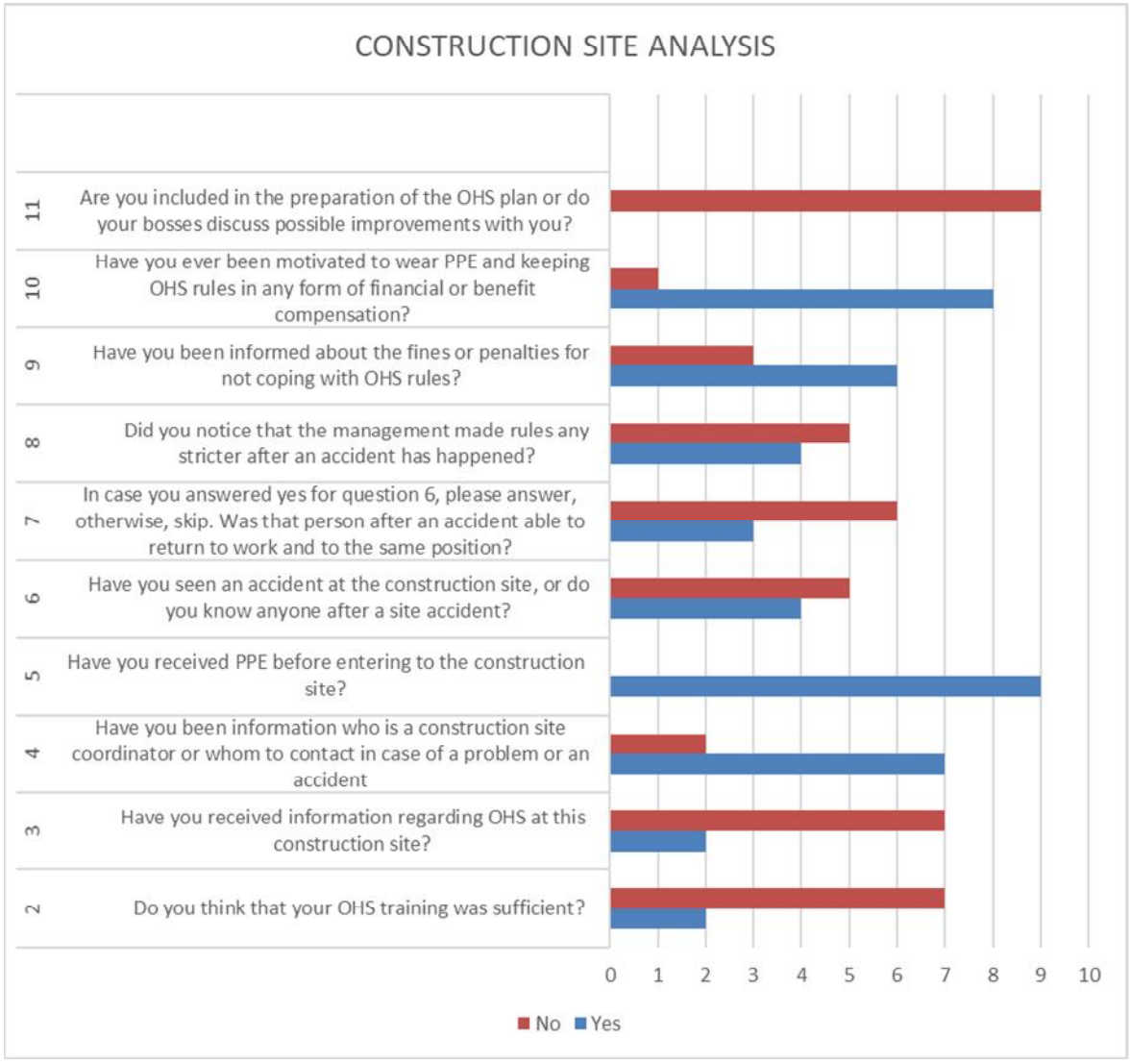
of replies by the employees. Each question is graphically presented to reinforce visually the successfulness of occupational health and safety procedures in real-life examples.



