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RECYCLING RESULTING FROM DEMOLITION
CASE STUDY

BY

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Abstract. Annually are generated large amounts of waste, which if not managed properly they pollute the environment and affect human health. Large volume of civil, industrial, hydro, bridges and communication means construction, led to intensive and extensive exploitation of alluvial deposits of gravel beds, coming even to change the relief, by exploiting the various rocks that enter into the composition of mountain massifs. Construction waste results from construction, renovation and demolition of buildings, street pavement projects, repair of bridges, cleaning associated with natural disasters. Even if today is redeemed a small percentage of construction and demolition waste, a significant quantity is likely to be recycled in the future as a result of storage tax and legislation.

It should be noted that construction and demolition waste are equal in weight with total amount of household, commercial and industrial waste. In most countries they are deposited in a landfill waste. Because of legal restrictions and environmental regulations imposed at Community level, this possibility becomes increasingly reduced. In this paper will be presented some aspects of collection, treatment and recovery of building materials from demolition and/or decommissioning.

Key words: demolition; recycling; waste; recycling materials.

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1. Introduction

The term *construction and demolition waste* refers to waste resulting from activities such as construction of buildings and civil infrastructure, total or partial demolition of buildings and civil infrastructure, modernization and maintenance of streets. It should be noted that construction and demolition waste are equal in weight with all the household, commercial and industrial waste. In most countries, they are deposited in a landfill waste. Because of legal restrictions and environmental regulations imposed at Community level, this possibility becomes increasingly reduced. In these circumstances raises the question of how the two issues can be solved, taking into account that the solid waste from demolition and construction represents more than 25% of all solid waste in a country. An effective way is to recycle these materials so they can be reused.

These possibilities are different possibilities to recycling materials from construction. They depend on several factors, such as

a) the existence of a sufficient quantity of waste in their area to allow recycling;

b) the existence of recycled materials markets in the area;

c) resulting a sufficient income, or by awarding the one who recycle or from fees for the one which produces the waste;

d) the cost of storing the waste in landfill;

e) promotion for recycling.

In what follows a case study is presents that aims to solve some issues regarding the collection, treatment and recovery of building materials from demolition and / or decommissioning.

The building (Fig. 1) was built in 1955 and is located in Jassy. C1 assembly building, that will be demolished, is a ground floor building with ground dimension of 10.36 × 8.86 m and the ridge height of 4.50 m.

Fig. 1 – Existing structure before demolition.

The construction has the resistant structure made of masonry brick walls with wood floor, wooden roof framing with roof tile coverings. Foundations are under walls continuous concrete foundation type. C2 assembly building, that will be demolished, is a ground floor building and has the destination of garage. The resistance structure is made fully of metal.

2. Characteristics of Material Resulting from Demolition

According to H.G. *856*/2002, inert waste categories, materials resulting from construction and demolition, are concrete, bricks, tiles and ceramics, mixed concrete, tiles and ceramics, wood, glass, plastic, aluminum, iron and steel, mixed metal, cables, earth and stones and dredging waste, scrap ballast, insulation materials, building materials based on gypsum (Figs.2 and 3).

Fig. 2 – Mixture of concrete, tile, brick, ceramics.

Fig. 3 – Debris resulting from demolition.

Table 1

Resulting Materials from Demolition and their Quantities

No.	Material	Quantities
1	Sales parcel tile, [m^2]	95.70
2	Sales cover asbestos tiles, [m^2]	11.75
3	Sales roof boarding, [m^2]	107.45
4	Sales roof (structure) , [m^2]	102.15
5	Sales gutters, [m]	33.48
6	Sales spouts, [m]	12.60
7	Sales of wood floor, [m^2]	102.15
8	Dismantling wooden floor insulation, [m^2]	102.15
9	Demolition of doors and windows a) doors, [m^2] b) windows, [m^2]	 18.06 15.53
10	Demolition of brick wall, [m^3]	39.48
11	Demolition of reinforced concrete elements, [m^2]	16.67
12	Undo floor a) floor tiles, [m^2] b) flooring, [m^2] c) mosaic, [m^2] d) cement dapper, [m^2]	 5.95 51.79 4.28 2.72
13	Undo sidewalk, [m^3]	21.90
14	Demolition of reinforced concrete foundations, [m^2]	44.95

Many materials resulting from demolition may be recovered, cleaned, refurbished and used in similar construction project or other construction projects. Before recycling a material recovered from demolition, it must be made a separation of wasted materials.

Fig.4 – Structure during demolition.

The first step in waste separation involves both manual work and the specific equipment such as loaders, hydraulic excavators, conveyor belts and other appropriate equipment. After an initial basic sorting, of the material, it will be separated in accordance with size and type. Demolition of the structures piece by piece allows the separation and cleaning of the material resulted from demolition, but requires a very intense work. The duration of the demolition piece by piece is also much higher than mass or automatic demolition. Most projects do not have enough time to dismantle the building by hand; in this case is necessary to evaluate the materials in terms of durability.

