

Chapter 90

Lift and manual transport of loads: description of ergonomic improvements in the maintenance sector of machinery and equipment in civil construction

  <https://doi.org/10.56238/devopinterscie-090>

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ABSTRACT

This study was proposed to describe the measures of ergonomic improvements regarding the lifting and manual transport of loads implemented in the sector of maintenance of machines and equipment in civil construction. To achieve what was outlined, bibliographical research was used to structure the theoretical basis of the study associated with the case study. As a result, it was possible to verify that the implemented ergonomic interventions contributed significantly to the improvement of working conditions, generating more comfort and well-being for the worker. Ergonomic actions such as bench restructuring, and the use of "Giraffes" and Bobcats made it possible to preserve the health of workers, especially regarding risk factors present in the work environment, and possible generators of diseases.

Keywords: Ergonomics, manual transport, construction.

1 INTRODUCTION

Since 1943, when the Consolidation of Labor Laws was approved by Decree-Law No. 5,452 (BRASIL, 1943), individual and collective labor relations have been regulated, including aspects involving hygiene and safety at work.

Later, thirty-five years later, Ordinance No. 3,214 (BRASIL, 1978) approved the Regulatory Norms - NR relating to Occupational Safety and Medicine. Ten years later, the Federal Constitution of 1988 (BRASIL, 1988) in its 7th article reinforced the obligation to promote health and safety for workers and ensured this right.

All these mechanisms were developed to provide favorable conditions for the execution of professional tasks, to achieve well-being, and maximize performance. But this was not always the established path. In the period of the industrial revolution, working conditions were bad, with no precautions for the physical and mental integrity of the worker. At that time, there was no knowledge of

the risks that the craft activity exposed to those who performed them, one of the reasons why improvements were not implemented (MENDES; DIAS, 1991).

In the current 21st century, knowledge of these threats to the integrity of the worker's health is common sense, with, as already mentioned, standardized safety parameters, through medicine and occupational safety, which are extremely important tools for preserving vitality. and propagation of the well-being of employees who are part of the labor environment (PUSTIGLIONE, 2017).

In civil construction, as in all economic segments, the aforementioned parameters must be used. Especially in civil enterprise, one of the characteristics of the tasks carried out in it is the great physical mobility of the worker, largely based on manual strength (RIBEIRO, 2011).

This scenario leads us to the observation of a Regulatory Standard (NR) that describes the so-called Ergonomics. NR 17 (BRASIL, 2022, p. 1) "establishes the guidelines and requirements that allow the adaptation of working conditions to the psychophysiological characteristics of workers, to provide comfort, safety, health and efficient performance at work". It is of crucial importance the implementation of Ergonomics within a construction site, where it will allow the adequacy of the crafts, making their execution more comfortable, safe, and efficient.

As presented, ergonomics directly influences the psychophysiological factors of the human being, from this aspect it is possible to deduce that this condition interferes with the productivity standards of the worker who works in the field of civil construction.

Thus, considering the information presented, the following research problem was developed: what are the measures for ergonomic improvements aimed at manual lifting and transport of loads to be implemented in a sector of maintenance of machines and equipment in civil construction?

During the elaboration of the research, the general objective was to describe the measures of ergonomic improvements regarding the lifting and manual transport of loads to be implemented in the sector of maintenance of machines and equipment in civil construction.

This research was carried out in a shed in the machinery and equipment maintenance sector in a civil construction company located in the municipality of Aparecida de Goiânia-GO.

2 DEVELOPMENT

According to USP (1997) within the civil construction, there is the presence of the construction site, which can be defined as the place where all the processes for the elaboration of a building will take place, in which the execution procedures, support, and all apparatus such as equipment and materials for production.

Ribeiro (2011) treats the construction site as a factory compound, this being the place where the production and performance of civil workers will take place, needing to outline all aspects to maximize indices related to performance such as cost and time of production.

A construction site is a place that exposes the worker to both physical and mental impairments. In this aspect, measures that seek to reduce occupational risks are extremely relevant. Within this opportunity, Ergonomics is an important tool to achieve the aforementioned scopes, since it provides a series of requirements aimed at protecting the worker, providing him with comfort, safety, and the productive system, the desired effectiveness.

Gonçalves and Deus (2001) report the importance of using Ergonomics within civil construction as an artifice to increase the quality of work, which is extremely relevant.

Ergonomics can be applied in a civil construction environment in different ways, and in this sense it is necessary the presence of a trained professional in this area, who points out all the risks present in the place as well as their solutions, since construction sites works are distinct, with no well-established standard among them, varying according to the characteristics of the place and the building produced.

To demonstrate a practical example of how Ergonomics can be applied in a construction site, some actions that can be used in this economic segment, more specifically, in the maintenance sector, will be demonstrated in the present study, which guarantees a better environment for the accomplishment of the tasks.

Saad, Xavier, and Michaloski (2006) state that some measures can be taken to reduce risks in a construction site, such as positioning of materials, use of benches, work tools aimed at ergonomic protection, machinery for transport of medium/heavy weight loads, all factors that help in the preservation of the spine, lumbar and other portions of the human body.

When it comes to this aspect of Lifting, transporting, and unloading individual loads, NR 17 (BRASIL, 2022) in its item 17.5 defines parameters related to this and for this reason, it must be widely publicized and put into practice.

