The Importance of Recycling of Construction and Demolition Waste

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ABSTRACT: This article addresses the growing need for recycling of Construction and Demolition Waste (CDW), dealing with the historical context of the emergence and development of this practice, as well as some use cases. It is also reported damage or environmental benefits that recycling can provide residues of construction. This work is a literature review on the various ways of using CDW nationally and international. This study allows us to define that it is essential that there be stricter regulations, more research on appropriate technologies and environmental risks caused by these residues. In parallel, there must be awareness of building professionals about new recycled products, clarifying issues related to the main characteristics of these wastes, such as safety, cost and quality, because there is still great resistance with respect to the use of these materials. This paper aims to contribute to the awareness of professionals in the field of construction industry on the need to build more efficiently, using the correct management of exhaustible natural resources, reuse of products and the correct routing for your final destination.
Keywords: construction, recycling waste.

INTRODUCTION
The energy used in transport, production of consumer goods and construction has demanded an excessive use of natural resources. This causes an environmental imbalance, a depletion of these resources and an environment changes, and generate economic and social disorders. Construction is one of the activities that generate more environmental impacts; however, this activity is considered one of generating more jobs and income in Brazil [3].

According to the National Foundation Getúlio Vargas (2009), the construction industry in Brazil turns over R $ 224 billion and accounts for 8.3% of national GDP. However, it consumes approximately 75% of natural resources, and consumes 44% of total energy use in our country, and generates about 40% of all waste produced by the activity of men, which would be about 500 pounds of Waste of Construction and Demolition per capita. For there to be a balance between reducing the damage caused to the environment and the financial gains generated by this activity, one need to invest in technological innovation combined with sustainability [10].

The installation of new network equipment and infrastructure, and urban renewal programs created by governments in order to solve problems of quality and comfortable environment in cities, lead to fragmentation between new urban fabric and existing one. These technological and social transformations are implemented by physical reasons with an economic and political trends and concerns about environmental sustainability. These changes cause the demolition of buildings, thus generating a huge amount of construction waste [8].

The Construction and Demolition Waste (CDW) are made up of remnants of all building materials (mortar, sand, ceramics, concrete, wood, paper, metals, plastics, stones, bricks, paint, etc.) That originates in constructions, renovations and demolitions. Concern for the recycling these residues has been intensifying in recent years, but this technique has been used since antiquity in the cities of the Roman Empire, where they have recycled demolition materials as aggregate in new construction [6].

By 1860, Germany recycled cement concrete blocks to artefacts, however, applications have become relevant at the end of World War II, when Europe was faced with most of its buildings ruins and the lack of construction materials [6]. Since that time, European countries began to research more about this subject in order to obtain high quality recycled aggregates, i.e., more durable and resistant to compression [7 e 17].

With the increased of industrialization and population growth in the mid-80s, mainly in urban canters, the residues of construction became a major social and economic problem, because the amount of waste has increased dramatically, causing the scarcity of deposition area, problems of public sanitation and environmental contamination. The recycling process began in Europe in 1950 but only started in Brazil thirty years later, which caused considerable delay in the technology and application of this process in our country. Our
experiences are limited to municipal actions aiming to reduce costs and environmental impact, without worrying about the awareness of population and industries responsible for the waste [11]. In Brazil, this subject remains more in the scientific community than in practice, except for the cement and steel [4]. The industry that recycles more products from the construction is cement, which currently starts in Brazil the practice of co-processing, which is the burning of waste in cement kilns, reducing energy consumption and waste volumes in landfills. Another major recycler is the steel industry, since much of the steel composition of the concrete produced in the country is made almost entirely of scrap [1].

There will be cited two cases of projects of residues of construction recycling plants that have succeeded. The first will be on the program of Correction Provisions Boyz and Recycling Rubble done by the Municipality of Belo Horizonte, which is one of the first Brazilian experiences aimed at proper management of these residues. This case stood out in the country and internationally, and has received several awards, and is widespread in both scientific publications and in television news programs, becoming a model to be followed by various governments [15].

This program consists of two recycling plants of CDW (Estoril and Pampulha), and 23 Units Receive Small Volumes of Debris, and a third plant is under implementation. The complementary actions of reclamation and support for waste transporters, as well as guidance and supervision of agents involved are part of this program. Belo Horizonte has obtained many benefits from these facilities, such as the lower cost of purchasing materials to build new municipal facilities and management costs of the CDW [15].

The second example is the Model Private Waste Management of Construction in California (USA), which is an ecological park Reuse / Recycling of residues of construction, created by Raisch Products Company[12]. The company joined with other companies and they process different types of CDW in the same place, which are sold to local contractors at low cost. In addition to these benefits, there are a number of community services as waste reduction, training and job placement, as well as the rehabilitation of drug addicts and young offenders and the development of educational projects [13].

