POLITECNICO DI MILANO

PhD in ARCHITETTURA, INGEGNERIA DELLE COSTRUZIONI E AMBIENTE COSTRUITO / ARCHITECTURE, BUILT ENVIRONMENT AND CONSTRUCTION ENGINEERING - 42nd cycle

THEMATIC Research Field: SUSTAINABLE INTERVENTIONS FOR CIVIL INFRASTRUCTURE

Monthly net income of PhDscholarship (max 36 months)
1400.0 In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
Motivation and objectives of the research in this field	The main objective of the research is to study the efficiency of different types of sustainable intervention techniques for civil infrastructure. The construction industry is responsible for a significant amount of CO2 emissions largely associated with the production of Portland cement clinker; therefore, it is necessary to address this problem by providing alternative solutions.The research focuses on studying different types of sustainable concretes, with the goal of defining the optimal mix design in terms of performance and durability. Particular attention will be devoted to the use of low-clinker cements and concrete mixtures characterized by high recycled aggregate contents. Despite their environmental benefits, the structural application of these materials is still limited by the lack of comprehensive experimental data regarding their long-term mechanical behaviour, durability, and performance under complex loading conditions.To bridge the gap between material innovation and structural reliability, a fundamental part of the study involves testing the bond strength of anchors within these sustainable concretes. This characterization is crucial, as it connects the material's properties to the performance of complex anchoring systems. Specifically, this bond performance will be evaluated in relation to the fatigue behaviour of stand-off base plate connections,

	addressing the current lack of technical guidelines and ensuring long-term stability.Furthermore, the same anchoring reliability is essential for infrastructure safety elements, such as bridge curbs and barriers, which will undergo impact testing. The goal is to verify that the use of sustainable solutions can strictly guarantee the highest safety standards and reliable resistance during collisions.Ultimately, the research aims to provide intervention techniques that are both sustainable and reliable, ensuring that civil infrastructures remain safe while significantly reducing their environmental footprint.
Methods and techniques that will be developed and used to carry out the research	The research will be developed following three different approaches: -Numerical analyses: initially, simplified numerical models will be developed to identify the optimal solutions for the different intervention techniques. This preliminary phase will be useful for selecting the configurations to be tested experimentally. In a second phase, detailed non-linear finite element analyses will be performed on the tested configurations to develop parametric studies to limit the experimental effort. - Experimental investigations: the most promising solutions will be through targeted validation campaigns carried out within the advanced structural and material laboratories of the University and ITC-CNR.. -Theoretical analysis: based on the numerical and experimental results, simplified analytical models and design approaches will be developed and proposed.
Educational objectives	The Ph.D. student will improve/learn: - numerical skills - design and execution of laboratory tests - develop design models - work in an international research team
Job opportunities	The Ph.D. candidate will have the chance to get position in both University/Industry.In particular he/she will be able to get positions where high level numerical/design/experimental skills are required.
Composition of the research group	1 Full Professors

	1 Associated Professors 3 Assistant Professors 1 PhD Students
Name of the research directors	Sara Cattaneo

Contacts
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Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents	--

Scholarship Increase for a period abroad	
Amount monthly	700.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

Additional support: **Budget for the research activity (only for positions supported by scholarship):** total amount Euro 5.707,20per studentIn detail:- 1st year Euro 1.902,40- 2nd year Euro 1.902,40- 3rd year Euro 1.902,40

Additional information about the organization and regulations of ABC-PhD programme can be found in the Regulations for the 42nd Cycle of ABC-PhD: download is available at link: https://www.dottorato.polimi.it/corsi-di-dottorato/architettura/architettura-ingegneria-dellecostruzioni-e-ambiente-costruito

Additional information about ABC department and ABC-PhD programme: available at link: https://www.dabc.polimi.it/

Desk availability: The ABC department provides non-permanent desks to be temporarily booked in common PhD rooms.