Mixed ferrous and nonferrous materials (copper, steel, aluminum) are stored in specially designated areas and their separation is done manually or with specialized equipment and then processed for use them as other products.

Woody material resulting from demolition can be used as filler, cleaned and then used as formwork for the new structure; cut can be used for power generation, as wood fiber products and may be used as amendment in agriculture soil, or can also be recycled.

Materials from disposal of roof (tile and slabs of cement) have a small-area of use, the only possibility remained is recycling. Soil can be used as filler.

Concrete can be crumbled by breaking machine and can be used as fill structure or aggregate.

Concrete with recycled concrete aggregates is usually more expensive than concrete with ballast aggregate because of additional quality control (research conducted in Sweden and Great Britain shows that the costs for use in other purposes than waste disposal on landfill waste are ten times higher). For this reason it is necessary to adopt measures to stimulate the reuse of demolition waste, while limiting production of natural raw materials. Therewith it is necessary the capitalization of the operation for the recycling demolition materials (crushing, sorting, s.o.), so they can be profitable for the company

who produce them, and storage fares to be attractive for those who produce waste.

Glass can be recycled as fiber glass or used instead of sand as paving material.

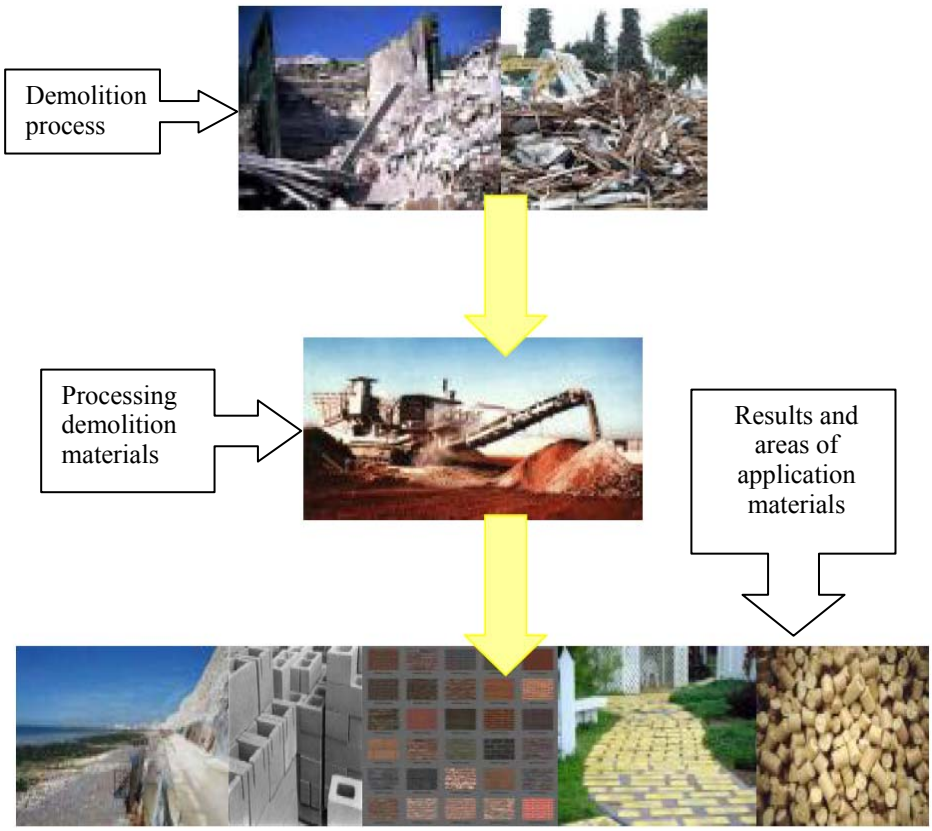

Fig. 5 - Demolition – Processing – Application of building materials resulting from demolition.

3. Possibilities of Recycling Materials

Construction and demolition waste have, generally, the following composition

a) 40...50% debris (brick, mortar, plaster, dust, s.o.);

b) 20...30% waste wood (various scrap wood – stumps, boards, divisions, beams, paneling, shingles);

c) 20 ... 30% mixed solid waste (panels painted or contaminated, metal, pitch-based products, glass, plaster, asbestos and other insulation materials, petroleum products, sanitary, thermal and electrical items).

Many materials resulting from demolition may be recovered, cleaned, refurbished and used in similar construction project or in other construction projects. They appeared and became common in EU countries stores selling used building materials (second-hand), which supports certain types of materials. Typical materials that can be reused are the followings:

a) beams and other structural elements;
b) the subdivision of wood materials;
c) masonry materials;
d) bricks, terracotta, tiles, s.o.;
e) doors, windows;
f) various items for decoration, ornaments;
g) electrical components, mechanical fastening elements.

