



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

### **PHD STUDENT PROJECT**

#### **Funding and application details**

**Funding status:** Self funded students only

**Application instructions:**

Detailed instructions are available at <https://blogs.napier.ac.uk/scebe-research/available-phd-student-projects/>

*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: Vasiliki Dimitriadi (Email: [V.Dimitriadi@napier.ac.uk](mailto:V.Dimitriadi@napier.ac.uk))
- 2<sup>ND</sup> SUPERVISOR: Daniel Barreto

**Subject Group:** Built environment

**Research Areas:** Civil Engineering, Geotechnical Engineering

**Project Title:** The concept of sustainability in ground improvement methods.

**Project description:**

Designing foundation solutions in challenging soil conditions is at the core of geotechnical engineering and every practising geotechnical engineer has come across this challenge more than once. Heterogeneous soil conditions are sometimes difficult to foresee and can considerably affect multiple aspects of large-scale projects ranging from the suitability of a chosen foundation type to different financial, societal and cultural implications. As a result of the complex foundation conditions, there is an abundance of ground improvement methods that the geotechnical engineer resorts to, in order to bypass or remediate the problematic foundation soil. Choosing the appropriate ground improvement method has traditionally been based on a cost-benefit approach, also considering

constructability issues. In view of the increasing awareness of project owners and stakeholders to structures' sustainability and associated carbon footprint, it is becoming increasingly important for the chosen ground improvement method to be within acceptable standards regarding its carbon footprint and overall sustainability. To that end, the proposed project aims in exploring the concepts of sustainability and carbon footprint in a wide range of ground improvement methods. An indicative description of the project is explained in the following paragraphs.

Initially, the PhD candidate will perform an in-depth literature review of all the typically used ground improvement methods in geotechnical engineering. It is important to become familiar with different aspects of each method, ranging from areas of application, suitability, used materials, different construction stages, pre and post application requirements, current design approaches and relevant design criteria and guidelines, pre- and post- application monitoring of the improved area, indicative construction costs etc.

In the following stage, the PhD candidate is going to explore the concepts of sustainability and associated carbon footprint of different ground improvement methods. The construction of complex foundation solutions, which involve the use of a ground improvement method, does not only make up a significant part of the project's financial budget, but also requires the use of large amounts of natural or mechanically fabricated construction materials, such as concrete, steel, rock, water, aggregates etc. In some cases, the surrounding landscape is even altered by extensive quarrying activities. To that end, a framework to assess the sustainability and quantify each method's carbon footprint is going to be proposed.

The ultimate goal of the proposed PhD project is to have a complete and detailed framework for assessing the sustainability and carbon footprint of the most widely used ground improvement methods in the industry. The development of such a tool is going to be particularly useful for many industry applications.

## **References:**

## **Candidate characteristics**

### **Education:**

A first-class honours degree, or a distinction at master level, or equivalent achievements in Civil Engineering

### **Subject knowledge:**

Soil mechanics, deep foundations, ground improvement methods

### **Essential attributes:**

- Strong analytical skills
- Solid background in geotechnical engineering
- Attention to detail

### **Desirable attributes:**

- Professional experience in geotechnical engineering