

## Main issues related to the construction and demolition waste management in Romania

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### Abstract

The risk of environmental pollution is a real problem, as humanity is alarmingly close to the moment of environment degradation irreversibility. An important contribution to environment pollution is construction and demolition waste. Romania, and particularly big Romanian cities, are facing asphalt works, changing curbs, residential construction/renewal, chaotic urban development and construction and demolition debris that cannot be ignored any longer and thrown away on the wayside. According to The Romanian National Institute of Statistics, in 2006 the amount of municipal waste collected by the salubrity companies in Romania was about 6.8 mil. tonnes, out of which 6.96% represents construction and demolition waste. The amount seems lower than the European average (25-30%) because the construction companies are developing their activity on sites all over the country and do not have a centralised waste record. On the other hand, construction and demolition waste is eliminated without being weighed on old landfills or free spaces. Following this observation a consortium of three universities (The Academy of Economic Studies, The Technical University of Civil Engineering and The University of Medical and Pharmaceutical Studies) and two research institutes (The Institute for Computers and The Institute of Prognosis) elaborated a research proposal that was accepted to be financed by The Romanian National Research Authority. The project has several goals. One of them is to create a database containing analytical forms for every material/equipment used in construction and demolition, which can be considered potential waste. Another goal would be to elaborate new solutions regarding waste storage in the urban environment, according to EU regulations and to develop a regional distribution map of the existent storage solutions and



of the necessary ones at the moment of the analysis. The paper will reflect the research results of this project up to that point.

*Keywords: waste management, environmental protection, construction and demolition waste, recovery, recycling.*

## 1 Introduction

According to statistic surveys, quite a large amount of waste materials is being generated yearly in Romania. Unless adequately managed, they might contaminate soil, water and air, thus jeopardizing human health.

Romania has 21.5 million inhabitants and adhered to the European Union in 2007. Regulating waste had been a fundamental prerequisite for Romania's admission in the European Union and led to a total transformation of the national legislative and institutional framework for waste management. Unlike other Member States, who had adjusted their legislative frameworks within more than 20 years, our country had to do this in quite a short time (less than 5 years).

After removing the communist regime in 1989, concurrently with salary income increase, economic diversification and market liberalisation called for an ascending trend on the Romanian building market. The Romanian growing civil and industrial building market generated an ascending evolution of waste amounts. In 2009 Romania also experienced economic crisis, which brought about a contraction of the investments in the Romanian building sector.

The European Union has already identified the construction and demolition waste-C&DW as a priority waste stream. This means that particular attention will be paid to policies and measures to ensure increased recycling of C&DW. Among measures to minimise C&DW, there are: re-using, recycling and reducing its generation through control of aspect such as design quality, applied technology and habitual construction methods Ekanayake and Ofori [1].

Chong and Hermreck [2] found that the recyclability of construction wastes are affected by regional variables, such as the distances between project sites and recycling facilities, the regional recycling capabilities and facilities, the existence of a market for the recycled materials; social variables, such as regional purchasing habits; and design variables, such as the ease of deconstruction and recycling of construction materials.

The present state of C&DW Management is different in each Country and/or Region, and is determined by the management instrument used, and degree to which their content has been developed Rodriguez *et al* [3].

## 2 Guiding acts for the management of construction and demolition waste in Romania

In compliance with the requirements of the E.U. legislation, the national waste management strategy involves two main components, namely:

- The National Waste Management Strategy – represents the framework which settles Romania's goals in waste management;



-The National Waste Management Plan – represents the Strategy implementation plan and contains details of the activities to be undertaken in order to attain the Strategy goals, the way these activities should deploy, including terms and responsibilities.

The 2003-2013 National Waste Management Strategy was drawn according to Romania's responsibilities after transposing the E.U. waste management legislation. This Act classifies the types of urban solid waste generated on the entire territory of the country as follows:

1. municipal and recyclable waste, representing the total waste generated in urban and rural areas from households, institutions, commercial units and service companies (residual waste);
2. street waste collected from public areas, streets, parks, grass plots;
3. construction and demolition waste;
4. sewage from the city water purification.

