



## PhD in DESIGN - 38th cycle

### PARTENARIATO PNRR Research Field: PLANNING OF ACTIVE AND SUSTAINABLE MOBILITY: DEFINITION OF TOOLS AND TRANSPORT MODELS

#### Monthly net income of PhDscholarship (max 36 months)

**€ 1250.0**

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

**CUP:** D43C22001180001; **Decreto di concessione:** D.D. 1033 del 17/06/2022

The research will be strictly connected to the development of the Italian PNRR with a specific focus on the activities CENTRO NAZIONALE DELLA MOBILITA' SOSTENIBILE.

In the last decade, light vehicles and active mobility have been one of the most fast-growing sectors in terms of units sold. This growth is particularly evident as a consequence to Covid-19 pandemic and it is likely to play a prominent role also in the coming decades. Active multimodal mobility is spreading thanks to the large availability of Powered Two-Wheelers, and to the more recent e-mopeds, e-bikes and e-scooters (2-3-4 wheel) together with suitable HMI for interacting with the surrounding environment, so as to create a connected ensemble made of vehicles, services, infrastructure, and individuals. Active and light mobility has many pros, like being suitable for door-to-door services, being a sustainable and healthy alternative to single occupancy vehicles, having zero to low-energy requirements and consumption, granting higher social accessibility and affordability, offering space and time savings, minimizing the environmental, economic and social costs of traffic congestion and land usage, fostering novel sustainable and healthy lifestyles, promoting cycling and sustainable tourism. Although light vehicles and active mobility are protected by suitable regulations, safe lanes, and a well-established and widespread culture and practice, they are



	<p>considered as the weakest road users and mostly exposed to negative consequences in case of an accident (Vulnerable Road Users). Mobility safety is one of the key point, broadly comprising vehicle safety, infrastructural safety and, most of all, users' safety. Improving safety means planning the surrounding space and the overall mobility, accordingly, investing in key enabling technologies. Some other main goals to be achieved are:</p> <ul style="list-style-type: none"> <li>•develop methods and tools to devise a Safe-System approach for the integration of light vehicles and active mobility with the other road users and the environment</li> <li>•define optimal placing and integration strategies for the design of smart road infrastructure. Provide decision support tools for planning the infrastructure (dedicated lanes, main routes and charging infrastructure location)</li> <li>•define methods and tools to investigate mixed traffic conditions (light vehicles and automated vehicles)</li> <li>•identify design solutions with improved socio-technical sustainability profile</li> <li>•propose human-centered solutions to favor the modal-shift, with optimized incentive schemes that ensure social fairness.</li> <li>•support the planning of proper, safe and diffuse infrastructures to promote active mobility</li> <li>•define transport policies able to support and reward active mobility</li> </ul>
<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>The present research may need the development of the following main methods and tools:</p> <ul style="list-style-type: none"> <li>•innovative tools for active and pedestrian mobility planning: network supply and demand analysis</li> <li>•innovative analysis of user's behavior and trips with respect to different vehicles and infrastructure situations</li> <li>•GIS tool for the optimized planning of a soft mobility network that includes the location of multimodal nodes and recharging points;</li> <li>•innovative mobility planning tools and behavioral analysis for the improvement of road safety</li> </ul>



	<ul style="list-style-type: none"> <li>•guidelines for the planning of shared active mobility and micro-mobility within a multimodal concept of urban mobility;</li> <li>•quantitative analysis of human-centered incentive policies at design time</li> </ul> <p>In order to develop the above capabilities, the following types of tools and techniques will be used:</p> <ul style="list-style-type: none"> <li>•traffic simulation models and related software (both at the microscopic and macroscopic levels), aimed at studying the effects of light vehicles on overall mobility and other traffic components, as well as for estimating impacts on safety and pollutant/climate-changing emissions</li> <li>•service design techniques and skills, aimed at the integrated design of systems and services based on the use of light vehicles to meet different mobility needs</li> <li>•use of instrumentation for the analysis of user behavior while driving light vehicles and for monitoring the relative psychophysical state (such as eye tracking tools, smartwatches, virtual/augmented reality visors, sensorized t-shirts, etc.)</li> </ul>
<b>Educational objectives</b>	<p>The program aims to train researchers who will contribute original knowledge to the field of mobility service design. Their contributions can be used to develop tools and methods that can be put into practice and to develop critical analysis of mobility systems and related services.</p> <p>More specifically, researchers will be able to learn</p> <ul style="list-style-type: none"> <li>•how to analyse mobility systems, in terms of transportation supply and demand and their interaction</li> <li>•how to geo-represent transportation networks and highlight spatial correlations with the surrounding environment, urban planning, etc.</li> <li>•how to simulate the operation of transportation networks and the vehicles that move in them, both on a microscopic and macroscopic scale</li> <li>•how to analyse the behaviour of users in vehicles, their psychophysical state, and their perception of their</li> </ul>



	<p>surroundings, and evaluate the related consequences in terms of safety</p> <ul style="list-style-type: none"> <li>•how to design and optimize sustainable transportation systems based on light vehicles and active mobility</li> </ul>
<b>Job opportunities</b>	<p>At the end of the course, the researcher will gain the skills and experience to be able to enter various professional, work and research fields. By way of example, job opportunities may be available at these types of subjects:</p> <ul style="list-style-type: none"> <li>•companies involved in the design, development and implementation of innovative and sustainable mobility systems and services</li> <li>•companies that design light vehicles for active mobility</li> <li>•government agencies and authorities involved in transportation system planning and road safety</li> <li>•universities and research organizations that study issues related to design and mobility and transportation</li> </ul>
<b>Composition of the research group</b>	<p>0 Full Professors 1 Associated Professors 4 Assistant Professors 1 PhD Students</p>
<b>Name of the research directors</b>	Luca Studer

<b>Contacts</b>
<p>e-mail: luca.studer@polimi.it, phone:+39 02 2399 5848</p>

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

<b>Scholarship Increase for a period abroad</b>	
<b>Amount monthly</b>	873.07 €
<b>By number of months</b>	6

<b>Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information</b>
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**Decreto Direttoriale Avviso:** D. D. 3138 del 16/12/2021 rettificato con D.D. 3175 del 18/12/2021

"Avviso pubblico per presentazione Proposte di intervento per il Potenziamento di strutture di ricerca e creazione di "campioni nazionali" di R&S su alcune Key Enabling Technologies da finanziare nell'ambito del Piano Nazionale di Ripresa e Resilienza, Missione 4 Componente 2 Investimento 1.4 "Potenziamento strutture di ricerca e creazione di "campioni nazionali di R&S" su alcune Key Enabling Technologies" finanziato dall'Unione europea - NextGenerationEU"

Educational activities (purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences):

financial aid per PhD student

max 5.095,96 euros per student (total for 3 years)

Teaching assistanship: availability of funding in recognition of supporting teaching activities by the PhD student there are various forms of financial aid both for research and teaching activities. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.

Computer availability: 1st year, 2nd year and 3rd year: Each research group will supply PhD student with a computer, if necessary.

Desk availability: 1st year, 2nd year and 3rd year: Each research group will supply phd student with a desk