



# Uretek Ground Engineering



# WORLD-WIDE LEADERS IN GROUND ENGINEERING



*For some 30 years URETEK has led the world in developing and offering the most advanced and accurate systems of geo-polymeric injection techniques for ground engineering.*

*In Australia we have been part of URETEK Worldwide since 1995 and in New Zealand since 2001. We have also operated wholly owned subsidiaries in Thailand and Japan since 2001.*

*We have successfully treated over 10,000 sites, varying from small domestic applications to large commercial, industrial, civil and mining projects. Worldwide, URETEK has completed tens of thousands of projects.*

*All URETEK works are planned, supervised and executed by our own experienced personnel. Our business is not franchised and we do not sub-contract. We guarantee our products.*

*Philip Mack, CEO, URETEK Ground Engineering*



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AUSTRALIA: The Mainmark Corporation Pty Ltd, ATF The Mainmark-URETEK Trust, ABN 27 719 024 122, trades as URETEK Ground Engineering and operates with these Building Contractor Licences: NSW: 41231 ACT: 200413804

QLD: Licensee: PCT Mack QBSA Act Licence No: 80949 VIC: CB-L 529 & DB-L 1551 TAS: CC 4676 P NT: LH. BPD. 0024084 SA: BLD 170715

NEW ZEALAND: Uretek Ground Engineering (NZ) Limited, Co. No. 2186481.

## CONTENTS

Advanced Ground Engineering Technology..	4
Lifting, Levelling and Re-supporting .....	6
Deep-Injection.....	7
PowerPile Polymer Pillars.....	8
Re-levelling Homes.....	10
Driveways and Parking Areas.....	12
Floors and Buildings Re-levelled.....	14
Factory and Warehouse Applications.....	15
Airport Applications .....	16
Pavement Rehabilitation.....	18
Culverts and Other Infrastructure.....	20
Seaport Facilities.....	21
Mining Industry Applications.....	22
Heritage Buildings & Sporting Facilities.....	24
Railway Applications.....	26
Leak Sealing & Other Applications.....	28
Technical Data.....	29

### URETEK offers Many Benefits:

- URETEK is fast! Most jobs take a day or two.
- No excavation. Constant structural support.
- Treated areas may be used again in minutes.
- No mess. Clean structural resin injection.
- No water or moisture. Little noise.



- Minimal disruption. Usually no need to vacate,
- nor move furniture – or machinery & shelving.
- Fast. Cost-effective. Permanent.

#### BRANZ APPRAISAL

The Building Research Association of New Zealand has appraised the suitability of URETEK for the raising, re-levelling and re-support of on-ground structures.



DISCLAIMER: This publication depicts and describes results we have typically and repetitively achieved for many years. However site conditions vary. Only our written quotation will describe your particular project.

- We do NOT offer our services as consulting engineers.



In essence The URETEK Method is like keyhole surgery. It's the answer to the drawbacks of traditional underpinning and pressure grouting.



# URETEK: ADVANCED GROUND ENGINEERING TECHNOLOGY

Technology for raising, re-levelling, re-supporting and strengthening moving and sunken construction resting on or in the ground. Applications include buildings and other structures, concrete floors and pavements, in residential, commercial, industrial and civil environments.

## Uretek Slab-Lifting (USL)

Raising and re-levelling, carried out by injecting expanding geo-polymeric structural resins under the element to be raised, through holes the size of the old one cent coin.

## Uretek Deep-Injection (UDI)

Improved ground bearing capacity is achieved by this patented technology that compacts and densifies foundation soils, again by similar injection through tiny holes but down to multiple depths in weak strata.

## Uretek Geoplus

The patented UDI resin formulation, brings to bear controlled forces of up to 10,000 kPa.

## Uretek PowerPile (UPP)

Patented and initially offered as UPP Compaction, prefabricated elements are inserted through 36 mm Ø holes and expand up to 350 mm, replacing soil whilst concentrating soil densification in a very defined volume. Structural versions of UPP's are to provide more pile-like support with skin friction and end bearing characteristics.

## Uretek Liquefaction Mitigation

In regions prone to earthquake, patented injection is available to alter the characteristics of non-cohesive foundations at depth, to limit the risk of liquefaction and resulting catastrophic collapse.

## Uretek Stitch-in-Time

Patented process for restoring load transfer to jointed, cracked or otherwise damaged concrete highways, roads, taxiways & runways. This system is

far superior to conventional steel dowel-bar retrofitting, in terms of cost, performance and time.

## Uretek Hyper-Optics

Non-invasive inspection and analytical technology which finds and maps voids under pavements.

## Uretek Polymer Pile system

This patented system involves the creation of an insitu polymer/aggregate pile that cures instantly to act like a friction pile.

## Resources

Sharing the results of scientific testing and continual practical experiences worldwide, URETEK in each country provides practical remediation solutions to a wide range of problems. We encourage the involvement of our client's engineer as consultant or works superintendent.

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## Environmental and Sustainable Technology

All URETEK components are completely machine pre-mixed before injection. The result is an inert material that is non-toxic, has an indefinite life span and can not leach out into the environment. There is nothing to run into drains during or after installation – and no solvents. URETEK is clean, quiet and is used in hospitals and nursing homes as well as by the food industry.

