URETEK®






NON-DISRUPTIVE GROUND ENGINEERING

WE KEEP YOUR WORLD RUNNING

URETEK is a contractor with global presence who invented the concept of non-disruptive ground engineering by injecting expanding geopolymer. Its patented processes are used worldwide, with more than 100,000 projects completed in commercial, infrastructure and residential sectors.

With our high levels of technical expertise, combined with the quality of our work and more than 30 years' experience, URETEK sets the standard for non-disruptive ground engineering. We are proud of our reputation and keen to preserve our market-leading position by continually developing ground engineering solutions which are both non-disruptive and durable over time. By increasing investment in research & development, we are providing our clients with quicker, less disruptive and more cost-effective solutions.

CREATOR OF NON-DISRUPTIVE GROUND ENGINEERING

The URETEK story began in Finland in the 1970s. In northern countries, recurrent periods of frost and thaw compromise the soil's mechanical properties, leading to subsidence. In the 1990s, an engineer experimented with a revolutionary new method for treating sunken slab floors: an expanding geopolymer injection technology.

Over the years, and thanks to significant investment in R&D, URETEK has developed three new techniques for injecting expanding geopolymer. Since 1982, the company has filed for exclusive patents for several processes worldwide.

The most popular process is the ground improvement solution, which consolidates soils deep below the surface as a result of the injection of a high-density, highly expansive geopolymer which generates a very powerful expansive force. This innovative technique is used to stabilize buildings by increasing bearing capacity of the soil. This process offers an excellent alternative to traditional underpinning techniques.

Reasons why URETEK is a market leader:

- Recognised know-how and expertise in its sector
- Global reach
- Faultless support and monitoring of projects
- Engineers and geo-technicians trained in how to meet the requirements specific to each project.

As the inventor of these solutions, URETEK has already acquired more than 30 years of experience in the injection of expanding geopolymer, and masters this technology perfectly. This is why we present URETEK as the company "setting the standard" in this sector.

LOCATIONS

50

Countries worldwide

PROJECTS

+100,000 PROJECTS

completed worldwide

HISTORY

2015
Presence in Belarus, Saudi Arabia, Baltic States.

2014
Presence in China.

2013
Presence in Russia.

2012
50 countries landmark.

2011
100,000 projects landmark.

2007
Introduction of structural support solution.

2004
Introduction of void filling solution.

1996
Geopolymer innovations for foundation stabilization and ground improvement.

1980
First projects completed in Finland.

URETEK ENGINEERS

KNOW-HOW

Our engineers work in the field and on site to study each project; they are skilled in different disciplines: civil engineering, geotechnical and structural engineering. They all share a common characteristic: unique know-how in their field that lets them propose the right solution. The engineering teams are complimented by our highly effective project managers who are experienced in handling the most complex projects.

WORK CARRIED OUT

Autonomous teams equipped with mobile workshops carry out work on-site.

OUR REGIONAL AGENCIES PROVIDING A LOCAL SERVICE

(URETEK Saudi Arabia) is the license holder of URETEK Worldwide in Kingdom of Saudi Arabia.

Certificate №0651262312
in recognition of this commitment
you're hereby awarded
with this Certificate as of May 1, 2018

OVER 30 YEARS OF INNOVATION

Otso Lahtinen,
President
URETEK Worldwide Oy

THE BASIC PRINCIPLES OF URETEK EXPANDING GEOPOLYMER INJECTION

URETEK utilises the expansion properties of a mix of unique structural geopolymers.

URETEK geopolymer components are mixed on site as a part of an injection process, this is called “polymerisation”.

Initially, the geopolymer is a liquid and can easily penetrate the smallest crack or crevice.

As the chemical reaction progresses the geopolymer expands, its volume can increase by a factor of up to 30 depending on the degree of confinement. The expanding geopolymer compacts the ground, generating pressures as high as 10 MPa in the case of the ground improvement process.

Within a very short time period the geopolymer cures to a strong, stable and enduring matrix which is environmentally neutral.

Our solutions can be measured to within 250 microns

THE PROPERTIES OF URETEK GEOPOLYMERS

The characteristics of the geopolymer and its effects in the ground

Standard EN 12715, which governs the execution of special geotechnical work, covers all injection (also known as “grouting”) techniques. Most of the processes described involve injecting cement-based products. The standard also mentions the use of geopolymeric resin or of concrete containing resins.

Within this range of techniques, the URETEK technology occupies a special place since it combines an impregnation injection with hydraulic fracturing and compacting. The effects of the injection of expanding geopolymer are considered both in the category of injections “without ground displacement” and “with ground displacement”. Its characteristics are quite unusual.

URETEK STRUCTURAL GEOPOLYMERS

- Rapid expansion for perfect control of the injection process
- High expansive force
- Strong in compression, tension, bending and shear.

The geopolymer has a high rate of expansion

The pressure exerted by the geopolymer as it expands is a key element of the technology. This pressure, which can exceed 10 MPa (about 1 000 000kg/m²), facilitates the penetration of URETEK geopolymer into fine soils and impermeable ground through a process of hydraulic fracturing.
This action, combined with systematic, three-dimensional static compaction, significantly reduces the permeability of the in-situ soil structure. It thus limits any shrink-swell phenomena caused by repeated drying and rehydration.

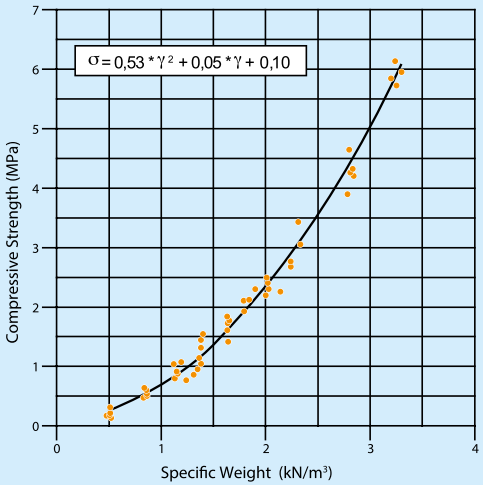
The geopolymer does not increase the water content of soil

One of the key differentiating characteristics of the URETEK geopolymer is that it does not increase the water content of soil. Their state changes with variation in the water content. When water is added, some soils change from a solid to a plastic, and then to a liquid. Consequently, the absence of water in the geopolymer ensures that the injection does not cause any plasticisation of the soil.

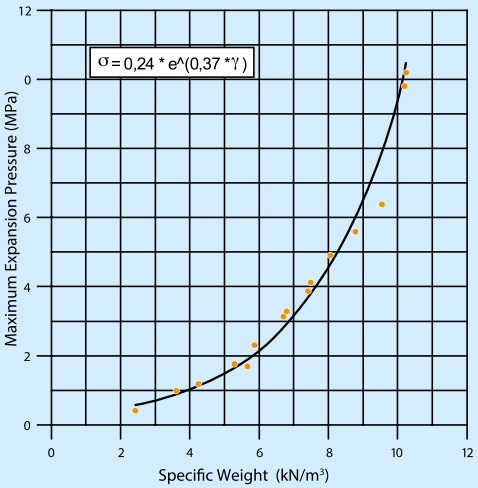
Shrinkage (a loss of volume) can affect most cement-based techniques (which contain water) as the ground dries out. The geopolymer hardens not by drying but by a process of polymerisation. Since it is also solvent-fee, no shrinkage occurs during hardening.

The resin is a geopolymer

Unlike cement-based products, URETEK geopolymer tensile strength is excellent. The chains of molecules formed during polymerisation are extremely resistant to all forms of chemical attack or mechanical stress. Moreover, its compressive strength is remarkable, and much greater than the loading exerted by the structures above. URETEK geopolymer does not rot or biodegrade.



Expansion test: increasing the expansion pressure as a function of unit weight of material.



