RESEARCH ARTICLE OPEN ACCESS

Individual protection equipment for use in the construction civil sector - case study in the city of Medianeira in Brazil

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ABSTRACT
Safety at work is defined as a set of measures that are based on technical standards and aimed at accident prevention, in Brazil it is governed by Decree-Law No. 5,452 of May 1, 1943, approving the Consolidation of Labor Laws - CLT. The construction is the sector that suffers most from industrial accidents and is labeled as the champion as the rates of work accidents. This study aimed to carry out a survey of the works of the construction industry situation in the city of Medianeira in Brazil about using Security Personal Protective Equipment (PPE) and relate to the use of such equipment with the occurrence of accidents. To carry out the research were used 40 works, and for the data used in the survey, a questionnaire was applied to each work, which was answered by the foreman. With this research found up those 50% of employers in this sector in the city are not complying with the legislation as the provision of PPE and only 10% of employees are using all PPE required for their safety.
Keywords **-** accident, PPE, prevention, safety.

I. INTRODUCTION

Safety at work is defined as a set of measures based on technical standards, which are aimed at preventing accidents [1]. In Brazil safety at work is governed by Decree-Law No. 5452 of 1 May 1943, approving the Consolidation of Labor Laws - CLT.

In the construction sector the likelihood of a worker suffering injuries is enhanced. According to [2] this sector is labeled as the champion among various business areas such as the rates of occupational accidents, and for [3] most accidents occur by falling height. [4] raised in his studies only in the period between January and September 2013 the construction sector had 2434 work accidents occurrences in the state of Parana.

According to the NR 6 (Norm), it is considered Personal Protective Equipment (PPE) every device or product, for individual use used by the worker, for the protection of susceptible risks to threaten the safety and health at work. NR 6 also defines the obligations by the employer, employees and the regional MTE agency (Ministry of Labour and Employment) and the supply, use and supervision of PPE, the standard states that the employer is required to provide to employees, free, appropriate to the risk PPE, in good condition and functioning and it is up to the employer on the EPI the following functions:

a) acquire PPE appropriate to the risk of each activity;
b) require its use;
c) provide the worker only equipment approved by the competent national body responsible for safety and health at work;
d) guide and train workers about the proper use, storage and conservation;
e) immediately replace when damaged or misplaced;
f) be responsible for cleaning and routine maintenance;
g) inform the MTE any observed irregularities;
h) register the supply to the employee and may be adopted books, records or electronic system.

It is up to the employee as to EPI:

a) use, using it only for the purpose for which it was intended;
b) to be responsible for the safekeeping and conservation;
c) inform the employer any alteration that makes it unsuitable for use; and,
d) comply with the employer's determinations on the proper use.

It is the regional agency MTE:

a) monitor and advise on the appropriate use and quality of PPE;
b) take samples of PPE; and,
c) apply, within their sphere of competence, the applicable penalties for the breach of NR [5].

According to [6] in accordance with current legislation regarding safety and medicine at work for construction (NR 5), PPE, which are required, are divided into four groups: head protection, to protect

the body, protection for the arms and hands, protection for the legs and feet in addition to the seat belt.

For [7] the main equipment to be used by construction professionals are:

1. Helmet: Impact protection in the skull;
2. Glasses: eye protection;
3. ear protector ear protection;
4. Mask for dust protection and chemical work: protection for the respiratory tract;
5. wear clothes like trousers and long shirt;
6. Leather gloves or plastic: protection against corrosive or toxic material and against material that can cause cuts;
7. boots or boots: chemical protection, spiked material and impacts;
8. Seat Belt: fall protection;

For [1] the use of personal protective equipment in construction is necessary because of the risk of accidents that the worker is prone to a work. The use of such equipment can reduce the risk of exposure of employees due to the high degree of insecurity in this activity. Since its establishment until today, the work of the security-related laws are becoming stricter and accidents is shrinking. It is the direction of the work ensure compliance with the measures envisaged in laws, especially regarding the use of personal protective equipment [8].

This paper aims to survey the works of the construction industry situation in the city of Medianeira in Brazil as the Personal Protective Equipment use (PPE) and to relate the use of such equipment with the occurrence of accidents, and inspection with economic level of the building.

II. MATERIAL AND METHODS

The survey was conducted in the Medianeira of town in the state of Paraná West region. The city population according to the census of 2010 is of 41,830 inhabitants, the city is constantly growing, and the construction sector was on the rise in recent years, and according to city officials in June 2015 were registered 307 building permits which have not been finalized.

To carry out the research were used 40 works and for the data used in the survey, a questionnaire was applied to each work, which was answered by the foreman. Through the questionnaire the following questions were raised:

1 - Type of work (building or home);
2 - Film of the work (m^2);
3 - Number of employees working in the work;
4 - Periodicity of the engineer responsible presence in the work;
5 - Executor (construction or on their own);
6 - Providing PPE: Supplied PPE are adequate to the risk of each activity performed?
7 - There is guidance and training for proper use and maintenance of PPE?
8 - The employer carries out maintenance and cleaning of individual use of equipment?
9 - The employer supervises the use of PPE?
10 - Employees make use of PPE? Which?
11 - There have been work accidents by lack of use of safety equipment?
12 - How many accidents have occurred in the work?
13 - How often is supervision?

