

Queen's Doctoral Training Programme on **Secure Connected Intelligent Design and Manufacturing**

Title: DTP: Infrastructure 4.0 digitising transport networks to meet future climate and mobility demands

This project is part of the Queen's Doctoral Training Programme in Secure Connected Intelligent Design and Manufacturing. Many of today's industrial approaches require transformative changes to ensure long term societal, economic and environmental resilience and sustainability. PhD projects in this programme explore the potential of emerging digital technologies, such as artificial intelligence, robotics, and the Internet of Things, to transform the way we design, manufacture and operate products and services.

Project description:

Industry 4.0 has transformed the manufacturing industry resulting in increased efficiency, streamlined operation, and predictive maintenance techniques to limit downtime or mechanical failure across the process. This research looks at the potential to translate the technological advancements and digital tools to the construction industry. Focusing on large scale civil infrastructure systems, specifically transport networks and the development of predictive maintenance methods for critical structures such as bridges. Predictive maintenance at network level is particularly complex due to the considerable level of heterogeneity encompassed across various bridge types and functions. Additional complexity stems from the operating environment and rapidly changing climate and societal mobility needs, advanced AI approaches will be required to develop a roadmap for a digital twin of transport networks at national level. In collaboration with Translink and The Department for Infrastructure the Northern Ireland transport Network will act as a research platform to evaluate the use of advanced manufacturing techniques to increase resilience in civil infrastructure.

Aims and Objectives:

1. Transform existing and historic rail bridge inspection data to a structured format which can be analysed for predictive/prescriptive maintenance methods across the network and establish means of producing meaningful visual data.
2. Develop a novel means to identify the fragilities within the network and use data for priority risk consequence ranking of bridge repair programs across the network to enhance resilience and inform decision making.
3. Quantify the correlation between network wide rail and road bridge behaviours and deterioration
4. Facilitate interoperability of management systems across the transport network and allow for input of data from multiple sources which evolve as new vectors emerge with an increasing integration between systems.
5. Provide a means of understanding investment trade-off's across rail and road transport modes ensuring the sustainable mobility of rural and urban populations.
6. Cluster assets to maximise the potential of real time Structural Health Monitoring data.

Key skills required for the post: The candidate should have a minimum 2.2 honours degree (or equivalent) in a relevant scientific or technical discipline. Applications are encouraged from highly motivated individuals who want to influence how future systems are designed across the system stack: from hardware/software co-design, to operating systems and data processing engines.

Key transferable skills that will be developed during the PhD:

The programme offers a bespoke research and training programme that aims to develop students into cross-disciplinary, industry-conscious thinkers and leaders who will influence the roadmaps of future advanced manufacturing technologies and their applications. They will have a balanced understanding of ICT (security, communications and data analytics) in the context of their application to Advanced Manufacturing and High Value Design.

Lead supervisor:

Dr Myra Lydon, School of Natural and Built Environment. M.lydon@qub.ac.uk

Other supervisor(s):	Jesus Martinez del Rincon, School of Electronics, Electrical Engineering and Computer Science, j.martinez-del-rincon@qub.ac.uk
Guaranteed stipend:	This is a 3.5 year funded Queen's DfE DTPs studentship with Training Grant, to commence on 1 October 2020 (N.B. stipend for 20/21 is not yet known, but is likely to exceed £15,000). The studentship covers fees and maintenance and is available for UK residents (see full eligibility criteria - nationality, residency, and academic qualification at: http://go.qub.ac.uk/dfeterms). When applying using the Queen's portal please ensure you include "DTP:" along with the project title.
Conditional top-up available:	

Queens University Belfast is a diverse and international institution which is strongly committed to equality and diversity, and to selection on merit. Currently women are under-represented in research positions in the School and accordingly applications from women are particularly welcome.