



PhD in ARCHITETTURA, INGEGNERIA DELLE COSTRUZIONI E AMBIENTE COSTRUITO / ARCHITECTURE, BUILT ENVIRONMENT AND CONSTRUCTION ENGINEERING - 41st cycle

THEMATIC Research Field: DEVELOPMENT OF RETROFITTING DEVICES TO REDUCE THE SEISMIC VULNERABILITY OF STEEL STORAGE PALLET RACKS

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

A sustainable strategy to reduce the seismic vulnerability of steel storage pallet racks is to increase the life cycle and the lifetime of the existing frames. This will aid in reducing economic and environmental impact of new constructions but also avoiding downtime in logistics, which may cause high direct and indirect economic loss (e.g. cost of dismantling and replacement or downtime/business interruption along with issues for workers).

The project responds to this need by delivering innovative retrofitting strategies that will be used to enhance the seismic performance of existing racks. Different approaches and devices, aimed at improving the strength and ductility of the connections (longitudinal direction) and of the upright frame (cross-aisle direction) will be developed and investigated. The proof-of-concept for such devices will start with the selection of case-study rack configurations, after which several prototypes of the devices will be developed and characterised to define their behaviour and performance. The next phase of the project will foresee the integration of the different developed devices in the racks themselves. At the same time, an extensive numerical modelling campaign of the dynamic behaviour of the selected racks, with and without



	the different devices will assure the extension of the experimental outcomes to additional configurations.
Methods and techniques that will be developed and used to carry out the research	<p>The project will develop new seismic devices to reduce the seismic risk of steel storage pallet racks, both existing and newly built ones. In order to validate the proposed technologies, the project foresees an extensive experimental campaign aimed to first characterise the selected racks, then to develop and characterise the new devices, and finally to verify the efficiency of the improvements with an authentic simulation of earthquake sequence through shake-table tests. To do so, the project needs to follow a well-thought methodology and should be based on clear concepts. To achieve such requirements, three main phases can be identified:</p> <ul style="list-style-type: none"> i. characterisation of materials, racks and devices; ii. numerical modelling and seismic design and analyses; iii. validation of the developed devices through full-scale tests. <p>The project offers hence a proper mix between experimental and numerical activities.</p>
Educational objectives	<p>The Candidate who will participate to the project will develop new skills on:</p> <ul style="list-style-type: none"> i) advanced numerical modelling of complex structures; ii) design of complex steel structures made by thin-walled cold-formed profiles; iii) seismic analysis of structures equipped with seismic dissipation devices; iv) understanding of the laboratory work to perform experimental testing on complex structures.
Job opportunities	At the end of the PhD the Candidate can be directly inserted inside one of the companies involved in the research project.
Composition of the research group	1 Full Professors 0 Associated Professors 1 Assistant Professors



	0 PhD Students
Name of the research directors	Marco Simoncelli

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

Stage and period abroad	
Institution or company where the candidate will spend the period abroad (name and brief description)	
By number of months abroad	0

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<p>Additional support:</p> <p>Budget for the research activity (only for positions supported by scholarship):total amount Euro 5.707,20 per student.</p> <p>In detail:</p> <ul style="list-style-type: none"> -1st year Euro 1.902,40 -2nd year Euro 1.902,40 -3rd year Euro 1.902,40. <p>Additional information about the organization and regulations of ABC-PhD programme can be found in the Regulations for the 41st Cycle of ABC-PhD:download is available at link: https://www.dottorato.polimi.it/en/phd-programmes</p> <p>Additional information about ABC department and ABC-PhD programme:available at link: https://www.dabc.polimi.it/</p> <p>Desk availability:The ABC department provides non-permanent desks to be temporarily booked in common PhD rooms.</p>