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Identification of Construction, Refurbishment and Demolition Wastes in the Urban Area of Porto Nacional - TO

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***Abstract*— With the development of the civil engineering business, cities are growing, and new construction is emerging, leading to the generation of construction waste, renovation and demolition. Therefore, this work aimed to identify these residues in small works in the urban region of Porto Nacional - TO. Through a survey of data, we studied 10 (ten) works of the municipality, observing the waste in relation to its identification, classification, separation and destination, was noted if there was presentation of compliance with current standards and laws. This is because improper disposal of these materials generates environmental, social and public health impacts. Thus, after the analysis of the works, waste management was proposed to minimize these problems with alternatives for reuse and recycling of these products. Hopefully, this study can bring improvements to local health, as well as help in the development of the city, and may even cause savings in the construction process.*

***Keywords*— Identification, Impacts, Management, Reuse, Waste.**

I. INTRODUCTION

With the development of the civil engineering business, cities are growing, and new construction is emerging, leading to the generation of construction waste, renovation and demolition. This fact is relevant since there is an irrational waste of materials, which causes environmental and social impacts to the population. Thus, it is necessary to know and classify the waste, so that they can have a correct destination.

Thus, the materials from buildings are composed of various products, which are classified in: soils, ceramic materials such as natural rocks, cement based on lime and mortar, red ceramic residues, white ceramic, plaster and glass; metallic materials, such as steel, galvanized steel sheets, brass, among others; organic materials represented by woods, plastics, bituminous materials, paints, packaging paper, etc. (JOHN ; AGOPYAN, 2000) .

According to Siqueira (2017), through the Brazilian Technical Standard (NBR) 10004: 2004, the Brazilian Association of Technical Standards (ABNT) divides the waste in relation to the possible dangers to the environment and public health in: class I - hazardous and class II - not dangerous.

Waste that may be hazardous to health or the environment is Class I waste due to its physical, chemical and / or biological characteristics. Also, they have at least one of the following properties: flammability, corrosivity, reactivity, toxicity and pathogenicity (ABNT, 2004).

Waste considered non-hazardous, which are class II, can be separated into: class II A, which have biodegradability, combustibility or solubility in water as properties, are classified as non-inert; and class II B, which do not have their constituents solubilized at higher concentrations, water potability standards, except for color, turbidity, hardness and taste characteristics, are classified as inert (ABNT, 2004).

National Environmental Council (CONAMA) Resolutions No. 307 (2002), No. 348 (2004), No. 431 (2011) and No. 469 (2015) classify waste into Class A, Class B, Class C and class D where:

- Class A: Reusable or recyclable waste as aggregate (ceramic materials, mortar, cladding plates, concrete, soil, pipes, etc.);
- Class B: are recyclable waste for other uses (plastic, paper, cardboard, metals, glass, wood, plaster, etc.);
- Class C: are residues that are not designed techn ologies or applications eco nomic feasible that allows its recycling or reclamation;
- Class D: Hazardous wastes, such as paints, solvents, oils and others or those contaminated or harmful to health,

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as well as tiles and other objects and materials containing asbestos or other products harmful to health.

Thus, in order to improve disposal on the construction site, appropriate internal storage and transport should be carried out for each type of waste, thus facilitating the separation and sorting of Construction and Demolition Waste (RCD), making them more viable to be reused and recycled, thus minimizing the impacts of their disposal.

According to Schneider (2003), when these residues are irregularly disposed, they damage landscapes and threaten public health, since they work with niche for several species of pathogenic vectors such as rats, cockroaches, fungi, viruses, among others.

S ccording Nagalli (2014), there is the re management system solid síduos which aims to reduce, reuse or recycle these wastes, including perform and comply with planning, responsibilities, practices, processes and resources in order to describe the fundamental steps to achieving of the steps mentioned in programs and plans.