Resistance test compression with free lateral expansion: increased resistance depending on the specific weight.

URETEK & THE ENVIRONMENT

With regard to resin-based processes, it is understandable to query their possible effects on the environment, and on health and safety. Since its inception, URETEK has adopted a strict policy on these subjects - both to safeguard the health of its technicians and clients, and to preserve ecosystems.

URETEK geopolymer has no negative impact on the environment

Studies conducted on the polymerised resin have shown that it does not contaminate the ground (refer to the table opposite). This absence of contamination is due to the fact that the multiple components, once mixed, form closed and very tightly bonded chains of molecules.

The quantities of geopolymer injected rarely exceed 2 to 4% of the volume in the treated area (0.2 to 1% by weight). The migration of the geopolymer away from the point of injection is limited (up to 2m) since polymerisation progresses very rapidly. 90% of remediation treatments are carried out near to the surface (at a depth of 3 to 4m).

Carbon footprint

The process generates very little carbon compared with traditional solutions. The drilling work is performed using electric drills with low electrical demand. Moreover, projects are completed quickly – between two and ten times faster than micro-piling.

Very little product is transported compared with concrete. Five tonnes of liquid geopolymer transported by tanker can expand underground to produce 70m^3 of polymerised resin.

Packaging

The tankers are equipped with fixed stainless steel tanks which are filled from re-usable depot-based tanks. We do not therefore consume any packaging, and do not produce any waste.

IMPACT ON THE ENVIRONMENT

Presentation of the data obtained by analysing a sample of high-density geopolymer. This sample was made in accordance with the French standard defined by the French ruling of 15 March, 2006

The original sample submitted by the requester in the form of compact cubes with a density of 240 kg/m^3 was ground and sieved; the results for the solid in this form (table 2) were obtained by analysing the product when passed through a 4mm sieve. A leaching test was also performed on this product with a liquid/dry solid ratio of 10 l/kg, in accordance with French standard NF EN 12457-2; the eluate from the leaching test, with its inherent pH value, was subjected to the analyses presented in table 1.

Table 1: Presentation of the results obtained by analysing the eluate from the leaching test

Parameter	Units of measurement	Value	Limit defined in appendix 2, table 1 of the French ruling of 15 March 2006
Antimony	mg/kg of dry matter	< 0.001	0.06
Arsenic	mg/kg of dry matter	< 0.01	0.5
Barium	mg/kg of dry matter	1.43	20
Cadmium	mg/kg of dry matter	< 0.03	0.04
Total chromium	mg/kg of dry matter	< 0.1	0.5
Copper	mg/kg of dry matter	< 0.1	2
Mercury	mg/kg of dry matter	< 0.001	0.01
Molybdenum	mg/kg of dry matter	< 0.1	0.5
Nickel	mg/kg of dry matter	< 0.2	0.4
Lead	mg/kg of dry matter	< 0.3	0.5
Selenium	mg/kg of dry matter	0.01	0.1
Zinc	mg/kg of dry matter	0.67	4
Fluorides	mg/kg of dry matter	0.1	10
Phenol index	mg/kg of dry matter	< 0.1	1
DOC	mg/kg of dry matter	435	500
Soluble fraction	mg/kg of dry matter	200	4000

Legend: DOC: dissolved organic carbon

Table 2: Presentation of the results obtained by analysing the resin in its native form.

Parameter	Units of measurement	Value	Limit defined in appendix 2, table 1 of the French ruling of 15 March 2006
TOC	mgC/kg of dry matter	686000	30000
BTEX	mg/kg of dry matter	< 2.2	6
PAH(*)	mg/kg of dry matter	< 0.03	50
PCB(**)	mg/kg of dry matter	< 0.01	1
Hydrocarbons (C10 - C40)	mg/kg of dry matter	< 10	500

Legend: TOC: total organic carbon. BTEX: benzene, toluene, ethylbenzene and xylenes. PAH: Polycyclic aromatic hydrocarbons. PCB: Polychlorinated biphenyls.
Hydrocarbons (C10 - C40): Hydrocarbons whose carbon chain has between 10 and 40 atoms of carbon.

(*)The "PAH" parameter identifies a family of compounds for which the Italian standard sets limits for each compound and a limit for their sum. The French standard does not set a limit for each compound, but does set a limit for the sum. In the results presented above, and in test report No. 075/2009, the compounds considered are those listed in the regulatory decree of the Italian Republic 152/2006, section IV, heading V, appendix 5, table 1, and the sum of the concentrations of the said compounds was calculated.
(**) The "PCB" parameter identifies a family of compounds which is normally expressed as a sum of congeners; the French standard specifies that the family to be analysed should contain 7 congeners. In the presentation above, and in test report No. 075/2009, 12 congeners were considered. The "WHO (1998)-PCB-TEQ excl. (or incl.) LOQ" designation indicates a weighted sum based on the toxicity of the congeners.

Tables 1 and 2 reveal that the only value greater than the limit value set by the French standard is for the TOC parameter obtained by analysing the resin in its native form (table 2). However, the fitness for purpose of the resin is not compromised by this finding, since the limit value for the DOC, determined by measuring the eluate from the leaching test, complies (table 1). Parameter units of measurement value limit defined in appendix 2, table 1 of the French ruling of 15 March 2006. Test reports Nos 75 and 76 are appended to this presentation. Padua, 3 September 2009, Analyst (Mrs A.Sandon), Head of Department (Prof. P. Ruol).

Table 1

THE URETEK

GROUND INJECTION PROCESS

Ground improvement, a unique, safe and fast stabilization process with real-time verification of effectiveness.

1 Drilling

2 Insertion of tubes

THE VARIOUS STEPS

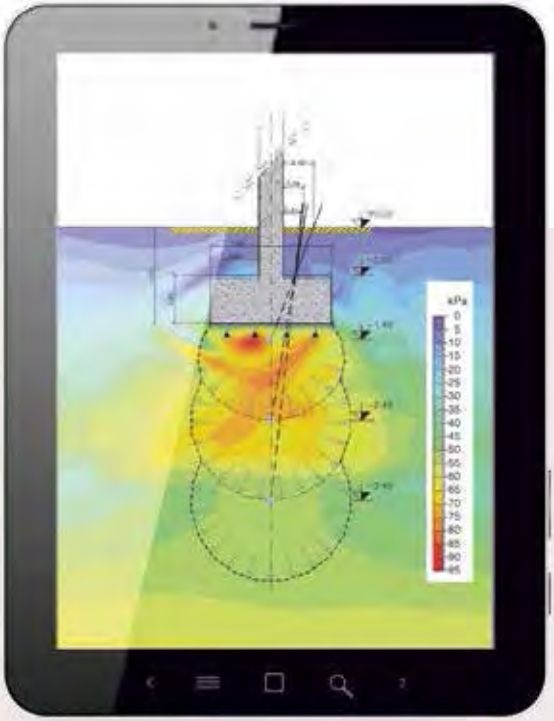
A prerequisite to proposing the ground improvement process is a thorough study of the soil.

A precise understanding of the ground to be treated establishes whether or not the remediation is feasible. On a more practical level, it is used to determine the depth of the treatment and the quantity of geopolymer needed.

Before commencing the drilling work, all the utilities (pipes and cables) passing through the work zone must be identified and located.

During injection, the movements of the structure are monitored continuously using laser measurement systems. The detection of uplift at any time during injection provides real-time confirmation that the treatment has achieved its objective.

The work is conducted from outside the structure and it does not generate any vibration or dust and no excavation or demolition work is performed.