Summary of One Way Analysis of Variance (ANOVA) on Causes of Accidents on Construction Sites.

S/N	Causes of Accidents on Construction Sites	Sig. Level	Accept H_0	Reject H_0	Accept H_A	Reject H_A
1	Non implementation of safety plans on site	0.000	×	√	√	×
2	Failure by management to enforce safety rules	0.000	×	√	√	×
3	Unsafe acts or unsafe working condition	0.000	×	√	√	×
4	Incompetence of worker or improper attitude	0.006	√	×	×	√
5	Ignorance on safety technique or	0.004	×	√		×

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	lack of knowledge					
6	Poor site layout	0.000	×	√	√	×
7	Non implementation of safety policies by management	0.000	×	√	√	×
8	Non adherence to safety policies	0.002	×	√	√	×
by worker		0.000	×	√	√	×
9	Inadequate personal protective					
clothing and equipment		0.000	×	√	√	×
10	Lack of site control measures i.e.					
safety signs, tags, barriers, etc		0.000	×	√	√	×
11	Inadequate employees training					
Using unsafe equipment, hands instead of equipment or using equipment unsafely		0.644	√	×	×	√
Operating equipment at unsafe speed		0.975	√	×	×	√
14	Using unsafe method for work	0.027	√	×	×	√
execution		0.000	×	√	√	×
15	Inadequate or Unsuitable					
illumination		0.000	×	√	√	×
16	Pre-job and post-job briefings					
about safety		0.019	√	×	×	√
17	Fatigue					

Summary in above table of the one way analysis of variance (ANOVA) performed on causes of accidents on construction sites. This table reveals the factors responsible for the causes of accidents on construction site which are the following: Non implementation of safety plans on site; Failure by management to enforce safety rules; Unsafe acts or unsafe working condition; Ignorance on safety technique or lack of knowledge; Poor site layout; Non implementation of safety policies by management; Non adherence to safety policies by worker; Inadequate personal protective clothing and equipment; Lack of site control measures; Inadequate employees training; Inadequate or Unsuitable illumination; and Pre-job and post-job briefings about safety

VIII. CONCLUSION

Research from the collected governmental data demonstrates the presence of a high number of accidents within the construction industry. Even though the trend for the last decade indicates a certain decline in the overall number of accidents within construction, numbers are still attracting our attention and ask for an improvement.

The thesis studied available resources that can eliminate the occurrence of such accidents. Occupational Health and Safety is the key aspect that is designated to control and manage adherence to pre-set rules. Previous research showed that with the support of Personal Protective Equipment, several accidents can be prevented. Refereeing to the conducted survey, construction workers are adhered to Occupational Health and Safety principles as well as to Personal Protective Equipment, to some extent.

At the same time, as mostly communication issues were uncovered judging by the obtained results from the survey, there is an evident area for improvement in regards of communicating the OHS principles towards the employees. Similarly, construction site management should be able to pay attention to employees' opinions, as they are often the ones better aware of the circumstances of the practical application of established rules.

Moreover, an interest was set in the means of the convalescence of the workers that underwent an accident. Even though there were some situations described, due to insufficient data it was not possible to examine further on this

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matter. On the other hand, it was discovered, that those employees that were in a contact with an accident at the site, were well aware of the seriousness and importance of coping with the OHS guidelines.

Therefore, it may be concluded, that all established guidelines are proving effective and their application in real-life scenarios makes great sense. However, its promotion and further development of the preventive measures are essential for the reduction of accidents occurring at the construction sites.

REFERANCES

[1]. "Safety health and welfare on construction sites A Training Manual", International Labour Office, Geneva.

[2]. Pratibha Joshi, Promila Sharma, T.C. Thakur, and Amit Khatter, "Safety in Construction Line: Important issue for Risk Identification", International Journal of Advanced Engineering Research and Studies, IJAERS/Vol. I/ Issue III/April-June,2012/30-34.

