BUSINESS MEETS INNOVATION 2022

The Italcementi Challenge - CDW₄C²

Construction & Demolition Wastes for Circular Concrete





Italcementi commitment in fostering Circular Economy

WASTE AS A RESOURCE

Italcementi, as part of HeidelbergCement Group, will continuously increase the:

- substitution rate of natural raw materials by using by-products or recycled materials;
- use of recycled aggregates in the fresh concrete portfolio.



Construction & Demolition Waste: the framework

According to the EU Commission, about 450-500 million tonnes of construction and demolition waste (C&DW) is generated every year in Europe, at least a third of which is concrete. Nevertheless, only around a third to two thirds of the C&DW generated is recycled*. This low recycling rate is not due to technical difficulties - it's market realities. Against this backdrop the European Commission has embarked on several initiatives to analyse and improve construction and demolition waste (C&DW) recycling rates across Europe.

Concrete can be **100% recycled after demolition**. Recycling concrete from C&DW offers **two main benefits**: it **reduce**s

- the dependence on primary raw materials and
- the amount of waste sent to landfill.

There are two main ways in which recycled concrete is reused:

- As a recycled aggregate in **new concrete**
- As a recycled aggregate in **unbound applications** such as road construction and earthworks





C&D Waste: issue statement

Italy is still lagging for several reasons, ranging from local **bureaucratic complexity** to the availability of C&D valorization facility (authorization still extremely complex) and, in general, because of the difficulty to sort out suitable quality materials from the **mixed cumuli available** in several areas (e.g Amatrice and surroundings).

Nation	Production of C&D [10 ⁶ t]	Reused fraction [%]
Netherlands	14	60
United Kingdom	45	51
Germany	53	28
Denmark	2	25
France	25	10
Italy	35	5
Spain	13	4
Belgium	9	2





C&D Waste: the as-is flow of the concrete recycling process

The situation "as is"

A feeder delivers the material to a jaw crusher that processes the materials in order to have it ready for the next step;

A magnetic field strips out the iron scraps and delivers it to a separate process aimed to recycle it;

An initial screen separates the sand (0/4 fraction) from the coarser one, which can be subjected to further reworking until the desired particle size is reached;

The materials are delivered separately to quality check and inspection facilities to evaluate the feasibility of the reuse in concrete mix design for new structures and/or buildings;

The fractions that after the treatment are still not suitable for the scope are landfilled



*Source: Yury A. Villagr'an-Zaccardi *, Alastair T.M. Marsh , María E. Sosa, Claudio J. Zega , Nele De Belie , Susan A. Bernal , Complete re-utilization of waste concretes–Valorisation pathways and research needs, Resources, Conservation & Recycling 177 (2022) 105955



C&D Waste: the need

Given the restriction by the legal & standards framework in force, it is necessary to make an **appropriate selection of the materials** in order to separate the ones made of concrete from the rest (i.e., masonry, woods, metal or other materials). Such a need requires the **ability to recognize and sort out the different materials correctly**, similarly to what is being done for wastes doomed to landfilling. Given the **huge amount of material** available, some **automation is required to boost efficiency** and optimize the workforce. In this sense, **AI and ML seem appropriate** to solve the issue.







CDW₄**C**² C&D Waste for circular concrete: the new frontier of Urban Mining for the construction sector GENERAL OBJECTIVES OF THE CHALLENGE

Global perspective

As the available technologies, the objectives are:

- Fostering the adoption of solutions ready to push the circular economy approach in everyday business
- Implementing the C&D sorting and selection in the areas where it is more abundant and requested for the construction operations, such as Milan area
- Benefitting from a consistent and scalable operating and business model





CDW₄**C**² C&D Waste for circular concrete:

SPECIFIC OBJECTIVES OF THE CHALLENGE

Detailed perspective

Following the previous statements, from a technical point of view, the objectives are:

- Delivering an AI and ML based technology to sort C&D waste to select aggregates from concrete or cementitious origin, featured by a post-lab development stage (i.e., TRL > 5) solution available;
- Delivering a material range:
 - separated at least in two main fractions suitable for concrete uses: coarse recycled concrete aggregates (CRCA) and fine recycled concrete aggregates (FRCA) and
 - ready to be technically evaluated and tested according to the standards in force at the present.





Have a good start_{UP}!