Data were collected from April to May 2015 and the responses of each form were organized into an Excel spreadsheet and then proceeded to statistical analysis.

For statistical evaluation first data were separated into two groups according to the type of work, the first group encompassed the building construction type and the second group homes with up to two floors. With the data separated into two groups proceeded to descriptive statistical analysis of qualitative data, which is calculated mean, median, maximum, minimum, standard deviation and coefficient of variation.

To investigate the relationship between the variables proceeded to the making of bar charts with some of the variables. It has also been generated pie chart to check the percentage of works in which employees use each PPE.

III. RESULTS AND DISCUSSION

The questionnaire was applied to works of the kind building and home (houses with up to two floors). Of the total 40 books analyzed, 28 are houses and 12 buildings are. Initially there was the descriptive statistical analysis of quantitative variables length of the work and number of employees working in the work in order to characterize each type of work.

Homes in the analyzed the minimum length was 40 m^2 and 616 m^2 maximum length, and the works of this category showed an average of 168.2 m^2, with a coefficient of variation (CV) of 68.34%. Work in each work an average of four employees, and the minimum are two employees and a maximum of 11 employees. Respondents buildings (Table 1) have an average of 1920 m^2, a minimum of 476 m^2 and not more than 5450 m^2, and the data showed a CV of 95.87%. In each building they work an average of 11 employees, with a minimum three and a maximum of 35 employees.

When evaluated the periodic presence of the engineer's work according to the type of work (building or home) (Fig. 1) was observed that 100% of the buildings analyzed the engineer is regularly in the work, since for the category houses in 67.85% the works the engineer is present and 32.14% the engineer do not go to work. Where this is the

engineer the work in 16.13% of cases the engineer goes to work three times per week at 32.26% attend twice a week at 16.13% of the works once a week in 9.68% twice a month 25.81% and is present only once per month.

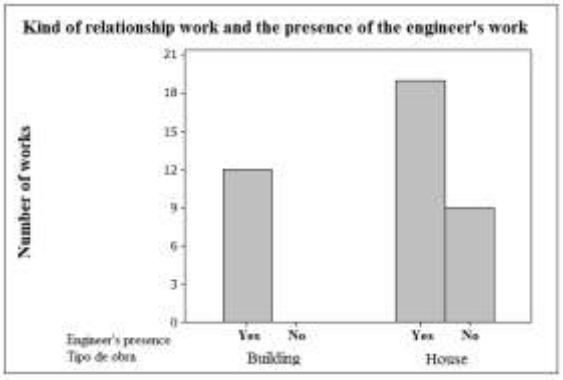

Fig. 1: Graph representing the ratio of the periodic presence of the engineer's work with the type of work (building or house).

It was also related the provision of PPE with the employer who is performing the work, whether it is construction or on their own (Fig. 3). It was found that 70% of the analyzed works are being performed on their own, and the other 30% are being performed by construction. In the works performed on their own, in 64.29% of them the employer does not provide PPE and 35.71% employer provides PPE. Already in the works performed by construction only in 16.67% of cases the construction company is not providing PPE and 83.33% in the contractor performs the provision of PPE. Overall (considering all the works analyzed) in 50% of the work the employer provides PPE and the other 50% the employer is not providing PPE. The results found by [9] 68% of companies are providing PPE. It was also found that employers who perform the supply of PPE also make supervision over the usage, and the proportion of employers who oversee the use of PPE was also 50% (Fig. 2).

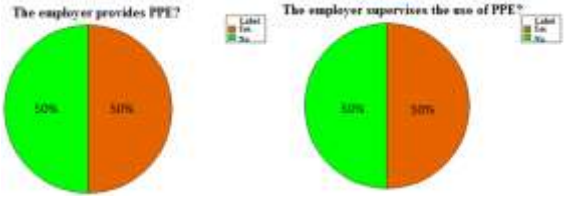

Fig. 2: Proportion of employers providing PPE and employers overseeing the use of PPE.

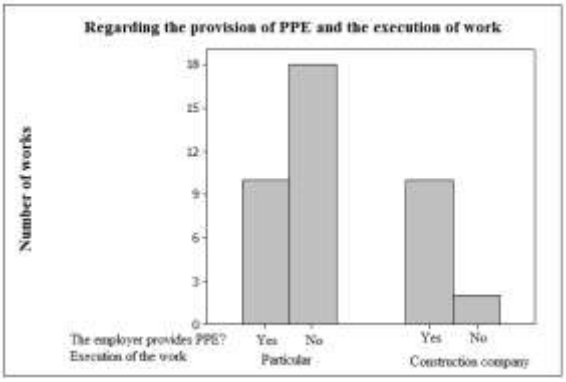

Fig. 3: Graph representing the ratio of the supply of PPE with the employer who is performing the execution of the work, whether by itself or construction account.