Therefore, in view of the risks posed by the dumping of RCD in inappropriate places, this study aimed to identify the construction, remodeling and demolition wastes in the urban region of Porto Nacional - TO, observing the possible impacts of these materials and proposing ways of management for the municipality.

II. METHODOLOGY

The research was descriptive, qualitative and quantitative, by indirect approach procedures through field research.

The present study was carried out in the urban area of Porto Nacional - TO, located at a latitude of 10 ° 42'29 " south and a longitude of 48 ° 25'02 " west, zone 22, with about 60 km from the state capital, as shown in fig. 1.

Fig. 1: Location of the study area.

Ten (10) construction, renovation and demolition works were selected at random in the urban area of Porto Nacional, in different sectors of the city. Because it is an indirect approach, the works were not identified and were differentiated by letters, from Artwork A to J.

Technical visits were made to each of the selected works, and a waste identification questionnaire was applied to the works and the types of RCD produced in each one were observed. After obtaining the data, spreadsheets were produced for analysis of the identification, classification and final destination of the waste.

Construction and demolition solid wastes were identified according to Conama Resolution No. 307 (2002) in:

- materials from buildings;
- Reform materials;
- Materials from repairs and demolitions of civil works;
- Materials resulting from land preparation and excavation.

RCDs were classified at first according to NBR 10.004: 2004 in class I for hazardous waste, and class II for non-hazardous, and also within class II, class II A (non-inert waste) and class II B (inert waste).

They were then classified according to Conama Resolutions No. 307 (2002), No. 348 (2004), No. 431 (2011) and No. 469 (2015) where the waste was separated into class A, class B, class C and class D.

The destination was verified and the conformities and nonconformities were verified according to the Conama resolutions nº 307 (2002) and nº 448 (2012), where the waste should be destined according to the classes A, B, C and D.

After verifying the destination, appropriate final provisions and management methods were proposed for each of the works analyzed, according to the amount of waste identified.

III. RESULTS AND DISCUSSIONS

Through the application of a questionnaire containing 11 (eleven) questions, we identified how the management occurs and estimated the types of waste most produced in the region, from the works analyzed, based on November 2019. The results obtained with the questionnaire are presented in Graph 1 to Graph 12.

Of the 10 (works) visited, 04 (four) were located in the Jardim América sector, 03 (three) in the Aeroporto Sector, 01 (one) in the Jardim Brasília sector, 01 (one) in the Centro sector and 01 (one) in the Jardim Querido sector, as shown in Graph 1.

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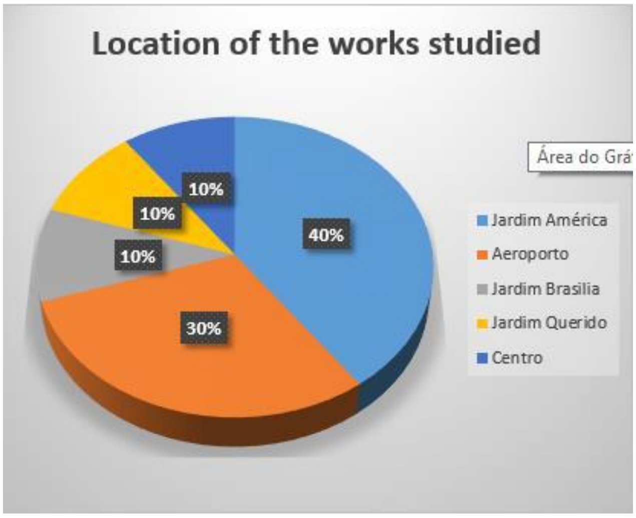
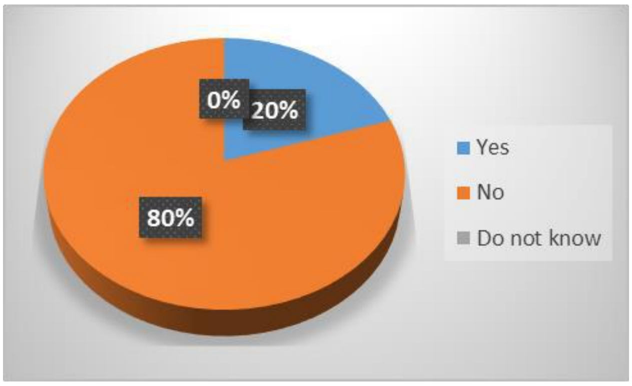


Graph 1: Location of the studied works.

