

# Building in Challenging Geology

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**S**arawak is known for its hornbills and orangutans, but its uniqueness does not stop at ground level. Dig deep under Kuching City and engineers will gather around its unique and eccentric geology, which is neither exactly “soil” nor “rock”. It consists of weathered rock which fractures as soon as you dig into it. The friability of this weathered rock-soil makes it a tough challenge to build on.

Engineers have been building in this geology but not very efficiently. The approach has been “better safe than sorry”, which means using more resources than needed. My research tries to understand and predict the behaviour of the fractured rock so that engineers can predict the eccentric rock behaviour in their designs of tunnels and buried infrastructure.

This research is particularly suited for pipe-jacking — a construction method where a tunnel-boring machine drills and inserts the pipe simultaneously before the walls around the tunnel can collapse. It is so useful that an engineering company, Hock Seng Lee Berhad has partnered with us so that we can advise them on their building projects. This has been particularly exciting as I can see my research become tangible.

What I’ve built is a numerical model of the pressuremeter test. I know it’s a mouthful so let me explain.

The pressuremeter, which was developed in France, measures the strength of the soil and how it behaves under stress. The advantage of this machine is that the test can



be done on site. This is especially useful as the nature of our rock-soil doesn't even allow us to extract a core sample to send to the lab. With the pressuremeter we can now bring the test to the field.

Most of the pressuremeter probes in the market are designed for stiff soils which are much weaker than rocks. The challenge arises when we use this pressuremeter in Sarawakian rock-soil. It cannot measure the "plasticity" of the soil resulting in an incomplete test.

My numerical model of the pressuremeter test provides the missing link. It simulates a virtual pressuremeter test and replicates the way the rock would have behaved and fills in the "incomplete" data allowing us to calculate the strength of the rock.

Builders can now know the nature of the fractured rock soil — how much it will collapse when you try to dig a tunnel. This is vital as the pipes have to withstand the pressure of the ground and can now be made with the specific pressure in mind.

*Fredrik has been selected by the Malaysian Geotechnical Society to present his research at the 2017 International Young Geotechnical Conference in South Korea.*