The term "construction and demolition waste" refers to waste resulting from building, renovating, rehabilitating, repairing, consolidating, demolition of civil and industrial constructions, city structures, transport infrastructure as well as the activity of dredging and clogging up.

The typical national strategic goals in what construction and demolition waste is concerned are as follows:

- a) Promoting reuse and recycling of uncontaminated construction and demolition waste.
- b) Contaminated construction and demolition waste treatment in view of either reuse or disposal of waste.
- c) Developing the facility system for an adequate waste disposal.

At the moment, the National Waste Management Strategy and the National Waste Management Plan are being revised because they had been drawn three years before Romania had adhered to the E.U. At that moment more focus had been made on adopting the legislative framework and transposing the key regulations concerning waste and environmental protection into the Romanian law. Less stress had been laid on other important aspects of waste management, such as raising awareness in what waste management is concerned, developing data management informatic systems, encouraging investments on the private sector, increasing the authorities' capability to ensure law observance, etc. The revision of the National Waste Management Strategy takes into account the current implementation stage, the achieved progress, the weaknesses because of which goals have not been attained and new European strategic trends in waste management.

Under the revised Waste Management Strategy Act, among the main design goals to be achieved by the upgraded management of C&D waste, one takes the place of pride, namely the goal of increasing the mass amount of re-used/recycled non-hazardous waste, from 15% as it was in 2010, up to 70% by 2015.

In addition to The National Waste Management Plan, several similar Regional Plan Acts together with other similar County Plan Acts have enforced in Romania the stipulation of the European Council Directive 2006/12.



Most of the Regional Waste Management Plans, which were drawn in 2007, settled the following targets in C&D waste management:

- Treating the contaminated C&D waste so that they may be re-used or / and finally safely disposed of.
- Treating the contaminated C&D waste deriving from road construction, building industry and excavations, so that they may be re-used or / and finally safely disposed of.
- Re-using and recycling uncontaminated C&D waste.
- Re-using and recycling uncontaminated excavation waste.
- Implementing the recycling and re-using technology for 50 percent of the waste resulted from road constructions.
- Developing a waste disposal technology for non-reusable C&D waste.

There is no specific nationwide legislation dealing exclusively with C&D Waste. In 2007, a Draft Government Decision on C&D waste management was submitted to the Parliament and it is now waiting for a parliamentary approval. The main reason of this Government Decision is to regulate both the activities that generate waste at construction sites and those that manage it in keeping with the goals set out by the already adopted Waste Management Strategy Act. To note among new provisions, the mandatory classification of the waste as soon as it has been generated and, should it be found as non-contaminated, it may be either re-used/recycle or removed without further notice.

### 3 Description of construction and demolition waste generated in Romania and in the European Union

About 850 million tonnes of C&D waste is generated in the E.U. per year. This represents 31% of the total waste generation in the EU and varies significantly among the Member States ETC/RWM [4]. The rates *per capita* in each country are spread within a quite large range namely from the highest 5,5t in France, 2,24t in Germany, 1,89t in the U.K., to the lowest 0,02t in Romania (see fig. 1).

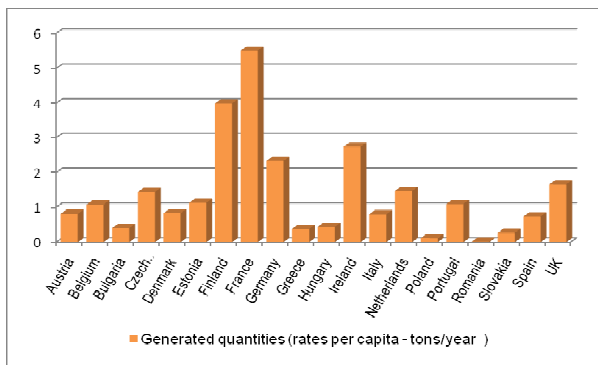


Figure 1: Generation of C&DW per capita in the EU countries in 2006 or latest available data (Source: ETC/RWM).

