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Risk Assessment for Professionals Performing Excavation Services in Civil Construction: Case Study in Manaus - Amazonas

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Abstract— *The purpose of this study is to analyze safety conditions during excavation services, seeking to identify risks to employees in situations of ignorance or use of safety measures. Therefore, this study was conducted through a qualitative study, exploratory and descriptive, seeking to diagnose the main impacts of the adequacy of NR-8, NR-12 and NR-18 in a construction site in Manaus-AM. The results showed lack of signaling on the excavation perimeter, no use of personal protective equipment and residue around the excavation perimeter. The nonconformities found imply exposure of the employee to situations of imminent risk, compromising their safety and health. Training proposals to raise awareness of the importance of safety standards for the execution of activities can contribute to a safer scenario regarding working conditions.*
Keywords— ***Risk assessment, Construction, Excavation.***

I. INTRODUCTION

The high indirect costs of health and safety issues draw attention to the amount of resources spent each time an accident occurs, which is a strong argument to motivate research in the area. It is also noted the possibility of expanding the knowledge regarding the understanding of the nature of accidents in a broader aspect. Possible causes of accidents on a construction site include poor diet, managerial authoritarianism, neglect of health, and even the employee's poor preparation to perform their daily tasks.

Ignorance of the risks present in the workplace is perhaps the most relevant factor in the precariousness of Occupational Safety and Health (OSH) in Brazil. In civil construction, this picture is evident, especially for employees not directly linked to the OSH service (managers, architects, engineers, clerks, human resources sector, masons, servants, carpenters, etc.), who do not know the basics about these risks. It will be seen throughout the text the seriousness of the OSH situation in an open pit excavation site and how important is the participation of all involved in the production process of buildings and infrastructure, in general, in this prevention exercise, aiming at the health and well-being of all workers.

Prior to commencing the excavation task, access to the containment and excavation design for site knowledge is required[1].Generally speaking, structural works require previous earthmoving or earthmoving work. Open-pit excavation is a particular earthmoving work designed to deepen the lower elevation to coincide with the foundations work. This paper analyzes one of the most important earthmoving or earthmoving operations - excavation.

II. THEORETICAL REFERENCE

Each Brazilian regulatory standard (NR's), determines minimum requirements to be met, if the Labor Inspection Agents observe the breach of legal requirements determined by the NR's, they can notify employers granting deadlines for their regularization, or even fine the company [2].

2.1 NR - 18 - Buildings

NR-18 establishes administrative, planning and organizational guidelines that aim to implement control measures and preventive safety systems in the processes, conditions and working environment in the Construction Industry[3].

2.2 Work Accidents

Civil construction is a branch of activity of great importance in the Brazilian economic scenario. Beside its

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importance, it also houses a harsh reality with regard to working conditions: is considered one of the most dangerous in the world, including Brazil, leading the rates of fatal, non-fatal work accidents and lost years of life [4].

There are several factors that, articulated, make work accidents in this field of activity gain such dimensions: the low wages of workers; lack of infrastructure and carelessness of those responsible for safety at construction sites; intensified use of the workforce; the disorganization of work collectives; and the way work is organized.

2.3 Open Pit Excavations

Open pit excavation is a manually or mechanically opened foundation in the ground consisting of dug-out pits using drill-driven augers above the water table. The open pit excavation can be carried out according to the quota agreed in the construction project and afterwards the base is widened and the concrete filling process is started, preferably thickened. The construction of foundations with sharks is especially suitable for works with loads considered high (above 3,000 kN), – such as bridges, overpasses, and large buildings - for groundwater and landslide hazards[5].

In order to avoid landslides, landslides the standard sets the required safety conditions to be observed in project design and execution of open-air civil works on soils and rocks, not included for tunnel mining [6].

2.3 Equipments for Individual Safety (EIS)

The use of Personal Protective Equipment is provided for in the Labor Consolidation Laws (CLT) and regulated by the Regulatory Standard of the Ministry of Labor and Employment., being the same, the current legislation, obligatory [7]. The provision of EIS´s is the responsibility of the employer who also has the obligation to supervise the use by his employees.

Under Federal Law 3214/78, last amended by Ordinance No. 292 of 2011, the PPE is "(...) any device or product, individual use used by the worker to protect risks that may threaten safety and health at work". Knowing that the construction sector is an environment where accidents are very easy to deal with,the use of EIS's is one of the ways provided by law to prevent injuries caused by work accidents[8] [9].