URETEK materials & processes have a low carbon footprint. Expansive resins greatly reduce material consumption compared to alternative methods, substantially cutting down on production & transportation emissions. Our efficient processes involve no demolition, excavation or heavy machinery & create no waste; repairing not replacing; restoring not rebuilding.

Bio-resins made from sustainable resources are available on request.

40 tonnes of glass remained in place and normal work continued as URETEK raised and re-supported this floor.



# URETEK LIFTING, RE-LEVELLING AND RE-SUPPORTING



Small holes are drilled through the slab.



Multi-component, structural resin is injected. It expands immediately, filling any voids and compacting the substrate.



After re-supporting the slab, continued injection raises it, guided by laser level.

The unique URETEK Method used to raise concrete floors, roads and even whole buildings, we call Slab-Lifting because that was its first area of application back in 1983. It is fast and economical and causes minimal inconvenience to our clients' normal activities.

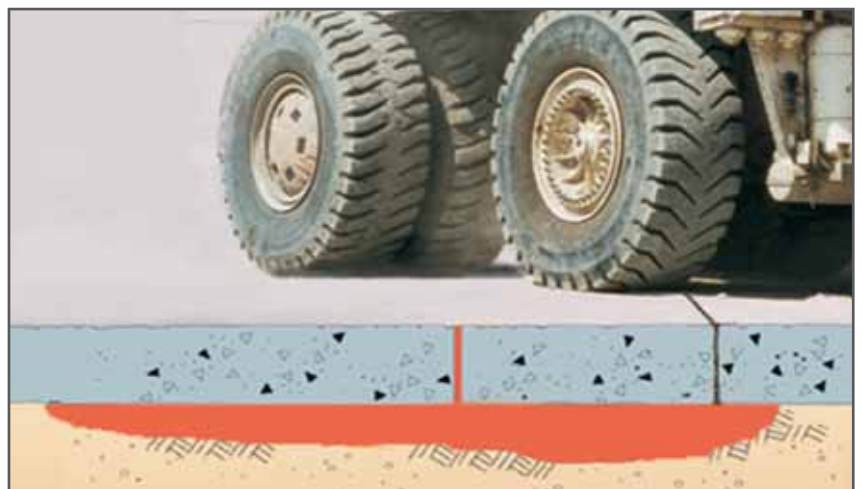
Experienced technicians inject the appropriate URETEK resins through tiny pattern-drilled holes, immediately below the slab or footing. The components are precisely machine-mixed and chemically expand almost immediately, exerting a mould pressure that fills voids encountered, re-establishing or confirming structural support. They cure, again almost immediately, to a strong stable and long lasting material that is immediately trafficable and environmentally neutral.

Sub-grade compaction has been found to occur contemporaneously down to 500 mm in weak ground. Continued injection allows



lifting to fractional tolerances. The spread of material is controlled, whilst the rate of lift is a gentle, precise operation. Movement is carefully monitored by laser and computer level. Results are immediate and permanent.

With a mould pressure of up to 400 kPa, (40 tonnes per square metre), it is usual to lift floors - and entire buildings - with shelving and machinery in place, resulting in huge savings in both time and money.



Less than 30 minutes later the area is completely trafficable again!

# DEEP-INJECTION TO INCREASE GROUND SUPPORT

For over 12 years, the fast and cost-effective alternative to piling and underpinning. Patented URETEK Deep-Injection has strengthened ground bearing capacity by up to 500%.

Foundation soils are improved continuously down to considerable depths – or at just one specific depth – by injection of a controlled quantity of URETEK’s expanding UDI resin, through small diameter injection tubes that are installed to predetermined depths.

