

Occupational Safety Analysis at a Construction Site in the City of Manaus/AM

Virna Costa Souza¹, Dâmaris Silva Reis², Walzenira Parente Miranda³, Erika Cristina Nogueira Marques Pinheiro⁴

^{1,2}Civil Engineering Student, Estácio of Amazonas College, Manaus, Brazil

³Civil Engineer, Work Safety Engineer (Specialist in Didactics in Higher Education) Graduated in Law -University Professor (Faculdade Estácio do Amazonas College, Nilton Lins University).

⁴Civil Engineer, Work Safety Engineer and Degree in Mathematics (Specialist in Didactics in Higher Education and Tutoring and Teaching in EAD –University Professor (Faculdade Estácio do Amazonas College, Nilton Lins University, Unip).

Received: 25 Mar 2021;

Received in revised form:

03 May 2021;

Accepted: 21 May 2021;

Available online: 11 Jun 2021

©2021 The Author(s). Published by AI Publication. This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/>).

Keywords—Occupational Safety, Regulatory Standards, Construction Site, Accident Prevention.

Abstract—The object of this case study is the analysis, according to regulatory norms, of the construction site located in the city of Manaus/AM. The study begins with the approach of concepts and norms related to occupational health and safety inside the construction site environment. An inspection was held, through a questionnaire, of the measures taken by the company about occupational safety at the construction site. Lastly, it was possible to verify the conditions of the site concerning the safety established by the responsible company. Therefore, what could be seen was the lack of organization and cleanliness of the site. It was identified the lack of concern with regard to safety equipment by the employees themselves. But still, it was seen a great concern with the employees' safety by holding of meetings and lectures on accident prevention.

I. INTRODUCTION

Currently, civil construction has been standing out as an area of great labor risks. According to data from the Statistical Yearbook of Work Accidents (AEAT), in 2018 there were about 576,951 injuries in Brazil, an increase of approximately 3.34% compared to 2017. In the area of civil construction, there were about 29,612 accidents, corresponding to 5.13% of the total.

Even with the increase in accidents, companies have not paid due attention to employee safety, bearing the economic and social costs of accidents on site.

The research will address occupational safety through a case study of the construction site located in the Industrial District of Manaus / AM. An analysis will be carried out, according to regulatory norms, which will define whether

that environment can be considered safe or whether measures need to be taken to improve its safety.

The objective of the work is to address the concepts and norms related to Occupational Safety at the construction site, the inspection of how and what measures are taken to establish safety at the construction site, and the presentation of a report demonstrating the improvements that must be implemented to comply with legislation.

II. THEORETICAL REFERENCE

In order to theoretically substantiate this case study, concepts on the topic of Occupational Safety and Environment Analysis at a Construction Site in the City of Manaus/AM will be undermentioned in this item, notes referring to the historical context of Occupational Health

and Safety, Legislations, Brazilian norms that must be followed and indications on procedures to be adopted at a construction site to meet the Occupational Safety Norms.

2.1 Health and Safety of Work - Historical Context

There was already long before Christ the safety concern, for example, in the construction of pyramids. Considering this, in the book of Deuteronomy, chapter 22, verse 8 of the bible, there is the text, “When you build a new house, you shall make a parapet for your roof, so that you will not bring bloodguilt on your house if anyone falls from it.”

The history of occupational safety begins around 1700, with the publication of the book “Diseases of Workers” in Italy, written by physician Bernardino Ramazzini, the work describes numerous diseases related to some professions at the time. The repercussion was worldwide, making Ramazzini “the father of occupational medicine”.

In England, around 1760 and 1830, the relevant Industrial Revolution took place. The historical fact gave rise to an increase in health problems related to work activities.

“The bosses stayed, without restrictions, the daily working hours. They took the liberty of defining, according to their own needs and interests, the number of hours of work, without distinction among adults, minors, and women, and not even between painful activities or not.” (OLIVEIRA, João Bosco de Castro)

Thus, with so many alarming situations, the work environment becomes hostile, marked by typical accidents and illnesses or aggravated by activities performed at work. Furthermore, there were no laws to support workers in those situations and, without receiving their wages, they felt insecure in the context they were in. It was then that, in the mid-1800s, in England, France, Germany, and Italy, the first labor protection laws were created.

