

Management of construction and demolition wastes as secondary building resources

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Abstract. The article analyzes the methods of management of construction and demolition wastes. The authors developed suggestions for improving the management system of the turnover of construction and demolition wastes. Today the issue of improving the management of construction and demolition wastes is of the same importance as problems of protecting the life-support field from pollution and of preserving biological and land resources. The authors educed the prospective directions and methods for improving the management of the turnover processes for construction and demolition wastes, including the evaluation of potential of wastes as secondary raw materials and the formation of a centralized waste management system.

1. Introduction

Construction wastes are generated under construction of new facilities; reconstruction and repair of buildings and structures, disassembly and demolition of existing buildings; during the process of enterprise activity of manufacturing reinforced concrete products, bricks, fiberboard, chipboard, ceramic products. Practically each kind of construction manufacturing generates a large amount of waste, characterized by high raw materials quality.

A significant part of construction wastes with or even without subsequent processing can be effectively applied in new production cycles as secondary raw materials or secondary resources. In order to achieve this aim each participant of the construction industry should know his or her target responsibility in the system of handling construction waste.

2. Methods

The structure of waste generated, for instance, under new construction process, differs from the structure of demolition and disassembly waste of objects qualitatively and quantitatively. The construction of buildings and structures mostly involves waste of soils generated during excavations, small and medium-sized building materials. But when the same objects are demolished, the most part of waste consists of large pieces of load-bearing structures and a whole range of different sizes of facing and finishing materials, disassembled engineering communications, etc. It should be taken into account when making decisions on the organization of disassemble works and waste disposal. Companies executing construction and installation works and plants manufacturing building materials should exclude valuable components from the total mass of waste at the initial stages of sorting and collection [1].

The market of secondary construction raw materials mainly differs from the market of primary materials by the fact that the generated construction wastes are not the objective of a production



processes' complex. The reason of building demolishing is not the need for certain material, but the loss of technical and functional characteristics of the building. Whereas the production of primary raw materials aims at producing a specific material, which is already demanded by the consumer. This difference assigns the lower quality of secondary building materials if compare with their natural analogues and the partial processing of construction waste into secondary resources. Figure 1 shows the structure of the cycle of managing construction and demolition waste [2].