As can be seen in Fig. 4, the 40 works analyzed, 11 works (27.5%) employees said that there is guidance and training on the use of PPE by the employer and the other 29 works (72.5%) does not occur this guidance.

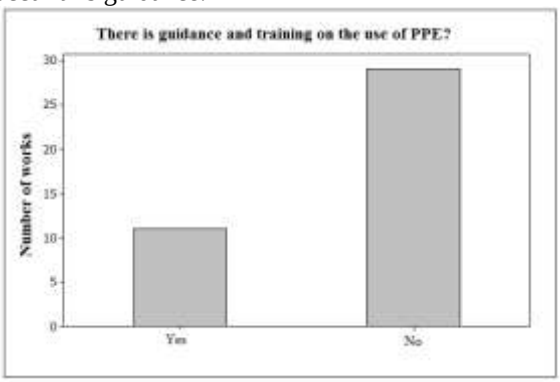

Fig. 4: Graph the existence of guidance and training on the use of PPE.

It was found that in 75% of analyzed works employees do or say to make use of any personal protective equipment and 25% of the works employees said they did not make use of any PPE. The results are similar to those raised by [9] in his research, which found that 71% of the works employees make use of PPE.

As accidents at work, it was found that 11 works analyzed (27.5%) there have been some type of working accident with employees, and has registered a total of 18 accidents analyzed in the works. [9] in his paper raised that in 20% of the works employees have suffered an accident at work. When evaluated the relationship between accidents at work and the use of PPE (Fig. 5), it was found that accidents occurred in 23.33% of the works in which employees use some type of PPE and works where officials say not using any type of PPE accidents occurred in 40% of cases.

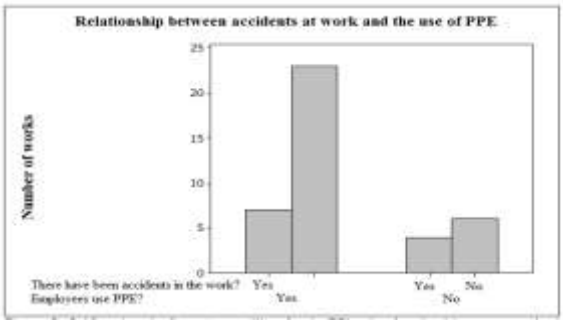

Fig. 5: Graph relationship between the use of PPE by employees and accidents at work.

In the works where employees said they use some type of PPE, the use of percentages of each EPI were observed (Fig. 6). In 30% of the works employees reported using only boot, 22.5% said they used boots and helmet, 2.5% use boot, helmet and mask, 10% use boot, helmet and gloves, 2.5% use boots, helmet and goggles, 5% use boots, mask, helmet and glove, another 5% use boot, helmet, glove and belt, 2.5% use boot, helmet, goggles and glove, 10% use boot, helmet, glove, goggles, masks, seat belts and another 10% said they use all PPE required for your safety. 100% of the works employees analyzed using boot and 70% use also hardhat, which are the most used equipment.

[6] in his research up to 100% of the works employees make use of PPE boots and hard hats. 100% of the works employees have said routine monitoring by the CREA, City Hall and the Ministry of Labor and Employment.

Importantly, this research was conducted through interviews and to have a clearer diagnosis of the reality of the demand and use of PPE is needed in the works taking place observation research at construction sites.

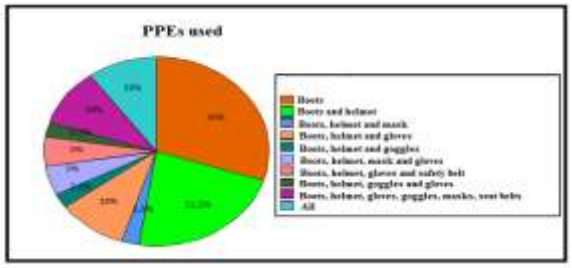

Fig. 6: graph of the percentage of use of PPE.

IV. CONCLUSION

With this survey it was found that 50% of employers in the construction of the Mediatrix-PR municipality are not complying with the legislation governing the delivery of Personal Protective Equipment (PPE), and when taken into account if the employer is the owner the work or a construction company, 83.33% carry out the provision of PPE and only 35.71% of the work performed by their own employer is carrying out the provision of PPE.

Only 10% of employees who report using PPE use all necessary safety equipment.

Through the data observed in the survey, it can be seen that the non-use of PPE is not the sole fault of the workers because the employer who has the responsibility and obligation to provide them and demand them, does not provide much of the same .

Regarding the requirement of use, it could be seen that his percentage is exactly the same as supply, ie employers provide PPE also require their use.

In the larger works, which are mostly performed by construction companies, civil engineer performs more frequent monitoring the work, which may also have increased guidance on the provision and use of PPE to employers and employees.

In 100% of cases the inspection is taking place, although it can be seen with the results that it is not being effective.

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