In Brazil, in January 1919, the first law related to occupational medicine was created, providing for the concept of the accident at work, legal action, and other general provisions. So, the advent of these facts contributed to the existence of occupational health and safety.

According to the World Health Organization, safety is understood as “the state of being free from unacceptable risks of harm” and health “the state of physical, mental and social well-being, and not merely the absence of disease or infirmity”.

Therefore, it can be said that Occupational safety is the set of measures adopted to minimize accidents at work, occupational diseases, as well as protect the integrity and work capacity of the worker.

On the other hand, health at work, or occupational health, is the way to promote and protect the health of workers in the workplace, enabling a better quality of life in three general aspects of well-being: physical, mental, and social.

All activities related to safety are extremely important, but at the construction site, they are indispensable for a construction project to be successful in all aspects. Valuing the health and well-being of the workers involved in this process is not only an obligation of the construction company but also brings several advantages to the work environment and the results delivered (Figure 1).



Fig. 1: Construction Site Environment. Font: Correios do MS, 2019.

Regardless of the size of the site and even the number of professionals involved, effective management of what happens at the construction site ensures not only the increase of productivity. But also, higher quality deliveries, reduction in the number of accidents at work and cases of occupational diseases, security of legal approvals, and resource savings.

2.2 Laws and Regulatory Standards - Safety at Work

The Brazilian Legislation and Norms aim to ensure that buildings and installations, as well as the constructive and maintenance process, have minimum conditions of safety, hygiene, health, aesthetic harmony, and accessibility, so that constructions and renovations are executed in a coherent and non-disorganized manner, and also for the technical characteristics to be maintained under the relevant Brazilian Norms.

For this case study, we are mentioning the Laws that apply to the Municipality of Manaus/AM, and the Brazilian Norms that instruct on safety at a construction site.

- Law No. 3724, of January 15, 1919, regulates the resulting obligations from accidents at work;
- Decree No. 5.452, of January 15, 1919, regulates the resulting obligations from accidents at work.

• Decree No. 5.452, of January 15, 1919, regulates the resulting obligations from accidents at work. This approved the Consolidation of Labor Laws – CLT, where chapter V refers to Occupational Safety and Medicine.

- NR-01;
- NR-04;
- NR-05;
- NR-06;
- NR-07;
- NR-09;
- NR-10;
- NR-12;
- NR-13;
- NR-15;
- NR-17;
- NR-18;
- NR-21;
- NR-23;
- NR-26;
- NR-33;
- NR-35;
- Fire Department;
- Works Code.

2.3 Safety Management at Construction Sites

2.3.1 Relevance and Compliance with Legal Aspects of OSH: Disobedience and Impacts on Vast Legal Sectors.

Companies suffer serious penalties when there are accidents. One of the consequences is media exposure that weighs negatively on the image of any company. In addition, there may be legal proceedings involving the Ministry of Labor by workers or family members when it is a fatal case. In this sense, companies will have high expenses and may have a tarnished image, failing to conquer new customers.

To avoid all these consequences, the construction site must be seen very carefully, observing the so-called risk agents. They are present in equipment, machines, materials, whether small or large sites.

The Occupational Health and Safety Management – OSH must step in to ensure that the risk agents are removed. There must be a lot of effort and observation on the part of all involved because the health and physical integrity of workers must be the greatest responsibility.

2.3.2 Construction Site Management: SESMT, PPRA, PCMAT, PCMSO E CIPA.

The Occupational Health and Safety Management of every company has a mandatory mission to work with the

participation of all employees through CIPA; the clarity of the actions planned through the Medical Control and Occupational Health Program (PCMSO), Environmental Risk Prevention Program (PPRA), and the Construction Industry Conditions and Environment Program (PCMAT); the implementation of the planned measures; and verification and analysis of results.

The Specialized Service in Safety Engineering and Medicine at Work - SESMT is organized with the beginning of the hiring of an occupational safety technician and as the company's employees grow, new professionals specialized in the area are employed, maintenance required by Regulatory Norm No. 4 .

It is common for accidents to occur due to a lack of understanding or the fact of disobedience to orders on the part of construction workers. There are still command failures on the part of those responsible for the execution of services that do not give the required orders for the safety of those involved.

For good OSH management, must be drawn up strategy plans that enable to evaluate and correct acts of insecurity, and in some cases being necessary to transmit knowledge of the procedures to the company's employees.

