POLITECNICO DI MILANO

PhD in INGEGNERIA STRUTTURALE, SISMICA, GEOTECNICA / STRUCTURAL SEISMIC AND GEOTECHNICAL ENGINEERING - 39th cycle

THEMATIC Research Field: ADDRESSING AGEING OF THE TRANSPORTATION INFRASTRUCTURE: A COMBINED EXPERIMENTAL AND NUMERICAL APPROACH

Monthly net income of PhDscholarship (max 36 months)
€ 1195.5 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	Railways are critical infrastructures for the European transportation network. They play a pivotal role in facilitating the movement of people and goods across the continent. Presently, the rail infrastructure suffers from ageing degradation, with one of the signals being increased perception of vibrations. Under the pressure of increasing demand and increasing climatic impact, advanced tools to address the assessment and to evaluate remediation measures are mandatory. The research is willing to understand the source, evaluate the consequences and address solutions to the problem. The research is willing to contribute to better identifying the loading history of the current rolling stock, isolating the possible degradation sources of the infrastructure under increasing climatic impact, and predicting the consequences of the combined increased loads and decreasing performance of the infrastructure on the built environment.
Methods and techniques that will be developed and used to carry out the research	A staggered multiscale numerical approach is proposed to address the analysis of ground borne vibrations in the built environment. The successful candidate will have access to a body of historic vibrations measurements, which will serve numerical back-analyses to identify the “true” load characteristics on the infrastructure. The identified load will be used to predict radiation and

	damping of vibration in the ground, depending on the state of the ballast, of the concrete structure and of the ground layers surrounding the rail track. Special attention will be focussed on ballast, which is one of the most vulnerable elements of the construction, in spite of its paramount role in distributing the load and filtering the radiated vibration. The consequences of the most frequent causes of ballast degradation, abrasion and fouling, will be studied with the aid of discrete modelling techniques. Using DE models as a virtual replica of ballast samples, various degraded and fouled scenarios can be analysed and eventually validated on experimental test, to be performed in a large triaxial apparatus at ZAG.
Educational objectives	The successful candidate will improve multiscale numerical modelling skills and expertise. Besides, she/he will grow an experience in experimental testing and monitoring. She/he will cooperate with international researchers, public managers and professionals, thus developing skills in team-working in a comprehensive perspective on the infrastructure. She/he will participate in the PhD educational programme and may be involved as teaching assistant in the BSc and MSc courses of relevance, to improve the educational skills.
Job opportunities	The PhD candidate will open wide perspectives towards an academic as well as a design/management professional career, by developing combined theoretical, experimental and numerical skills to address current European priorities.
Composition of the research group	2 Full Professors 1 Associated Professors 2 Assistant Professors 1 PhD Students
Name of the research directors	Luca Martinelli & Cristina Jommi

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https://www.dica.polimi.it/research/sections/structures-and-environment-section/geoengineering/?lang=en

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	597.75 €
By number of months	6

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

Universities, Companies, Agencies and/or National or International Institutions that are cooperating in the research:

•Delft University of Technology
•Slovenian National Building and Civil Engineering Institute (ZAG)
•MM S.p.A.
•ProRail (NL)

Educational activities (purchase of study books and material, funding for participation to courses, summer schools, workshops and conferences): The Ph.D. course supports the educational activities of its Ph.D. students with an additional funding equal to 10% of the scholarship, starting from the first year.

Teaching assistanship (availability of funding in recognition of support to teaching activities by the PhD student): Ph.D. students are encouraged to apply, upon prior authorization, to the calls to support teaching activities at the undegraduate and Master levels at Politecnico, being paid for that. The teaching assistantship will be limited up to about 80 hours, maximum half of them devoted to teaching and classroom activities and the rest to support classworks and exams.

Computer availability and desk availability: Each Ph.D. student has his/her own computer for individual use.Each Ph.D. student has his/her own desk, cabinet and locker.