

CIVIL AND ENVIRONMENTAL ENGINEERING

MUR DM 117/LPM - Innovative materials and technological processes for a sustainable and digital development of the precast concrete industry

Funded By	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584] LPM LATERIZI PREFABBRICATI MONDOVI' SRL [P.iva/CF:00455370049] Politecnico di TORINO [P.iva/CF:00518460019]
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Context of the research activity	<p>New and innovative materials and technologies to produce lightweight, durable and multi-functional concrete structural elements. The achievements of the present project will contribute to meet the increasingly pressing needs of reducing the consumption of raw materials, reducing the carbon footprint and the enhancement of the manual work in the precast concrete industry.</p> <p>Progetto finanziato nell'ambito del PNRR - DM 117/2023 - CUP E14D23001990004</p>
	<p>The main objective of the project is to accomplish the steps needed to transfer recent developments in the field of materials and production technology from the laboratory scale to the precast concrete industry. The project encompasses four themes having, as a common denominator, the increase of sustainability of the construction industry: foamed concrete, Glass Fibers Reinforced Polymer (GFRP) rebars, recycled concrete and 3D printing technology.</p> <p>The foamed concrete is a revolutionary cement-based material that combines a low weight with good mechanical and physical properties. It is particularly appealing for non-structural elements, such as precast walls. The reduction of weight has an important beneficial effect on the handling and transportation phases, while the low thermal transmittance makes it possible to use foamed concrete as an insulating material.</p> <p>The GFRP bars are quite a novelty in the construction field. However, they are emerging as a valid alternative to conventional reinforcement, consisting of steel rebars. Main advantages reside in the mechanical performances, low weight and resistance to corrosion. The latter property, in particular, makes GFRP bars the suitable reinforcement material for new generation concretes,</p>

Objectives

poor of Portland cement and for foamed concrete, which is much more permeable than conventional concrete.

3D printing, which is still in its infancy for what concerns the building industry, is attracting considerable interest because of some peculiarities such as the possibility to produce materials with variable properties and elements of any desired shape. In this context, the precast concrete industry is an ideal environment to test and exploit the potentialities of 3D printing.

The PhD student will work for a period of at least six months at the premises of the industrial partner of the project (LPM Prefabbricati srl), and will spend six months abroad (host institution still to be defined).

Planned activities include:

- getting experience about the design approaches and the production processes of precast concrete elements;
- experimental activity in the laboratory, aimed at assessing the material properties and testing the behaviour of full-scale elements;
- design and production at the LPM prefabbricati premises of innovative full-scale precast elements;
- development of design models and optimization procedures for the use of GFRP rebars;
- feasibility studies concerning the use of 3D printing.

Skills and competencies for the development of the activity

The candidate shall have a master degree in civil engineering, building engineering or architecture, with strong competencies on structural design and mechanics of materials, with particular regard to cementitious and innovative/composite materials. Experiences in the experimental field would be an asset.