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CIRCULAR BUSINESS | **FOCUS ON CONSTRUCTION AND DEMOLITION WASTE RECOVERY**

From waste to resource

Valorization of CDWaste in the construction sector

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In 2016, the waste generated by the construction sector account for around 35% of all the waste produced by economic activities in Europe (Eurostat).

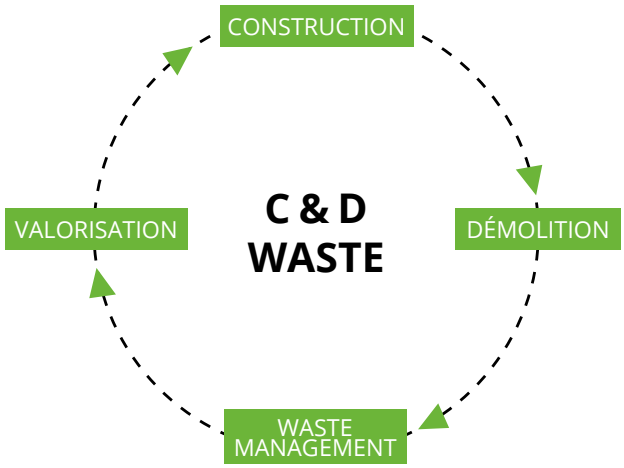
According to the Waste Framework Directive 2008/98/EC (WFD), the new EU challenge is to recover 70% by weight of CDW by 2020.

The progressive reduction of non-renewable natural resources has been a constant concern relating to the protection of the environment that, at the same time, leads the use of alternative materials. In particular, the construction industry is responsible for the production of millions of tons of construction and demolition waste (CDW) every year. For this reason, over the last years environmental sustainability has required a gradual increase of waste valorisation in the construction sector.

In 2016, the waste generated by the construction sector account for around 35% of all the waste produced by economic activities in Europe (Eurostat). Italy, with a production of about 54,5 million tons is the fourth European country for CDW production after Germany, France and Netherlands.

According to ISPRA (2018) and to the WFD, 76 % of CDW were recycled at national level in 2015. However, the amount of CDW sent to the final disposal was still important (24 %).

In Lombardy (2014) were produced about 11,6 million tons of CDW and 16,5 million tons were treated: 73 % were recovered with R5 (recovery of inorganic substances) operations, 14 % were recovered with R4 (metal recovery) operations, 5 % were recovered with other operations, while only 8 % were disposed in landfillx[1].



924 million tons of CDW generated by the construction sector in Europe.

54,5 million tons of CDW generated in Italy.

11,6 million tons of CDW generated in Lombardy.

76% of CDW recovered in Italy (of which 25% recovered in Lombardy).

CDW is often a complex waste stream of many different materials like concrete, bricks, asphalt, plastic, glass, metals, wood and more. The composition is extremely variable due to the fact that currently the demolition techniques tend to reduce time and cost of the process compromising the debris homogeneity. This is possibly one of the most important problems to be solved for the future use of secondary raw materials.

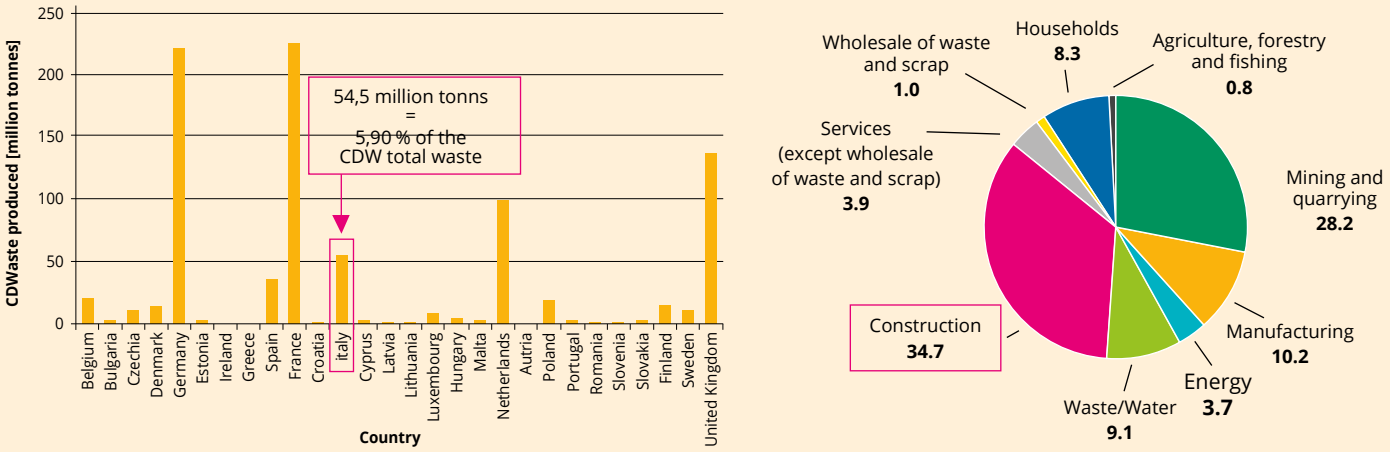
So, in order to improve the quality of the final recycled aggregate, a proper waste management is a key element. The European and Italian guidelines indicate that a correct CDW management starts with selective demolition practices (when technically and economically feasible), i.e. the initial separation of different types of waste from reusable components and their subsequent sending to suitable treatment plants. ■

