

IMPLEMENTATION OF A WASTE MANAGEMENT PLAN IN THE CONSTRUCTION SITE IN MANAUS-CASE STUDY

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ABSTRACT

The civil construction sector in Manaus is in continuous growth, just walk through the city and observe the excessive amount of construction, repairs and renovations. As a result, the development of techniques and methods to make sustainable day-to-day activities sustainable has intensified since the practice of reuse of construction waste is the worldwide trend towards mitigation of environmental problems. The reuse system is the technique that has been adopted by construction companies with the objective of lowering the environmental impact, as well as the reduction of costs with the creation of other new products of the same rhyme, which ensures the success of sales of the products in the construction market. As Manaus does not yet have a recycling and processing plant, as provided for in the COMANA Resolution since 2002 for these wastes, companies are at the mercy of the will of others that can easily lead them to places that are inappropriately used illegally. It should be noted that the survey carried out a survey of waste entering and leaving the worksite in the city of Manaus and proposed a roadmap for the implementation of a solid waste management plan to improve and correct waste disposal.

Keywords: Environment, solid waste, construction waste.

I. INTRODUCTION

The large amount of waste generated and the inadequate disposal you refer to the urgent need for a joint action of society – public authorities, industrial and construction sector organized civil society – in the search for solutions that aim to minimize the environmental impacts, preserve natural resources, and improve the quality of life in urban areas from economic and sustainable works [1].

The final disposal of the waste is disposed of inappropriately, in your vast majority in landfills, contributing to proliferation of vectors compromising the environment and public health. The city of Manaus, capital of Amazonas, is no exception in this respect. The search for a solution to the problem of final disposal of waste generated by the accumulation and lack of proper handling of solid waste has aroused discussions, pressure from environmental agencies and prosecutors, mobilizations and intense search for alternatives aimed at the sustainable balance of the environment.

The development of techniques and methods for enabling the sustainability of day-to-day activities in construction sites is becoming a global trend for the mitigation of environmental problems caused by inadequate drops. The practice of recycling is being one of the alternatives of construction industries, being the most effective way for the low environmental impact, as well as reducing costs with the creation of other new products with the same raw material securing reuse of material or even just reusing them. Some benefits can be identified, such as: reduction in the consumption of fresh raw material; of areas required for landfills; the volume of solid waste, among other spaces mainly on the banks of the water present in the urban perimeter of the city of Manaus. [2].

During the construction process, whether at the beginning of the work, when the Assembly of the construction site, the first movements of land for the construction of any work, the generation of the first waste that linger until the completion of the construction of building with the waste of materials of finishes.

Thus, this work aims to raise and show the setting of the solid waste disposal and environmental aspects, that the city still

does not have a recycling plant for these materials or even a proper system of collection, handling, packaging and destination less impressive and seek alternatives in the development of a solid waste management plan aimed at the sustainable balance of the environment.

II. DEVELOPMENT

The solid waste management, in the context of improper final destination, according to [3] produces large environmental impacts, causing pollution of surface and groundwater, soil and air contamination and proliferation of diseases; are not only an aesthetic problem, but also represent a serious threat to man and the environment, decreasing considerably the useful spaces available.

The sound environment is of fundamental importance for a better quality of life for people within the cities, so it is necessary to carry out the integrated management of solid urban waste in the management of municipalities, whereas the inadequate conditioning of waste entails environmental and social damage, with the most serious health-related. Because, as the Agenda 21 document, from the discussions that occurred during the United Nations Conference on environment and development, promoted by the UN in Rio de Janeiro in 1992.

Currently nearly 5.2 million people – including children – 4 million die every year from diseases related to the trash. Half of the urban population in developing countries have no solid waste dump services which makes the handling of it.

In Brazil, as the Panorama of solid waste produced by [4] the numbers regarding MSW generation offers a yearly total of 79.9 million tons in the country. The [4] has identified that the comparison between the amount of MSW generated and the amount collected in 2015, which was of 72.5 million tons, resulting in a coverage of 90.8% collection for the country, which leads to about 7.3 million tons of residue without collecting.

Such improper disposal given to solid urban waste in the country, the waste is not collected by the urban cleaning service is dumped in rivers, streams and vacant lots or green areas in cities. Such waste provisions carried out inappropriately offer several implications on the environment and consequently on human health.

According to [5] "is currently demonstrated clearly the relationship between the proliferation of certain diseases and inadequate solid waste management". Therefore, the functioning of the management system and management of municipal solid waste of quality, as well as the contemplation of this service in the city in your entirety, substantially contributes to the minimization of various environmental impacts the urban quality of life of people has a direct relationship with the environmental health.