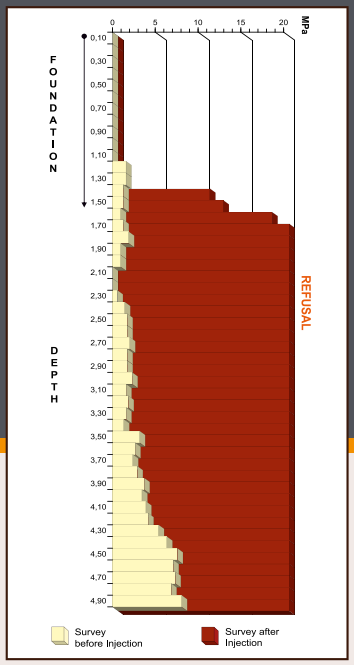
THE BOUSSINESQ PRESSURE BULB

The injections are concentrated in the Boussinesq pressure bulb, i.e. in the volume of ground which bears the loads applied by downward loading from the building.

As it expands, the geopolymer spreads up to 2 metres away from the point of injection. The geopolymer then solidifies quickly, resulting in almost immediate consolidation of the ground.

3 Injection of geopolymer and laser monitoring

4 Verification of the result (dynamic cone penetrometer test)



SOIL IMPROVEMENT TESTS

The test results clearly demonstrate the positive effect of the injection of expanding geopolymer on the deformation behaviour and bearing capacity of the ground studied.

Three types of ground were tested: non-cohesive soil (Leitha limestone) and two cohesive soils, a clayey soil (Tegel) and a loamy soil (Loess).

The tests primarily involved performing plate loading tests and surveying with a penetrometer.

Details of the sensors

The bearing plates fitted with sensors provided useful information about the deformation under load of the various types of soil. This method was effective in enabling us to measure and compare the soil improvement work.

Non-cohesive soils

In non-cohesive soils, the injection of geopolymer achieved a marked reduction in settling. Inspection of the point of injection revealed that the geopolymer completely filled the voids and produced a soil structure with all the characteristics of a conglomerate: i.e. with a very significant improvement in the cohesion.

Cohesive soils

In fine soils, injection again achieved a significant reduction in the settling induced by the loads. The resin penetrates the weak zones and forms a network of strips. This sheet-like structure both significantly reduces the permeability of the soil and increases its compaction.

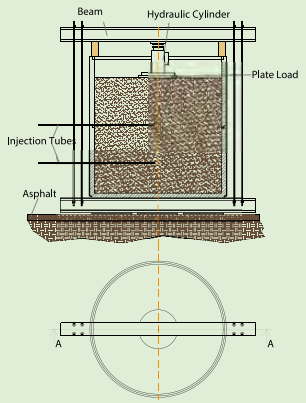
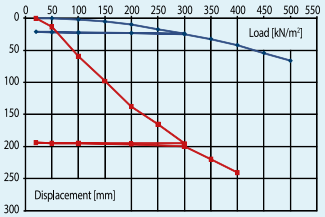
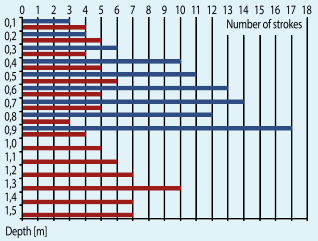
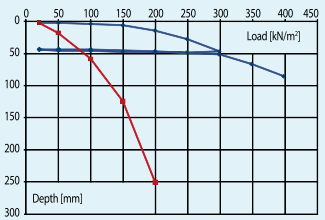
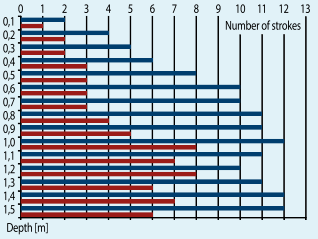
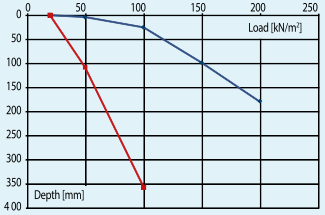
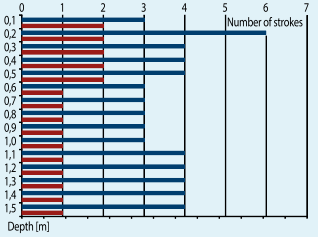
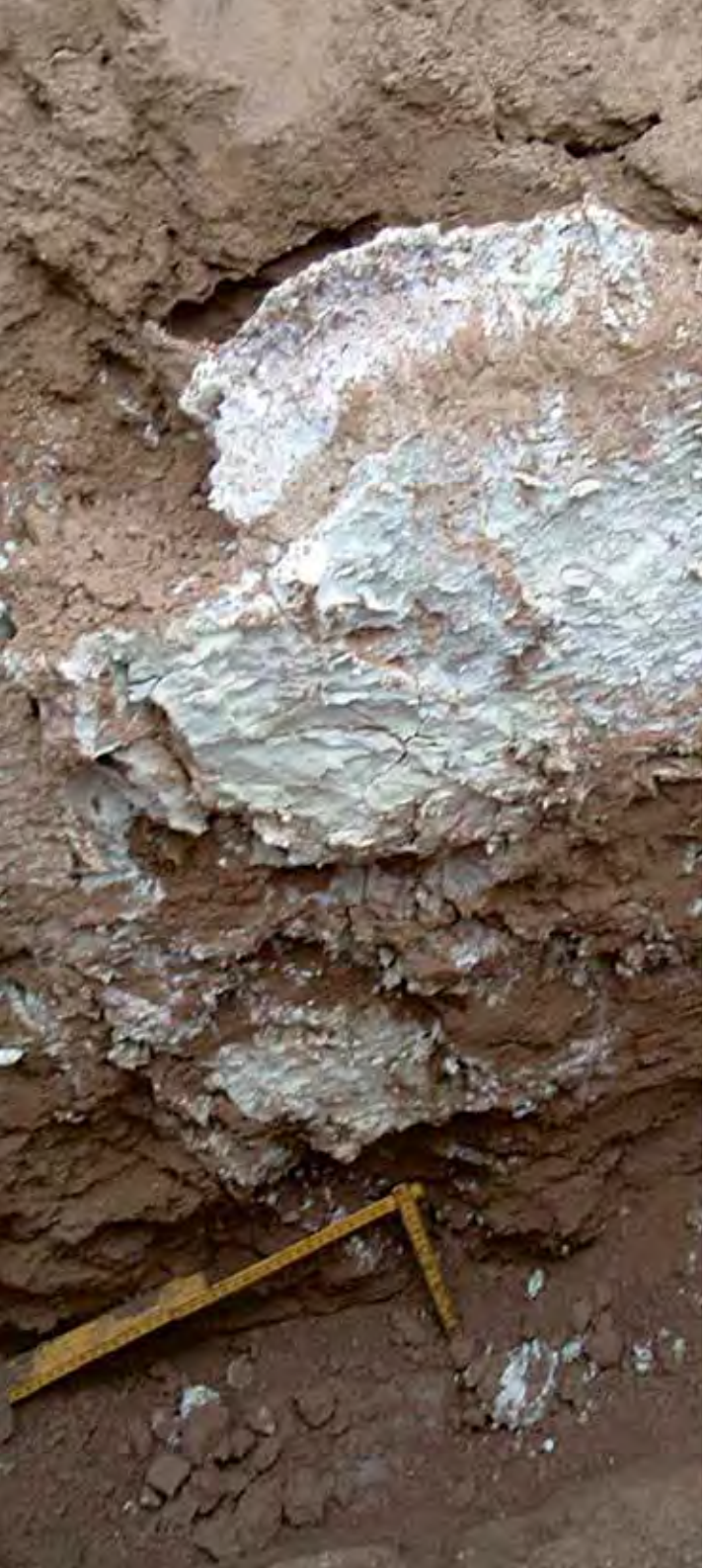


Diagram of the plate loading tests

Type of test ▶	Loads / Displacements	Light dynamic penetromenter
TYPE OF SOIL		
NON-COHESIVE SOILS		
 Gravels		
COHESIVE SOILS		
 Clays		
 Loams		