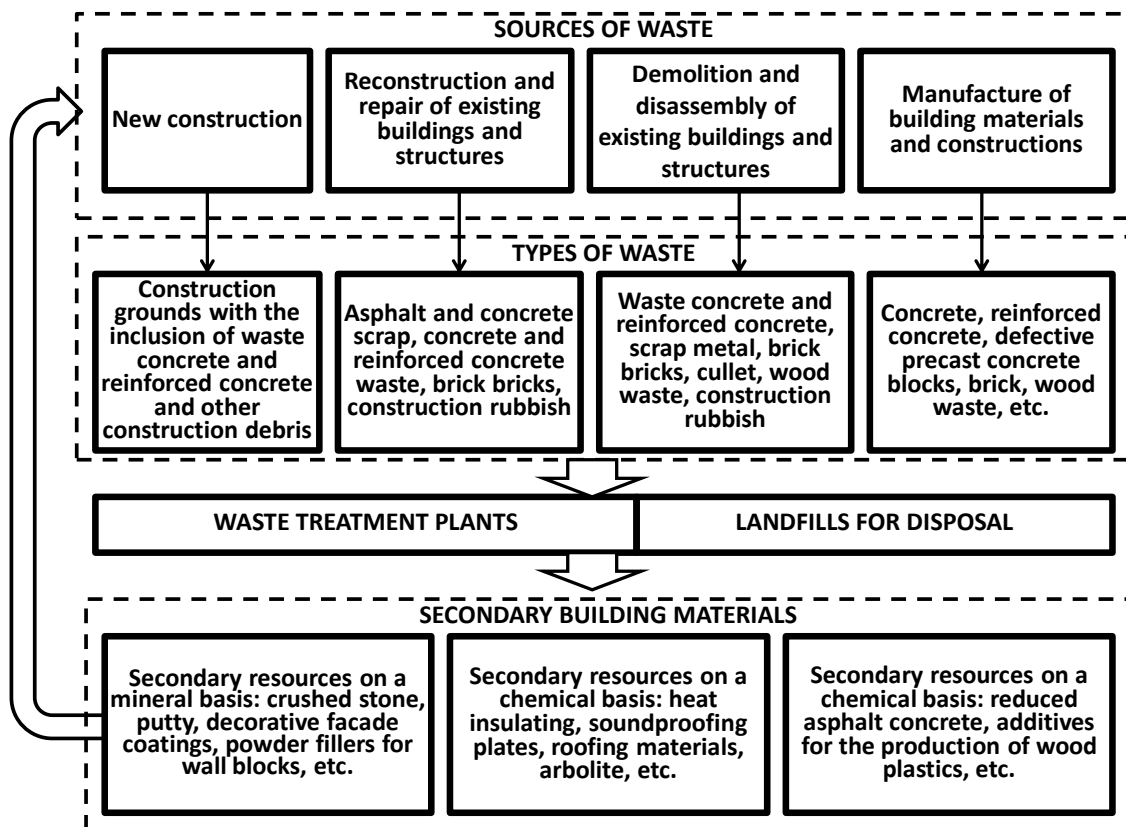


Figure 1. The cycle of waste treatment in construction area

According to the structure of the waste treatment cycle (Figure 1), the flow of construction and demolition waste is divided into two parts after the collection and sorting process. The first part goes to the plants for further processing, and the second goes to the disposal. According to the recently introduced regulatory documents of the federal and regional levels, the overwhelming part of waste should be processed, and only the categories unsuitable for processing are prescribed to send to the disposal [3]. At the exit from the sections of waste-processing plants, construction wastes get the status of secondary construction materials. From this moment on, they come upon special high demands in terms of technical reliability and safety for the environment and people: the absence of radioactive radiation, carcinogenic elements, etc. Such materials can be used only after specialized laboratory studies and the development of official documents regulating their use. Based on the results of research and analysis, it is necessary to create a classification base for secondary building materials with an assessment of the prospects for their further application. The active use of secondary building resources is contributed by scientific developments and improvements in the production of building materials.

3. Results

Before entering the construction markets secondary raw materials must pass the certification and certification procedures, confirming their technological properties and safety characteristics for the

environment and human. The manufacturer of secondary materials is beneficial to certify their products, since the availability of a certificate contributes to the increase of consumer confidence and the growth of demand [4].

Construction production waste can be divided into three groups on the basis of their use as secondary material resources.

1) The first group includes wastes that can completely replace primary resources by their properties, for example, secondary crushed stone, the characteristics of which are similar to natural crushed stone.

2) The second group of wastes are materials that serve as raw materials for the production of secondary raw materials. For example, roofing bitumen-containing coatings, of which after processing bitumen is melted in bitumen-welding boilers, used for the preparation of primers, roofing emulsions and mastics.

3) The third group includes wastes that have fundamentally new characteristics, which are not peculiar to primary raw materials.

For effective functioning of the sphere of circulation of secondary raw materials, there is a need to establish links between all its participants on the basis of integration of their interests. This issue is also possible to solve with the help of the development of a traffic management system for the secondary construction stream, based on the introduction of modern information technologies and marketing methods in the management process that promote the secondary production [5].

The system of traffic control of the flow of secondary building resources includes the following participants (Figure 2):

1. manufacturers of construction and demolition waste (construction companies);
2. reception points for construction and demolition waste;
3. enterprises engaged in the construction and demolition waste treatment, and also producing secondary construction products;
4. warehouses for temporary storage of secondary construction products;
5. consumers of secondary construction products.

Each particular region requires a specific diversity of participants, depending on the existing structure of circulation of secondary products. The movement of construction waste streams and secondary products is difficult to organize without their temporary concentration in the transshipment points, waste reception points and warehouses for temporary storing secondary products. The effective functioning of the transshipment points significantly affects the rationalization of the turnover cycle of waste and secondary resources, on the vehicles provision and the value of total costs [6].

Creating reception points for construction and demolition wastes is inappropriate if there is a sufficient number of processing enterprises and a relatively short distance to them from waste generation sites in a particular region. In this case, the waste stream is firstly sent to the waste treatment plant without intermediaries. If there is a need for creating reception points, they can also take the responsibility of preparing the waste for processing (sorting, separation into smaller fractions, etc.) [7].

Warehouses for temporary storage of secondary construction products are not an obligatory element of the waste circulation system as well. Consumers can take necessary products from the treatment plants by their own. However, the existence of such a transshipment point contributes to the regular and rhythmic functioning of the "waste-processing plant – consumer" system by solving the following issues:

1. Warehouses for temporary storage enable to compensate the imbalance between supply and demand for secondary resources, create stock for the continuous production process, which is especially relevant, because the consumption of building materials is seasonable.
2. Warehouses can offer transportation services to consumers of secondary resources. The buyer often orders a parcel of goods less than the standard vehicles can contain, which greatly increases the cost of delivery of such goods. To minimize transportation costs, a warehouse can combine small parcels of goods into larger ones. Thus, the delivery of products to several customers on fully loaded vehicles is carried out.