It is also essential that there is full participation by employees, designating some as responsible for security actions (with a focus on CIPA members) to keep themselves informed.

2.3.3 Internal Accident Prevention Commission - CIPA.

CIPA aims to prevent accidents and occupational diseases. It is also responsible for assisting the SESMT, formed by professionals specialized in occupational safety, while the CIPA is constituted by generally lay employees in accident prevention.

For better management, CIPA's actions extend to observing and exposing existing risk conditions to solve the problems encountered by creating measures to prevent future accidents.

2.3.4 Environmental Risk Prevention Program - PPRA.

The Environmental Risk Prevention Program - PPRA is established through the regulatory norm NR-9, which are drafted by companies and employers aiming at the health and safety of their employees, through a planning of control of environmental risks that may exist within the workplace.

For the preparation of the PPRA, the technical content must be expressed clearly and objectively, having the

company's presentation, clearly pointing out the risk agents within their sectors and their form of exposure.

2.3.5. Occupational Health Medical Control Program – PCMSO.

2.3.5.1. Regulation and fundamentals.

Regulatory Norm No. 7 establishes the implementation of the occupational health medical control program, which is the set of medical, preventive, corrective and analysis and tracking actions to monitor and ensure the maintenance of healthy physical conditions of each employee of the company, in all its sectors, locations and activities and should not be understood or confused as medical care, analogous to that provided by physicians contracted by the company.

The PCMSO is mandatory for all companies, regardless of the activity fields and the number of employees, and shall comply fully in its preparation and implementation with the PPRA.

2.3.6. Conditions and Environmental Program of work in the Construction Industry - PCMAT.

2.3.6.1. Regulation and fundamentals.

PCMAT should be understood as a specific OSH project for a particular construction site and not as a manual or a collection of rules and figures of the “can”, “cannot” type to be presented in an inspection. Obviously, it must be kept at the construction site.

According to Regulatory Norm No. 18, the PCMAT is a set of documents composed of:

- Memorial properly updated about the analysis of all risk agents present at the construction site;
- Specifications and projects of collective and individual protections;
- Initial and posterior layout of living areas;
- Training program, and
- Schedule of all planned actions.

It is not an immutable document and neither can it block the activities of the construction site. On the contrary, it must be revised and updated as often as necessary due to the dynamics of the site, which is a non-delegable obligation of the company that is the main technical person responsible for the project, the one that will command the works from its first day.

2.3.7. Relationship between Contracting Party and Contractors: Duties and Obligations of the Parties Faced with OSH Requirements - Regulation and Fundamentals.

In the set of NRs, the most explicit requirement for articulation between the hiring company and its contracted,

with regard to OSH legal obligations, is contained in NR-5, with the most relevant items being:

CONTRACTORS AND CONTRACTED:

5.48 The contracting part and the contractors, who work in the same establishment, shall implement, in an integrated manner, measures to prevent accidents and occupational diseases, resulting from this NR, in order to ensure the same level of protection in terms of safety and health to all employees of the establishment.

5.49 The contracting company will adopt the necessary measures so that the contracted companies, their CIPAs, the nominees and the other workers allocated in that establishment receive adequate protection.

5.50 The contracting company will take the necessary measures to monitor compliance by the contracted companies that work in its establishment with safety and health measures at work.

By applying item 5.50, any irregularity committed by the contracted company, when diagnosed by the inspection, may generate two notices of infraction: one against the contracted company, for objective failure, and another against the contracting company, for not having prevented it.

2.3.8. Approach and Analysis of the Main Causes of Accidents in the Construction Industry.

Accident at work is the one that occurs during the exercise of an activity, in the service of the company or as a self-employed worker, causing:

- Death;
 - Bodily injury;
 - Functional disturbance;
 - Loss of ability to work, temporary or permanent,
- and
- Reduction of ability to work, temporary or permanent.

Occupational diseases, work-related illnesses and accidents on the way (“in itinere”) are equated with accidents at work.

The most frequent typical accidents in CI activities around the world are:

- Levels different drops - NR-35, item 35.5.8.1;
- Burials – NBR 9061/85 – Safety for Open Pit Excavation, by ABNT and NR-18, item 18.6;
- Contacts with electricity - NBR 5274 - Electricity Graphic Symbols and NR -10.