- With URETEK geopolymer
- Reference ground without geopolymer



THE EFFECT OF THE GEOPOLMER IN CLAY

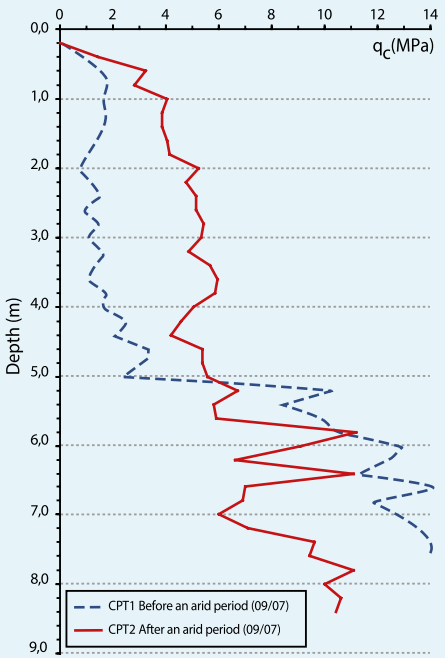
The higher density of the soils compressed by the injection of URETEK expanding geopolymer reduced the probability of large variations in volume occurring in the future. By replacing the water in the soil with a geopolymer, the water content is reduced, and thus there is less chance of settling occurring due to further losses of water.

Treatment with URETEK expanding geopolymer:

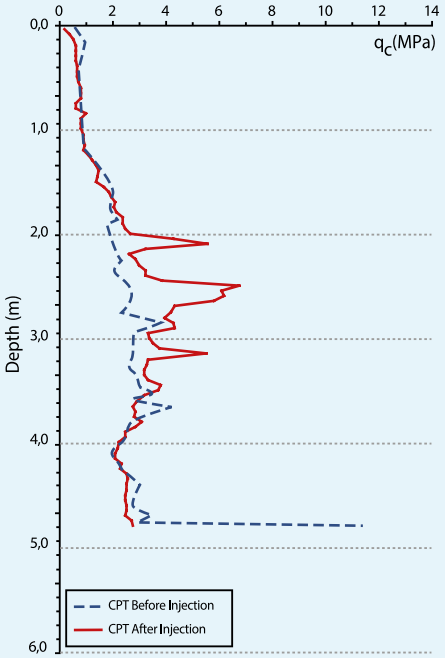
- Increases the soil's dynamic resistance
- Saturates the ground with the geopolymer, which reduces the natural water content (Wnat).

These effects correspond precisely to those observed following periods of very dry weather, with the geopolymer restricting the shrinkage experienced by a clay soil.

Comparison of cone penetrometer tests performed before and after a dry period:



Comparison of cone penetrometer tests performed before and after using the URETEK ground improvement process to inject 20 kg of geopolymer down to 2.8 m:



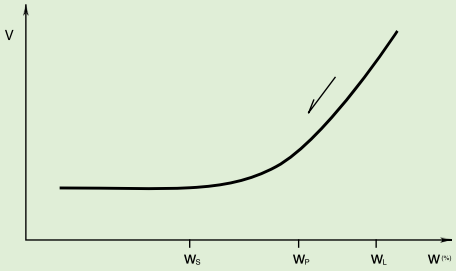
Comment: Diagram 2 shows the effect of a single, one-off injection, 2.80 m deep. In practice, when treating the ground under a foundation, a number of injections are made which have effects over the entirety of the treated height, which combine with the effects of grouped injections.

As part of the study, a calculation method was used to assess the reduction in settling resulting from the RPE treatment: The study considers a private home in Antibes (southern France) which suffered the effects of dry weather (Ip = 39): Since the volume of geopolymer injected into the ground equates approximately to:

$$RV = \frac{Vr}{V} = \frac{40}{1000} = 0.04 = 4.0\%$$

and since the formula used to determine the volume of water replaced by the resin is:

$$w = \frac{Vw}{V} \cdot \frac{\gamma_w}{\gamma_d} = 0.04 \cdot \frac{10}{17} = 0.023 = 2.3\%$$



then this shows that injecting URETEK expanding geopolymer down to a depth of 3.00 m:

The plot of the shrinkage test indicates that the future reduction in settling due to further loss of water is approximately 35mm.

Alberto PASQUETTO, Mattéo GABASSI, Gianluca VINCO, Cristiano GUERRA - Université d'Urbino

GROUND IMPROVEMENT SOLUTIONS

SOIL CONSOLIDATION AND REINFORCEMENT

The ground improvement solution process involves injecting an expanding geopolymer into the ground to improve the soil's mechanical properties. Initially, the geopolymer penetrates the soil by impregnation, with or without fracturing. During a second phase, and as a result of the pressure generated as the geopolymer expands, the product compacts the ground.

The expansion force is sufficient to raise the height of the buildings supported by the remediated soil. Each millimetre of uplift is detected by laser levels. This continuous monitoring ensures that optimal levels of ground remediation is achieved in terms of soil properties. The ground improvement solution process is frequently used when serious damage has been caused by subsidence under the foundations or slab. It is also used to increase the bearing capacity of a soil as part of a renovation project. This technique is well-suited to the stabilization of all kinds of building, regardless of the type of foundation: individual houses, apartment blocks, historic structures, old buildings, churches, factories, roads and railways. Our techniques make it possible to improve almost all soils, even clay soils.

THE WORK INVOLVED

Drilling

Holes as small as 16mm in diameter can be drilled through the foundations to reach the volume of soil to be treated with precision. Tubes are then inserted into the drilled holes to transfer the geopolymer into the ground.

Injecting

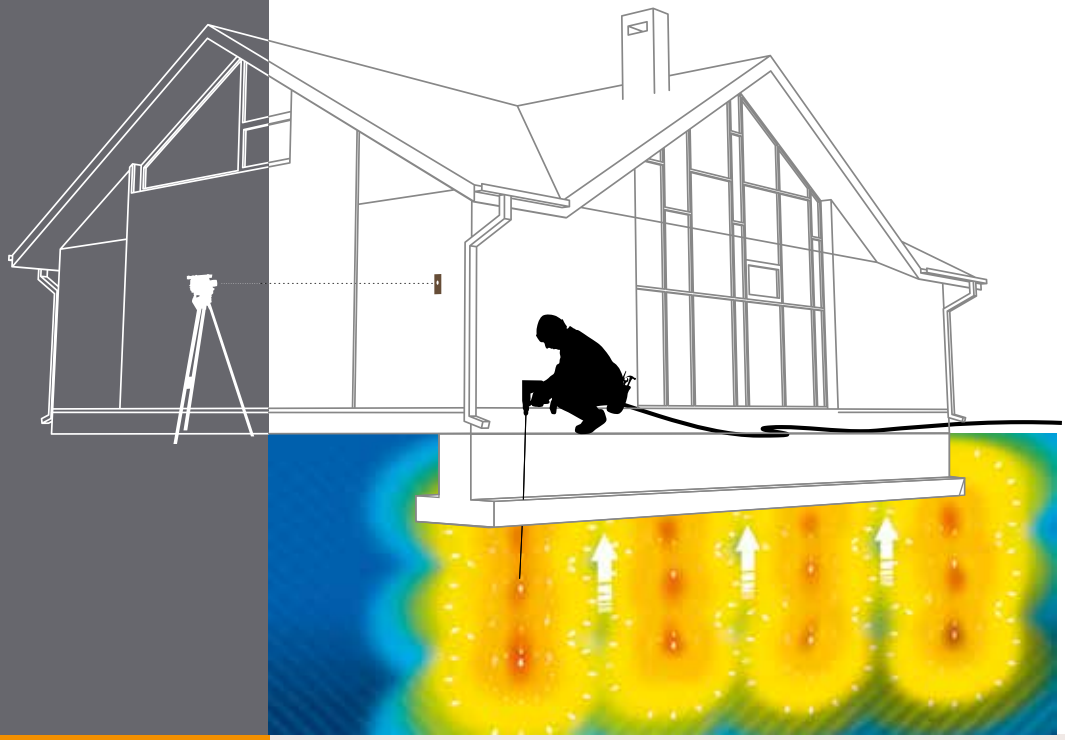
The geopolymer is injected in liquid form. In this state, it penetrates and diffuses through the soil before starting to expand. During the expansion phase, the expansion force generated can be 10,000 kPa or more, depending on the confinement and the loading exerted by the building being stabilized.