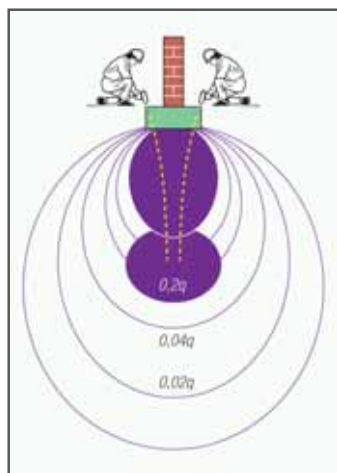
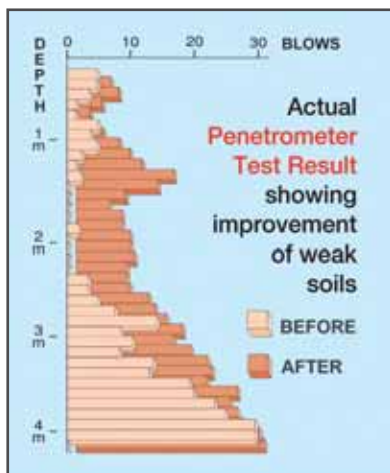
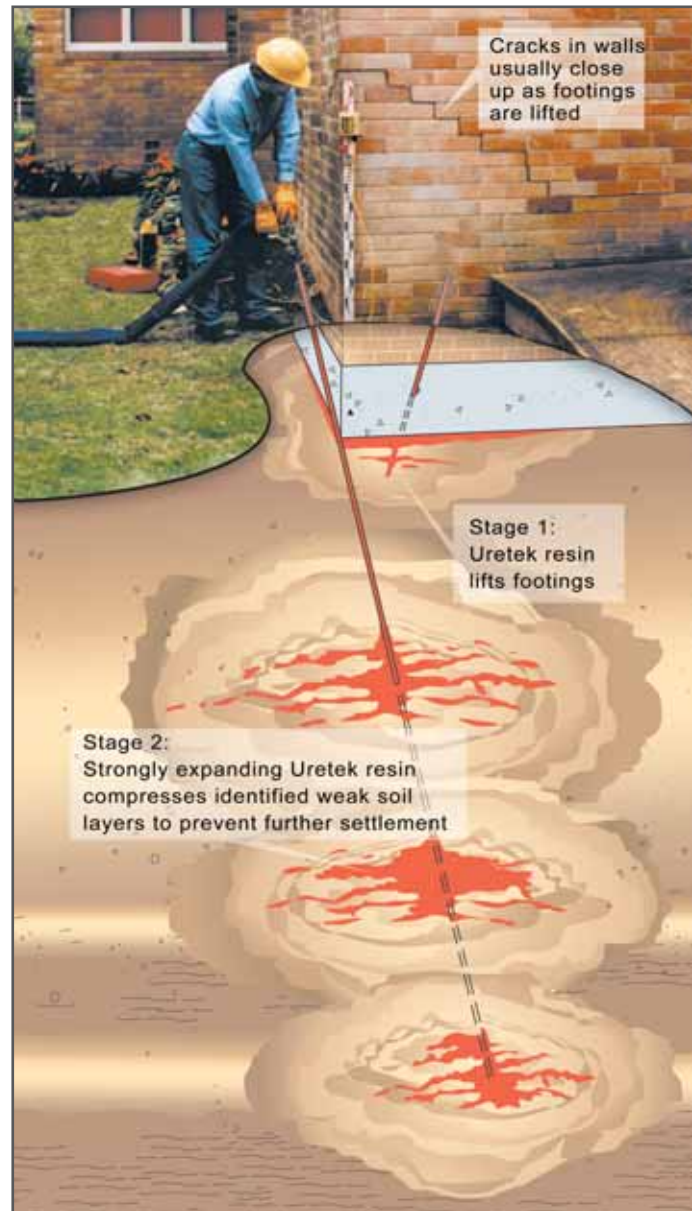
The expanding resin force first compresses the surrounding soil until it can no longer be resisted by the counter-force of the entire structure and soil mass above and the friction angle of the soil.

At the precise moment the structure begins to lift, monitored by laser, injection is halted, leaving a foundation with a considerable factor of safety. Alternatively it can be continued and the structure lifted and re-levelled as required.

The properties of URETEK Geoplus UDI resin, that offers controlled forces of up to 10,000 kPa, are essential to the procedure.

## Penetrometer Testing

Investigation by the client’s geotechnical engineer can predetermine ground suitability, weak stratum and injection depths for UDI. Alternatively our advanced hand-portable penetrometers may be used to establish the weaker layers of the foundation soils down to 10 metres and afterwards to give an approximate indication of the extent of improvement.



# POWERPILE® POLYMER PILLARS...KEYHOLE SURGERY...



## Unique and Patented Ground Engineering from URETEK

URETEK PowerPiles provide a means to easily retro-improve foundation support . . . like keyhole surgery.

Accomplished cleanly, without excavation or mess, through cored holes not much bigger than a 50 cent coin, these expanded polymer, compacted pillars suit strata that will yield under pressure.

### **Installation of PowerPiles is convenient and precise:**

1. A 34 or 38 mm diameter hole is driven into the ground by machine.
2. A compressed 32 mm diameter, shrink-wrapped, prefabricated PowerPile element is inserted manually.
3. Its central 10 mm diameter pipe core . . .
4. is then connected to a computer-controlled extraction machine . . .
5. and URETEK resin is injected as the pipe is slowly withdrawn, expanding the element up to 340 mm in weak soil strata.

PowerPiles are not piles in the traditional sense. They work efficiently as combination soil replacement and compaction grouting elements, aided by skin friction/cohesion and base resistance.

All materials and equipment arrive on site in one purpose-designed self-contained vehicle, with a team of three men. Installation equipment is portable and one man can safely carry several compressed 30 mm diameter, shrink-wrapped, prefabricated PowerPile elements at a time. Element lengths are currently available from 1000 to 5000 mm, and potentially longer in the future.

In essence, an installed PowerPile is a geotextile shell filled with an expanded URETEK resin that can have a compressive strength of 1,000 kPa to 10,000 kPa; and more, if required. Using geotechnical bore-hole information, resin quantities are predetermined and computer-monitored.

As the compressed element is expanded from the bottom up, adjacent weak ground is displaced and compacted. The resin hardens and there is immediate increased support. The shape of the PowerPile should be irregular, the shape being affected by the varying strength of ground resistance at the different depths. Can be installed in soft, loose sand.

