Assessment of the CDW management system implemented in Lombardy region (Italy)

L. Rigamonti[1,2], S. Pantini[1,2]

[1]Department of Civil and Environmental Engineering, Politecnico di Milano, Milano, 20133, Italy
[2]Centro Studi MatER, c/o LEAP, Piacenza, 29121, Italy
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Presenting author email: lucia.rigamonti@polimi.it

Construction and demolition waste (CDW) has been identified as a priority waste stream by the European Union due to its significant generation level and its high recycling potential. The local government of Lombardy Region (Italy) has selected the Life Cycle Assessment (LCA) methodology as a strategic support decision tool in the planning of the regional waste management. After having used this methodology to prepare the new municipal solid waste management plan in 2013 (Rigamonti et al., 2013a, 2013b), Regione Lombardia has decided to use it again but in the context of CDW management. The goal was in both cases the same, i.e. to use the LCA to assess the current regional situation in order to define possible future scenarios with better environmental performance than the current one.

In this case the focus was on the following non-hazardous waste streams: cement, tiles and ceramics (codes 1701), reclaimed asphalt pavement (RAP) (code 170302), gypsum-based waste (code 170802) and mixed construction and demolition waste (code 170904). The following activities were performed: i) quantification of the amount of CDW generated at regional scale and the current level of recycling for each waste stream by elaborating official raw data provided by the regional agency for environmental protection; ii) collection of information about the type, quality and actual uses and markets of secondary materials, i.e. the materials produced through the recycling activities; iii) evaluation of the type and amount of primary resources that can be replaced by secondary materials for the different end-uses; iv) assessment of 15 environmental impacts associated with the current CDW management system by applying the LCA methodology (Figure 1); v) comparison of alternative management scenarios to identify possible improvements of the system based on LCA results.

Results of activity i) are summarised in Table 1. In 2014, about 7 Mt of the wastes of interest were managed in the regional system: the mixed waste (code 170904) was the main flow, accounting for approximately 76%. Moreover, the wastes were mainly treated in recycling facilities (91.2%) and only a limited amount (3.1%) was disposed of in landfills; the remaining 5.7% was stored in transfer stations without being subjected to any further treatment.

Table 1. Amount and management of the CDW streams under study in Lombardy Region in 2014 (with the exclusion of exports).

Type of waste	Storage (t)	Recycling (t)	Disposal (t)	Total
1701	45,669	704,270	14,011	763,950
170302	68,502	892,953	10,201	971,656
170802	2,951	17,793	244	20,988
170904	303,243	5,119,930	202,805	5,625,978
Total	420,365	6,734,946	227,261	7,382,572

The LCA study allowed to identify the most beneficial option for recycling each waste stream from which recommendations were formulated to the local government. For example, in case of the mixed waste, the promotion of the existing and new markets of mixed recycled aggregates resulted a crucial point and, to this end, the enforcement of green public procurement laws, the dissemination of information relating to their technical properties, as well as the restriction of mining activities, appeared essential. In particular, the potential climate change can be reduced from 3.40 $kgCO_2$ eq. to 1.78 $kgCO_2$ eq. per tonne of waste (Borghi et al., 2018). About RAP, the promotion of its recycling in hot mix asphalt while reducing its use as unbound material in road construction was recommended. Results also showed the lower performances associated to cold recycling techniques due to the use of bitumen emulsion and cement, whose production processes appear highly impacting, and to the inferior quality of cold mix asphalts compared to hot mix asphalts which implies a replacement coefficient minor than 1 to guarantee the same pavement lifetime (Pantini et al., 2018). Finally, the recycling of

gypsum-based waste in dedicated plants and the adoption of adequate technologies able to achieve high-quality recycled gypsum and to separate cardboard/paper sufficiently pure to be destined to paper factories was recommended to improve the environmental performance of the system. Specifically, the use of recycled gypsum as a soil amendment in substitution of agricultural lime was recognized as the most sustainable option (Pantini et al., 2018).

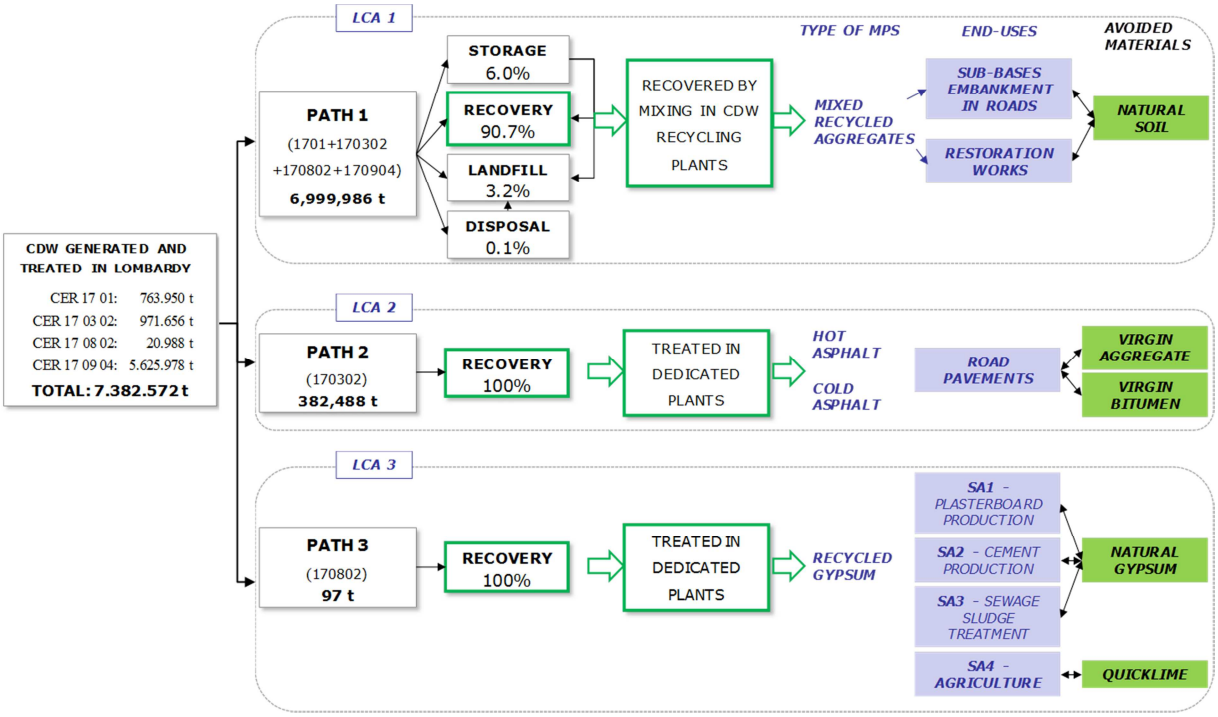

Figure 1. Representation of the LCA applied to the current regional system for managing CDW in 2014.

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