Uplift and consolidation

The geopolymer continues to expand until the ground cannot take any further radial compression. The geopolymer then expands in the direction of least resistance - upwards - to lift the building. Laser receivers are installed in the building and detect the first signs of any uplift. If uplift does occur, the injection at this point can be halted since this movement provides evidence that the bearing capacity has increased.

STRENGTHS

- No damage to the structure of the building as the work is limited to drilling and injecting through the foundations
- Option to limit work to specific, localised points
- Minimal vibration
- No excavation work, or support structures
- Quick and immediately effective



TECHNICAL DATA

- Pressure of up to 10 MPa
- Increases the bearing capacity of the soil prior to further renovation using traditional techniques
- Stabilises all types of buildings
- Improves almost all soils, including clay soils.

THIS SOLUTION IS RECOMMENDED:

- For remediation after subsidence under the foundation or slab
- As a preventative measure, when renovating a building on unstable ground.

URETEK

After inventing the technology and filing the patents it has now perfected the execution of the processes.

Individual houses

The URETEK technique is frequently used to stabilize the foundations of private homes. The most common causes of settling are the drying-out of the soil, leaks from pipework and shallow foundations.

Period properties

The ground improvement process is well suited to the ground under old buildings. No excavation or demolition work is required. Since grade beams don't have to be laid, the cost of stabilising using this technique is less than traditional solutions.

Apartment blocks

The force exerted by the expanding geopolymer is sufficient to stabilize apartment blocks a few floors high. The occupants do not generally have to move out while the work is under way. The remediation is often carried out externally or via the basement. The stabilization of load-bearing walls is straightforward.

Infrastructure

URETEK ground improvement solutions can be used to increase the bearing capacity of soils in various types of infrastructure. It works ideally to treat subsidence, for example under rigid or flexible pavements, and is often chosen over traditional methods because of its minimal disruption and longevity under dynamic loading.

STABILIZATION SOLUTIONS

STABILIZE GROUND

Our ground, earth and soil stabilization solution is a specifically controlled process whereby resin is injected into the ground to prevent movement, whilst not raising any of the existing slabs or structures.

We achieve this precision control through the specific selection of slow expanding resins depending on the ground type and we set up multiple monitoring systems to ensure we achieve no more than 250 microns of resistance on the concrete slab. Fundamentally, this precision measures a lateral lift too small for the eye to see, which indicates the ground beneath has been stabilized.

The stabilization process has resins injected at points beneath a slab, pad or foundation where it expands to fill any voids in underlying soils and compact any existing made ground.

This method is widely used on the UK road and rail network, together with airports. Where an asphalt surface is cracking or potholes appear, the cause is typically ground movement beneath, URETEK injects resins under the concrete to prevent any further movement. This process is used before a new surface layer is applied to a road or airfield.

In the rail sector URETEK is the fastest method to treat track beds where underlying ground movement is reducing line speed. We inject beneath the slab to ensure the sub-base is fully stabilized, we verify this using Network Rail monitoring and the line can be returned to full operation use.

The benefits of our stabilization process:

■ Preventing slab rocking ■ Preventing surface failure ■ Preventing lateral movement of rail

WORK PHASES

Once the area to be treated has a works programme agreed, our teams identify underground pipes and cables and the position of gas mains, electricity cables, drains, etc. is determined.

Drilling

The holes are generally drilled with 6-12 mm diameter at depths depending on slab size or amount of weak ground

Insertion of the injection tubes

The tubes are placed in each drilled hole to the required depths, we treat at multiple depths where necessary.

Injection

URETEK geopolymer components are mixed on site as a part of the injection process, the chemical reaction takes place underground at varying speeds depending on ground type and the material we use.

Stabilization

The geopolymer penetrates the voids under the asset and compacts the bearing layer. stabilization is controlled through laser monitoring and post process measurement.

PROCESS OVERVIEW

The geopolymer is injected in liquid form. In this form, it is able to penetrate all the voids under the assets before transforming firstly into a gel and then into a solid.

The chemical reaction causes the geopolymer to expand. It is not the pressure applied during injection which stabilises the ground, it is the expansion pressure generated by the polymerisation (or curing) of the geopolymer and the hardening of the material within the soils or made ground.

TECHNICAL DATA

- Maximum expansion pressure: 10 MPa
- Geopolymer density: varies from 45 to 120 kg/m³ (occasionally higher)
- Uplift: up to 30 cm
- Expansion capacity of the geopolymer: up to 30 times the initial volume (depending on containment)
- Various geopolymers can be injected in wet conditions

THIS SOLUTION IS RECOMMENDED:

- For stabilising ground beneath roads and rail
- Preventive treatments, e.g. when renovating buildings standing on unstable ground
- Stabilising rocking slab problems

STRENGTHS

- Fast, localised teams to prevent disruption to normal operations
- No excavation work, or support structures required
- The asset or facility can be brought back into use within 30 minutes.

Rail

The URETEK solution is applied beneath rail slab track to provide a solid footing and prevent movement. Lateral movement can be completely prevented by injecting resin in very short possession times, meaning line speeds restrictions can be removed.

Airports

URETEK re-level major airport runway and taxiways and slabs around ports, the fast overnight works mean normal operation is not affected and the surfaces can be used in hours.

Commercial and industrial premises

The stabilization process causes almost no disruption. The work is completed quickly and generally with 'business as usual'. It offers the perfect solution for stabilising slabs.

Roads

The key benefit of URETEK is extending asset life. Our solutions future proof roads against degradation of the surface as a result of the weakened ground beneath. The long-term cost benefit of future proofing a surface can run into millions of pounds.

RE-LEVELLING SOLUTIONS

UPLIFTING SLABS

Injecting expanding geopolymer under floor slabs

The re-levelling process stabilises and raises sunken slabs. Our geopolymer is injected into the bearing layer under the slab. During the hardening phase, as the geopolymer expands it consolidate the bearing layer before raising the level of the slab.

This uplift, which may be as much as several centimetres, is monitored continuously using laser levels. The re-levelling process can be used in residential properties to remediate sunken slabs. In industrial facilities, the re-levelling process can resolve several problems:

- Lifting sunken floor slabs
- Ensuring continuity of business operations
- Neutralising slab rocking phenomena.

The work may be consolidated by the additional injection of geopolymer at depth, in accordance with the ground improvement process.

WORK PHASES

Identification of underground pipes and cables. The position of gas mains, electricity cables, drains, etc. is determined.

Drilling
The holes are generally drilled with 6-12 mm diameter bit.

Insertion of the injection tubes
Placed in each drilled hole, the URETEK expanding geopolymer is injected through these tubes.

Injection
URETEK geopolymer components are mixed on site as a part of the injection process.

Lifting
The geopolymer penetrates the space under the slab and compacts the bearing layer. The uplift is controlled so that only those zones which need to be lifted are lifted.

Laser monitoring
A laser level system is used to monitor, continuously and precisely, the uplift produced.