### **1. Driving hole**



### **2. Inserting PowerPile**



# RESIDENTIAL - COMMERCIAL - INDUSTRIAL - CIVIL



**Developed particularly for retrofitting and for sites with special needs and access considerations.**

- *No demolition or excavation.*
- *Fast, clean, quiet, precise operation.*
- *Immediate results – no curing time.*
- *Portable equipment – for sites with difficult access.*
- *Install to 5000 mm depth, even from under low ceilings.*
- *Can be installed in loose/soft sand.*

PowerPiles themselves require no excavation and thus contribute no resultant spoil that needs disposal. Site conditions of course vary but 10 PowerPiles per day to 5000 mm depth is achievable.

Installation necessitates little disturbance to landscaping. PowerPiles can be inserted down to 5000 mm, even from under a normal domestic ceiling. There is minimal noise and the process is remarkably clean. Work can be done overnight.

PowerPiles would normally be installed up to the underside of footings but shorter lengths may be lowered and expanded to locally 'bridge' individual weak layers and lenses at depth, transferring load.



**3. Core extension**



**4. Attaching extractor to core**



**5. Extracting core pipe . . . while injecting resin**



## RESIDENTIAL CORRECTION BY THE URETEK METHOD...



*URETEK is minimally intrusive: our Operations Rigs are fully self-contained and all work is done outside if possible. The only equipment taken inside may be a drill & lead, a laser level and a resin injection gun & hose.*

**URETEK raises, re-supports and re-levels sunken homes fast, economically and with minimal disruption to occupants.**

Building footings are returned to correct levels comparatively rapidly. Similarly raft slabs, 'Waffle-Pod' slabs and infill slabs, as well as driveways.

Where required, weak foundations can be strengthened with URETEK Deep-Injection. Generally, as footings are lifted back to their correct levels, wall cracks tend to close up and windows and doors begin to work properly again.

There's minimal inconvenience to the household. The URETEK Method is fast, so many residential works are completed in a day. There is usually no need to vacate premises or move much furniture.

### **Key Benefits**

- Like keyhole surgery. No need to vacate.
- Minimal disturbance to landscaping & pathways.
- No demolition. No excavation. Just tiny holes.
- Structural resin. No water. No mess.
- Substantial direct and indirect cost savings.
- Fast. Economical. Permanent

*The row of 'before' and 'after' photos below shows typical results of URETEK Ground Engineering correction: exterior brickwork closure, architrave correction, floor level raised and wall cracking closed up.*



# THE MODERN ALTERNATIVE TO CONCRETE UNDERPINNING



*As building footings are raised, cracks like these usually close up so much that only minor repointing of the mortar joints is required. A typical result of URETEK correction is shown in the 'before' and 'after' photos above.*

With URETEK there is no excavation and no weakening of support. Landscaping is mostly undisturbed. Further, with no demolition, internal wall and floor corrections are effected through 16 mm drill holes. These represent huge advantages over traditional underpinning.

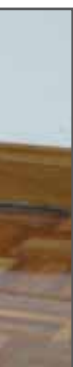
Often most work is done from outside. When working inside and where floor surfaces such as parquet or ceramic tiles require it, injection can be carried out through even smaller 6 mm holes, placed carefully to be as unobtrusive as possible.

Unlike piling or masonry or concrete 'Underpinning', URETEK is not rigid and does not transfer the load directly to a different stratum of soil - which could cause differential movement between then unequally supported sections of the building\*.

## Insurance Claims

When buildings have sunk due to earthquake, flood or wash-away from broken pipes, insurance loss assessors and engineers often turn to URETEK for the most cost-effective, long-term solution and convenient to their client.

\* Ref (Australian Standard, AS2870, warns, "Underpinning should generally be avoided where the problem is related to reactive clay," & "Deep underpinning should only be considered as a last resort").



# DRIVEWAYS & PARKING AREAS CORRECTED ACCURATELY



**URETEK raises, re-supports and re-levels sunken and moving pavements of residential, industrial and civic properties – quickly and economically, with minimal disruption.**

With The URETEK Method there is no excavation, no demolition, no water and practically no mess. URETEK is generally more economical and much more convenient than cutting out, removing and replacing slabs.

URETEK work is fast! Driveways, walkways, loading docks, hardstand areas and parking areas generally only take hours per section to correct. Concrete is re-supported, surfaces are re-aligned and water ponding removed. Cars, forklifts and even the heaviest of trucks can drive over the area 30 minutes later.

Often pavement failure is manifested by dirty water pumping out from under a slab due to the passage of a vehicle. Sometimes during dry weather, past staining is evident or there is a deposit of sand along the joint line. This sand or dirty water indicates erosion of the sub-base and heralds slab failure. URETEK can fill and correct 'pumping' before failure occurs.

Sometimes very important is the need to preserve the existing finish/appearance of the surface. We can lift, re-align joints, remove trip hazards and correct falls through tiny holes, without the need to replace or resurface.

