Title:-

The Assessment of Jacking Forces Due to Microtunnelling in Kuching

Research Partner:-

Hock Seng Lee Berhad & Jurutera Jasa (Sarawak) Sdn Bhd

Contact person:-

Ir Dr Dominic Ong (elong@swinburne.edu.my)

Description:-

With the Kuching Wastewater Management System, a network of trunk sewers was constructed using trenchless technology i.e. micro-tunnelling by pipe-jacking method, which is a pioneering endeavour in Sarawak. This beneficial and sustainable construction technique presents several new and complex challenges to the local construction industry, such as the understanding of the highly variable geological conditions of Kuching, the evolution of frictional pipe-jacking forces for local conditions, and the influence of on-site construction activities on forces during the jacking process, such as lubrication effort, stoppages, and jacking speed.

A novel technique is being developed incorporating the testing of reconstituted excavated spoils with the back-analysis of pipe-soil frictional properties. Further verification of the technique is achieved through three-dimensional modelling of in-situ microtunnelling works. The understanding of pipe-jacking within the local Kuching geology is an emergent necessity, and can ensure the effective and efficient implementation of future construction of pipe-jacked tunnels. The long-standing benefits this sewer network will ensure sustainability of the living standards for future generations, and ameliorate the environmental situation of the Sungai Sarawak.

Graphical Abstract:-

Title:-

Development of Geopolymer Concrete Technology Using Fly Ash Available in Sarawak

Research Partner:-

Centre for Sustainable Infrastructure

Contact person:-

Ir Dr Dominic Ong (elong@swinburne.edu.my)

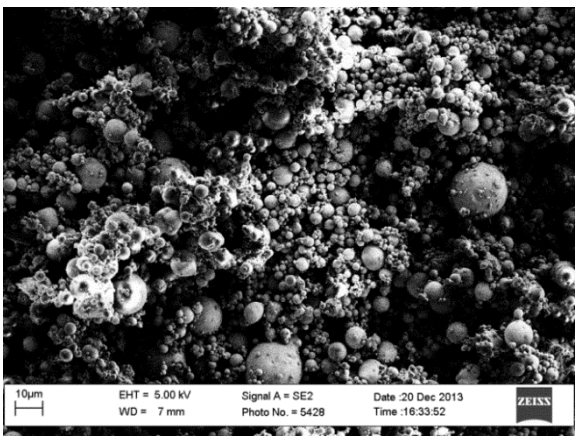
Description:-

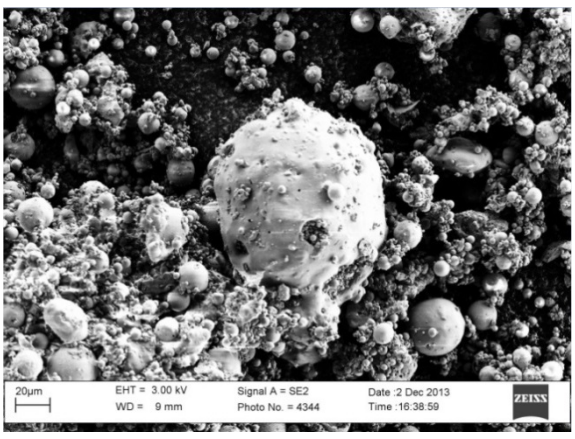
Geopolymer concrete is an attractive environmental and sustainable alternative construction material to OPC. It is generally known that fly ash, the by-product from coal fired power plant, is dumped into ash pond and being an industrial waste material. By incorporating fly ash into concrete, it aids to reduce the environmental pollution as well as reducing the problem of disposing fly ash in industry. The benefits of being environmental friendly and energy conservation potential on geopolymer concrete can be seen through its low carbon footprint and less energy consumption than OPC.

The main aim of this research is to study and evaluate the mechanical properties of geopolymer concrete using locally available fly ash in Sarawak. It gives insights into the potential and practical applications of fly ash in Sarawak.

Laboratory works for this research include X-ray Fluorescence (XRF) analysis of fly ash, casting and curing of geopolymer concrete, compressive strength test and Scanning Electron Microscope (SEM). The chemical composition of fly ash is initially be analysed using SEM. The casting of geopolymer requires alkaline solution, aggregate and fly ash. The ratio of Na2SiO3/NaOH and the ratio of sand-to-liquid will affect the properties of geopolymer. The outcome of the research is expected to show the geopolymer concrete has low carbon emission but higher capabilities of fire resistance, acid resistance, strength, workability and durability. The research will be beneficial to many stakeholders such as property owners, engineers, contractors and authorities in the infrastructure and construction industries in Malaysia.

