POLITECNICO DI MILANO

PhD in INGEGNERIA STRUTTURALE, SISMICA, GEOTECNICA / STRUCTURAL SEISMIC AND GEOTECHNICAL ENGINEERING - 40th cycle

PNRR 630 Research Field: BUILDING WITH "UNSUITABLE" SOILS

Monthly net income of PhDscholarship (max 36 months)
€ 1700.0 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	Onshore constructions and management of waterways and near-shore infrastructures are increasing uncontrolled soil consumption. Current practice requires dredging and excavation of large volume of soils, which are considered unsuitable for re-use and, hence, become waste material and need permanent disposal. At the same time, sand is required in the current “good practice” for near-shore constructions and reclamation works. Consumption of sand, need for transportation of large volumes of “good” soils, disposal of “unsuitable” soils are feeding a vicious circle, which has to be stopped and, possibly, reverted. Actually, classification of dredged and excavated soils as “unsuitable” materials comes from lack of scientific and technical knowledge on their re-use, from the transportation stage to the operational life of the earthwork. The research project is willing to reduce the knowledge gap in the field, with the aim of improving the sustainability of future construction, by systematically recycling available material and reducing soil consumption.The research adheres to the United Nations Sustainable Development Goals SDG 9 - Sustainable Industrial and Infrastructure Developments, SDG 11 - Sustainable Human Settlements -, and SDG 12 – Responsible Consumption and Production, as well as the objectives of the Italian National Recovery and Resilience Plan (PNRR), coherently with mission M2C1.1 to waste

	management and circular economy.
Methods and techniques that will be developed and used to carry out the research	Heterogeneous excavated and dredged materials are hydraulically pumped or barged to reclamation sites and dropped to form an initial lumpy fill, characterised by the presence of large voids formed by stacking of large lumps. The main challenge is to ensure that large voids can be reduced down to develop stiffness and strength and avoid potentially large creep behaviour during the lifetime of the construction. To follow the excavation, transportation, construction and ripening of the material, the scientific approach will include theoretical, numerical and experimental techniques, bridging and developing existing knowledge on different aspects towards combined technical solutions to be validated in the field. The theoretical and numerical expertise developed at Politecnico di Milano will serve the interpretation of existing field data coming from the industrial partner, will suggest laboratory tests to deepen the knowledge on the material hydromechanical response, and will support the development of more efficient and controllable construction stages, and reliable monitoring procedure. The industrial partner will support the research with investigation and monitoring data from large construction sites. Laboratory tests can be managed by all partners, including the host Academic partner. It is expected that Delft University of Technology, will host the candidate, and contribute with experimental devices, such as the geotechnical centrifuge for small scale validation of the designed techniques.
Educational objectives	The project will allow the candidate to develop advanced numerical, experimental and engineering skills, by interacting with top class scientific and industrial partners. The candidate will gain knowledge of design of testing and monitoring, across different scales including the real scale site, as well as analytical and numerical advanced modelling skills. The candidate will have the opportunity to join the industrial environment and develop fruitful collaboration, both in desk work and onsite construction management.

	The candidate will participate in the PhD educational program and may improve educational skills by participating as teaching assistant in BSc and MSc courses of relevance.
Job opportunities	The research advances theoretical, experimental and numerical knowledge towards solutions, which are applicable and effective in practice. As a result, successful PhD research completion will open numerous opportunities for an academic career as well as high level professional career in the engineering design, consultancy, and management, with a greater awareness and knowledge of infrastructure sustainability.
Composition of the research group	2 Full Professors 2 Associated Professors 1 Assistant Professors 3 PhD Students
Name of the research directors	C. Jommi, G. Della Vecchia, G. Messa

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Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	850.0 €
By number of months	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	Boskalis, ITA (or NL) https://boskalis.com/
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	Delft University of Technology https://www.tudelft.nl/citg/over-faculteit/afdelingen/geoscience-engineering
By number of months abroad	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
Educational activities (purchase of study books and material, funding for participation to courses, summer schools, workshops and conferences): financial aid per PhD student per year. The Ph.D. course supports the educationalactivities of its Ph.D. students with an additional funding equal to 10% of the scholarship, startingfrom the first year. Teaching assistantship: availability of funding in recognition of support to teaching activities by the PhD student. There are various forms of financial aid for activities of support to the teaching practice. The PhD is encouraged to take part in these activities, within the limits allowed by the regulations. Computer availability: each Ph.D. student has his/her own computer forindividual use. Desk availability: each Ph.D. student has his/her own desk, cabinet and locker.