From the promulgation of the National Sanitation Policy, instituted by Federal law 11,445 from 05 June 2007, has been a concern with the management of solid waste, is jointly with the Brazilian solid waste Policy, established by the 12,305 Federal law of 02 August 2010 complements the regulatory theoretical solid waste management in the country, which shows a change in the Brazilian scenario as the measures taken the problem of municipal solid waste.

According to [6] municipal solid waste (MSW), under the Federal law n° 12,305/2010, include household waste, that is, those originating from domestic activities in urban homes and urban cleaning residues, which are originating in the sweeping, cleaning of public places and public streets, as well as other urban cleaning services.

According to [7] worldwide, the construction sector stands out as the largest consumer of natural resources, mainly in mortar and sand and larger waste generator, so is considered one of the major causes of impacts environmental. Due to the lack of awareness and negligence of the population, many wastes are deposited in inappropriate places, cause various risks and environmental impacts, such as proliferation of vectors of diseases, siltation of streams and rivers, and therefore visual pollution, causing damage to the city and disorders like that and citizens [7].

According to [8], in the municipality of Caçapava (SP) are generated 100 t/day of RCC and dumped in inappropriate locations, without any form of reuse, these residues, which could improve the local economy when well handled. One of the main actions aimed to change this framework was the publication of the CONAMA resolution No. 307 of 2002, which classifies the waste into 4 classes (A, B, C and D) establishing the purpose of the use of the 3Rs (reduce, reuse and recycle), as well as other guidelines as the generator is responsible for the proper disposal of this waste among other purposes.

Due to the problems encountered by the great generations of RCC has several viable solutions to minimize environmental impact. Today there are many technologies for total or partial recycling construction waste with economic viability, reducing cost in the purchase of raw materials and in new raw material extraction. [9] So the RCC remains a problem and becomes a sustainable outlet for shortages of some materials extracted from natural resources.[10]

With recycling of RCC life cycle closes within the construction sector, being of great importance, bringing a balance between the demand and the availability of the by-product. [11]

According to [12] the recycling of waste is one of the most important management variables, since the generation of these is inevitable and that the processing with reinsertion of recyclable materials in the production cycle makes the economy more sustainable. According to the author, many are the advantages of recycling to society, such as: conservation of natural resources; energy saving; reduction of volume of landfills; reduction of pollution; job creation; reducing the cost of environmental control by industries; increased durability and economy of currencies.

However, one cannot defend the recycling only by environmental aspect. It is necessary to understand recycling as productive activity, because it generates employment, income and knowledge. In addition, recycling must be economically profitable, which would make the activities more attractive to the business community. [10]

III. METHODOLOGY

The proposed work was accomplished through a bibliographical research and on-the-spot visit in a company in the construction business and a critical scientific civil and reflective on the subject that were obtained from the references.

The company is taken as a reference to this study is located in the city of Manaus/AM and works in the construction business, where information was obtained for the completion of this work.

This organization is considered of medium businesses and has as its main activity the maintenance and renovation of buildings and building corrective federal agencies. In the process of this work, had a visit in loco a work with reform and preventive and corrective maintenance, which were estimated time of a month, with obtaining result through applications of interviews, as well as a survey that allowed the deepening of knowledge and qualitative results relating to the generation of wood waste in the organization. In addition, described the ins and outs of the steps in the process of

maintenance, as well as the waste from those steps. The interview was applied to responsible (civil engineer) by containing questions that addressed the forwarding process and treatment of wood waste, and on the operating conditions of the company on environmental issues.

The company cited above, requested that didn't have your name published, but gave extensive information and contribute to improve and this work solutions. Figure 1 shows where the company cited in the present work, services and reform in Manaus.

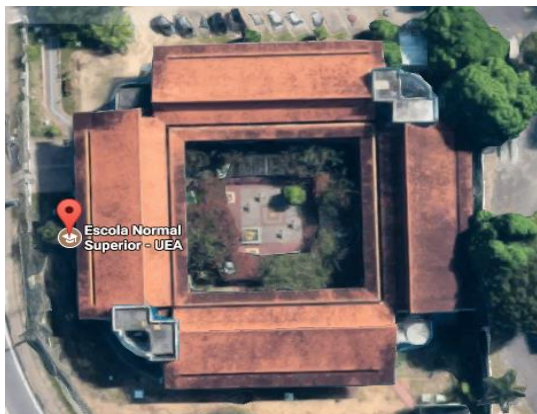


Figure 1: Higher Normal School – UEA – Where is made the provision of maintenance service and retirement.

Source: [13].

On-the-spot visit, the company cited earlier building maintenance service on higher education school-UEA with the object of building maintenance of the institution, and this maintenance is subdivided in stages, which were reported qualitatively all entries (inputs), outputs and waste generation, as described in table 1:

Table 1: Steps Performed by the Company, With their Respective Inputs, Outputs and Wastes.

