RePlaCe Project

Protyping of Recycled Plastic Conveyor Belt Machine and Demonstration of Recycled Plastics Structural Applications

recovery of waste | waste management

PROJECT DESCRIPTION

The **RePlaCe** project aimed at developing an **innovative method** to produce structural parts for conveyor belts using **resistant recycled plastic** to replace other raw materials, such as aluminum. The process studied and developed within RePlaCe has focused on the reuse of plastic waste of industrial origin for the construction of industrial machines. The use of recycled plastic material, as well as having a significantly reduced environmental impact, means a substantial economic benefit.

OBJECTIVES

The main objective of RePlace was the design and construction of a **prototype conveyor belt** in which some structural components, such as the side bars, were printed in recycled plastic rather than in metal. In the second phase of the project, also a product for industrial flooring was created aimed at demonstrating the possible application of this process for the creation of other products, even of structural function, with recycled plastic components.

In order to construct performing structural elements it was necessary to separate the collected plastic material to allow working with homogeneous substances. In the specific case mechanical recycling was used, which consists in the processing of plastic waste which is transformed into secondary raw material for the production of new items. This process represents one of the possible ways of recovering thermoplastic polymers and requires minimum workability of the material.

PROJECT PHASES

The project activities were divided into three functional areas, in order to allow an efficient implementation:

- **project management**, involving development of systems, and setup of coordination and monitoring procedures, in line with the envisaged planning, for the entire project;
- **technical activities**, relating to the development of the **conveyor belt** prototype and other structural applications. The design and construction of structural components molded with **recycled plastic** was divided into actions and specific sub-actions monitored *ad hoc*:
    - design of the conveyor belt prototype having the lattice's side bars and the junction in recycled plastic;
    - preparation of the press for molding;
    - preparation of tools for molding and compensation of components;
    - molding of plastic components;

- assembly of the conveyor belt prototype;
- dynamic and static tests of the plastic components to check their wear conditions;
- tests of the conveyor belt to assess its under- and overload resistance.

The first components made of recycled plastic were the side bars of the conveyor belt made up of two parts: lattice and junction. Subsequently other structural parts were created, such as heads and joints.

Following the design phase, tests of functionality and of workload of the machine were performed to understand how the regenerated structural components must be compensated and profiled, and research on plastic materials to be used for the prototype was carried out. The tests have shown that the most suitable material recyclable from industrial waste for the construction of the prototype belt (subject of the project's activities) is polypropylene with added glass fiber.

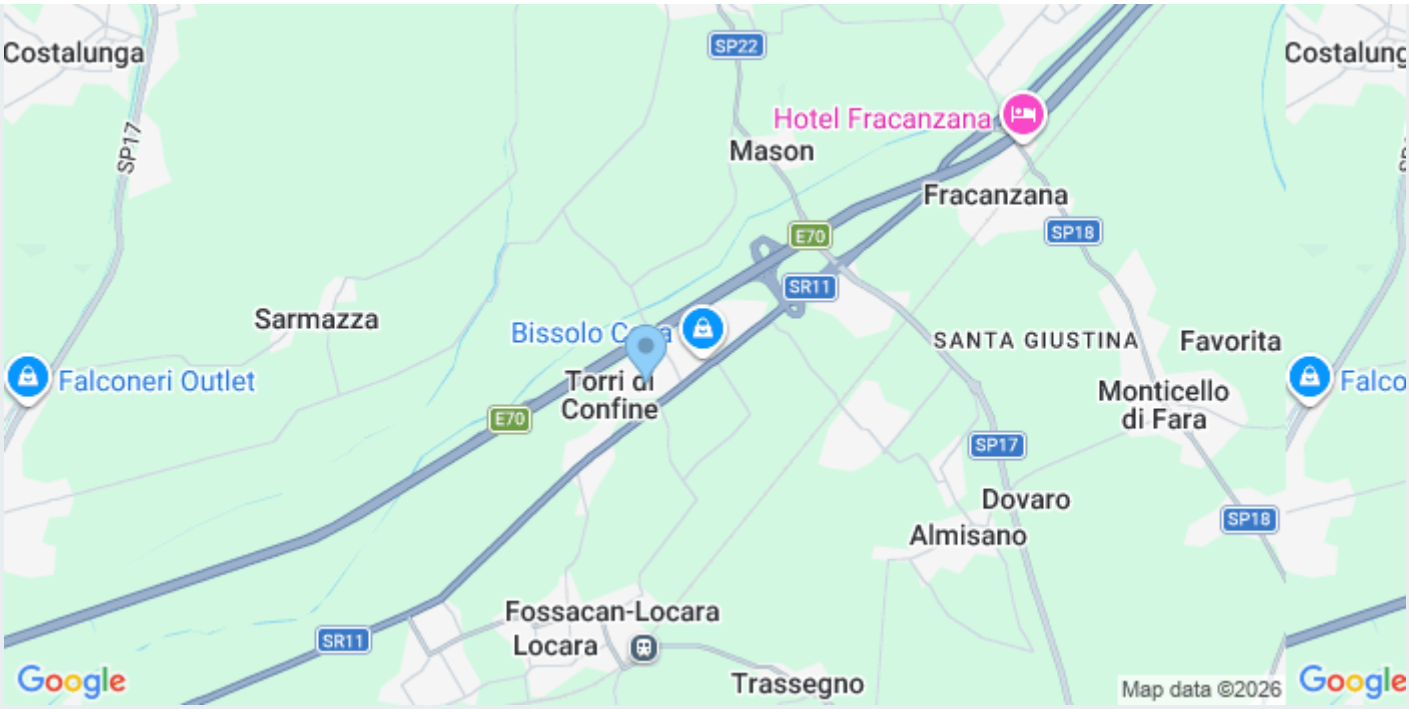
- **communication**: the promotion of the RePlaCe project's results focused on large-scale actions, such as the organization of events, publications in local newspapers, and training courses at schools. There were also specific activities such as workshops for professionals and publications in technical magazines. Targeted communication activities such as project conferences open to companies of the plastic and industrial machinery sector and interventions in international fairs have been carried out too.