Different construction new techniques, various traditional construction practices, different construction materials in use, a large variety in the conception of construction, depth of foundation ground, high seismicity hazard as well as the existence of a business friendly environment may have in a lesser or higher degree, accounted for substantial gaps among the rates.

As seen here above, Romania is credited with the lowest rate per capita – 0,02 tonnes – among the E.U. countries. Poor accuracy of the recorded data may account for this figure. Note that keeping evidence of the track covered by any waste – from the generating site down to the location where it is re-used or disposed of – is not yet mandatory here. Moreover, the C&D waste materials are usually dumped without being weighted as often they are simply discharged on free spaces Iacoboaia *et al* [5].

This state of affairs does not favour the creation of a reliable database which could mirror more accurately the actual condition of this business on the free market. Processing such database would make it possible for the analysts to obtain figures with the required accuracy in expressing the above rates.

During the same year 2006, the operators providing town sanitation servicing picked up 6 808 837 tonnes of municipal waste out of which 474 350 tonnes were considered as C&D waste i.e. a yearly amount of 0,02 ton per capita RNEPA [6] (see table 1). During the year 2007, about 51% of the inhabitants (out of which 79% were lodged in urban areas) derived advantage from the sanitation public servicing that collected municipal waste.

The existence of a business friendly environment led to a significant growth of investments in the building sector of the Romanian economy particularly over the early period 2000-2007 of the first decade. To illustrate this growth, we reproduce in fig. 2 the cost-index diagram expressing in percentages numbers relative to the records of the year 2000, the evolution of this growth.

The composition of C&D waste materials is in strict correspondence with the predominant building techniques and materials in common practice over a certain period of time European Commission [7]. The Measure Unit of the length

Table 1: Yearly municipal waste collection within 2003–2007 in Romania (Source: Romanian National Environmental Protection Agency).

Year	2003		2004		2005		2006		2007	
M.U.	1000*Ton		1000*Ton		1000*Ton		1000*Ton		1000*Ton	
Waste Category	Gene rated	Re-used	Gene rated	Re-used	Gene rated	Re-used	Gene rated	Re-used	Gene rated	Re-used
Domestic	5044	13,23	5161	74,20	5557	136,3	5362	40,5	5243	64,4
Municipal	996	4,23	840	9,30	1001	9,1	972	0,5	945	1,4
<b>C&amp;D Waste</b>	<b>247</b>	<b>2,3</b>	<b>646</b>	<b>0,3</b>	<b>467</b>	<b>0</b>	<b>474</b>	<b>0</b>	<b>734</b>	<b>6,8</b>
Miscel'os	66	-	69	-	-	-	-	-	-	-
Total	6353	19,76	6716	83,8	7025	145,4	6808	41,0	6922	72,6

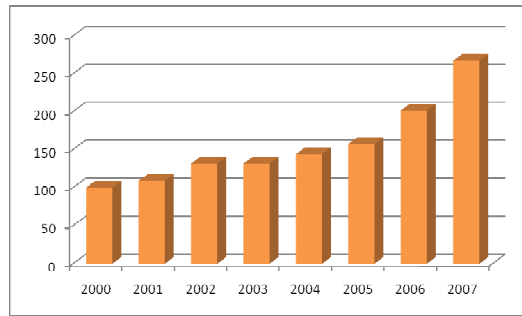


Figure 2: Variation of cost indices (%) 2000-2007.

of time over which a construction is considered still serviceable, is the decade. Usually demolition of large ones occurs or will occur, in several decades. It is obvious the fact that for the proper classification of the waste resulted from demolition work carried out nowadays, many obsolete materials will keep relevancy as such or recycled, while other require special managing as they proved to be hazardous ones (like asbestos which should be prohibited from now on). On the other hand, many materials used nowadays will turn over five up to ten decades to obsolete waste that would require recycling in order to be re-used.

Most of the existing buildings from Romania are made of burnt-clay brick masonry and reinforced concrete as well as from materials lasting a shorter period of time like sun-dried brick (adobe) and half-timbered frame (trellis). Wood has been least used.

