



School of Computing, Engineering, and the Built Environment Edinburgh Napier University

PHD STUDENT PROJECT

Application instructions:

Detailed instructions are available at :

<https://www.napier.ac.uk/research-and-innovation/doctoral-college/how-to-apply>

Prospective candidates are encouraged to contact the Director of Studies (see details below) to discuss the project and their suitability for it.

Project details

Supervisory Team:

- DIRECTOR OF STUDY: Prof. Pat Langdon (Email: p.langdon@napier.ac.uk)
- 2ND SUPERVISOR: Dr Faheem Malik

Subject Group: Built Environment

Research Areas: Sport Management, Tourism, Operational Research, Environmental Engineering, Electrical Engineering, Energy Technologies

Project Title: Are rural e-bike routes manageable and cost-effective?

Project description:

Cycling routes have been identified as an area for development to significantly reduce carbon emission and support health and wellbeing by encouraging active travel. Such research has received more impetus, considering the Scottish Government's commitment to reduce car travel, and are in line with the UN SDG's. e-bikes are handy personalised transportation modes, that helps overcome adverse gradients and physical exertions. Recent development of battery and charging technologies of e-bikes, that have the added advantages of potential to extend the scope of cycling to older age groups and inclusive populations while covering larger distances. This has the potential to incorporate this mode of transport outside the big urban centres, and be a critical transport modes for semi-urban and rural areas, and for intercity/inter-city transport modes. Development of new routes that connect existing cycling infrastructure to national rural cycleways to create lengthy linear or circular routes is a new area of multidisciplinary research presenting

significant challenges of policy, technology, engineering, human factors, mapping and economics for these longer routes. Hence, this PhD will aim to answer the following research questions/ challenges:

1. Develop optimal modelling of the provision of effective e-bike infrastructure on long routes, including incorporation of existing charging infrastructure as well as an analysis of development of new charging and mobile charging facilities.
2. How to undertake Engineering analysis of the optimal or resilient provision of charging for e-bikes, including battery-swap, overnight charging, mobile charging and provision of over-night or fixed period charging facilities?
3. How to undertake transport economics analysis of the factors affecting the use of such routes by different demographics and usage groups, including qualitative approaches such as surveys and focus groups?
4. How to undertake operational analysis of the management and operation of such routes, including the roles of local businesses, communities and populations. This would include tourism, public health, seasonality, security, franchising and rental schemes?
5. How to develop Business case analysis of operator fitness, and an example concept of operations tied to existing exemplars in Scotland and based on data and experiences collected in real-world practice.

Methodology could include that from, surveys, field work, engineering design, modelling of operations and designs; economic modelling and analysis, and public acceptance.

Possible Outcomes:

1. Modelling framework for e-bike infrastructure charging,
2. Transport Economic model for e-bikes routes
3. Understanding of the public acceptance of e-bike charging infrastructure
4. Business Case framework development for e-bike charging infrastructure

References:

Constantinos N. Genikomsakis, Nikolaos-Fivos Galatoulas, Christos S. Ioakimidis, Towards the development of a hotel-based e-bike rental service: Results from a stated preference survey and techno-economic analysis, *Energy*, Volume 215, Part A, 2021, 119052, ISSN 0360-5442

Sigal Kaplan, Francesco Manca, Thomas Alexander Sick Nielsen, Carlo Giacomo Prato, Intentions to use bike-sharing for holiday cycling: An application of the Theory of Planned Behavior, *Tourism Management*, V47, 2015, P 34-46, ISSN 0261-5177

Malik, F.A., Egan, R., Dowling, C.M. and Caulfield, B., 2023. Factors influencing e-cargo bike mode choice for small businesses. *Renewable and Sustainable Energy Reviews*, 178, p.113253

Candidate characteristics

Education:

A first degree (at least a 2.1) ideally in an Engineering or Human Factors discipline

Subject knowledge:

Good fundamental knowledge of Transport and Civil construction operations, economics and management; or battery and charging systems, sustainable design, public health, engineering design; or Human centred design, and design for inclusion.

Essential attributes:

- Experience of fundamental Engineering or Human Factors discipline
- Competent in Modelling, Engineering analysis, Engineering design OR Transport engineering
- Knowledge of Electrical and mechanical engineering, Human centred design, Public Health
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:

- Familiarity or experience with: cycling societal issues; Transport planning; e-bike operations