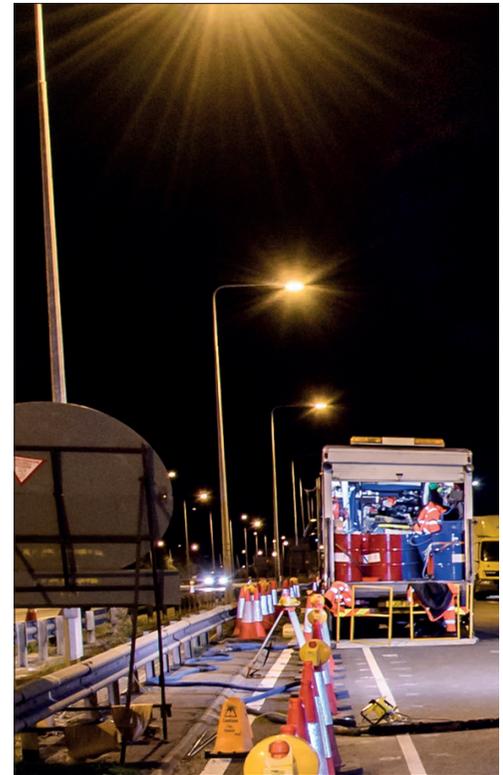


SWELL TO GET WELL

Expanded geopolymer injection can save taxpayers millions of pounds in disruption caused by road, rail and airport maintenance work.



Polymer injection specialist Geobear says its mission is to challenge convention to expedite efficiency improvement in the construction industry. In transport infrastructure the company aims to minimise time on track or road during maintenance.

The financial costs of maintenance are already large, but the costs imposed on transport infrastructure users in terms of delays, vehicle operating costs, safety, emissions and unreliability can also be very substantial. A system which judges maintenance bids on a combination of capital costs and user costs would lead to better maintenance procurement, resulting in better overall outcomes and lower societal cost.

Creating incentives or disincentives for maintenance contracts on early completion/delay would encourage innovative new techniques for delivering maintenance works faster and more effectively.

Geobear wants to challenge existing methods of transport infrastructure maintenance, in particular relating to

filling voids, re-leveling surfaces and strengthening soils. It asks:

- Is it mandatory to close the asset to solve problems caused by dynamic loading, wear and tear or water ingress?
- Does all void filling/soil improvement require mass drill and grout injection, piling or mass excavation and refill which tends to close the asset down for months?
- How effective are cement grouting or piling methods in terms of programme, cost and environment?

Nine per cent of annual roadway maintenance is assumed to be replaceable with between two and 10 times faster maintenance methods. The estimated saving is £80M per year in socioeconomic costs in terms of fuel, noise, time spent on detours and wear and tear of highways and vehicles. It is fully based on the socioeconomic cost to road users who finance roadway maintenance but are not compensated if roads are closed during maintenance.

Between 219 and 416 of rail asset management civil engineering works each year can be replaced with between two and 10 times faster maintenance methods, which has a savings potential

of £400M per annum assuming highest possible alternative speed of installation and heaviest used routes where cost of closure is highest.

Faster than traditional installation will save asset owners such as Network Rail and Transport for London from paying financial penalties and will save end users and train operators rerouting costs. The socioeconomic saving on high demand lines is over £5M per day according to public sources.

In addition, efficient maintenance solutions are directly linked to the safety of those undertaking track-based maintenance activities, as they spend less time on track and use fewer people. This effectively reduces the cost of rail-based possession planning and simplifies the track handback process, avoiding disruption to the travelling public.

Based on like for like comparisons between geopolymer injection and cement-based ground improvement methods, it can be demonstrated that geopolymer based solutions can generally be installed with a 40% to 50% smaller carbon footprint, mostly because the material expands up to



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infrastructure can be replaced with geopolymer injection, which solves the root cause of problems such as cavities, water ingress or weak soil through the chemical expansion force of geopolymer. The expansive force generated is equivalent to 300m of overburden and the amount of lift generated by the materials can be accurately predicted. The installed material cures and reaches 95% of its compressive strength in less than three minutes.

Geobear says that using a mobile 3m² injection unit, 16mm drill and injection holes and three to five person teams on site to install the geopolymer with millimetre precision will minimise carbon footprint and closure of the asset.

The solution meets the industry standard set by cementitious grouts and piling methods in the following manner

- durability: 120 year design life based on third party testing
- sustainability: lower than cement based product carbon footprint
- environmental impact: does not constitute ground water activity
- design: expansion force of geopolymer can be modelled and controlled.

Generally applicable design principles exist.

The chemical expansion and fast curing of geopolymer enables two to 10 times faster delivery than mass excavation, grouting or piling methods.

Assuming pound to pound direct capital cost versus traditional alternatives, the faster installation can still save over £500M of British taxpayers' money per annum as a result of improved road, rail and airport maintenance and £4.3bn across the G7 nations.

30 times its liquid volume and hence desired results can be achieved with relatively small quantities of material.

Non-disruptive maintenance of infrastructure assets using geopolymer injection has traditionally been used to fix domestic subsidence.

The savings potential for the UK economy has been quantified, the product has been sold in increasing volumes to infrastructure asset owners, main contractors and specifiers, and has a solid track record of saving indirect socio-economic costs. Examples include the M11 Girton interchange, Heathrow Airport and Vauxhall Station for Network Rail.

The solution is a response to the most fundamental challenges of geotechnics:

- unknown cavities or weak soil layers in foundation soils. On discovering the formation of cavities or weak soil layers with non-intrusive testing methods such as ground penetrating radar (GPR) or falling weight deflectometer (FWD) targeted and non-disruptive treatment can be applied without excavation.

- permafrost-induced stability challenges in Finland. These triggered

Geopolymer injection can resolve ground engineering maintenance issues with less disruption than traditional

its initial development. It has been applied successfully in 38 countries since its origination.

The geopolymer injection method is used as a subcontracted service as part of transport infrastructure asset management work.

Geobear says it can resolve challenging ground engineering maintenance issues through its innovative methods and technology and through collaboration. Fostering proactive collaborative behaviour is critical to understanding the infrastructure challenge and applying the best solution for asset owners, their appointed contractors and consultants.

The solution can be specified according to BS EN: 12715. 2000 (Execution of Special Geotechnical Work) and other relevant specifications, and must be delivered by accredited and experienced specialist contractors such as Geobear. Patent protection applies to most novel geopolymer injection techniques.

Most of ground improvement, cement grout void filling or piling methods in stabilising transport