**BENEFITS AND LOSSES THAT THE RECYCLING OF CDW CAUSE TO THE ENVIRONMENT**

The last century was a period of major innovations in building materials. There are currently about 100,000 types of materials, and most are not suited to recycling and reuse. The recent concern about the environmental and economic impacts caused by disposal of these materials has led several countries to draw up new laws and take other actions that would minimize these problems [9].

Much of the materials used in construction usually have a very short life cycle, from 50 to 100 years, that happens because the quality of materials used is not required. However, this situation is changing slowly. About 10 countries are starting to reuse existing buildings rather than demolish. In the Netherlands, for example, some systems have been developed to facilitate concrete disassembly and reuse of buildings [5]. The main benefits of reuse, recycling or reducing the materials of the work are energy savings and decreased use of natural sources [16]. We can also cite the reduction of local and global environmental impact and the reduction of use of premises for the extraction of materials and land for disposal of materials. Efforts are being made to make various countries use different systems for disassembly in construction. New industries are processing building components for reuse in new buildings, and this can result in the use of this practice on a large scale[5].

For recycling to be attractive from the point of the waste generator, it is necessary to have competitive cost and also provide other advantages. Transport, waste disposal and environmental fines are some factors that should be taken into account when assessing the economic viability of recycling. One must evaluate the waste according to their physicochemical characteristics, durability, performance, suitability for the user and others, always having the best possible use, if necessary, for this, the involvement of a multidisciplinary team [18].

There are some problems to be faced in the implementation of this process: there are no many tools available for disassembly, the cost of land for disposal of construction waste is low, the disassembly process is long and the environmental and economic benefits still were not well established and old buildings and their components were not prepared for this process [5].

Should also evaluate the risk that a recycled material can cause on the health of workers at a recycling industry and users, because that may contain hazardous materials such as heavy metals, and volatile organic compounds and, in case of recycling, they can lose the guarantee of detention. Therefore, it is necessary that the choice of recycling be very careful about the consumption of raw materials and of energy through the recycling process. The recycling of residues of construction may cause damage to the environment, depending on the amount of materials and energy needed to process [18].

The type of waste and the use of the method of recycling technology employed, may involve risks, since these residues are often made of hazardous elements. The lack of adequate technology for the treatment of the residue, lack of place to dispose of it after be used and the cost of the recycling process must also be studied in order to do a correct choice of the recycling process to be executed [18]. An example that demonstrates that old buildings are
not prepared for disassembly process and there are no many tools available for disassembly is the demolition of Hume Hall, University of Florida (Figure 1)[5].

Some actions can accelerate deployment of this process, like how to design the building and its components already thinking about reuse, recycling or remodelling and promote incentives for the reuse of old buildings. The Robert Gordon University in Aberdeen, Scotland, considers some important points to increase the durability of a building: information about the materials more accessible and simplicity of the technique of construction, non-use of adhesives for connections, easy access to materials with low durability and independence between the layers of construction [5].

The choice of material in the project design based on the concern of the use of appropriate materials is crucial to reducing environmental impacts. For this to occur, should take place some factors, such as reducing the type of material to be used, durability and design flexibility, the flexibility of design, flexibility of connections, independence of layers of buildings, information and IDs of accessible materials, among others [9].

The embodied energy is the energy needed for production or manufacturing of a product which includes the power used in a process and used for the material and its transport infrastructure and production machines used in this production activity. One must be aware of the embodied energy expended throughout the life cycle of a building, which can vary from 30% to 50%. Reusing materials can greatly reduce the energy used to produce new materials that would be put in place the old [2].

Another very important factor is the analysis of the life cycle of the materials used, from material extraction to the final process of eliminating it, verifying the energy spends and available sources of materials, effects caused to health and human impacts on the environment. He cites the analysis of the life cycle of materials facilitates their choice, because with it you can adapt the materials according to their properties [16].

The life cycle of a product, focused on environmental design, characterized by its production stages, from extraction of raw materials to its final disposal, going from "cradle to grave." The analysis of the life cycle it is important to be able to assess the environmental impacts caused by this product and the definition of new strategies which aim to reduce these impacts [14].

The concept that the life cycle of materials ranging from "cradle to grave" has changed a lot, because today we can say that this succession of steps that a material passes from the extraction process as raw material is from "cradle to cradle", the materials have been recycled, reused or manufactured, and restart the cycle [14].

CONCLUSION
We examine technology used in the recycling process, performance, reliability and maintenance required for the new product, marketing and environmental risks from recycled material. As the development of the text, we realized the immense need for the establishment of the recycling process of the residues of construction in Brazil, because the benefits of this procedure have already been proven in numerous cases.

There must be more stringent regulations, more research on appropriate technology and environmental risks made by universities and research centers with a reputation in the market and especially the awareness of population and industry professionals that this new recycled product is safe, low cost and high quality.

There must be awareness of population and industry professionals about the new recycled product, clarifying issues related to the main characteristics of CDW, such as security, low cost and high quality, since some prejudice still exists with regard to this material due to lack of information.

REFERENCES