3. The organization of storage of goods in a warehouse is more rational than temporary storage of secondary products in waste-processing plants. The storage system initially implies the optimal placement of products in the warehouse and management of it. The introduction of automation and dispatching of the logistics organization of the warehouse economy will allow to ensure a clear control of all operations and to respond as quickly as possible to external and internal negative impacts [8,9]

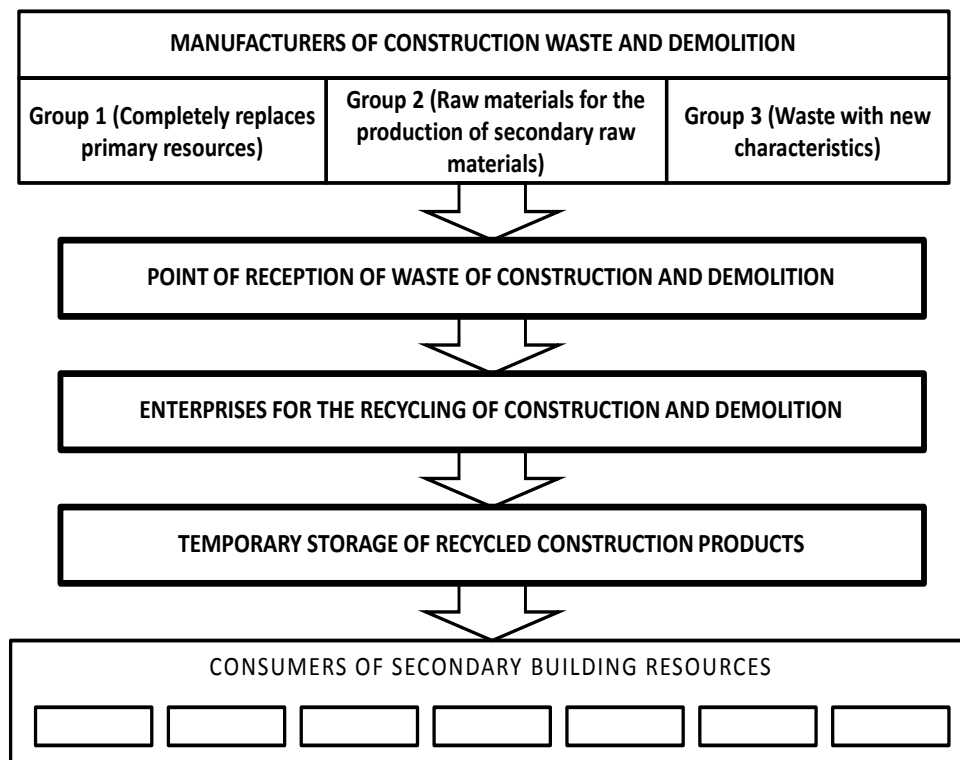


Figure 2. The system of flow control of secondary building resources

4. Conclusions

The benefits from formation of a system of managing secondary building resources flows on the basis of producers interacting with consumers of materials made of secondary raw materials, with the participation of points of reception of construction and demolition waste, of waste processing and secondary building production manufacturing enterprises and of warehouses for temporary storage can be represent the following:

1. ensuring more effective ways of saling products of secondary raw materials;
2. expanding the range of goods, increasing accessibility and bringing it to consumers;
3. reduction in the volume of costs for the distribution of secondary products.

The specifics of waste management of construction and demolition as secondary construction resources is generally proved by the fact that construction wastes are not the aim, but a by-product of a complex of production processes. Today the market of secondary resources consequently represents an extremely unbalanced mechanism. At the same time, a significant part of construction waste can be effectively used as secondary resources or raw materials in production recycling.

Analysis of the cycle of construction and demolition waste treatment showed the need to organize targeted interaction of all participants of the system for the construction waste treatment realized by the

integration of their interests for effective management, expansion of the market of secondary resources and stimulation of their use as raw materials for new construction.

The specifics of waste management of construction and demolition as secondary construction resources is explained by the fact that construction wastes are not the aim, but a by-product of a complex of production processes. It follows that today the market of secondary resources represents an extremely unbalanced mechanism. However, a significant part of construction waste can be effectively implemented as secondary resources or raw materials in production recycling.

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