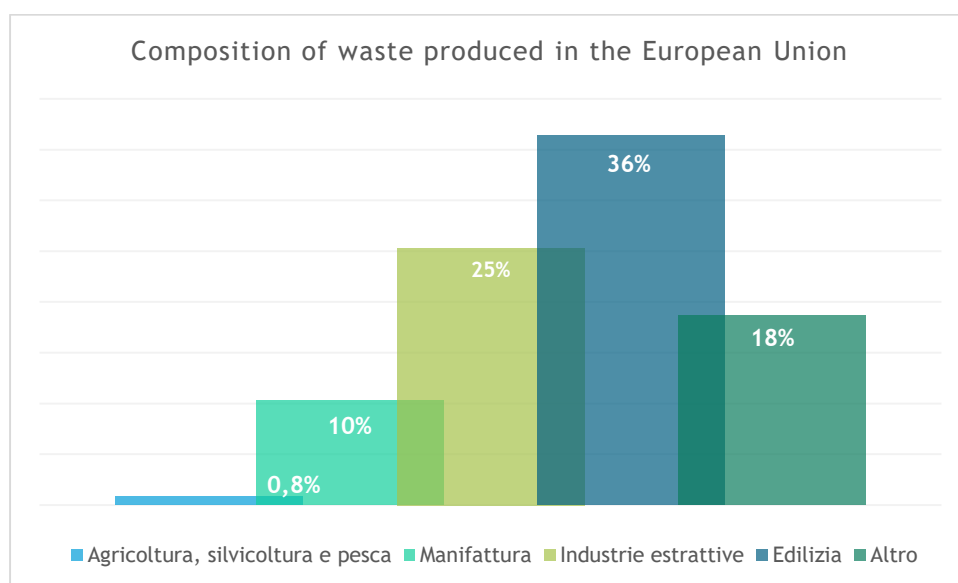


The most suitable materials and procedures for the production of urban equipment with the processing of construction waste

Management of construction and demolition waste - regulatory framework

Eurostat statistics reveal that in Europe, 36% of special waste is generated in the construction sector during excavation and demolition, renovation of existing buildings and construction of new ones. As summarized in Chapter 17 of the European Waste List, construction and demolition waste includes various types of materials such as wood, metals, glass, excavated material, asphalt and, in larger quantities, bricks, bricks and fragments of reinforced and unreinforced concrete conglomerates.



Vir: Eurostat

With Directive 2008/98/EC, the European Union set a target for member states to achieve a 70% recycling rate of construction and demolition waste by 2020, and to this end provided a series of tools designed to promote more sustainable management of waste. The directive introduced the concept of a "waste management hierarchy", which prioritizes prevention, reuse and recycling, in that order, instead of processing for energy and landfilling; it also provided criteria for determining the conditions upon fulfillment of which "waste ceases to be waste" or the so-called i. "waste termination status" (EoW); at the end, it also provided the classification of hazardous waste and possible procedures for the removal and processing of materials in order to enable member states to coordinate and harmonize waste management activities. This directive provided the legal basis on which each member state formed its own legislation in the field of waste

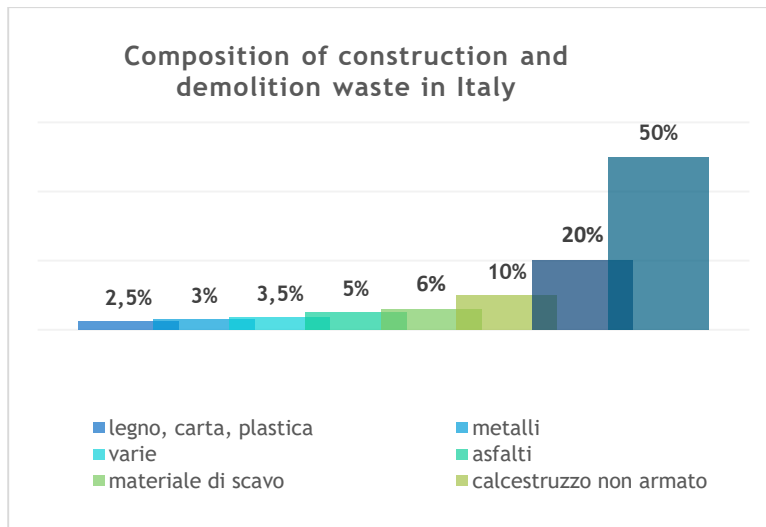
processing and disposal, but it was insufficiently precise regarding the management of construction waste and waste from the demolition of buildings. In the next ten years, the European Union has committed to define procedures for easier identification, collection and processing of construction waste and to strengthen confidence in the quality of recycled materials from this waste. These guidelines were collected in the EU Protocol for the management of construction waste and demolition waste from 2016 and partially transferred to Directive (EU) 2018/851 amending and supplementing that of 2008. In the last directive, the category "construction waste and demolition waste", which also includes waste generated by the work people do themselves in private households, and some possible ways of recovery and reuse are also defined.