Process steps	Entries (Inputs)	Out (Products)	Waste
Block masonry	Block, sand, cement, sand and mortar	Maintenace of the wall	Block and mortar
Pipes	Water, sewer, electricity.	Pipes	Pipes PVC
Finish (floor, wall and lining)	Plaster, paint, solvent and plaster	Floor, wall and ceiling.	Plaster, paint, solvent and plaster
Coverage	Wood, tile and Grout.	Coverage	Wood, tile and grout.
Final Finish	Mortar, glass, wood, paint and plaster.	Finishing	Mortar, glass, wood, paint and plaster.

Source: Authors, (2019).

During the visit it was verified the process that runs the same, since the start of the stage, is being disposed of some wastes come from work.

For a better understanding of the process of building maintenance activities are briefly described below: – maintenance of:

- 1) Block masonry wall, the parts requested in the survey of the said company.
- 2) Pipe-removal of damaged pipes and placing new pipes.



Figure 2: Facade of the Building of the UEA, Demonstration of termination of work.

Source: Authors, (2019).

- 3) Finish (floor, wall and ceiling)-was made necessary in order to repair and protection of appearance improvement.
- 4) Finish (floor, wall and ceiling)-was made necessary in order to repair and protection of appearance improvement.
- 5) Finish (floor, wall and ceiling)-was made necessary in order to repair and protection of appearance improvement.

IV. RESULTS AND DISCUSSION

During the visit it was analyzed that the company does not have a correct disposal for wastes from the works, everything was exposed the solution to the problem, being necessary to the implementation of a solid waste management plan or PGRS, as are known, are implementing national policy instruments which contribute to a greater control of the disposal of waste by the public authorities. The preparation of these plans by the Government will help to improve the selective collection of solidarity already implemented by many institutions.

It is understood, therefore, that public institutions should draw up their plans, since the selective collection, based on Decree No. 5,940/2006 and therefore may improve the actions already implemented aimed at management and allocation environmentally appropriate. This, no doubt, will contribute to increase the quality of recyclable and income generation of collectors of recyclable materials. It should be noted that public bodies must be geared to promote exemplary actions that have as their purpose the sustainability.

Environmental education should be understood as one of the basic instruments are indispensable in the process of environmental management, providing a permanent reflection, being necessary to train and empower each participant as co-responsible for management of the actions deployed. The plan must incorporate:

- 1st phase: Municipal Waste Management Programmer of construction, designed, implemented and coordinated by the municipality;
- Step 2: construction waste management, elaborated and implemented by the generators.

The projects of construction waste management are developed and implemented by the generators not framed within the Municipal programmed of construction waste management. Presents itself, then, a suggested script for preparing the project, as

well as a model for separation of waste in a construction site. What would be proposed to the company, would be a plan of solid and liquid waste produced by the works, the separation of each residue in their respective collections.

Table 2: Proposal for Allocation and Actions and Waste – (sustainable alternatives).

Residue	Fate and actions
Dump steel, concrete, mortar, finishing materials, brick, tile, shackles, fabrics, cardboard, plastics, wood	Is prohibited the burning of trash or any other material inside the construction site. All debris will be collected, stored in suitable location for your subsequent withdrawal. The steel scrap can be stored separately. Will be provided by the responsible for cleaning equipment needed for debris removal.
Material from the experience of the construction site containers, paper, plastics, rags, scraps of food.	The waste generated in the areas of experience must be placed in containers (wastebaskets) and collected and stored in plastic bags and placed in suitable location for the subsequent recoil.
Dust and light splashes of waste plaster, plaster dust, dust of Earth	Will be provided by the responsible for cleaning equipment needed for your removal. During the removal of rubble, unloading and transportation of materials should be taken care of to avoid excessive lifting Dust and their attendant risks.
Sewage and wastewater	Sewage and wastewater (rainwater, excavations, etc.) should be collected separately, through independent systems. All sewage generated by the construction site will be collected through the existing connection. The toilets, sinks and drains are connected directly to the existing sewer network:

Source: Authors, (2019).

Whereas the construction waste generators must be responsible for the activities of construction, renovation, repair, and demolition of structures and roads, as well as those resulting from the removal of vegetation and soil excavation .

Classification and Separation model in the construction site for the implementation of the selective collection of waste in a work, suggests the following steps:

Step 1: planning of actions to take effect and where they will be deployed, in order to target efforts to that the goals are reached.

Step 2: mobilization of personnel, which can be made by means of lectures, supplemented by posters, messages on pay stubs and other appropriate means.

Step 3: characterization of RCCs generated in the main phases of the work, being variable during your implementation. 03 table illustrates the main waste generated at each stage of the work and the most appropriate destination.

Table 3: Plan and Strategy for the implementation of collection.