III. METODOLOGIA APLICADA

The present study was carried out in a construction works classified as "works of foundations" and therefore has a degree of risk 4.The total number of employees is less than 250, so there is a need for a work safety technician, a work safety engineer and a work doctor.The work is located at José Romão Street, Novo Aleixo, s / n, Construction Company Soma S / A, in Manaus-AM, (Figure 1).

Data collection was carried out during the period from 10 to 20 September 2019. The mechanical excavation of the open pit was followed for the construction of the retaining wall, observing the conformity in the processes of execution of the work and the proper use of EIS's.

Fig. 1: Study Area Location, Source: Google Maps (2019)

IV. RESULTS ANALYSIS AND DISCUSSION

4.1 Excavations and Foundations

The excavation was observed, and proved that it is not in accordance with the legality of the NR-18, in the process of digging ditches, where it happens in soil or rock, with the lack of proper signs, warning not to cause accidents (Figure 2).

Fig. 2: Excavation for the construction of the retaining wall.

4.3 Signaling and EIS's

Two errors were found in the work: 1- lack of signaling in the excavation perimeter, disagreeing with the NR-18; 2- employees without protective equipment characterizing

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unlawfulness in the safety norms NR-6.Figure 3 shows the conformities and nonconformities of excavation items as observed at the construction site.

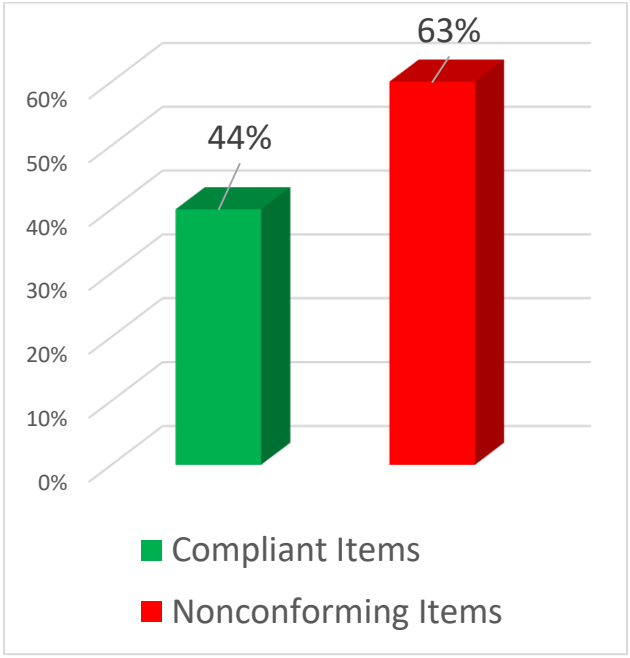

Fig. 3: Compliance and nonconformity chart of excavation items.

The entire perimeter of the excavation work should have warning signs that define the traffic of people, vehicles, machinery and equipment. Safety signs should be planned to prevent accidents. Traffic near excavations should be diverted and, if not possible, vehicle speeds should be reduced. At least two access roads must be built, one for pedestrians and one for heavy machinery, vehicles and equipment. Excavations should be signaled and isolated to prevent falls from people and / or equipment.

For the safety of all workers involved in the excavation, it is necessary to evaluate and select the applicable collective protections as well as safe means of access in the areas where the services will be performed [9] [10] [11].

In this type of work the PPE must be used to suit the existing risks, namely, helmet, safety shoes, goggles, protective gloves and reflective vest.Being able to do these jobs without human intervention at the bottom of the excavation and being outside would avoid many problems and a large number of fatal accidents.

For now, and waiting for new technologies to avoid worker presence in ditches and wells,we must use the means available to us by applying the necessary safety measures for risk control in accordance with the regulations in force.

In order to minimize accidents at the site, the inspection carried out by occupational safety agents should be maintained and,instruct employees daily to use EIS's and tools properly.

V. CONCLUSION

It is concluded that in civil construction, there are several activities that can endanger the safety and physical integrity of employees. Several factors contribute to this, among them the following can be mentioned: work environment not in compliance with safety standards, lack of correct use of safety equipment, lack of instructions, misuse of tools and equipment among others.

Initial planning for the execution of the work is extremely important, thus identifying the safety conditions during the excavation services, thus avoiding the risks to the employees in the excavation perimeter.

The results of the study, and the implementation of safety improvement programs in open pit excavation services for workers, are beneficial when integrating around an objective to minimize the risks to which they are exposed.

To preserve the integrity of employees, investing in quality of life must be provided to provide a working environment with adequate conditions. This leads all employees to direct their full potential for better quality.

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