Construction and Demolition Waste Management: Case study of Kosovo

M. Nikolaou, A. Karkazi, A. Mentzis, N. Gargoulas, 1
I. Dimitriadis 2
1 EPEM Engineering S.A., Athens, 10446, Greece
2 ANAKEM S.A, Thessaloniki, 54655, Greece
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Presenting author email: mnikolaou@epemengineering.com

During the last decades, countries and cities with large expansion of the construction sector are facing severe challenges in the field of managing construction and demolition waste (CDW). Solid waste generated from construction and demolition activities constitutes a significant amount of the overall municipal solid waste worldwide. More specifically, it is estimated that this category represents at least 30% of the solid waste generated in the world. In the case of Kosovo, a country that was significantly rebuilt and developed after the 1999 war, the generation of this waste stream is increasing rapidly, without the aligned action for appropriate waste management (Ma et al., 2023).

The aim of this paper is to investigate and analyze the transition of a country to the circular economy, through the optimal CDW management and the development of the "National Construction and Demolition Waste Management Plan", which was funded by EBRD and was concluded in May 2023. The scope of the National Plan is to provide a framework, define the guiding principles, and specify the necessary conditions for the sustainable management of CDW, while guaranteeing the protection of the environment and public health. The policy objectives of the Plan were set out to fundamentally implement the waste hierarchy and prioritize waste separation and recycling ahead of disposal. The waste management system was developed in line with the EU provisions, such as the Circular Economy Action Plan and the European Green Deal, the national legislation and good environmental practices.

CDW is defined as waste produced during new building construction, reconstruction, demolition and maintenance, as well as any excavation waste that cannot be used without prior recovery. CDW consists of concrete, masonry, asphalt, wood, mineral, metal, gypsum and other material (Advances in Construction and Demolition Waste Recycling, 2020) (Gálvez-Martos et al., 2018). In Kosovo, approximately 620,000 cubic meters of CDW, corresponding to 515,000 metric tons, are generated annually, excluding excavation soil and public works. Around 60% of CDW is generated in Prishtina region, the area with the highest construction activity. It is expected that the CDW generation quantities will increase significantly (~70% until 2040) in the following years. The existing CDW management system has several shortages, such as lack of data regarding CDW generation, lack of information about CDW disposal, material recovery and reuse, and lack of an organized network of licensed CDW collection operators, handled by construction companies or municipal contractors.

Specific targets and principles are defined in the National Plan, and one of the most important issues that the Plan was focused on is to comply both with the existing legislative provisions, as well as the objectives and targets that have been set in the Kosovo "Integrated Waste Management Strategy 2021-2030" (IWMS), while taking into account the direction of the future policy and the anticipated market developments. The basic targets of the National Plan are the following:

- Create an Integrated System for CDW Management, including the strategy for reduce-reuse-recycle
- 40% separate collection of CDW until 2030, with the development of a network of temporary storage areas and centers
- > 20% recovery rate until 2030
- < 75% disposal rate until 2030

For the purpose of CDW management, a future estimate of the number of the generated waste in the coming years was calculated based on data from the Kosovo Agency of Statistics. It was considered that Kosovo will follow an urbanization trend of approximately 10% until 2030 (or 1% per year). The results are presented at the following table:

Table 1. CDW Generation in Kosovo

(m^3/yr)	2022	2025	2030	2035	2040
Construction Waste	457,890	509,304	643,060	701,445	765,470
Demolition Waste	183,156	203,721	257,224	280,578	306,188
Soil	894,561	995,005	1256,319	1370,383	1495,467
Total CDW from Buildings	1,535,607	1,708,031	2,156,603	2,352,405	2,567,125
Total CDW from Public Works	811,471	902,585	1,139,628	1,243,097	1,356,562
Total CDW from Households	12,357	12,418	12,405	12,268	12,041
Grand Total	2,359,434	2,623,034	3,308,636	3,607,770	3,935,728

For the proper CDW management, it is important to establish suitable waste management areas. The substantial amount of CDW generated, makes long-distance transportation economically unfeasible. The National Plan proposes the development of six (6) Regional CDW Management Systems, at Prishtina, Prizren, Gjilan, Peja, Mitrovica and Ferizaj. Each regional system will serve 5 to 7 Municipalities, depending on their geographical location, and will be served by one treatment-disposal facility and will have a network of temporary storage - drop off points and mobile recycling facilities. For the collection of CDW at national level, a network of Civic Amenity Centers (CACs) / Drop off points is proposed to be developed in three phases.

Common CDW treatment techniques are analyzed in the National Plan, and a specific design regarding CDW treatment is proposed. The Plan focuses in the transition to circular economy and follows the waste hierarchy, including avoidance, reduce, reuse and recycle strategies, before the least preferable strategy, which is waste disposal. There is a prompt need for waste prevention alternatives and initiatives to 3R's of CDW management. CDW can be recycled and reused for multiple purposes, depending on the composition and characteristics of the waste. Major CDW applications include Granular Sub Base, Recycled Concrete Aggregates, Recycled Aggregates and Manufactured Sand. As such, the National Plan includes measures to motivate and promote the use of secondary material from CDW and to overcome the gap from a linear waste management approach to a circular one.

Mass flows concerning the overall CDW management in Kosovo at the year 2030 and maps that include indicative locations for the proposed CDW management infrastructure (CACs / Drop off points, Recycling and Disposal facilities), based on the processes, transportation and estimated generation of CDW, are developed within the elaboration of the National Plan. Also, the environmental and social impacts of the potential sites for the construction of CDW treatment (recycling) and storage facilities are defined in the National Plan, towards the adoption of an optimum siting solution.

The CDW fractions that belong to the hazardous waste category and cannot be recycled, will be separately collected, and exported until infrastructure for hazardous waste treatment and disposal are developed in the country (it is considered that such infrastructure will be developed after 2030). Asbestos will be separately collected, and exported until dedicated cells within the CDW landfills are developed to receive this waste fraction.

The National Plan emphasizes on the need to implement intermunicipal cooperation in CDW management The new approach in CDW management (regional / intermunicipal cooperation), will require several adjustments in the institutional and legal framework and different models are proposed to be implemented governing the responsibilities of the intermunicipal entities.

In conclusion, the "National Construction and Demolition Waste Management Plan" will play a decisive role in the organization and development of a sustainable, and harmonized with the international environmental goals, modern country. Through the National Plan, Kosovo intends to adopt sustainable CDW management services for its citizens, aiming at protecting the environment and public health, supporting growth in business and employment and move towards a circular economy.

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