Project title: **Tunneling in soft soil under both static and seismic events**

Project number: IMURA0072

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Research Academy theme/s
List only the research academy theme/s that is relevant to the project
1. Infrastructure engineering
2. Advanced computational engineering, simulation and manufacture

The research Problem Project Title

Construction of urban tunnels in soft soil requires meticulous considerations in terms of geotechnical site investigations, construction methods, types of tunnel boring machines, tunnel support systems, instrumentation and monitoring of surface subsidence and the subsequent impact on nearby buildings and services. Among the considerations, the most important aspect is the control of surface subsidence to minimize any disturbance to nearby buildings and services. The study of surface subsidence is limited to mainly empirical solutions based on field studies, and very few analytical studies have been carried out. The tunnels are usually subjected to either static or seismic loads during their lifetimes. The devastating effects of earthquake on tunnels are well known. Also the tunnels in soft ground under static and seismic loadings are generally subjected to collapse due to soil amplification, cyclic mobility, caving and other design and construction problems. The available analytical solutions are not sufficient to include complex ground conditions and hence a comprehensive analytical solution coupled with numerical modelling is necessary to model the effect of those loads on the performance of tunnels.

Project aims
The main aims of the project

1. To propose a better and complete design aspect for the tunnel in soft ground under static/seismic loading conditions
2. Improved understanding of the behaviour of tunnel performance and above ground structures under those loading conditions
3. To develop simple design methodologies for tunnels behaviour.

Expected outcomes
From this project a detailed design methodology for the tunnels in soft ground subjected to both the static and seismic loading will be obtained which can be easily used for the practical construction purpose of the tunnels. Effect of soil amplification and cyclic mobility on tunnels which are the common problems associated with the seismic loading in soft ground will be studied. Also the behaviour of some typical tunnel sections in soft ground

through the above computational analysis will give a better understanding about the construction and design

problems which needs to be addressed for the tunnels. Finally a generalized design approach for the tunnels will be proposed.

Which of the above Theme does this project address?

This project will address the main research themes on (1) Infrastructure engineering by handling the design and model behaviour of tunnels constructed in soft ground subjected to both the static and seismic loads, and (2) Advanced computational engineering, simulation and manufacture by carrying out the improved version of FLAC3D static and dynamic analysis of tunnels in soft ground.

How will the project address the Goals of the above Themes?

Design and construction of tunnels in soft ground is a common practice worldwide. It comes under the infrastructure engineering. But the devastating effects of earthquake on tunnels are well known and also the failures of tunnels due to static loading are also very common. To understand the behaviour of tunnels constructed in soft ground which can be subjected to soil amplification and/or cyclic mobility due to the earthquake shaking, an advanced computational engineering and simulation of the problem using the modern FLAC3D static and dynamic module is necessary. Hence the goals of the above themes will be addressed by rigorous analysis of the tunnels in soft ground subjected to both the static and seismic loadings.