2.3.9. Collective Protections - Regulation and Fundamentals

The legal provisions on collective protections required for IC construction sites are disseminated in many items of the NR-18 and also in other NRs, such as, for example:

- N° 10 - Security in Installations and Services in Electricity;
- N° 12 – Safety at Work in Machinery and Equipment;
- N° 33 – Occupational Safety and Health in Confined Spaces;
- N° 35 – Work at height.

Collective Protections (PCs) must be provided for installation before having workers at risk in a particular activity, location, or any other, potentially hazardous exposure. Most of the time, the implementation should be preceded by the elaboration of a consistent project and appropriate to the desired protection (Figure 2).

However, before the project, it must have a process of analysis and selection on which PC will be chosen, because different strategic options involve significant differences in cost, implementation time, durability and possibility of reuse of materials and effectiveness of the intended objective.



Fig. 2: Collective Protection Equipment. Source: Meelco, 2019.

2.3.10. Individual Protections.

The specific norm for the theme EPI NR-06, together with the NR-18 norm regulate the use of personal protective equipment.

Other norms that can assist in individual protection, guiding the use of protective equipment, are:

- NR-09 – item 9.3.5.5
- NR-10 – Safety in Installations and Services in Electricity: item 10.2.9
- NR-35 – Work at height: Item 35.5.

Within the legislation we highlight the following precepts:

The use of PPE is the last of the measures that an employer should consider in its strategy of eliminating or minimizing the harm that a particular risk agent may cause to the health and/or physical integrity of its employees.

As a priority, all alternatives should be exhausted in combating the risk agent using collective protections. If they are technically unfeasible or insufficient, administrative or work organization measures should be implemented and only in the last case should personal protective equipment (PPE) be used.

It should be emphasized that when implementing disproportionately costly solutions, the cost factor is not considered as a valid justification by the supervisory agents when it is detected that collective protection appropriate to the risk are not implemented and counting only on the use of PPE.



Fig. 3: Personal Protective Equipment. Source: Saúde e Vida Group, 2020.

2.3.11. Activities in Machinery and Equipment.

2.3.11.1 Movement and Transportation of Materials and People - Regulation and Fundamentals

The regulatory norm that guide the movement and transport of materials and people are:

- NR-18 – Item 18.14 - Movement and Transportation of Materials and People;
- NR-12 – General use of machinery and equipment;
- NR-12 – Item 12.85 - Material conveyors;
- NR-12 – Annex II, programmatic training content for safe operation of machines;
- NR-35 – Work at height;
- NBR 16200/2013 – Elevators of sites.

2.3.11.2 Material Handling

On a construction site, there are several options for moving materials: belt conveyors, elevators, platforms on tower and rack, column winches (Velox), cranes, pulley/trouble system, and other assemblies.

In these operations, there is almost always involvement of large materials and/or weight that, poorly moved can cause serious accidents both material and personal. Adding also the height factor, characteristic of CI, there is a worsening of the risk, and it should be remembered that

even smaller loads, when falling from high heights can motivate even fatal accidents.

For such reasons, the list of requirements, recommendations, and normative precepts contained in the legislation indicated above is justified.

2.3.11.3 Movement of People

For the exclusive movement of people in an IC construction site the equipment used is the elevator, pulled by steel cables or moved through the rack pinion system, usually identified only as a rack elevator.

The legislation relevant to elevators has been the subject of intense analysis, discussion and alterations since 1998 and with the objective of minimizing as much as possible the probability of new accidents and easing the highest level of safety for elevator users at the CI construction sites, the NBR 16200 / 2013 norm was elaborated.

2.3.12. Guindar Equipment – Regulations and Fundamentals

The regulatory norms that guide the use of hoist equipment are:

- NR-11: Item 11.1.3 e 11.1.3.1;
- NR-12: Use of energized machines and equipment in general;
- NR-18: Item 18.14;

In common, all hoist equipment (cranes, cranes, column winches, electric hoists, gantries, cranes...) must take special care for their load lifting components according to the guidance of nr-2, NR-11, NR-12, NR-18 and NR-35 norms.

2.3.13. Acidentes no Canteiro: Procedimentos Legais e de Emergência - Regulamentação e Fundamentos.

The regulatory norms that guide the occurrences of accidents at the construction site are:

- NR-07;
- NR-18;
- Ordinance MTE. 589 of 28/04/2014;
- NR-35.