Graphical Abstract:-





Title:-

Behaviour of Riverine Infrastructure subject to Detrimental Riverbank Soil Movement & Changes in Geomorphology

Research Partner:-

National University of Singapore

Contact person:-

Ir Dr Dominic Ong (elong@swinburne.edu.my)

Description:-

Riverine infrastructures namely jetties, ferry ramps, wharves and bridges are commonly constructed in riverbanks to facilitate movement of people and goods along the many rivers in Sarawak. Lately, many damages and failures to riverine infrastructure have been reported due to detrimental riverbank soil movements.

This research aims to fill the gap of lack of in-depth technical knowledge of complex soil-structure interaction caused by the ever-changing river geomorphology as a result of large tidal fluctuations and soft riverbank deposits.

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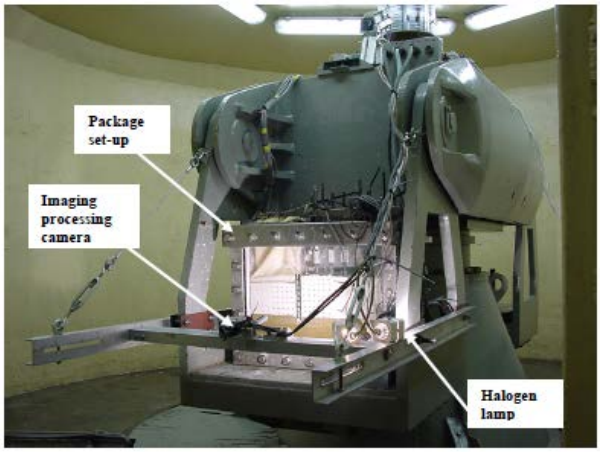

Title:-

Development of Bio-soil using local Sarawak bacteria

Research Partner:-

Bachy Soletanche

Contact person:-

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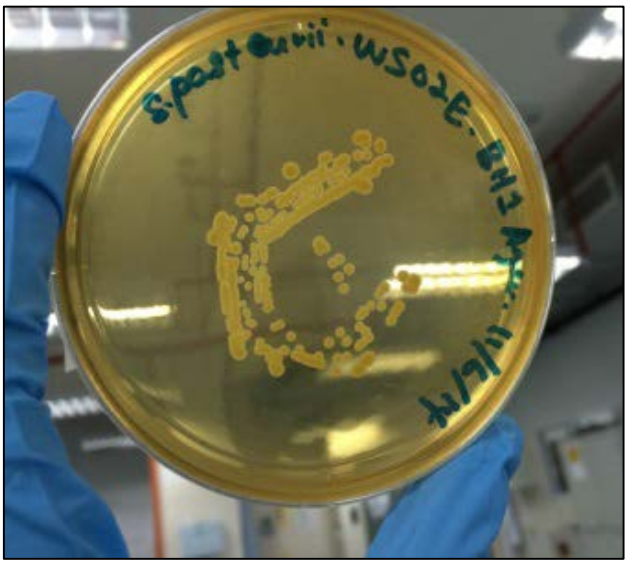
Description:-

A recently developed technology known as Microbially Induced Calcite Precipitation (MICP) has been an important breakthrough in the field of geotechnical engineering as it seems to a viable ground improvement technique that incorporates the use of bacteria to facilitate calcite precipitation in order to bind the soil particles. It is a trans-disciplinary research project since it integrates the fields of microbiology, geochemistry and civil engineering applications.

The main and unique aim of this research project is to utilise locally available bacteria in Sarawak for the development of bio-soils, in view of the State's rich natural biodiversity.

It is to be proudly mentioned that the Sarawak Biodiversity Centre (SBC) together with the Sarawak State Government have recently approved the Research Centre's application to harvest the collection of local bacteria for this particular project, focusing on the development of biotechnology, lab-scale injections and possibly field trials.

Graphical Abstract:-



Title:-

Innovative Ground Improvement Method to Treat Thick Deposits of Soft Clay

Research Partner:-

Keller (UK plc)

Contact person:-

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Description:-

Soft soils usually occur naturally at floodplains near to river mouths, along riverbanks & coastlines, valleys between hills in the hinterland. The presence of soft soils present engineering challenges such as having low bearing capacity and relatively large consolidation settlement over a very long time.

In view of very thick soft soils typically more than 30m, this research focuses on the design aspect of 'floating' stone columns (i.e. installed much shorter than 30m). The efficiency of stone columns is evaluated using theoretical & numerical methods and comparison will be made to measured field data.

Graphical Abstract:-