PROJECT RESULTS

The LIFE REPLACE project has succeeded in demonstrating that it is possible to use recycled plastic in industrial components. The replacement of primary raw material with recycled material implied a series of assessments regarding the cost and design of the components aimed at developing a new production cycle attentive to the economic, environmental and social aspects.

The main achievements were:

- **realization** of a **functioning prototype of conveyor belt** designed with recycled structural components. To assemble it, it was necessary to evaluate: the loads to which the side bars are subjected to choose the most suitable recycled plastic; the additives to be used and the thicknesses of the pieces. The choice fell on **polypropylene** with 30% of 0,8 mm-long glass fiber, and expanding, nucleating and stabilizing additives to increase its mechanical performance;
- **economic, energy and environmental benefits**. The replacement of metal parts - currently the only ones with structural function - with plastic components, involves not only a considerable saving of energy, but also a decrease in production costs (less treatment of materials and lower cost of the raw material) and environmental benefits. The price per kg of virgin aluminum is 2 euro (2011 prices) against 0,70 euro per kg of virgin plastic and about 0,35 euro of recycled plastic. Even comparing the energy costs of aluminum and plastic, both virgin and recycled, it is clear that the life cycle of polypropylene is widely preferable to that of metal: 200-400 GJ/ t for the aluminum compared to 80/ 40 GJ/ t for respectively the virgin and recycled plastic. At the same time, the CO2 footprint also differs in similar proportions: 12.000 kg CO2eq/ t in the case of aluminum, 2.000 Kg CO2eq/ t for virgin plastic and 300 Kg CO2eq/ t for recycled plastic;
- **saving of raw materials**. To produce items in aluminum it is necessary to use natural resources such as bauxite and water applying a very energy-intensive process. The use of plastic in place of metals foreseen by the RePlaCe project, preserves natural resources while reducing CO2 emissions.
- **waste reduction**. The innovations both of the plastic material and its application in the conveyor belt allow greater resource efficiency and recycling of waste. The reduced environmental impact in the final disposal of the machine is also to be mentioned. The less heavy structure implies the use of fewer support components, such as screws, dowels, brackets, moreover these components realized in plastic can be recycled at the machine's end of life, unlike the aluminum components that are difficult to recover;
- **stakeholders database.** The project involves a multiplicity of entities, companies, trade associations and individuals. All these stakeholders have been cataloged and entered in a data base and contacted directly to ensure maximum dissemination of the results;
- **14 Clean Plastic-Points**, information points set up in different events and visited by about 500 people. The campaign was aimed at increasing the quantity and quality of the collected plastic waste, and at the same time raising the awareness of all citizens and companies engaged in separate collection.



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Acronym
RePlaCe

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LIFE08 ENV/IT/000393

Reference Programme
LIFE

Beneficiary Coordinator
Plastic Metal S.p.A

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666.350,00

Call Year
2008

Start Year
2010

End Year
2012

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Description

Gambellara (Vicenza) Provincia di Vicenza; Regione Veneto