In case of accidents, the determinations of the norm regarding initial care and filling of pertinent documentation must be followed.

In case of fatal accidents, immediate care of the injured and the isolation of the accident must be made, preserving the area of the accident until the performance of the investigation.

In case of finding occupational diseases, it should be treated as an accident at work and procedures should be adopted according to the guidelines of the norm.

III. METHODOLOGY

The methodology for completing this course conclusion paper was developed through a case study.

To base this case study, we present in the Theoretical Framework the literary content, Brazilian laws and norms that govern the study in question.

This research is exploratory and explanatory, because initially we will take note of the current conditions of the object of study, and later we will deepen into a specific condition of the problem to which we expose our theme.

The Case Study includes making face-to-face visits to the Construction Site with questionnaires applied to security officers and technicians involved in the site, with analysis in the environment that the site was located and is being executed.

3.1 Description of the Work

The site held is located in the Industrial District neighborhood in the city of Manaus / AM inside a factory having industrial character belonging to a large construction company active in the market since 1973, which has 2 civil engineers, 1 pointer, 1 master builder, 2 in charge, 2 engineering interns, 10 servants, 10 bricklayers and 4 carpenters for the site in question.

The construction company also works with outsourced companies that contribute to the execution of excavation services and the assembly of metal structures. With about 30 employees of the company X, 25 employees of the company Y and 20 employees of the company Z.

The site has approximately 2,300 m² and an area formed by 2 assembly lines as can be seen in Figure 1. During the visit, the site was in the stages of foundation execution, masonry execution, floor concreting and metal structure assembly.

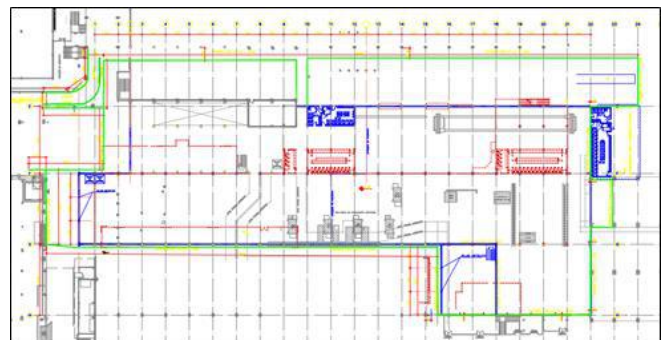


Fig. 4: Layout of the Work

3.2 Application of the Questionnaire

During the visit, the questionnaire was answered by the security technician who worked on site. The questions were elaborated for the analysis of some points that were

considered more important and that make it easier to see clearly the application of work safety in a construction site.

1 - According to NR-4, does the company have SESMT?

Due to the great demand of employees (both the company and outsourced), the company had professionals specialized in Work Safety, these being members of SESMT. The company contracted by the services of the construction company also worked with a SESMT team that helped significantly in the work.

2 - According to NR-5, does the company have CIPA?

The contracting company of the construction company's services had CIPA, and registrations were made for employees and elections for the commission. The construction company also has CIPA formed by employees who meet once a month to discuss the problems found to prevent similar situations in the future.

3 - Does the company offer PPE? Under what conditions?

The construction company made personal protective equipment available to each of its employees. For greater control of the equipment provided, each employee had a control form, the so-called "PPE Sheet", which contained which equipment were delivered and also the serial number. This was important for possible accidents in which the equipment proves to be defective.

4 - According to NR-7, does the company have aPCMSO document?

The company has a document of the Program for Medical Control and Occupational Health. The company performs all admission, periodic, dismissal, and role-changing exams. All employees had their occupation health certificate up to date and are renewed within one year. The contracting company also required these documents for greater control of employees who worked at the factory, even so, that their health was intact.

5 - According to NR-9, does the company have a PPRA document?

The company had in the site a document referring to the Environmental Risk Prevention Program. The outsourced companies involved also had documentation about the program.

6 - According to NR-18, the company had PCMAT?

The documents related to the Program of Conditions and Work Environment in the Construction Industry were present in the site. Thereby, have the prevention of accidents and identifying the risk factors found in the construction site.

7 - Did the construction site have sanitary facilities? What are your conditions?

Yes, there were two sanitary facilities in containers. Both were in good condition and the environments were well lit. Cleaning was realized daily and twice a day. There was also a control of the day and time that the facilities were clean, contributing to the health of employees.