The composition of construction and demolition waste depends also on the construction works, when there is a new building or a rehabilitation of an older building. Rehabilitation/ modification of an older building produces a bigger amount of waste than the construction of a new building. Newly erected or rehabilitated constructions shared 75–80% of the whole building industry activity, while maintenance shared the balance.

By this time, most of the C&D waste generated throughout European Union has been dumped together with miscellaneous kind of waste materials on vacant ground. Disposing in such a way the waste not only bars any land reclamation work that could have been performed on large surfaces but also contributes to the pollution of air, natural water and of the very covered ground. The environment is polluted by noxious gases like CO<sub>2</sub> and CH<sub>4</sub>, which have listed so far among main factors liable for the development of the greenhouse effect at planet level. To note that the latter was specified in the Kyoto Protocol to be monitored by the Signatory Parts. Waste depositing along with farming (mainly zootechny) industry, have been considered since then, as generating most of the marsh gas. As reported in 2005, emission of such noxious gases generated by the C&D waste deposits, amounted to about two p.c. of the total recorded at E.U. level.

As far as Romania is concerned, C&D waste has been either disposed of in more or less laid-out deposits or simply dumped along road kerbs (partially

removed by public services), unfortunately for the environment that grew polluted and temporarily uglier.

Construction and demolition waste materials do not belong to mixed deposits of miscellaneous stuffs; they do to specialised ones, where they can be easily sorted with a view to carry them to the next plant for further re-use or further treatment required for the recycling process.

Lennon *et al* from The Institution Recycling Network [8] claims that upon the whole, 90 up to 95% of the waste materials mass collected at almost all construction and demolition sites, are suitable for further recycling process .

The European Union, namely its Commission, has manifestly backed up the recycling solution of the C&D waste issue, fact that may be inferred from the acts concerning this matter, the E.U. has so far put into circulation. In its latest Frame Directive on the waste at issue CD2008/98/EC recycling is given a prominent position ahead of incineration or depositing waste as landfilling.

So had recycling been in countries like Denmark, Germany and Netherlands that already successfully enforced specific legislation on only C&D waste, providing incentives for undertaking recycling process while discouraging any kind of uncontrolled landfilling. To be specific, the latter means higher taxes and costs for landfilling and use of virgin concrete aggregate as well. Avoiding such charges turned to be an incentive to directing investments in C&D waste sorting and recycling facilities where among others things, recycled aggregate is being produced. These fact accounts for achieving recycling annual rates above 80% in these countries, as illustrated by fig. 3. On the other hand, countries like Hungary, Romania and Spain registered poor annual rates.

There are significant differences regarding the annual rate per capita of the C&D waste being generated and recycled throughout the E.U. countries but on the whole, the average annual rate amounts over 50%. Most of the E.U. countries

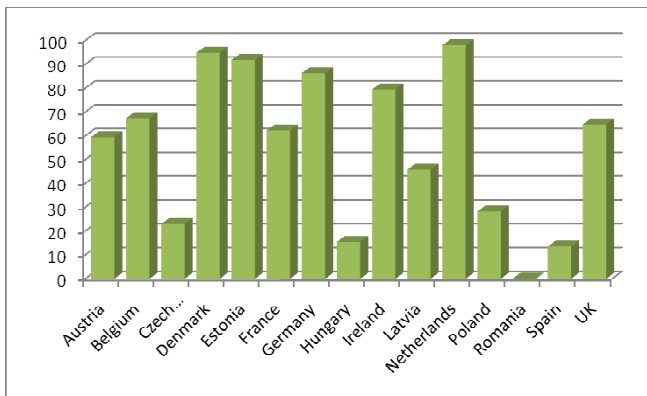


Figure 3: Recycling of C&DW in percentage of generated amount in the EU countries in 2006 or latest available data (Source: ETC/RWM).

mainly do recycle recovered (plain, reinforced) concrete elements, masonry bricks and road asphalt as well as significant amounts of proper landfilling materials like clean earthen spoil, sorted gravel and crushed rock.