Factory and warehouse operations can continue whilst URETEK work is being done. And, if required URETEK work can be carried out at night or during other factory down-times.



Bumps and trip hazards removed quickly with minimal inconvenience. Vehicular traffic can resume just 30 minutes later.



# FLOORS AND BUILDINGS RAISED AND RE-LEVELLED

## Concrete Floors

The URETEK Slab-Lifting Method is capable of raising concrete flooring in every situation - industrial, warehousing, commercial and domestic, plus airports, roads and railways. No slab is too thick.

In almost every case the treatment can be applied without removing machinery or fixtures and fittings, resulting in huge savings in both time and money.

Weight is not a problem: it's an advantage! When new and heavier machinery is to be installed we generally advise that it be installed *before* URETEK correction or increased support is carried out. Or we ask for floors to be pre-loaded. That way, with the final weight from above, maximum pressure can be applied in the ground below. Thus the ground is compacted to the fullest extent, giving the greatest future stability.

Treated areas can return to normal use and even forklifts and trucks can run over a corrected area almost as soon as the URETEK injection is finished. There is none of the huge down-time, waiting and cost of cutting-out and replacing concrete floors.

The URETEK method causes minimal interruption to business: URETEK work can be done one area at a time, or at night, or during holiday periods.

*The extreme dishing of this workshop floor was corrected while positive drainage was retained.*



## Buildings

Single and multi-storey buildings can be raised and re-levelled or have their foundation soils strengthened. Structural settlement of over 250 mm has been corrected - and more is possible.

Within reason, building height and mass are typically no problem for URETEK: immense, controlled pressure can be used when it is required.

As building footings are lifted, wall cracks should close up; windows and doors work properly again.

*New, heavier printing machinery was installed prior to URETEK strengthening ground support.*



*Re-levelling this floor brought the shelving back into alignment and allowed forklifts to operate safely again.*



# URETEK FACTORY AND WAREHOUSE APPLICATIONS

Factory floors, walls and machinery bases can be re-supported, raised and re-levelled by The URETEK Method - very quickly, economically and with little or no interruption to your business.

We can treat one area at a time and work at night, if required. There's usually no need to move stock or machinery. Corrected areas are trafficable within 30 minutes.

## Key Benefits

- Floors and walls re-supported and re-levelled.
- Shelving returned to its correct alignment.
- Forklifts run smoothly.
- Trip hazards eliminated.
- Slab movement & deterioration corrected.
- Falls can be re-established. Ponding removed.
- Machinery vibration stopped instantly.



*Below: Raising slabs and footings back to level solved a number of problems in this factory. The doorway area had sunk 73 mm, so the column and the door frame were no longer supported by the floor structure. They were quickly re-connected as the floor was raised.*



## URETEK AIRPORT REHABILITATION...

Runways, hangars and taxiways have been cleared of movement, bumps, ponding and trip hazards; 600mm thick pavement raised and re-levelled.

The URETEK Method is fast, economical and permanent. It causes absolutely minimal disruption to airport operations, because it is so fast, can be done at night and/or one section at a time and because even the heaviest traffic can run over an area just 30 minutes after the work has been completed. In an emergency the works area is in fact immediately and safely trafficable!

The photos below show URETEK night work at Perth Airport, the levelling and re-support of hangar slabs at Sydney Airport following a burst water main and the re-support of slabs at Williamtown RAAF Base. In this last case the loss of support emanated from leaking stormwater pipes sucking in fines and causing voids under the sheltered pavement where the jet fighters stand. The pipes were re-lined prior to URETEK filling voids directly under the slabs and Deep-Injection was employed to compact the sub-base along 320 metres of pipeline.

Airports have relied on URETEK since 1991.



# RUNWAYS, HANGARS, TERMINALS & TAXIWAYS CORRECTED



This feature photograph shows the re-levelling of Gimpo Airport in South Korea by an Australian URETEK crew, especially flown in with their technical equipment and materials.

The project was to raise and re-level sections of the taxiway that had been ponding and thus causing potentially dangerous icy patches in winter. Previously traditional 'mud-jacking' had been trialled without success.



## URETEK PAVEMENT REHABILITATION...



The unique URETEK Method is widely and increasingly employed worldwide to rectify concrete and asphalt pavement problems - from raising and re-supporting suburban roads, to re-levelling long sections of major highways, correcting road anchors and raising and re-supporting bridge approach slabs.

As a result vehicles can ride smoothly again, voids are filled and joint movement and slab deterioration are arrested. On footpaths and roads, trip hazards are eliminated.

Re-supporting pavement slabs with URETEK, as on Brisbane's Gateway Bridge toll plaza (centre above) is generally far more economical than cutting out and replacing.

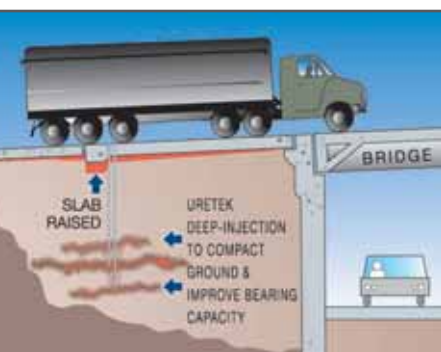
URETEK, as a replacement sub-base material, is a

proven longer lasting solution than 'Mud-Jacking', since URETEK resins do not powder and break-up under dynamic loading and pavement flexing: unlike thin cement grout, they retain a small measure of elasticity. Nor do they inhibit the required action of expansion joints.