It was observed that some answers of the questionnaires were omitted by the interviewees, because they were also made visual identifications and photographic memorials made for their verification, thus obtaining some contradictions.

The first question was about the knowledge of the RCD classes (Graph 2). It is noticed that 80% of the employees responsible for the works did not have knowledge about the RCD classes, which can directly interfere with the waste treatment.

According to Lima and Lima (2009), a qualification of the employees is relevant, so that they are trained and know how to classify the waste, so that they can perform an adequate separation.

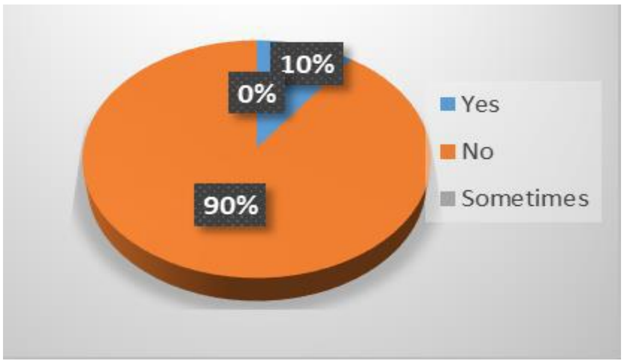


Graph 2: Knowledge of RCD classes.

Regarding the separation and sorting of CDW (Graph 3), it was observed that of the 20% of those who knew the waste classes, only half, make a separation. Therefore, no screening occurs in 90% of the analyzed works.

As Lima and Lima (2009) separate the waste on the site is important in the management of the RCD, because it helps to avoid its contamination by disposing them in categorically divided containers, thus contributing to their recycling. It is necessary that the RCDs are deposited until they reach an ideal volume for their external transport to the final deposit, where they can be recycled, reused or have a final destination.

Pereira, Jalali and Aguiar (2004) state that the separation of the RCD should be performed at the beginning of the work by selective demolition and selective collection of waste. It is noted that site separation can be difficult, and in some cases recycling at a plant is not feasible, due to the lack of efficient solutions for waste separation with excessive mixed materials and absorbed contamination.



Graph 3: *RCD separation and sorting.*

Although most works state that there was no separation or sorting, it was found that there were small separations, especially the separation of wood (class B) from other residues, for possible reuse, as shown in Fig. 2.

Fig. 2: RCD images separated in the works.

When asked about the implementation of the Civil Construction Waste Management Plan (PGRCC), 80% of the works in the region did not comply with Conama Resolution No. 307 (2002), Graph 4. This resolution states that construction companies have a duty to plan a PGRCC, being a requirement for the license of the projects with the municipalities. In the management project, it is important

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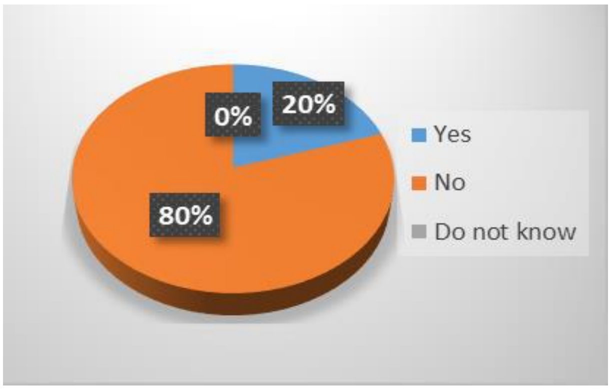
to estimate the amount of each waste, according to the classes resulting from that work, and the place where the waste will be sent safely and ecologically is established.