As many specifications overlook the use of recycled products, it is of paramount importance the development or revision of recycled product performance standards and specifications, in keeping with the concrete codes and vice versa, regulating the inclusion of recycled rubble in proportioning the fresh concrete mixture. Such revised regulations would certainly help in promoting the use of recycled products. Duran *et al* [9] explain that policy makers should impose taxes on the use of primary aggregates or use subsidies to reduce the cost of recycled aggregates.

Throughout European Union, the annual sale of all kinds of concrete aggregates amounts to round three milliard tons. In the southern European countries only 7% are by-products from recycled waste UEPG [10]. The availability in these countries of plenty cheap resources accounts for their achieved low rate.

In 2007, the C&D waste recycling rate based on statistically declared figures, amounted to 1% in Romania. Fact is that this figure overlooks an underground market of second-hand recovered waste materials that grew up further either to greater demand or to the rise in price there of.

Adopting a Waste-Wise legislation is a basic prerequisite for the Romanian Government to successfully address the recycling issue. In this respect, the Parliament should start at the soonest, examination of the already forwarded pertinent draft laws. Developed modern techniques dealing with the separation, recovery of C&D waste and their reinsertion into the manufacture flow as secondary raw materials, of the uncontaminated remains or waste, is another prerequisite. Recycling needs to be supported by sustainable market demand (another requirement to be met by intelligent solution). Recycling the waste is a paying concern when the incurred working expenses are less or roughly equal to those, the landfilling does incur. Should recycling expenses surpass by far the filling ones, the reluctant operators will be offered time and again an excellent excuse for their lack of concern towards recycling.

The above mentioned latest Frame Directive – CD2008/98/EC – embodies among others things, provisions on the scope, targets and term limits the recycling activity should achieve throughout the E.U. countries. All Member States have to set up by 2015 effective schemes for early separation of waste by material sort at least for paper, metals, plastics and glass, in order to prevent them being co-mingled. A rate of 50 per cent of the total mass, to be attained by 2020, should be the target of the business relating to domestic waste preparation and recycling, while the targeted rate for the preparation, recycling and/or reusing of processed C&D waste either as a raw material substitute or as a landfilling material, has been set to 70%.





## 4 Research objective and methodology

The most important introductory step of our project undertaking was the devising of a comprehensive questionnaire to get significant data concerning the construction and demolition waste (type and to what extent it was reused as a valuable raw material substitute). We distributed the questionnaire among some 50 main companies dealing with trades of this kind. They were aleatory selected from the Romanian Yellow Pages directory. The response rate felt well under expectation. A quite large of requested data and an actual apprehension to disclose confidential data that might conflict with the declared annual Environment Reports, may account for the displayed reluctance.

We still hope more data will flow in, as soon as the companies will be fully aware of the benefits that can be derived from this business.

The main purpose of this database is to get a better insight of this industry by keeping abreast all useful information the authorities, stakeholders, individual and public investors, contractors and other waste generators, designers may need or require. It is conceived to have two parts: the first one is to deal with construction and demolition waste issues only (no municipal waste), the second is to list on a regional basis all companies authorised to deal with such issues.

The database for construction and demolition waste types has the following suggested structure:

Table 2: The data base structure for construction and demolition waste.

Field name	Field type	Description
Character	Text - list	List possibilities for waste classification depending on the dangerous/non-dangerous character
Code	Number - list	List possibilities to classify construction and demolition waste according to HG856/2002
Waste type	Text	Classification according to afferent terms specified in HG856/2002
Subtypes	Text	Materials/ tools used in constructions and demolitions that may count as potential waste
Source	Text	Origin source of construction / demolition waste
Quantity	Number	[tons/year] Total waste quantity for each type of waste
Generation index	Number	[kg/place day] Total construction and demolition waste obtained daily per person
Means for recovery/elimination	Text	Possible methods for exploitation, or elimination of the waste subtype
Recovered waste quantity	Number	[tons/year] Total quantity of waste recovered in a year
Landfilled waste quantity	Number	[tons/year] Total quantity of waste landfilled in a year

The database for companies in the field of waste collection, transport and exploitation has the following suggested structure:

Table 3: The data base structure for waste companies.