Fig. 5: Sanitary construction site installation

8 - Were there measures to protect against height fall?

With regard to the prevention against fall from height, training was carried out that guided the employee to use the safety equipment correctly, since learning how to put the safety belt on a paratrooper type until climbing on a scaffold properly as shown in Figure 6. And lifelines and signs were also found that warned of the dangers that could be encountered as ahead in Figure 7.

Before performing the work at height, the employee underwent screening with the measurement of pressure to evaluate his conditions of doing the service and ensuring the health and well-being of the worker.



Fig. 6: Practical NR-35 Training

9 - How did the transport of materials and movement of people work?

For the transport of materials, a truck-crane was used for vertical transport and also for hoisting. The truck was a vehicle rented by a carrier company that performed these services.

For the movement of people, safe passages were always created with indications and signs so that there were no overtaking and so that they could be respected.

10 - Under what conditions were the scaffolding?

The company had its own scaffolding and also rented by a outsourced company that also did service on the site. Some scaffolding were without footers and without sufficient platforms for the worker's locomotion, although there were lifelines fixed throughout the site, yet there was a risk of high-level accidents.



Fig. 7: Scaffolding of the work.

11 - Under what conditions were the electrical installations of the construction site?

There were electric distribution board arranged by the site to facilitate the dynamics of each service. But in the area of the construction site were found many electrical cables on the floor that were being used or not. The danger was that many vehicles and machines passed over the cables and this could lead to accidents by damaging the cables, especially due to the existence of wet lands in the construction site.



Fig. 8: Electrical cable found in the worksite.

12 - Were there equipment, machines and tools being used at the time of the visit? Under what conditions?

Backhoes, articulated platforms and lifts, hammers were used. All these were rented by companies that offered the equipment and machines and were in good condition. There was also a concrete mixer that had all its safety and protection devices.

13 - How are safety signs made at the construction site?

In the site there were accident prevention signs that allowed the safety of the construction site to be emphasized. Places with ditches were isolated with cerquites at a safe distance.



Fig. 9: Sign board for risk of fall

3.3 Results Analysis

It was observed in the analyzed site that there are some forms of safety implementation that actually work for accident prevention. The company has qualified people in the area who are attentive to everything that happens in the site.

Something that was noticed during the visit was the so-called DDS - Daily Security Dialogue, which aims to talk to employees before performing their activities reminding them of the use of PPE and some safety care. Also performing labor gymnastics with all workers.

Another habit is once a week, two or more professionals of the specialized area walk through the construction site analyzing the situations and supervising the safety issues on site, generating a photographic report that allows the visualization of the issues that need to be improved and the advances within the work.

As soon as the employee arrives at work, training and integration are carried out (according to NR-18 norm) so that he is aware of his/her abilities and behaves safely. It is a way to raise awareness of the employee to understand the importance of his life.

Although many favorable things have been noticed regarding security, some problems have still been noticed. Like the electrical cables that circulated through the lower part and can be damaged and thus generating accidents such as electric shocks. Another factor was the random assembly of scaffolding that did not promote safety in relation to work at height, due to the lack of footers and platforms.

The solution that can be executed, is the creation of poles located in the course of the entire site for the passage of electrical cables through the top, allowing the safety of the movement of vehicles.

For the scaffolding, having the greatest control of their assemblies, inspecting and placing signs that signalizes their incomplete assembly.

For significant improvements, the company can invest in awareness lectures about the importance of acting safely and obey all the guidance given by technicians and professionals in the field of Occupational Safety. These lectures can be held once a month and highlighting employees who act according to safety standards.

Another improvement would be the daily supervision of the site, observing what can be considered a risk on the place. The safety technician would evaluate both the location and the employees. Checking that everyone is cooperating for safety such as the use of safety equipment and even the status of the used machines. About the machines, it is necessary to perform check-lists that enable daily care, seeing if it is necessary to perform maintenance or exchange.

IV. CONCLUSION

The objective of this work was to address the concepts and regulatory norms related to Occupational Safety and Environment within a construction site. And to see in the field, how a construction company behaves with the rules and norms for accident prevention. It was possible to understand the importance that the theme has over a general context, which includes from awareness so that workers realize how essential it is to return home alive to the practice of supervising unsafe work practices.

