



TRUSS
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TRUSS (Training in **R**educing **U**ncertainty in **S**tructural **S**afety) is a Marie Skłodowska-Curie Innovative Training Network funded by the European Union under the Horizon 2020 Programme. TRUSS is structured into taught modules combined with original and impactful research supported by secondments that will give the successful candidates significant insights and exposure to research and innovation in both academia and industry.

EARLY STAGE RESEARCHER VACANCY:
ESR 9



Project Title:
**RAILWAY BRIDGE CONDITION MONITORING
AND FAULT DIAGNOSTICS**

Host

University of Nottingham (UNOTT)

Address

Nottingham Transportation Engineering Centre, University of Nottingham, University Park, Nottingham, NG7 2RD

Country

United Kingdom

Main Supervisor

Dr. Rasa Rementye-Prescott / Prof. John Andrews

Background

The state of bridge structures is usually determined by manual inspection carried out at fixed intervals of time. When deterioration is observed at a degree which requires attention the work is scheduled for action. The process has many flaws including the fact that parts of the structure (such as the cables in suspension bridges) cannot be observed. On some bridges, sensors are located to monitor deflections and/or vibration to assist in determining the *bridge condition* but *these are not integrated with fault diagnostic approaches* which not only indicate when the structure needs attention but the location of the problem elements. **By developing an ability to determine remotely when a bridge needs attention and in addition what that requirement will be, TRUSS will vastly reduce the whole life cost of the asset.** It will also ensure that the structure is in a safe condition to operate. When accounting for all bridges in the world, many of which are in a poor condition, this approach has the potential to save substantial funding currently expended on this process. **This project is to design a method by which a fault diagnostic process can be established for**



bridges and will initially fix one particular bridge type determined by *UNOTT* jointly with *URS*. The design approach will determine the methodology and the number of sensors installed. Metal underbridges make up a large proportion of the bridges used on European railway systems. As their state deteriorates, by mechanisms such as corrosion, the strength of the structure reduces and the deflections it experiences with passing load increases. The state of the track used on the bridge is established by a measurement train at regular intervals. This has the effect of introducing a known load to the structure. Displacement patterns can be predicted for the bridge as the load moves across it using Finite Element (FE) models for a variety of deteriorated states of the bridge members. By using sensors to track the deflection patterns over time the deteriorated state of the structure can be monitored.

Objectives

The aim would be to use fault diagnostic methods such as Bayesian Belief Networks and pattern recognition methods such as Neural Networks to relate the measurements from the bridge to the state of the different members. In this way not only can the condition of the bridge be monitored but, when this falls below the required performance, the potential causes of the problem, where maintenance is to be focused, can be established.

Expected Results

Improved fault-diagnostic and pattern recognition monitoring methods of **bridge safety based on deflection patterns**.

Secondment

This project involves a secondment of some months to *URS*. Of particular relevance to this project is the structures and asset management team in *URS*. They are highly experienced in investigation, survey, monitoring, design and modelling all types of highway and railway footbridges and viaducts. They will provide the ESR info for a particular structure and assistance in its modelling, for use in developing the state diagnostic methodology. The ESR will gather information about the structure design and the states of the elements and start to generate a FE model of the structure.

Specific Requirements

- At the date of closure of appointments, candidates must have obtained, or finalize within 3 months, a Bachelor or a Masters degree in Engineering, Mathematics or Physics.
- Candidates should have strong mathematical skills.
- Prior knowledge and skills in programming are desirable but not mandatory.
- We are looking for candidates with a strong motivation to pursue a career in engineering and an open mind for new approaches and a lot of team spirit. Creativity and level of independence will be considered.
- Solid written and oral communication skills in English are prerequisites of any successful application.

Eligibility Criteria

- Researchers can be of any nationality and age.
- All recruited researchers **must be Early-Stage Researchers (ESRs)**. A ESR shall, at the time of recruitment by the host organisation, **be in the first four years of their research careers** and not yet have been awarded a doctoral degree. The four years start to count **from the date when a researcher obtained the degree which would formally entitle him/her to embark on a doctorate**.
- Researchers are required to undertake transnational **mobility** (i.e. move from one country to another) when taking up their appointment. One general rule applies to the appointment of researchers: **At the time of recruitment by the host beneficiary, researchers must not have resided or carried out their main activity (work, studies, etc.) in the country of their host beneficiary for more than 12 months in the 3 years immediately prior to the reference date. Note that the *mobility* rule applies to the beneficiary where the researcher is recruited, and not to beneficiaries to which the researcher is sent or seconded.**
- For all recruitments, the eligibility and mobility of the researcher will be determined at the time of their (first) recruitment in the project. The status of the researcher will not evolve over the life-time of a contract.

Salary and Working Conditions

- Each position is for a period of 36 months. These positions will be available from August/September, 2015. The Marie Skłodowska-Curie programme offers highly competitive and attractive salary and working conditions. Exact salary will be confirmed upon appointment. It consists of a living allowance (= 37320 euro/year [the Marie Skłodowska-Curie rules apply a correction factor to this amount to allow for the cost of living in different countries]) + a monthly mobility allowance (= 600 to 1100 euro/month depending on the family situation).
- Furthermore, PhD tuition fees for the ESR are covered and the research project is aimed at defending a thesis and obtaining a PhD degree. In addition to their individual scientific projects, all positions will benefit from further continuing training, which includes internships and secondments (All ESRs will be seconded at least once during this period at another partner site), a variety of training modules as well as transferable skills courses, active participation in workshops and conferences, and exposure to large enterprises, SMEs and Universities from different European countries involved in TRUSS.

Application Procedure

- (1) Check you meet **Eligibility criteria** and **Specific requirements for the ESR position** project/s you are applying for.
- (2) Prepare the following **application documents** (in English):
 - a. **A curriculum vitae**, including contact details, education (at University level and other), work experience, prizes/awards, language skills, etc... (max. 2 pages). The CV should reflect a representative array of achievements and qualifications appropriate to the post for which application is being made.



- b. **Official academic record** of undertaken courses & grades for Bachelor (and Master if required in specific criteria) degree.
 - c. **A motivational letter** in which the applicant describes his or her motivation to pursue postgraduate studies and to conduct the research project/s applied for. Mention the ESR project number or numbers (in the latter indicate order of preference if any) on your motivational letter and the subject of the email.
 - d. **A reference letter.**
- (3) Email your application documents as attached files to: trussitn@ucd.ie **before the 1st May 2015 deadline** and mention the ESR project number/s you are applying for in the subject line.
- (4) The documents provided will be used to select the best candidates. Successful candidates will be informed **before 29th May 2015**.

For more information on a position with TRUSS, please check
www.trussitn.eu/vacancies or email trussitn@ucd.ie