



## Stabilizing Subsided Residential Foundation with PU Injection on Alluvial Soft Clay, Klang Selangor

A two-story residential building experienced significant settlement due to non-Engineering design very soft alluvial soil conditions and a high-water table, causing extensive structural cracks.

The alluvial soil, characterized by high void ratios, low bearing capacity, and low shear strength, led to differential settlement, with the extension side settling more severely.

The floor slab sank approximately 20mm, resulting in popped tiles and ceiling collapses.

As a result, the building was deemed dangerous and unsafe for residents.



**Re-Level** employs various methods to address this type of issue, including underpinning, push pier, helical piling, PU grouting, and cement grouting.

However, in this case, the extended structure has a raft slab without ground beams.

The concrete thickness is insufficient for using underpinning, push piers, or helical piling, as these methods could risk causing punching failure in the structure.

Therefore, PU injection is the suitable method here, as it provides even and uniform filling to stabilize the foundation.

Additionally, the building owner favours PU injection, as it is non-intrusive, allowing the property to remain usable during repairs.

<b>Project</b>	<b>Foundation Stabilization for Subsided Residential Building Using PU Injection – Kapar, Klang Selangor</b>
<b>Company</b>	<b>RIYE ENGINEERING SDN BHD Kuala Lumpur, Malaysia.</b>
<b>Soil</b>	<b>Very soft clay, High water table</b>
<b>Building age</b>	<b>3 years</b>
<b>Method</b>	<b>PU grouting (Polyurethane Injection)</b>
<b>No. of Points</b>	<b>209 points</b>
<b>Treated Depth</b>	<b>3 m</b>
<b>Injected PU</b>	<b>2,300 kg</b>



The MASW method is a non-invasive, cost-effective geophysical technique used to assess soil conditions by analysing the propagation of surface seismic waves. Unlike traditional tests like SPT, Plate Load Test, and Macintosh. MASW captures wave velocities at various depths, providing detailed profiles of soil layers, stiffness, and shear wave velocity. This allows engineers to evaluate soil stability, identify weak zones, and make informed decisions about foundation design and construction safety.

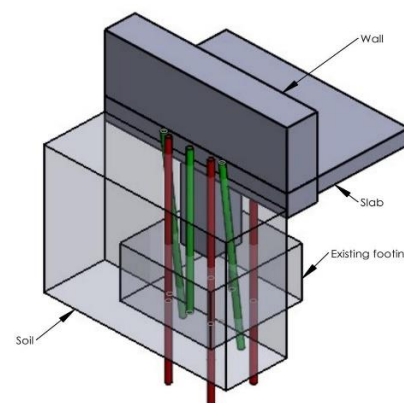
Additionally, MASW can detect changes in soil density, such as those resulting from PU foam injection, ensuring the effectiveness of soil stabilization. More budget-friendly than other methods, MASW reduces the need for multiple invasive tests and delivers valuable insights for both immediate foundation assessments and soil stability analysis.

**Re-Level** provides innovative foundation stabilization solutions with PU (Polyurethane) Injection technology. This state-of-the-art technique is designed to restore the stability of foundations affected by settlement and movement due to unconsolidated very soft clay.

Initially, 16mm diameter holes are drilled beyond the footing base and along the ground beam, specifically in areas affected by cracks. These access points ensure targeted treatment with minimal disruption to the building. Following this, 10mm diameter tubes, ranging in length from 2 to 3 meters, are inserted into the drilled holes. The tubes are used to inject PU foam, with the 3-meter tubes focusing on soil densification and stabilization, while the 2-meter tubes are used to control the lifting of the structure where feasible.

PU foam is injected into the soft soil through the tubes. PU injection enhances foundation stability through soil densification, as the expanding polyurethane fills voids and compacts the soil, strengthening support for the structure.

This method offers minimal obstruction to the building, allowing daily activities to continue with little disruption. It's an efficient, non-invasive solution that strengthens the foundation and provides stability for the structure and safeguarding the building against further settlement and providing enduring support.



Rotary laser level is a precision instrument used to establish a consistent horizontal or vertical plane across a site. During PU injection, it helps monitor and control the level difference of the structure by emitting a 360-degree laser beam. A level indicator receiver is placed on the structure to detect this laser beam, providing real-time feedback on any movement or lifting as the PU foam is injected.

This allows operators to adjust the injection process accurately, ensuring that the foundation is evenly stabilized and level throughout the repair.

The PU injection method provides a highly effective solution for repairing subsided building foundations.

By injecting polyurethane foam beneath the foundation, the foam expands and hardens, filling voids and densifies the surrounding soil.

This non-invasive technique restores the building's stability, prevents further settlement, and strengthens the foundation for long-term support. Additionally, it minimizes disruption to the property and the surrounding environment, making it a fast, efficient, and sustainable solution for foundation repair.

**Re-Level** greatly appreciate the support from:

1. Dr Norinah Abd Rahman from University Kebangsaan Malaysia.
2. Mr. Satishvaran from Universiti Teknologi Petronas.