The URETEK Method also gives an enormous time benefit because all traffic can flow over the area just 30 minutes later.

Increasingly heavy modern traffic imposes huge strains on pavements and sub-grades. Typical is the problem of repetitive pounding given by huge road freighters to the ground-supported ends of bridge approach slabs.

In such locations the sub-grade fill has often been inadequately compacted because of the proximity of



# ROADS, HIGHWAYS, BRIDGE APPROACHES ETC



the abutment or there is embankment bulging or a drainage problem etc. The ground becomes unable to withstand the dynamic loads imposed and the approach slab increasingly settles over time, eventually to become a virtual 'Ski Jump'.

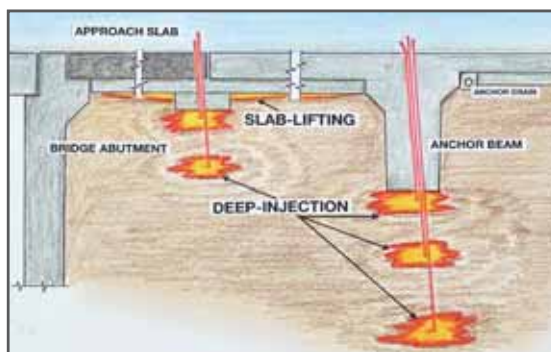
URETEK Slab-Lifting is used to raise the transition slab (and adjacent pavement) back to its correct position. Most importantly, URETEK Deep-Injection can then be used to compact and strengthen the sub-grade at the depths required.

Working with one lane at a time and, where appropriate, at night, involves the least possible inconvenience to traffic flow, both on suburban streets and major highways.

*Clusters of pipes for URETEK Deep-Injection to various depths to re-support a road anchor in a situation like that drawn below. In the background is a laser-level used for constant precision control.*

## Key Benefits

- Correct pavement settlement and water ponding.
- Eliminate differential joint settlement and trip hazards.
- Fill voids to re-support and prevent water ingress/erosion.
- Limit movement of 'pumping' joints.
- Correct sub-grade and trench subsidence and erosion.
- Densify inadequately compacted sub-grade.



# URETEK CORRECTING CULVERTS AND INFRASTRUCTURE

## URETEK has many and varied infrastructure applications:

- Culverts
- Manholes
- Pipelines
- Ducts
- Fuel tanks
- Basements
- Sheet piling
- Trenches



*Probing deep voids caused by fines washing away through construction holes and joints in culverts and eroding the sub-base fill under the roadway.*



*Injected from the roadway above, URETEK resins emerge into the culvert showing sealing is complete.*



## Leak Sealing

Joints and cracks are sealed from above without excavation, or, if man-accessible, from inside. Surrounding voids are aggressively filled. Seals against hydrostatic pressure and running water.

## Flood Erosion and Settlement

Quickly rectified. Voids filled and settlement of an entire length, or individual sections of a culvert, can be corrected.

## Trenches Across Roads

Poor backfilling techniques or loss of sub-grade due to water and fines infiltrating into pipelines causes local subsidence, often requiring repetitive topping. URETEK will seal any leak, fill surrounding voids and compact the fill... before resurfacing.

## Decommissioning Underground Tanks

In less than an hour disused fuel tanks are filled with special light-weight resin material and made safe. Tanks can later be removed and transported whole and cut up, the material being used as landfill.

## Abandoned Pipelines and Ducts

Filled from above with strong load-bearing material or with special lighter-weight materials that can be made to flow in excess of 100 metres, expelling residual liquids. Monitored by CCTV.



# URETEK RE-SUPPORTING SEAPORT FACILITIES

Because ports must operate around the clock, Port Facility Managers depend on URETEK to correct problems fast, with zero disruption to their operations.

All URETEK equipment and materials are contained in one truck and one confined section at a time can be corrected completely by a specialist team.

Finished areas are often back in use just minutes after the works area is vacated.

Port facility pavements - concrete, asphalt and brick - are frequently subjected to huge, almost point-loading, from straddle carriers and enormous 60 tonne forklifts carrying 40 tonne containers!

Our work at wharves has included hardstanding stabilisation and re-levelling and re-establishing surface falls towards drains. It has also included correction of subsiding warehouses and office buildings and re-levelling of crane rails, as well as replacement of sub-base eroded by leaking drains.

Patented Deep-Injection technology has been employed to increase foundation bearing capacity, whilst under a warehouse at Townsville, Queensland, voids created by 3.5 metre tides were filled to stabilise the deteriorating floor.