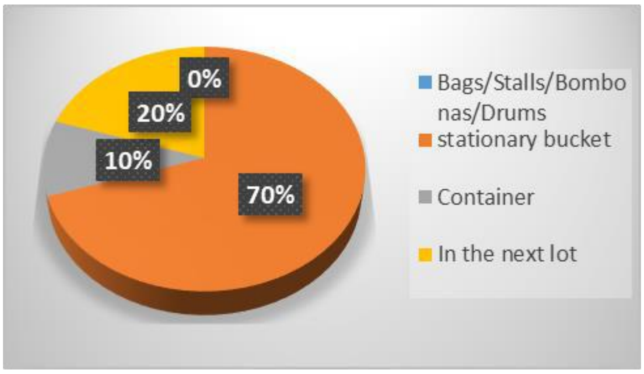
Paula (2017) argues that the placement and monitoring of PGRCC is a costly methodology in which it is crucial to understand the shortcomings and make suggestions for changes in order to achieve advances and improvements in the construction sector.



Graph 4: PGRCC Realization.

Regarding the temporary packaging of waste, most of the storage, about 70%, is done using stationary buckets (Graph 5). Currently, the most used tools for storing RCDs according to Lima and Lima (2009) are stationary drums, bags, bays and buckets, which should be properly marked showing the type of waste each one can keep, in order to maintain order in the work and preserve the quality of the packaged materials.

Melo and Fernandes (2010) point out that these buckets are of specific use to the RCD class A, which has several components that can be recycled in a common way. However, it is often analyzed the use of these buckets for the disposal of other wastes such as class D, which are considered hazardous wastes from the construction process, presenting some products harmful to health.



Graph 5: RCD Packaging.

Fig. 3 shows the identification of waste disposal in the stationary buckets of some works studied, with no separation, being placed even with household waste.

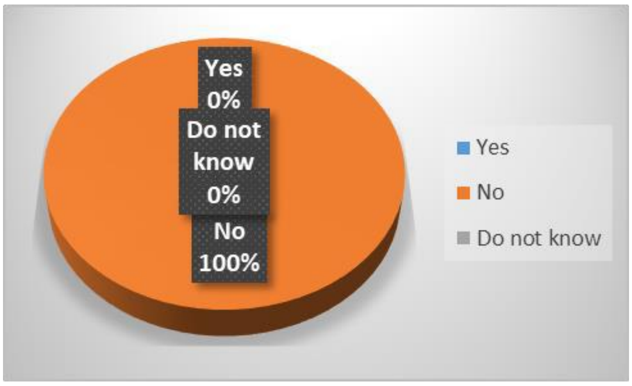
Fig. 3: Images of irregular RCD arrangement in works.

It was also observed the use of sidewalks and lots around the buildings, for the temporary placement of the RCD, as shown in Fig. 4, which can cause environmental damage to the region.

According to Oliveira and Mendes (2008), in most municipalities, a large portion of RCD is placed in inappropriate places such as river and stream banks or wastelands, causing siltation of streams and rivers, contamination, and proliferation. of disease vectors.

Fig. 4: Waste lot plotted RCD image.

Regarding hazardous waste (Class D), all respondents reported making no distinction regarding this waste (Graph 6), probably due to lack of knowledge about this classification.



Graph 6: Distinction of hazardous waste.

The temporary storage of hazardous waste, pending recycling, recovery, treatment and disposal, according to ABNT NBR 12.235: 1992 can be done in containers, drums, tanks and in bulk.