PROCESS OVERVIEW

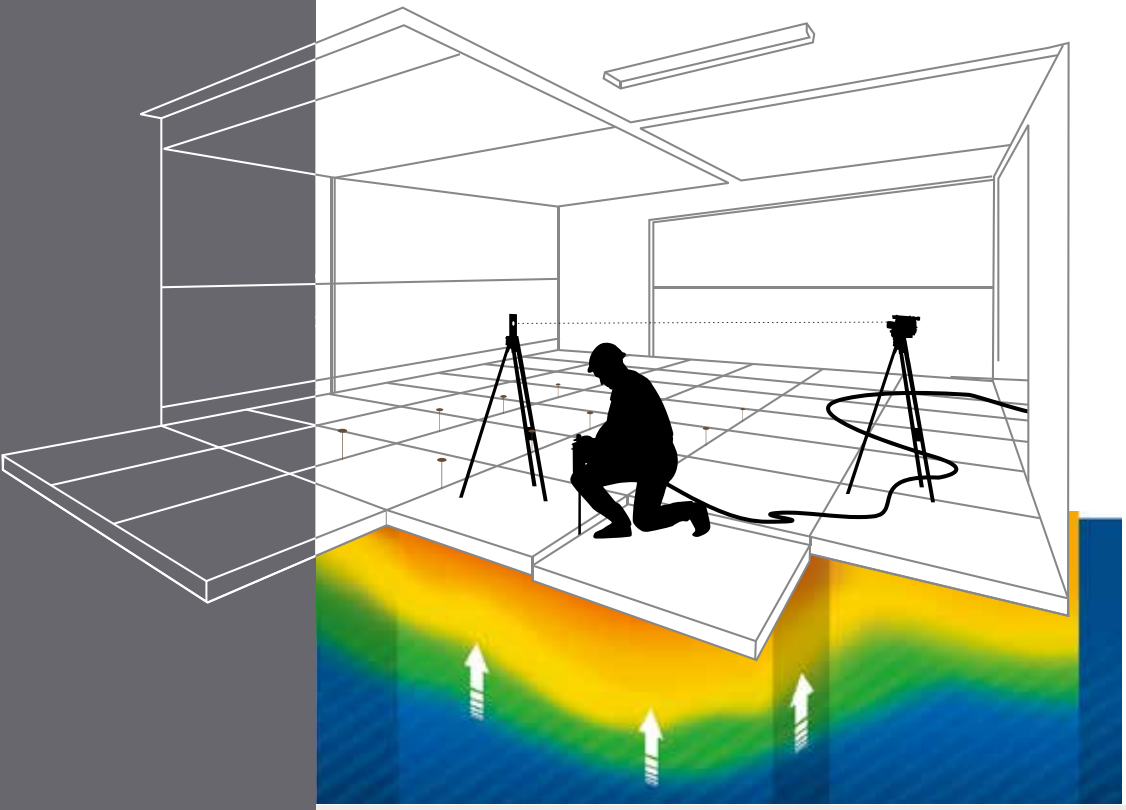
The geopolymer is injected in liquid form. In this form, it is able to penetrate all the voids under the slab before transforming firstly into a gel and then into a solid.

The chemical reaction causes the geopolymer to expand. It is not the pressure applied during injection which creates the uplift, it is the expansion pressure generated by the polymerisation (or curing) of the geopolymer.
This pressure is capable of lifting very heavy items such as machines or loaded storage racks.

The geopolymer is NOT biodegradable and will last for decades.

STRENGTHS

- Effective compaction of the bearing layer
- Slab can be lifted by a few millimetres… or even a few tens of centimetres
- Laser level monitoring systems ensure millimetric lifting precision.
- No disruption to commercial or industrial activity
- Clean and dust-free
- Work is completed very quickly



TECHNICAL DATA

- Maximum expansion pressure: 10 MPa
- Geopolymer density: varies from 45 to 120 kg/m³ (occasionally higher)
- Uplift: up to 30 cm
- Expansion capacity of the geopolymer: up to 30 times the initial volume (depending on containment)
- Various geopolymers can be injected in wet conditions

THIS SOLUTION IS RECOMMENDED:

- Re-levelling sunken floors, roads, walkways, etc.
- Preventive treatments, e.g. when renovating buildings standing on unstable ground
- Stabilising rocking slab problems

Airports, Ports

URETEK re-level major airport runway and taxiways and slabs around ports, the fast overnight works mean normal operation is not affected and the surfaces can be used in hours.

Facilities open to the general public

The work does not require any demolition and does not endanger public safety. The treated buildings do not have to be closed, and in general the facility can continue to be used normally.

Commercial and industrial premises

The re-levelling process causes almost no disruption. The work is completed quickly and generally with “business as usual”. It offers the perfect solution for slab rocking problems.

Roads, walkways, pedestrian zones

The process can be used to stabilize roads and transfer slabs. The geopolymer’s very fast hardening time means that the structure can be opened to traffic almost immediately.

STRUCTURAL SUPPORT SOLUTIONS

SOIL CONSOLIDATION AND REINFORCEMENT

A unique patented ground stabilization technology, PowerPile geopolymer pillar is suitable for treating subsidence and strengthening very weak ground. Narrow diameter pillars typically incorporating a casing are inserted underground via small, typically about 50mm, drill holes. A highly expansive geopolymer is injected inside a geotextile capsule creating a pillar of up to 340mm in diameter, which hardens almost immediately. PowerPile eliminates the need for costly and disruptive traditional underpinning/piling, resulting in minimal mess and disruption.

Usually PowerPile geopolymer pillars are installed directly below foundations, but if needed they can be used to support soil below the foundations. There is no need for additional load transfer structures. Conditions on different sites of course vary but the normal installation speed is 5 – 10 pillars a day. The installation site causes little if no disturbance in the surrounding area. PowerPile installation does not require excavation and so produces no waste. The silent installation process is clean and fast.

All equipment needed for PowerPile installation is delivered to the site in one vehicle designed for this purpose. Installation is performed by a team of two technicians.

The actual installation device moves on rubber tires as easily as a hand truck and only one technician is required to move the pillar elements. The longest elements available are 6 meters in length.

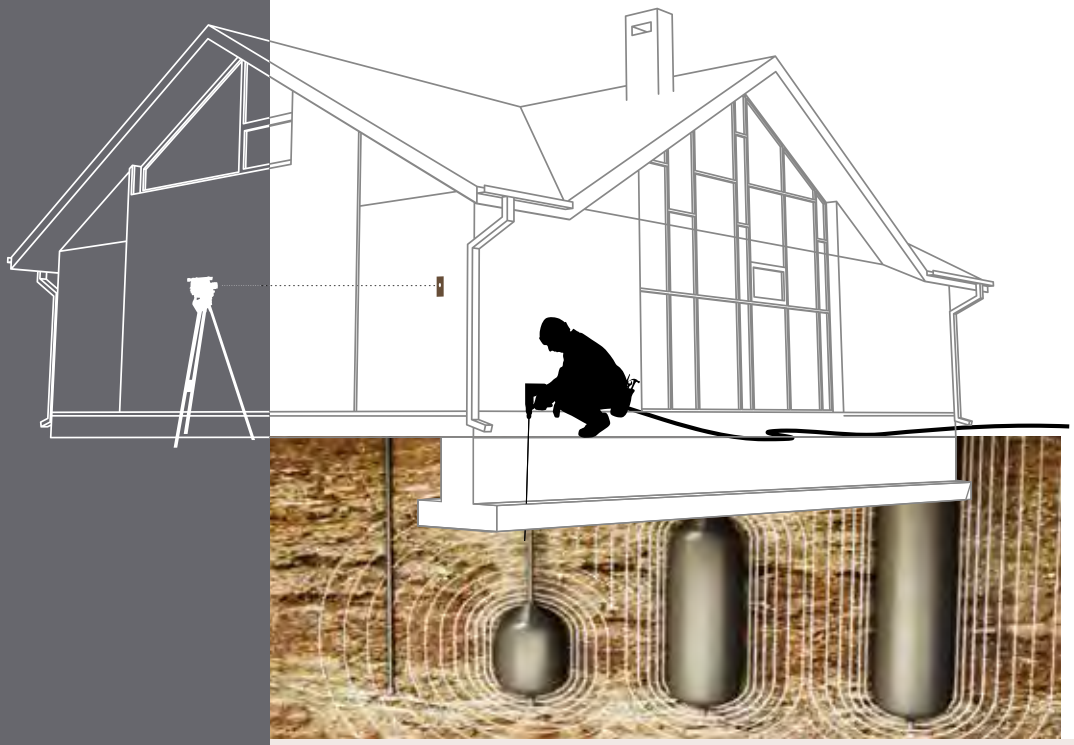
Described briefly, the installed PowerPile is a geotextile capsule, which is filled with chemically expanding geopolymer. With high density geopolymers, compressive strength can be up to 15 MPa. The material used in the process is selected based on the geotechnical information and the amount is controlled by a computer.