Demolition of structures piece by piece allows the separation and cleaning of demolition materials, but requires a very intense work. Duration is also much higher than mass or automatic demolition. Most projects do not have enough time to carve manual the building.

Since most of those who are recycling materials are specialized on certain materials such as metals or wood, the material resulting from the construction site must first be sorted so he can be accepted. When performing the separation on site it must be provided separate containers or must be made separately piles for each material, which then will be transported to those who are recycling.

In some countries superior recycling methods are applied to concrete from demolition, which pursue the separation of stone aggregates, cement, sorting and re-use in new concrete. These methods consist in treatment of crushed concrete waste in a tank furnace for 40…60 min at a temperature up to 300°C.

Fine cracks will appear between cement stone and aggregates. Then, the material is broken and the cement stone is subjected to abrasion by tubular mill or decay. Composition of heated recycled concrete is almost the same as the original aggregate whiles the composition of crushed concrete, thermal untreated, produces 44% fine powder. There are several international research programs to re-fine powder resulting from crushing the concrete from demolition, this problem being in attention of Durability of Construction Materials laboratory within INDPM-ICIM, Bucharest. In our country addressing the recycling of construction materials was done in several stages. A first phase (initiated in the 90s of last century) was the development of studies and laboratory research regarding the reuse of building materials from demolition.

In 2005 was initiated by MEWM – Substances Hazardous Waste Directive, a study regarding the development of a procedure for regulation and control of the storage of waste come construction and demolition, in order to exploit them in accordance with the overall strategic objectives for waste management, provided by the GD *1470*/2004.

In 2006 it was intended the development of a guide on establishing criteria for realizing the collection spaces, treatment and waste recovery from construction and demolition.

4. Conclusions

Early research on recycling construction materials domain in our country was made by Prof. A. Steopoe, in the period after the Second World War. Accuracy of research developed under the guidance of Prof. A. Steopoe as well as generally anticipation in recycling construction materials domain, directions that were to develop after a few decades, are remarkable.

If in Prof. A. Steopoe period the problem have currency (due to bombing during the war), now the problem have the currency of era we live, in the way that the construction of new buildings is extensive, also, a large number of constructions being rehabilitated, or repair works being performed, but, in the same time, structures that exceeded their lifetime, or that are not safe anymore being demolished.

In conclusion, to initiate and lead a program of recycling building materials in our country, we consider the next steps necessary facts:

1. Equipment of landfills in the main cities with a particular area for collection and storage of waste from demolition and/or decommissioning.
2. Conditioning the receipt of notices of demolition, renovation, repair, construction, transportation of waste produced in the compulsory arranged especially within the landfill.
3. Inventory of crushing equipment and other necessary equipment for recycling, currently existing in the country and creating incentives for firms to operate the recycled building materials, for these activities to be more attractive.
4. Issuing laws to stimulate the recycling of building materials while limiting the exploitation of natural materials.
5. Harmonization of regulations on the recycling of building materials with regulation regarding concrete technology.
6. Finance studies and research regarding recycling of construction materials.

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RECICLAREA PRODUSELOR REZULTATE DIN DEMOLĂRI

(Rezumat)

În societăţile industrializate impactul produs de exploatarea agregatelor din balastiere şi cariere este foarte important. Volumul mare de construcţii civile, industriale, hidrotehnice, poduri, căi de comunicaţii, a condus la exploatarea intensivă şi extensivă a depozitelor aluvionare din albiile râurilor, ajungându-se chiar la schimbarea reliefului, prin exploatarea diverselor roci care intră în alcătuirea unor masive muntoase. Deşeurile din construcţii şi demolări rezultă din construcţia, renovarea şi demolarea clădirilor, proiecte de repavare a străzilor, repararea podurilor, curăţenia asociată dezastrelor naturale. Chiar dacă în prezent este valorificat un procent mic de deşeuri din construcţii şi demolări o cantitate semnificativ de mare va fi probabil reciclată în viitor ca rezultat al taxelor de depozitare precum şi al legislaţiei. Trebuie remarcat faptul că deşeurile provenite din construcţii şi demolări sunt egale, ca greutate, cu întreaga cantitate de deşeuri menajere, comerciale şi industriale. În majoritatea ţărilor acestea sunt depozitate în depozitele de deşeuri menajere. Din cauza restricţiilor şi reglementărilor legislative privind protecţia mediului impuse la nivel comunitar, această posibilitate devine din ce în ce mai redusă. În lucrare sunt prezentate câteva aspecte privind colectarea, tratarea şi valorificarea materialelor de construcţii provenite din demolări şi/sau dezafectări.