ITEM	MATERIAL	CLASS	DESTINY
1	Construction steel	B	Marshalling yard of recycled
2	Aluminum	B	Marshalling yard of recycled
3	Wire	B	Marshalling yard of recycled
4	Sand	A	Inert landfill/Recycling
5	Sand	A	Inert landfill/Recycling
6	Hardened mortar	A	Recycling at Work
7	Hot Asphalt	B	Inert landfill
8	Cellular concrete block	A	Inert landfill
9	Common Concrete block	A	Inert landfill
10	Reinforced Concrete	A	Inert landfill
11	Hardened concrete	A	Inert landfill
10	Effluents, sludge and septic tank cleaning	D	Sewage treatment station (ETE)
11	Wire or aluminum cable	B	Marshalling yard of recycled
12	Wire or copper wire	B	Marshalling yard of recycled
13	Plaster	C	Create specific landfill
14	Plasterboard	C	Create specific landfill
15	Melamine blade	C	Landfill
16	Bodywork contaminated	D	Storage/industrial Landfill
17	Broken crockery	A	Inert landfill
18	Wood without chemical	B	Bakery ovens/boiler
19	Lumber	B	Bakery ovens/boiler
20	Vibrator hose	B	Landfill
21	Asphalt blanket	C	Landfill
22	Glass wool blanket	C	Landfill
23	Excavation material	A	Landfill

Source: Authors, (2019).

Step 4: assessment of the feasibility of the use of the components of the rubble.

Step 5: development of the entire process and arrangements relating to agreements, contracts, licenses, authorizations and other documents that allow the use of construction waste;

Step 6: development and documentation of procedures adopted for selection, packaging, dispatch and removal of waste. Provide containers for packaging materials to be segregated. On each floor, if applicable, must be taken to separate collection container, identified as the material to be selected. On the ground floor, cubicle installation is important to accumulate the collected

waste. The normalization of the default colors for the residue is given by Conama resolution 275/2001. Selective collection in construction site.

Step 7: establishment of transport logistics to removal of selected waste, in order to avoid accumulation in the construction site, which may discourage the separate collection. The selective collection of the waste from construction with the segregation in origin is of utmost importance for the functioning of the inert landfill, which can only receive class A waste.

Step 8: training of all those involved, through training. We also need specific training directed to officials who will make the removal of the waste from construction of containers for the stalls.

After this deployment the improvement in solid waste collection it is important to involve people with experience to aggregate in the strengthening of the issue as a way to recycle people with information and procedures updated, according to the strategies and logistics management.

It is essential that this reasoning is absorbed by all involved of the company and of the various sectors, and should become a standard knowledge of notions of selective collection seamlessly. Strategies for dissemination of knowledge and preparation of the servers, staff employees, students and visitors should include: training, sensitization and awareness, communication, development of multipliers and records of indicators.

Table 4: Plan and Strategy for the implementation of collection.

STRATEGY	BOOKMARK
Communication and training	Perform periodic training with employees (waste management, rational use of water and energy and good corporate practices);
Survey of waste management process	Check list of waste management applied to each sector and steps of the process, to highlight the improvements to be implement
Satisfaction survey	Questionnaire applied to the agents involved (sectors, servers, staff, General Services staff, students, guests)
Operational Procedures	Create warning system regarding incorrect disposal and, if possible, involve the cleaning crew through feedback of information

Source: Authors, (2019).

The development of the Action Plan is a management tool used for planning and allows the monitoring of the implementation of various activities so diversified and comprehensive, accessible and language having circulation in the quest to strengthen the waste management team, helping to achieve certain goals and objectives.

Some actions and initiatives implemented are important and recommended for correct waste management effectiveness on the part of the management team, committed to spreading knowledge and care processes. CITES, for example, the revision of the strategies used to assist the achievement of the goals of this PGRS as practices are adopted.

V. CONCLUSIONS

Solid waste the work generates, can be recycled and used in the actual construction site. With the deployment of equipment for recycling not only reduces costs, but it helps to preserve natural resources and minimize the environmental impacts caused by the construction sector. Noting that natural aggregates are finite and exhaustible resources, so viewing a future replacement for recycling will be something optional and will be mandatory.

On what was discussed, this study sought to show the construction waste generated on construction sites in order to characterize them as the on-site visit carried out within the company, we can observe that in spite of the efforts of those responsible for company to give a correct destination in the trash, the company has just not doing the correct disposal. What was raising as a solution for this company was the implementation of the waste management Plans Construction solid-PGRSCC, in the company, the ultimate destination of much of the material generated goes to the municipal landfill.

By the fact of Manaus for does not have a Municipal waste management Plan of construction, nor a WEEE recycling plant that is part of the plan, each construction company adopts its means to practice the techniques of reuse and recycling to reduce the impacts to the environment and consequently reducing costs.

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