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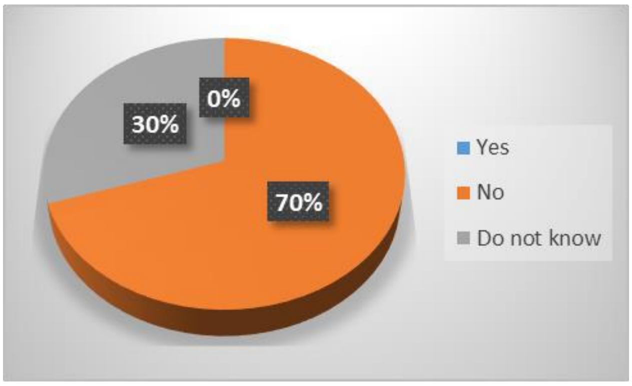
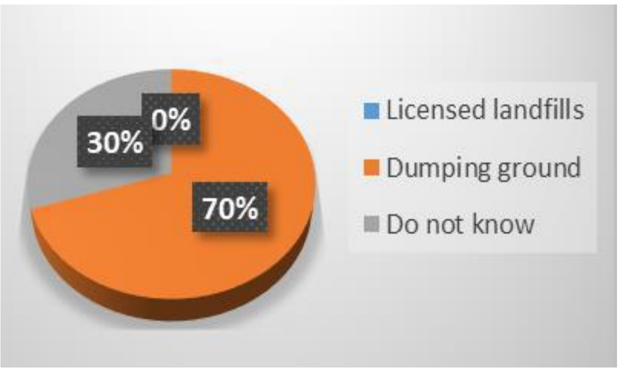
Regarding the issue of the Transport Manifest (MTR), it was found that 30% of respondents did not know if the work emitted MTR, and the other 70% stated that there is no emission (Graph 7). This result can be considered alarming, given that no monitoring occurs, which can lead to pollution and environmental damage.



Graph 7: MTR emission.

The MTR is used as one of the ways to prove the correct destination of the waste produced on site, being a monitoring tool of paramount importance to know the waste and to know its final destination. It is through this document that the generator proves that it correctly transported the waste and sent it to licensed areas (OLIVEIRA, 2010).

Regarding the final destination of the CDW, most of it is deposited in the dump, and the other part is not known where they are sent for reverse logistics, landfill or recycling depending on the final destination (Graph 8).

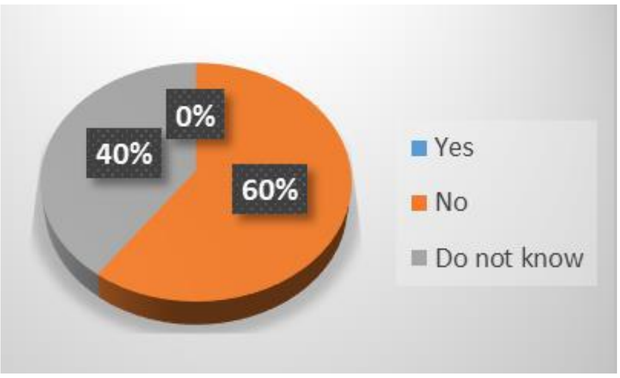


Graph 8: RCD Forwarding.

The final disposal of waste is a huge problem for construction, from small to large works. Santos (2009) argues that despite the existence of legislation for such a situation, in practice, the irregular deposition of RCDs, present in almost all Brazilian cities, is analyzed, especially when it comes to medium and small works.

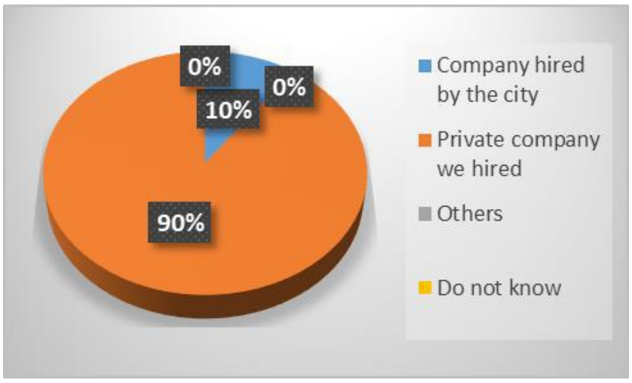
According to Law 12,305 of August 2, 2010, the environmentally appropriate final destination consists of reuse, recycling, composting, recovery and energy recovery, as well as other types of disposal accepted by the responsible agencies such as the National Environment System (SISNAMA), National Health Surveillance System (SNVS) and Unified Agricultural Health Care System (SUASA) . It should be noted that they must be attentive to specific operational rules, in order to prevent damage or risks to the population's health and safety, as well as reducing environmental impacts.