*Above right: Dockside crane rails re-supported.  
At right: Drainage gradient corrected.*



*Dockside slab down 50mm.*

*URETEK Slab-Lifting monitored by laser. The area is useable just 30 minutes later!*



*URETEK re-supporting this two kilometre long conveyor belt system in Western Australia.*



# URETEK SAVING THE MINING INDUSTRY TIME & MONEY



*URETEK raised, re-levelled and re-supported the rail of this coal stacker-reclaimer in the Hunter Valley.*

With our unique structural resin injection we are sometimes able to save mine owners millions of dollars. The savings can be in down-time and/or in dollars. We compact ground, fill voids and re-level structures, fast and economically.

In The Pilbara and in the Hunter Valley we have corrected multiple deformations in stacker-reclaimer rails thus re-establishing access to the vast stockpiles.

At another WA site (below right) we compacted the ground at 6 metres depth and lifted the 1500 mm thick concrete rail index machine slabs servicing 2 km long iron ore trains carrying 200 tonnes per wagon. We have strengthened escape shafts, re-levelled massive steel towers, re-plumbed silos and treated deteriorating workshop floors that service 100 tonne dump trucks.

OH & S issues are fixed fast and with minimal interruption to mine operations, which can continue while we work or begin again in just 30 minutes. Uretek materials are completely inert and will not leach into ground-water, so there are no environmental issues.

*This counter-weight tower base, below, was re-levelled by URETEK.*

*Rock-breaker footings stabilised, at a gold mine in NSW.*

*Below: This iron ore stacker-reclaimer rail in The Pilbara was also re-levelled and re-supported.*



*Below: Raising and re-levelling the slab restored proper engagement of the index machine gearing with the spline.*



# URETEK HELPING TO PRESERVE THE NATION'S HERITAGE BUIL



*A major section of this heritage-listed school in Darlinghurst, Sydney, was re-supported and raised by URETEK prior to effecting masonry repair and replacement.*

The URETEK Method is not confined to correcting concrete footings, although they are often the easiest to deal with. Numerous Australian and New Zealand jobs have been successfully completed, involving a wide range of other types of footings: bluestone, sandstone and brick being the most common.

Historic buildings feature heavily in the list: churches, (such as the one below with brick footings), schools, town halls and cottages. URETEK's unique and patented process of Deep-Injection very frequently

plays a major role in such heritage restoration by renewing and increasing ground support for the old structures.

Sporting facilities, for example the gymnasium in Tasmania shown below, are re-levelled with great precision by URETEK Slab-Lifting.

URETEK is sometimes used to correct alignments on sloping surfaces such as this motor car proving track in Victoria, below.



## DINGS... PLUS CORRECTING SPORTING FACILITIES ETC.



*The Post Office at Kempsey, NSW, had been founded on poor fill and subjected to protracted drainage issues, causing long term subsidence with major cracking and distortion of the brickwork across the entire rear section.*

Sometimes floors need to be adjusted to correct excessive slope while maintaining positive drainage, as has been done at a number of heavy vehicle wash bay facilities and some motor vehicle workshops.

Another example is the fire station at Sydney's Kingsford-Smith Airport, which required very precise 'un-levelling' to shed rainwater away in the fire engine garaging area, which has to remain open to the rain to allow rapid deployment.

Building height and mass are typically no problem for URETEK: immense, controlled pressure can be used when it is required.

The Town Hall, at Glenelg, S.A., (at lower right) was corrected by Deep-Injecting to strengthen various weak underground strata, then Slab-Lifting along one whole side, to restore support and to re-level the building. The process also closed up the huge wall cracks that had developed over time.

*This fine old heritage homestead re-supported by URETEK Deep-Injection now serves as Goulburn's museum.*

*Heritage Town Hall building Glenelg, Adelaide, S.A.*



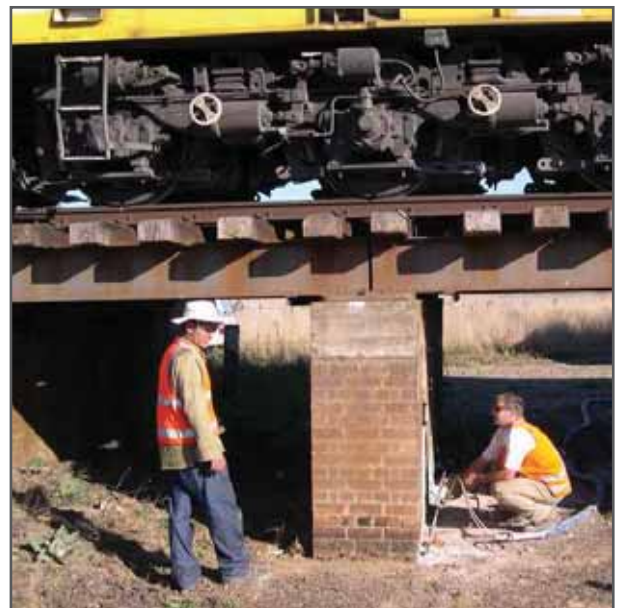
# URETEK RAILWAY RE-SUPPORT AND RE-LEVELLING



The greatest possible load applied to the foundation that URETEK is to strengthen, enables the greatest possible compaction. (Refer page 7: Deep-Injection)

The live load of this stationary 129 tonne locomotive (above) enabled maximum compaction of the sub-grade, as URETEK re-supported, strengthened and raised the rail bridge at Bredalbane, NSW.