Because the geotextile capsule is filled with expanding geopolymer from bottom to top, the surrounding soil compacts and is partially displaced. The material hardens fast and the new composite structure is supportive immediately.

The shape of the pillar usually depends on the form of the surrounding soil and density fluctuations inside the pillar.

STRENGTHS

- A minimally disruptive solution
- The installation site causes little or no disturbance to the surrounding area
- Silent installation process is clean and fast
- No hydraulic pressure is needed, as the expansion forces are generated by chemical reaction.



TECHNICAL DATA

- Compressive strength uo to 15 MPa
- Gives support to all types of buildings
- E-modulus: 10.0 MPa - 80 MPa
- Improves almost all soils, including clay soils.

THIS SOLUTION IS RECOMMENDED:

- Treating subsidence and strengthening very weak ground
- Suitable for remedial treatment

Individual houses

The structural support solution is frequently used to stabilize the foundations of private homes. The most common causes of settling are the drying-out of the soil, leaks from pipework and shallow foundations.

Industrial Buildings

The structural support solution is well suited to supporting the structures of industrial buildings. No excavation or demolition work is required. Therefore the business can keep running and there is no need to shut down production.

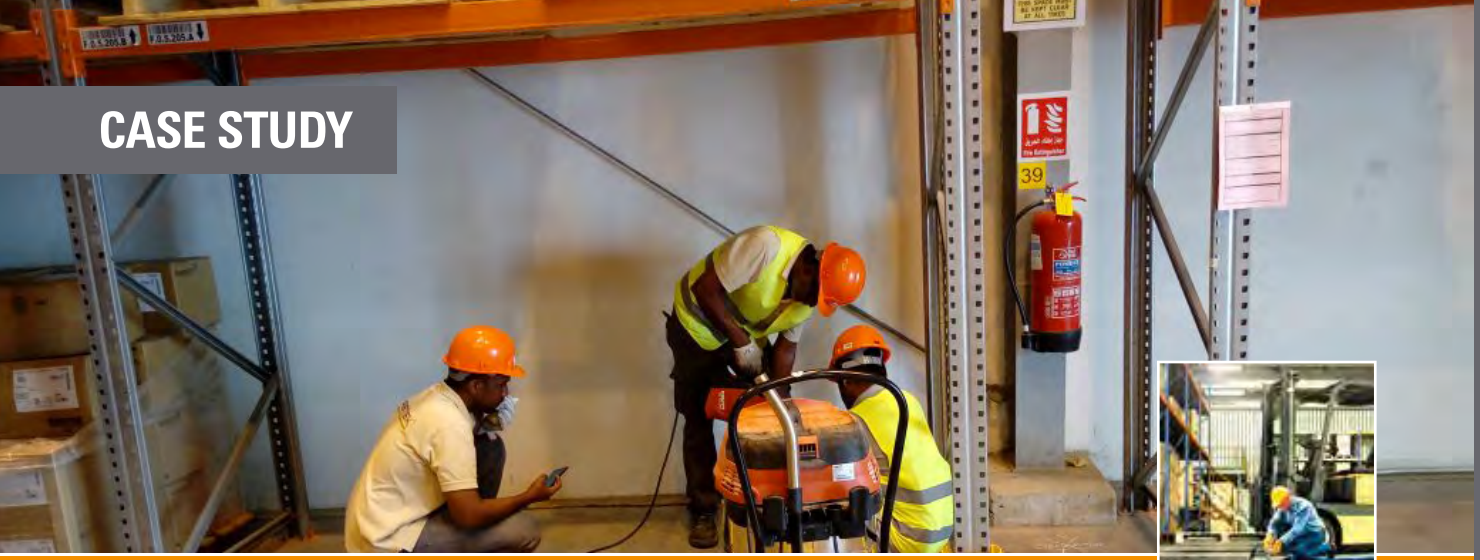
Infrastructure

In different types of infrastructure such as highways, railways and ports the structural support solution is ideal. As in most cases it is impossible to close highways, railways and ports from traffic.

Historic structures

The technique is suitable for old and relatively weak buildings such as historic structures. The cost of supporting historic structures is very competitive compared with traditional techniques.

CASE STUDY

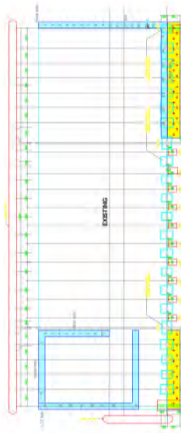


YANBU / KSA

WAREHOUSE

Duration: 30 days

RE-LEVELLING RESULTED IN COST SAVING FOR THE CLIENT



Technical drawing

REASONS TO CHOOSE URETEK

A perfect solution for rocking slabs, with no disruption to business operations.

SUMMARY

Settlement problems meant that two large warehouse slab needed re-levelling so that the business could continue to run safely.

OBJECTIVES

When fill material under the floor of two large warehouses belonging to delmon products ltd in *Yanbu KSA* proved inadequate to support high mobile racking, site operations were seriously affected. URETEK were called in as the fastest and most cost effective solution.

URETEK specializes in geopolymer injection processes which allowed restoration of settled warehouse and factory flooring to level without excavations. The lack of disruption usually means that facilities can continue in commercial use while repairs are carried out. Expanding geopolymer resins are injected through 15- 20 mm diameter holes drilled through the floor slab. The material immediately expands aggressively to fill voids, and further injection can then be carried out to provide upward expansion, to gently lift flooring back to level. The degree of lift is precisely controlled by laser level monitoring.

"Replacing a warehouse floor slab is incredibly expensive anyway, but this would have been double the cost because of having to include a new set of rails for the racking, which was incorporated into the slab."
Eng.Maged Mamdouh (Projects Associates Manager at Delmon products Ltd.)

"If we hadn't used geopolymer injection, the warehouse would have had to have all the mobile racking dismantled and taken away. I could imagine there would have been four months or more for each of the warehouses to be without storage facilities in half their areas, which wouldn't have been acceptable."

TECHNOLOGY APPLIED

URETEK teams first tackled 'hot spots' in the flooring, to enable the racking system to work on a temporary basis.

This provided enough time to plan for a wholesale lifting of two sections of the warehouse floors to achieve a very tight tolerance across any diagonal in any particular bank of racks.

The URETEK team took about 30 days in total for the complete work, but were able to move from section to section leaving the rest of the warehouse operating normally. Dealing with each particular bank of racking only took about 6 days.

URETEK were able to hit the target figures within a millimetre, which put the warehouse back within the required tolerance for the racking.

