



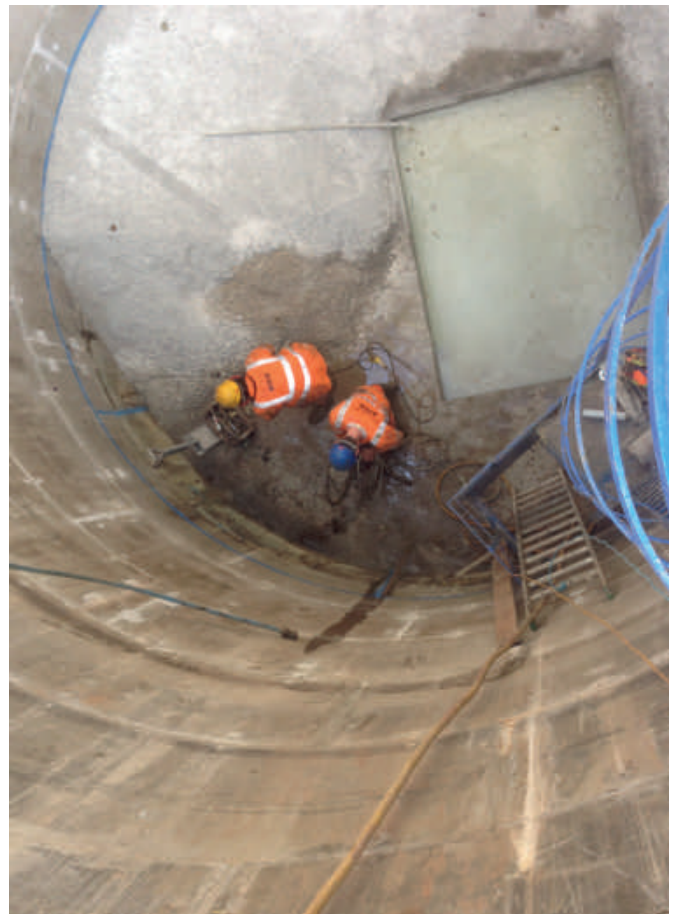
GROUND ENGINEERING INJECTION

After concrete waterproofing, ground stabilisation is probably the most common use of resin injection in the industry. Particularly in London, where ground works often face challenges from high ground water levels, tidal variations and heterogenous grounds, injection offers a fast, safe, and cost-effective solution to support challenging excavation and mining operations.

A typical object of stabilisation injection is temporary support to a structure, shaft or heading. Alternatively, the material can be used to fill voids, or to stop fast leaks. There is a series of suitable resin specifications, as well as different injection methods, both which have to be tailored to the specific project parameters.

Some application examples:

- For temporary works or to stabilise flowing sand, polyurethane (PU) is injected into the ground around a heading or shaft. The area can then be excavated safely, minimising risk of collapse. This process has successfully been applied in creating temporary piles under a scoured-out bridge foundation to give time for the main strengthening works.
- Creation of a mini pile by injection of PU resin through a hollow bar. Due to the small size of the pumps, this allows access where it is not possible for a drilling rig to attend.
- Use of resin injection to consolidate the ground to allow an opening to be cut into the piles/ retaining structure
- Void Filling: this can be carried out by either using PU material only, or a mixture of structural polystyrene and PU foam to fill in gaps. The expanded material is inert and can be removed easily. During injection, there is no need for structural shuttering as the material is self-supporting.
- Other applications include: all types of soil stabilisation, underpinning foundations and foundation stabilisation, consolidation for ground anchors, void filling, injection into saturated ground, tightening up after cement grouting, filling cavities in concrete and strata, stabilisation of cavities in tunnels, and consolidation of fractured rock, sands and gravel



PU injection for ground consolidation at bottom of shaft opening

TYPICAL APPLICATIONS

- Shafts
- Pipe connections
- Headings
- Tunnels
- Retaining walls
- Steel piles

KEY BENEFITS

- Can be easily removed
- Can be fireproof
- Can use high or low pressure (site dependent)
- Good chemical resistance
- All quantities can be measured and recorded

EQUIPMENT & RESIN SPECIFICATION

There's a wide range of acrylic, polyurethane, and colloidal silica resins, as well as microfine cements, that can be applied for ground engineering. Please contact us or a reputable supplier for professional advice on the right specification.



PU injection to consolidate before header opening



Breaking out for opening of a heading to connect to a pipeopening

APPLICATION CONDITIONS & LIMITATIONS

- The acrylic resins have permanent open times until an accelerator is added, giving maximum flexibility.
- Polyurethane is injected at the same time as the catalyst, and will set in minutes/ seconds, depending on the amount of catalyst added.
- All the acrylic and polyurethanes are affected by low temperatures, which usually slow down the reaction time.
- Any structure with missing pointing or cracking likely requires either surface repair or waterproofing with the thicker polyurethane, to avoid the material loss
- There is a risk of jacking

EXAMPLE GROUND STABILISATION/ FAST LEAK PROJECTS

- Southall UTX, Barhale/ trRIIO
- Tideway, Victoria Embankment, Barhale
- Hiams Road bridge, Cambridgeshire Council
- Denmark Road Tunnel, Nomenca
- Ogden Reservoir, JN Bentley/ Yorkshire Water
- DSJV for CrossRail Crossover 13, fast leaks
- Qatar Doha: Qatar Rail, Gold Line, Red Line South. Fast leak sealing and head interventions