Field name	Field type	Description
Domain of activity	Text	The society's domain of activity: sanitation operator, processing station for exploitation, recycling installations, thermal treatment installations, processing and recycling stations, sorting stations.
Location	Text	Town, district where the society operates
Area served	Text - list	Urban area, rural area or rural and urban area
Company name	Text	Company name
Contact	Text	Contact data- address, phone number
Number of inhabitants served/ type	Number/text	The number of inhabitants that benefit from the sanitation services/ The type of activity done when it does not serve the inhabitants.
Capacity	Number	[tons/year] Maximum annual quantity that companies can collect/ transport/ recovered and store
Materials/Domain	Text	Materials processed by the companies or the domain of services made

Another aim of the project was to map the distribution of the existent storage solutions via GIS technology.

According to the data disclosed by the Romanian Environment Ministry, 191 municipal waste deposits are being operated (fig.4), out of which only 26 comply

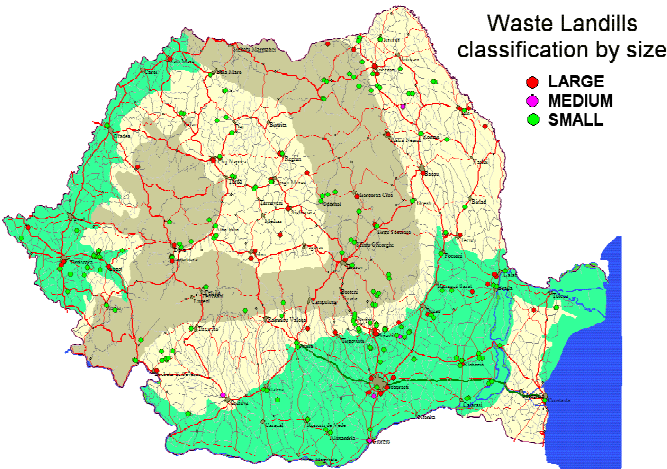


Figure 4: Waste landfills classification by dimension.

with the provisions of the European Commission 1999/31/EC, 64 should have been closed by the Government late July 2009 for non-compliance, as stipulated in the Adhering Treaty, and the balance of 101 units, is to gradually cease to be in operation until late July 2017 as the E.U. has granted a longer transition period. Both the former group of 64 units and the latter group of 101 units do not meet the European requirements as they have improper location and/or improper lay-out planning and do not possess any sewage system for leaching of the contaminated soil and for collecting the noxious marsh gas. Because they failed to meet these, requirements those platforms turned into a genuine jeopardy for the close environment and for the people living around them. Out of these reasons they ought to be shut down as soon as possible. The infringement procedure is looming above them as the European Commission seems prone to react more seriously should the authorities fail to shut down those improper platforms.

An analysis of the construction companies and recycling companies' territorial distribution was elaborated. The conclusion showed that there is a link between them. In most of the cases, a large number of building companies generated the emergence of a series of recycling and collecting companies to support the right implementation of the legal requirements in the industry. This can be seen in fig. 5.

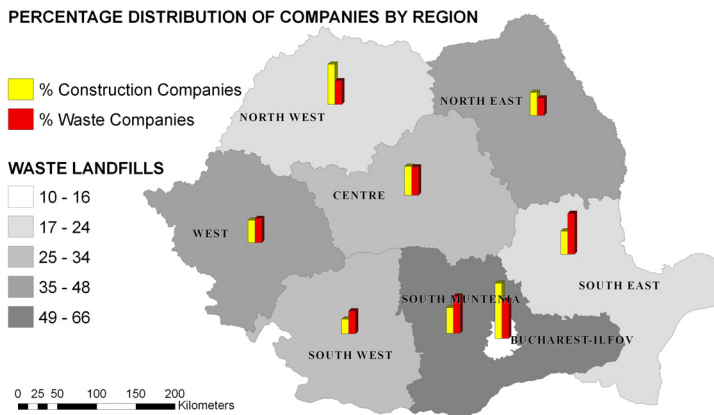


Figure 5: Territorial distribution of construction and recycling companies.

The research project is still a work in progress. The second phase will try to formulate technical and management solutions in order to reduce the negative impact generated by construction and demolition waste.

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