3 MATERIAL AND METHODS

For Gil (2002) there are two types of sources for research, which are bibliographic and documentary, the first is based on information taken from printed documents, for example, books, while the second is derived from sources that have not been submitted to an analytical study, thus, its process may undergo changes in subsequent inspections, in this segment materials of the most varied types, are established. Both were used during the study, for which some scientific matrices such as books and articles were used.

Regarding the form of approach, the present study used qualitative research, expressing parameters such as definitions, characteristics, and functions, among others, related to productivity and ergonomics focused on the field of civil engineering, mechanisms that allowed achieving the proposed objective.

Marconi and Lakatos (2003) consider that the deductive method has its origin in initial ideas made by those who analyze the object, in which its mandatory characteristic is veracity, which, due to this fact, the outcome of the reasoning will inevitably be truthful.

During the study, the deductive method was used and from it, it was verified the influence of Ergonomics in the activities developed in civil construction, more specifically, in the maintenance sector.

This research was carried out in a shed in the machinery and equipment maintenance sector in a civil construction company located in the municipality of Aparecida de Goiânia-GO.

Data were collected through on-site observation and photographic records during the workers' work routine. From this collection, data were analyzed descriptively.

4 RESULTS AND DISCUSSION

The assessee company is classified as risk level 4 according to Regulatory Standard No. 4 (BRASIL, 2016). This is the highest degree of risk on a scale of 1 to 4. Its National Classification of Economic Activity (CNAE), also according to Brazil (2016) is number 42.11.101 belonging to the Heavy Civil Construction branch. This coverage area has been in the labor market for 30 years and operates in the construction of highways and railways.

The machinery and equipment maintenance sector presents numerous Ergonomics variables that expose workers to risks and it is of crucial importance to mitigate them.

After on-site observation and photographic records made by the researchers, measures for ergonomic improvements were described regarding the manual lifting and transport of loads, a common and routine action practiced by workers on construction sites, which can compromise their health gradually and gradually.

Among the improvements implemented is the elaboration of an Operational Procedure for loading loads carried out by two employees, as shown in figure 1.

Figure 1. Operating Procedure in cargo transport



Source: Authors (2021)

This described action fits as a component of Organizational Ergonomics.

Still, with the manual handling of loads, the object of this study, mechanical devices that allow less effort by the worker is an important way to preserve their health during work activity.

From this point of view, given the need to avoid manual transport of loads within the construction site, machinery such as the “Girafa”, illustrated in Figure 2, is an important means of helping to lift and

transfer loads, preventing the worker performs this movement manually, preserving his joints, especially the lumbar spine region.

Regarding the activities carried out in the field under analysis, a "Girafa" was applied to meet the common actions at the construction site, so it has a capacity of 2000 thousand kg, being used to transport the engine, gearbox, tire of heavy machines, among others, thus avoiding the physical effort of the worker.

Figure 2. Giraffe intended for cargo transport



Source: Authors (2021)

Because of the performance of the "Girafa", some elements cannot be carried by it, therefore, in the workplace, a Bobcat is used to move loads that cannot be transported using the "Girafa", such as loads that are moved over large distances. Figure 3, shown below, demonstrates the clamp mechanism, which was adapted to be used with the Bobcat, for the transport of materials, such as 50 Kg bags of cement, example.

Figure 3. Tweezers adapted for use on Bobcat



Source: Authors (2021)

Another point that deserves attention within the construction site is the working position adopted by the performers. In most places, there is no concern about this aspect, since many construction workers adopt an uncomfortable position for a long period of the day, or perform repeated flexion movements of the spine to pick up something on the ground.

Thus, a practical example of such a situation occurs in the cutting of materials, in which the split is carried out in the soil itself. The benches are one meter and ten cm high (1.10 m), it is used for cutting and maintenance of small parts, preventing the worker from crouching down to carry out maintenance or any other activity. About the mentioned scenario, Figures 4 and 5 show some adaptations introduced in the layout of the construction site, for better preservation of the worker's health.

Figure 4. Polycut on a 1.10 m high bench



Source: Authors (2021)

Figure 5. Workbench for using tools



Source: Authors (2021)

Nas Figuras 4 e 5 é possível observar uma bancada de suporte para o trabalhador durante a execução das suas tarefas, evitando que o mesmo realize constantes flexões do tronco, possibilitando uma maior preservação da sua coluna lombar e evitando o aparecimento de enfermidades ocupacionais relacionadas a esse fator.

5 CONCLUSION

Regarding the work carried out, it was possible to verify the occupational risks that the civil construction worker, especially on the construction site, is susceptible to, given the demand and type of work to which they are submitted. Within this aspect, the work focused on the dangers present in the manual lifting and transport of loads, given that this is a common activity within the construction site.

To obtain an answer to the research problem that gave rise to the study, a case study was carried out, verifying the ergonomic vulnerabilities in the sector of maintenance of machines and equipment in civil construction, regarding the lifting and transport of loads. As a result, it was possible to verify that the place under study did not have any ergonomic concerns within the analyzed point, jeopardizing the health and well-being of workers in the short, medium, and long term.

Thus, some ergonomic changes were made, such as the introduction of "Giraffes", workbenches with a height of 1.10 m from the ground, and adaptive mechanisms to allow the Bobcat to lift and transport loads common to civil construction. After the implementation, it was possible to verify the positive effects generated, given that the workers do not carry out manual lifting and transport of loads, nor perform tasks

close to the ground, changes that made possible greater preservation of the joints, especially of the lumbar spine and consequent positive impact in all health.

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