Harmonization and application of harmonized regulations between different Member States is a goal that is not easy to achieve. From the analysis of the Italian situation, it is clear that even if, according to the data of the Italian Institute for Environmental Protection and Research (ISPRA), Italy already exceeded the share set by the European Union in 2016, this data, according to the report of the Observatory Recycle, which operates within the framework of the association Legambiente, are unreliable as they are based on the activities of a limited number of companies. The same report shows that a lot of waste is still dumped in landfills or illegally in nature, which is the result of the inadequacy of contractual provisions of public and private construction sites and regulatory gaps regarding obligations and ways of using materials obtained through recycling, which represent a major obstacle to development circular economy in the construction industry.

Definition of the most suitable materials for the production of urban equipment

Availability of recycled materials and current use

The recycling of construction waste and waste from the demolition of buildings is a complex activity due to the abundance and variety of waste produced. Therefore, it is first necessary to quantify the different types of construction waste and the recycled materials obtained from them, so that their availability can then be assessed. According to data from the Regional Environmental Protection Agency of Veneto (ARPA), construction waste in Italy is mainly bricks and reinforced and non-reinforced concrete, with smaller proportions of plastic, metal and paper. The following shows a non-exhaustive list with the proportions of generated construction waste and the most widespread methods of reuse in the construction industry.



Vir: Provincial Environmental Protection Agency of Veneta (ARPA)

Glass

Proportion: < 3.5%

The most common methods of recycling: Recycled glass can be reused in the construction industry in different ways, depending on the proportion of impurities. It can be used to make glass panels, doors or frames, or mixed with other materials to make ceramic products such as sanitary ware or tiles. In addition to cellular glass thermal insulation, it can also be used as an aggregate to reduce weight or as an additive.

Metals:

Proportion: < 3.5%

The most common methods of recycling: Ferrous and non-ferrous metals can be easily recycled and reused in a wide variety of fields.

Paper

Proportion: < 2.5%

The most common ways of recycling: Cellulose paper fibers can be used to make insulation boards, interior partitions or linings.

Plastic

Proportion: < 2.5%

The most common recycling methods: Thermoplastic polymers can be heated and molded to create new products, while thermosetting polymers, which are non-melting and insoluble, can be broken up and used as filler. These processes can be used to make furniture, flooring, pipes and insulation materials.

Wood

Proportion: < 2.5%

The most common ways of recycling: Recycled wood can be used to make wood agglomerates (chipboards) for the furniture industry or wood-cement bricks used in bio-construction.

Asphalt

Proportion: < 5%

The most common methods of recycling: Asphalt can be completely recycled and reused for new road paving.

Excavated material

Proportion: 6%

The most common methods of recycling: Excavated material, depending on the grain size, can be used for filling and backfilling, foundation and soil transformation.

Reinforced and unreinforced concrete

Proportion: 30%

The most common methods of recycling: The most common method of recycling concrete is to reuse it to make materials with lower yields, such as bases, screeds and asphalt.

Bricks

Proportion: 50%

Most common ways of recycling: Bricks can be recycled to make fillers and stabilizers for infrastructure, aggregates for concrete, mortar or calcium silicate bricks.

Among the various materials listed above, inert stone waste is certainly the most widespread and best regulated by recycling legislation, so that several types of recycled inert aggregates can be obtained from them for further use in the construction industry. Materials such as paper, wood, metals, glass and plastic are intended for processing and are partly reused in the same sector. Due to the sharp increase in the use of plastics such as polyvinyl chloride (PVC), polystyrene (PS) and polyethylene (PE) in the construction industry, experts are studying various techniques for recycling polymers, which are quite challenging.

Long-term innovative planning

In Italy, when planning outdoor spaces and urban equipment, a series of regional legal regulations must be taken into account.

The success of managing construction and demolition waste depends on a number of factors, including the ability to identify and collect waste by different types, the development of protocols based on common regulations and the management of recovery processes, and the process itself begins with a design approach that takes into account the life cycle product cycle in order to minimize the impact of the latter on the environment. The first goal for sustainable design is therefore the longest possible lifetime of the product, which must therefore be made of quality materials and designed in such a way that it can be easily renewed or repaired during its life cycle. Urban equipment can thus be made of several removable or replaceable pieces or made of the same type of materials, which enable the restoration of surfaces and the easy removal of any damage caused by external factors by sanding. An additional topic relates to the need to establish closed production cycles that enable the recycling of products made from recycled materials. For this purpose, it is important to take into account in the design phase the need to separate the different materials that make up the product at the end of its life, giving preference to dry assembly techniques or easily separable materials that are environmentally friendly and not they pollute.