(1) Regione Lombardia, 2018. Studi e ricerche per un'economia circolare nel settore dei rifiuti da costruzione e demolizione. Gli obiettivi della pianificazione regionale in materia di rifiuti.

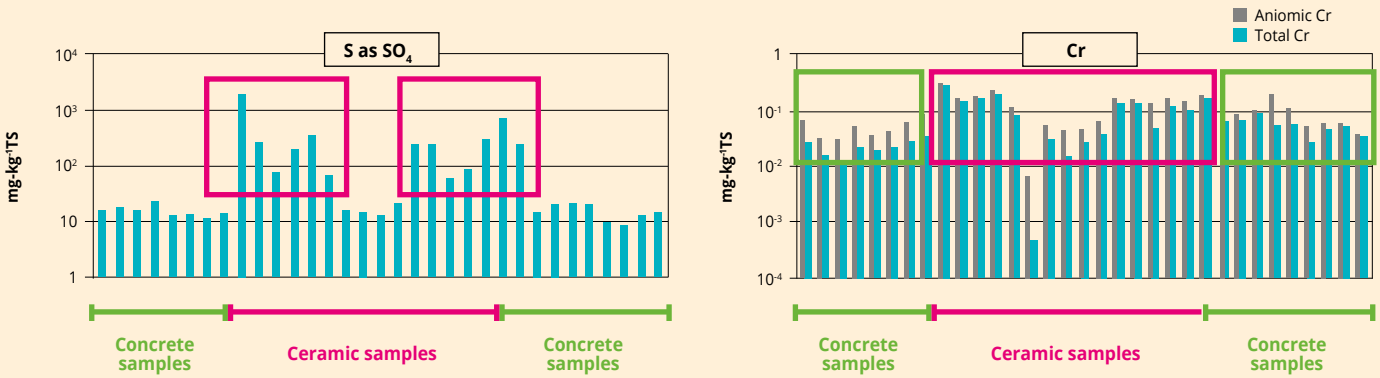
In order to allow the greater use degree, recycled aggregates (RA) must also be tested to ensure their environmental compatibility and to evaluate their mechanical characteristics. In particular, several studies highlighted that chromium and sulphate are the most critical compounds in the RA leachates.

The total chromium was released by ceramic materials and partly carbonated samples, indicating that source segregation and management practices may be important. High sulphate levels were detected by the gypsum-based materials, suggesting that segregation of the gypsum source could improve the leaching properties.

From a technical point of view, especially for concrete production, different studies highlighted that RA (especially coming from concrete structures) have good technical performances. In comparison with the natural aggregates, RA obviously still show slight decreases in terms of resistance but this can be compensated by improving the quality of the RA and reducing the replacement percentage.



Graphic 1. Waste generation by construction and demolition activities EU-28 (2016). [Eurostat]



Graphic 2. Leaching behaviour of concrete and ceramic samples and relative release of sulphates and chromium. [Butera et al., 2014]

So, the main problems related to the recovery and use of recycled aggregates refer to the leaching test. In particular, the release of contaminants from RA is influenced by several factors that mainly depend on the characteristics of the material, including the:

- heterogeneity in the RA composition;
- low quality of RA obtained by poorly treated CDW;
- non-optimal granulometric size distribution;
- level of carbonation (factor that conditions the pH of the material, extremely important in regulating the mechanisms of release of pollutants).

To overcome these problems, there are considerable technical indications for both the production and use of recycled aggregates. In particular, in order to improve the quality of the recycled aggregate, various measures can be taken both during the demolition phase and during the treatment of CDW such as:

- selective demolition procedures;
- selection and separation of specific fractions;
- double waste crushing operations;
- waste cleaning treatment.

Moreover, it would also be recommended to evaluate the leaching behavior through specific tests able to simulate the «real» recovery conditions and to validate in situ the behavior of the material in real conditions.

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