Regarding destination according to classes 60%, they stated that the waste is not destined according to classes and 40% did not know (Graph 9).



Graph 9: Destination according to classes.

Due to the fact that most of the works are private, it was noticed that the majority of the collection of RCD is done by companies contracted by the work, and the minority by companies hired by the city (Graph 10).



Graph 10: RCD Gathering.

ABNT NBR 13.221: 2003 reports that appropriate transport should be used, following the relevant regulations. In this case, the transport equipment must be kept conserved, offering no risk of waste leakage or spillage during the trip. In addition, the waste must be well packaged to prevent it from spreading on roads or railways. It should also be borne in mind that they should not be transported with food, medicine or products intended for human use or consumption, or with packaging.

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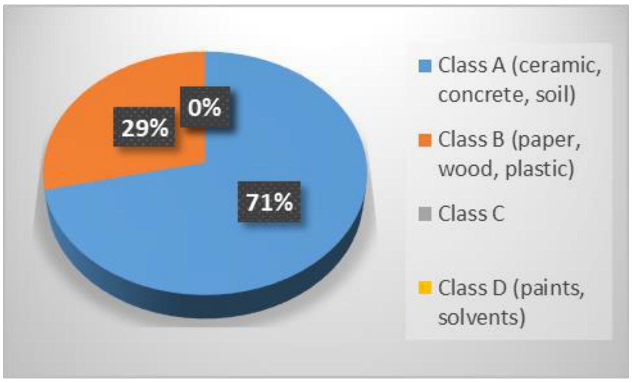
It was also observed that the most produced types in the region are Class A residues, as shown in Graph 11, which are ceramic materials, concrete remains, mortar, soils, among others, followed by Class B residues.

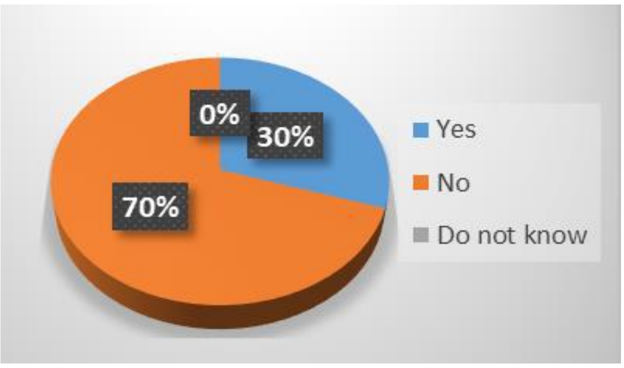


Graph 11: Most produced types of RCD.

Fig. 5 shows the most frequent residues in the visited works, in agreement with the data presented in Graph 11.

Fig. 5: Images of the most produced CDR in the work.

Regarding the reuse of materials (Graph 12), it is noted that only 30% of them do some sort of reuse, and the residues pointed to this situation were Class B, standing out for the reuse of wood remains.



Graph 12: RCD Reuse.

According to Lira (2016), this theme has been quite recurrent in the technical scientific environment, since the RCD have been used as aggregates for various jobs in construction, as well as in road paving. Therefore, reuse precautions should be taken for each type of waste, taking into account its class, destination and reuse.

IV. CONCLUSION

From the interviews and field identification it can be verified that most of the works do not have a control of the correct destination of the generated residues, besides the lack of knowledge by the workers. Specific qualification of the region's construction team is required for basic knowledge, such as differentiation of waste classes and sorting and handling modes. These measures are effective both to bring about savings in the construction process, as well as to minimize social and environmental impacts.

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