[3]. "SP70:2001, Handbook on Constructi on Safety Practices", (Reprint 2007)", Published by Bureau of Indian Standards, New Delhi110002.

[4]. The Building and Other Construction Workers Act, 1996, Commercial Law Publishers(India) Pvt. Ltd. , 2007 , New Delhi

[5]. Heinrich H.W.,1959, Industrial Accident Prevention: A Scietific Approach, McGraw-Hill,USA.

[6]. Cambrdrige Dictionary. (N/A). Meaninf of prevention in English. Cit. 2. January 2021. Dostupné na Internete: https://dictionary.cambridge.org/dictionary/english/prevention

[7]. Cambridge Dictionary. (N/A). Cambidrge Dictionary. Cit. 1. January 2021. Dostupné na Internete: accident: https://dictionary.cambridge.org/dictionary/english/accident

[8]. Certificaton of managing systems / Certifikácia manažérskych systémov. (2019). Certification of OHS managing system based on standard ISO 45001 (ex OHSAS 18001). Cit. 6. November 2020. Dostupné na Internete: https://www.cems.sk/produkt/18-certifikacia- systemu-manazerstva-bozp-podla-normy-ohsas-18001-iso-45001- 2018?gclid=Cj0KCQiA88X_BRDUARIsACVMYD_Xa_gcfUWtbtwoqP8PYELZol WnODlGDaNcc5oB5H29uIfziPjKUXsaAgpJEALw_wcB

[9]. Collins Dictionary. (N/A). Definition of postaccident. Cit. 1. January 2021. Dostupné na Internete: https://www.collinsdictionary.com/dictionary/english/postaccident

[10]. BIGRENTZ. (9. March 2020). 25 Construction Safety Statistics and Trends for 2020. Cit. 5. September 2019. Dostupné na Internete: https://www.bigrentz.com/blog/construction- safety-statistics

[11]. Block O'Toole & Murphy. (N/A). Causes of Construction Accidents. Cit. 29. October 2020. Dostupné na Internete: https://www.blockotoole.com/Construction-Accident- Help/Causes-of-Construction-Accidents.shtml

[12]. Building Radar. (29. January 2020). Data for the construction industry in Europe. Cit. 19. September 2020. Dostupné na Internete: https://buildingradar.com/construction- blog/construction-industry-europe/

[13]. Department of Chemical Engineering, University of Rome. (27. November 2019). Risk Profiling from the European Statistics on Accidents at Work (ESAW) Accidents′ Databases: A Case Study in Construction Sites. International Journal of Environmental Research and Public Health.

[14]. EUR-Lex, European Union law. (11. December 2008). European Union law. Cit. 14. October 2020. Dostupné na Internete: https://eur-lex.europa.eu/eli/dir/2002/44/2008-12-11

[15]. European Commission. (2004). ec.europa.eu. Cit. 12. December 2019. Dostupné na Internete: Eurostat: https://ec.europa.eu/eurostat/documents/3888793/5832069/KS-CC-04-006-EN.PDF/1af31b4a-037e-4f60-af83-4afe5a199df4

[16]. European Commission. (2008). Guideline of guaranteed standards for issuance of regulations (work at heights). Luxemourg: Office for issuance of governmental publications for European Union.

[17]. European Commission. (14. December 2011). Social Europe. Cit. 2020. Dostupné na Internete: Socio-economic costs of accidents at work and work-related ill health.

[18]. European Agency for Safety and Health at Work. (N/A). National legislation on safety and health at work. Cit. 4. December 2020. Dostupné na Internete: https://osha.europa.eu/en/safety-and-health-legislation/national-legislation-safety-and- health-work

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[19]. Eurostat. (2018). File:Non-fatal and fatal accidents at work, by working environment and economic activity, EU-28, 2017. Cit. 16. November 2020. Dostupné na Internete: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Non-fatal_and_fatal_accidents_at_work,_by_working_environment_and_economic_activit y,_EU-28,_2017.p