It is clear to note that without security there is no job well performed. For a long time, there was a concern for Health and Safety. But there was only greater awareness and knowledge when accidents and occupational diseases began to emerge.

For this reason, it is the duty of each company to focus on these crucial points to make them well evaluated. A company that seeks to have security in the first place begins to be respected by standing out as an example for others who are starting in the labor market.

REFERENCES

- [1] Associação Brasileira de Normas Técnicas. NBR 13434-2. Sinalização de Segurança Contra Incêndio e Pânico. 2004.
- [2] CB 32. Cinto de Segurança. 2006.
- [3] NBR ISO2408. Cabos de aço para uso geral - Requisitos mínimos. 2009.
- [4] NBR 15637 – 1. Cintas Sintéticas Planas. 2012.
- [5] NBR 15637 – 2. Cintas Sintéticas Tubulares. 2012.
- [6] NBR 16200. Elevadores de canteiros de obras para pessoas. 2013.
- [7] Câmara Brasileira da Indústria Da Construção. Guia Contrate Certo. Brasília. 2014.
- [8] Dúvidas Sobre Normas de Desempenho: Especialistas respondem. Brasília 2015.
- [9] Guia Orientativo Áreas de Vivência. Brasília. 2015.
- [10] Guia Orientativo de Segurança: Guia Básico para Implantação de Segurança e Saúde nos Canteiros de Obras. Brasília 2015.
- [11] Guia Orientativo de Incentivo à Formalidade. Brasília 2016.
- [12] BRASIL. Ministério da Previdência Social. Anuário Estatístico de Acidentes do Trabalho – AEAT. 2013. Available from: Accessed: 8 Oct. 2020.
- [13] Ministério do Trabalho e Emprego. NR 04 – Serviços Especializados em Engenharia de Segurança e em Medicina do Trabalho. Brasília: Ministério do Trabalho e Emprego, 2014. Available from: Accessed: 9 Oct. 2020.
- [14] Ministério do Trabalho e Emprego. NR 05 – Comissão Interna de Prevenção de Acidentes. Brasília: Ministério do Trabalho e Emprego, 2011. Available from: Accessed: 9 Oct. 2020.
- [15] Ministério do Trabalho e Emprego. NR 06 – Equipamento de Proteção Individual – EPI. Brasília: Ministério do Trabalho e Emprego, 2015. Available from: Accessed: 9 Oct. 2020.
- [16] Ministério do Trabalho e Emprego. NR 07 – Programa de Controle Médico de Saúde Ocupacional. Brasília: Ministério do Trabalho e Emprego, 2013. Available from: Accessed: 9 Oct. 2020.
- [17] Ministério do Trabalho e Emprego. NR 09 – Programa de Prevenção de Riscos Ambientais. Brasília: Ministério do Trabalho e Emprego, 2014. Available from: Accessed: 9 Oct. 2020.
- [18] Ministério do Trabalho e Emprego. NR 10 – Segurança em Instalações e Serviços em Eletricidade. Brasília: Ministério do Trabalho e Emprego, 2004. Available from: Access: 10 Oct. 2020.
- [19] Ministério do Trabalho e Emprego. NR 12 – Segurança no Trabalho em Máquinas e Equipamentos. Brasília: Ministério do Trabalho e Emprego, 2015. Available from: Access: 10 Oct. 2020.
- [20] Ministério do Trabalho e Emprego. NR 13 – Caldeiras e Vasos de Pressão. Brasília: Ministério do Trabalho e Emprego, 2014. Available from: Access: 10 Oct. 2020.
- [21] Ministério do Trabalho e Emprego. NR 15 – Atividades e Operações Insalubres. Brasília: Ministério do Trabalho e Emprego, 2014. Available from: Access: 10 Oct. 2020.
- [22] Ministério do Trabalho e Emprego. NR 16 – Atividades e Operações Perigosas. Brasília: Ministério do Trabalho e Emprego, 2015. Available from: Access: 10 Oct. 2020.
- [23] Ministério do Trabalho e Emprego. NR 21 – Atividades realizadas a céu aberto. Brasília: Ministério do Trabalho e Emprego, 1978. Available: Access: 11 Oct. 2020.
- [24] Ministério do Trabalho e Emprego. NR 23 – Proteção Contra Incêndio. Brasília: Ministério do Trabalho e Emprego, 1978. Available in: Accessed: 11 Oct. 2020.