OUTCOME

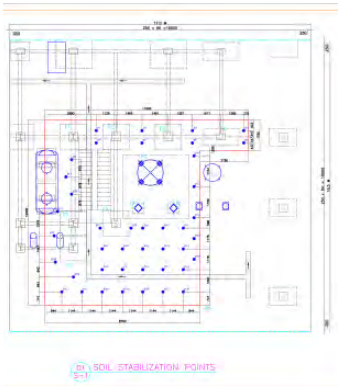
CASE STUDY

PRODUCTION PLANT
YANBU /KSA

INDUSTRIAL

Duration: 4 weeks

URETEK ENABLED CONTINUED CHEMICAL PRODUCTION BY RE-LEVELLING SENSITIVE TANK



Technical drawing

REASONS TO CHOOSE URETEK

A fast solution delivered without interruption to the client's business activites

SUMMARY

Settlement in foundations and ground slabs were observed and reported to Uretek. after a site visit Uretek technicians found that the settlement took place due to the differentiation of soil types (Pockets) at a depth of (3 : 7.5 m) and water seepages from production plant caused washing off the fine material from the bottom of the isolated footings as well as the ground slabs which resulted in cavitation.
The ground slab of affected area needed to have soil stabilization at a depth of (3 to 4 m) and slab lifting of sunken areas.

Moreover, the selected isolated footings required soil stabilization at (deeper levels -6.00 m to -7.50 m) in order to carry the imposed load of structure.

TECHNOLOGY APPLIED

Soil stabilization and Relevelling
This application applied to the whole slab area in intervals of 1.5 meters with 190 points to stabilize the soil at -3.00 from slab on grade.After that Uretek technicians used the same tubes (used for stabilization) to uplift the sunken areas (slab on grade) to restore its floor to the targeted levels. **Deep injection treatment for foundations (Stabilization & Uplifting)** applied down to a depth of (-3: -6 m) beneath the isolated footings carrying the steel structure.

OUTCOME

Affected area (slab and foundations) stablized and uplifted succesfully to its preoccupancy level

The sensitive chemical tank needed to be stabilized with out closing down the plant.

Cristal plant
Yanbu- KSA

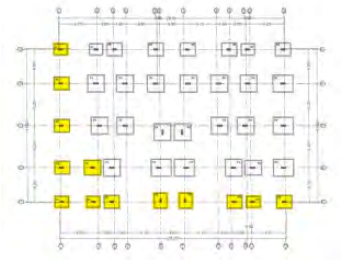
CASE STUDY

JUBAIL/KSA

APARTMENT BUILDINGS

Treated zone: 4 BUILDINGS

FOUR APARTMENT BUILDINGS CAME TO LIFE AFTER BEING STABILIZED BY URETEK



Technical drawing (Prototype layout)

SUMMARY

URETEK was contacted by the owner of the buildings. Uretek technical team visited the site and found settlement in some building areas along with many diaogonal cracks which represents the weak soil beneath the foundations. Uretek then selected the right method for the case by doing the preliminary soil test (DCPT) which indicated the weak soil layers up to 6 meters.

OBJECTIVES

To fill any voids beneath the foundations, strengthen the soil in order to increase its bearing capacity to counter force the imposed loads.

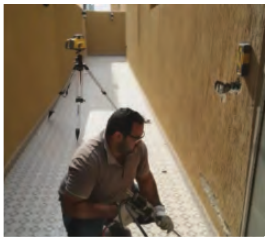
TECHNOLOGY APPLIED

Following a site visit, a programme of work was designed that would take URETEK one month to deliver. Ground improvement solutions were applied whereby the team on site could inject expansive geopolymer below the foundations to fill any voids and stabilize the existing fill area. The technical teams methodically injected at calculated points underneath the footing and used laser monitoring to control the stabilization process.

OUTCOME

We completed the programme of work on time, stabilizing the structure and ensuring its liveable for decades to come.

URETEK team with mobile workshops arrived on site



Laser measurement system was fitted to provide continuous monitoring of the work

DCPT done the after geopolymer injections to make sure the results are upto Uretek standards.

REASONS TO CHOOSE URETEK

The earlier the remediation is done, the less damage will be caused by subsidence - resulting in direct cost savings.

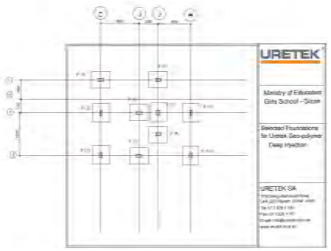
CASE STUDY

GIZAN/KSA

FOUNDATION STABILIZATION

Duration: 15 days

FOUNDATIONS OF SCHOOL BUILDING STABILIZED BY URETEK GEOPOLYMER INJECTION



Selected Foundations for rehabilitation

THE PROBLEM

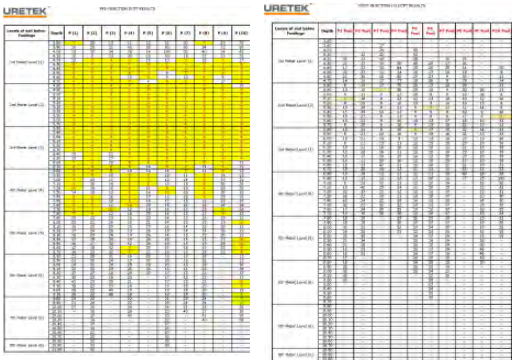
Engineers from Ministry of education of Gizan region approached Uretek for one of their schools. Uretek technical team visited the site and found cracks in the walls which indicated problem in no. of school isolated footings. The cause of this problem resulted from excessive water seepages which made foundations unable to bear the load of the structure.

Uretek identified 10 critical foundations which needed immediate treatment. Uretek technicians conducted the pre injection DCPT (Dynamic Cone Penetration Test) to identify the weak soil layers and according to the results those weak layers were upto 7 meters. Test revealed that there was significant amount of moisture in the lower layers.

THE SOLUTION

URETEK desgined the injection pattern for the selected foundations and selected the specialized hydro-insensitive geopolymer as per the soil type. Holes were drilled through the foundation to inject the Geo-polymer right beneath the foundation down to a depth of 7 meters. The injection process was designed in a way that it first made a base beneath the foundations and then stablized the soil. Geo-Polymer injection then strenghtened the soil to bear the load of the existing structure.

Uretek Geopolymer
Deep Injection up to 7 meters



BEFORE AFTER

Bearing capacity Test Results

REASONS TO CHOOSE URETEK

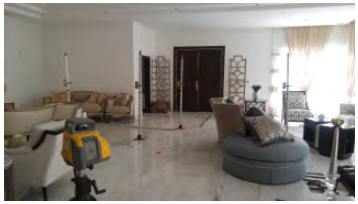
URETEK expanding geopolymer is suitable for all types of soil: sand, silt, clay etc.

CASE STUDY

RIYADH/KSA

RESIDENTIAL VILLA Treated zone: 200 m^2

STABILIZED FLOOR SLABS AND RAISED TO DESIRED LEVEL



Laser device set up for continous monitoring of uplifting

SUMMARY

Client approached Uretek SA to address the issue of his subsided floor. There was a floor settlement of 40 mm (average) in an area of 200 m^2. The challenge was client did not want to puncture the unique marble of the lounge, and Uretek Sa accepted the challenge and treated the problem from basement retaining wall . URETEK achieved the customer satisfaction by uplifting the slab to the preoccupancy level and handed over the site without any destruction.

OBJECTIVES

To stabilize floor slabs and relevel.

REASONS TO CHOOSE URETEK

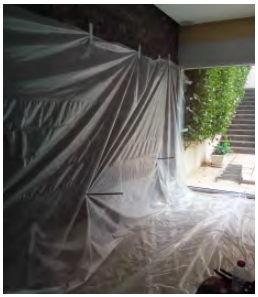
URETEK expansive geopolymer is the fast and non-disruptive solution for residential villas.

TECHNOLOGY APPLIED

URETEK's geopolymer inejction process was applied to the 200 square metres of slab and uplifted to its desired level.

OUTCOME

Within a week period, 200 square metres of slabs were stabilized and lifted to tolerances of +/- 3 mm with no disruption to the house.



Preparation for injection

AFTER URETEK treatment

Void filling

Zero Harm Water Sealing

Ground Improvement

Customer First

Structural Support

Re-levelling Growth

Professionalism

Stabilization

URETEK®

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