- [25] Ministério do Trabalho e Emprego. NR 26 – Sinalização de Segurança. Brasília: Ministério do Trabalho e Emprego, 2015. Available in: Accessed: 11 Oct. 2020.
- [26] Ministério do Trabalho e Emprego. NR 33 – Segurança e Saúde nos Trabalhos em Espaços Confinados. Brasília: Ministério do Trabalho e Emprego, 2012. Available in: Accessed: 11 Oct. 2020.
- [27] Ministério do Trabalho e Emprego. NR 35 – Trabalho em Altura. Brasília: Ministério do Trabalho e Emprego, 2014. Available from: Accessed: 7 Oct. 2020.
- [28] FUNDACENTRO. RTP 01 – Medidas de Proteção Contra Quedas de Altura. São Paulo. 2005.
- [29] RTP 02 – Movimentação e Transporte de Materiais e Pessoas. São Paulo. 2001.
- [30] RTP 04 – Escadas Rampas e Passarelas. São Paulo. 2002.
- [31] RTP 05 – Instalações Elétricas Temporárias em Canteiro de Obras. São Paulo. 2007.
- [32] Diretrizes Sobre Sistemas de Gestão da Segurança e Saúde no Trabalho. São Paulo. 2005.
- [33] MPAS-Ministério da Previdência Social. Manual de Instruções para Preenchimento da Comunicação de Acidente do Trabalho – CAT. Brasília. 2009
- [34] MTE - Ministério do Trabalho e Emprego. Manual Técnico de Caldeiras e Vasos de Pressão. Brasília. 1996.
- [35] Manual da CIPA: A nova NR-05. Brasília. 1999.
- [36] Trabalho Temporário Terceirização Orientação ao Tomador de Serviços. Brasília. 2001.
- [37] Guia de Análise Acidentes de Trabalho. Brasília 2010.
- [38] OIT - Organização Internacional do Trabalho. Segurança e Saúde na Construção. GEP/MTSS. Portugal 2008.
- [39] Diretrizes sobre Sistema de Gestão da Segurança e Saúde no Trabalho. FUNDACENTRO 2005.
- [40] Princípios Fundamentais de Segurança e Saúde no Trabalho Ed ACT / Portugal. 2007.
- [41] Locais de Trabalho Seguros e Saudáveis Ed ISHST. Portugal 2007.
- [42] Convenção 155 Segurança e Saúde dos Trabalhadores. 1981.
- [43] Convenção 167 Segurança e Saúde na Construção. 1988.
- [44] REIS, Roberto Salvador. Segurança e Saúde no Trabalho. 12. ed. São Paulo: Yendis, 2014.
- [45] SCALDELA, Aparecida Valdinéia et al. Manual Prático de Saúde e Segurança do Trabalho. 2. ed. São Paulo: Yendis, 2013
- [46] Serviço Social da Indústria Departamento Nacional. Técnicas de Avaliação de Agentes Ambientais, Brasília, 2007.
- [47] DIVISÃO DE SAÚDE SEGURANÇA NO TRABALHO. Manual de Segurança e Saúde no Trabalho: Indústria da Construção Civil – Edificações. São Paulo. 2008.
- [48] Segurança e Saúde no Trabalho para a Indústria da Construção. Brasília, 2015.
- [49] Segurança e Saúde na Indústria da Construção no Brasil: diagnóstico e recomendações para a prevenção dos acidentes de trabalho. Brasília 2015.
- [50] ANTONIO, Sérgio. Plano de Cargas para Gruas Instaladas em Canteiro de Obras. São Paulo. 2004.
- [51] CORREIOS DO MS, publicado em 2019. Disponível em: <<https://www.correiodoms.com.br/noticias/municipios/de-olho-na-seguranca-dos-trabalhadores-mpt-e-construtora-pactuam-medidas-protetivas-em-canteiros-de-obras>>Accessed November 18, 2020.
- [52] MEELCO, publicado em 2020. Disponível em: <www.meelco.com.br/produto-protecao-coletiva/>Accessed November 18, 2020.
- [53] SAÚDE E VIDA, publicado em 2020. Disponível em: <<https://www.saudeevida.com.br/importancia-do-uso-de-epi/>>Accessed November 18, 2020.