We have lifted, re-supported and strengthened many types of railway structures - from railway bridges, tunnel track-slabs and level crossing areas, to weighbridges, driveways and hardstands, to platforms and station buildings.



*Level crossing: Unanderra*

*Rail bridge: Henty*

*No.1 Platform: Sydney Central*



# URETEK REMEDIATION OF SEAWALLS, WEIRS & WHARVES



## LEAK-SEALING AND MANY OTHER APPLICATIONS



*This rock weir in Western New South Wales was solidified with URETEK structural resin, preserving its integrity and curbing excess flow of water.*

**Unusual requirements constantly challenge our imagination and extend our capabilities!**

One client had a 2 metre diameter tunnel borer stuck in collapsing soils under a railway embankment of Queensland's main Western line. URETEK stabilised the ground by Deep-Injecting to form a virtual arch around the machine, which allowed recovery and completion of our client's culvert contract.

Another Queensland client had several 33,000 volt transmission poles potentially unstable due to the

*Re-levelling a large council swimming pool.*



*A URETEK Operations Rig was brought on-site by barge to re-support this building at the old Powder Works on Sydney's Middle Harbour.*

unexpected soil conditions. URETEK conglomerated the non-cohesive soils, down to 5 metres, to withstand the lateral forces of wind on poles and aerials.

Another client was faced with water gushing through driven sheet piling. URETEK sealed the leaks 14 metres below the water table.

Working to seal joints in an 80 metre long, man-accessible culvert on the Johnstone River, in Far North Queensland, required a crocodile sharpshooter!

*Adjusting the falls in outdoor slab work.*



# URETEK MATERIALS - TECHNICAL DATA

**Overview:** Uretek resins are the driving force behind The Uretek Methods. It is the predictable expansion pressure of their chemical reaction, not the injection pressure, that aggressively fills voids encountered and then compacts soils, before lifting as required.

The quantity of resin to be injected at a given point depends on the weight of the structure or the resistance of the soil to be reinforced.

The density of solidified expanded resin increases according to the resistance opposing expansion.

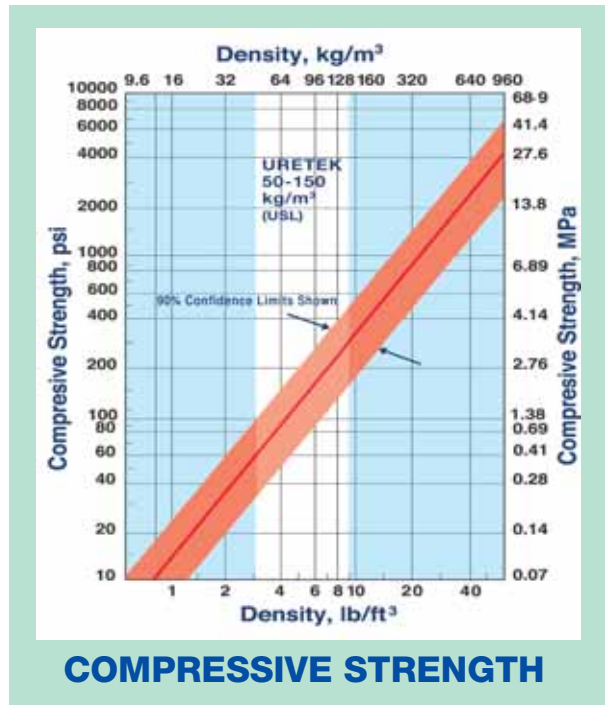
## Compressive Strength & Density<sup>1</sup>

Compressive strength increases proportionately to the applied density of the material. Under concrete pavements, for instance, the applied density may be about 50 to 150 kg/m<sup>3</sup>. In the case of Deep-Injection, 100 to 200 kg/m<sup>3</sup> and density may reach 300 kg/m<sup>3</sup> under very heavy structures or at depth.

Once the soil has been densified and/or the structure lifted, the hardened Uretek material functions as soil replacement, not as concrete replacement.

## Uretek Resins

URETEK uses several proprietary resin formulae, the selection depending on the particular job.



Geoplus is the most advanced geo-polymer resin on the market, providing an expansive force, under load, of up to 10,000 kPa - 20 times greater than that of preceding polymers.

## BRANZ Appraisal No. 698

The suitability of URETEK for raising, re-leveling and re-supporting was appraised by The Building Research Association of New Zealand in 2010. Appraisal No. 698.



*Field testing revealing Deep-Injected URETEK material agglomerating with the ground.*



# URETEK MATERIALS - TEST RESULTS

## Strength to Weight Ratio

A significant characteristic of URETEK materials is their strength to weight ratios. A confined cubic metre of URETEK with a mass of 50 kg would be able to support a load of some 40,000 kg. In practice however, when used for lifting (say) 40,000 kg/m<sup>2</sup> (40 tonnes), the applied density will be in the order of 150 kg/m<sup>3</sup>, ensuring the necessary factor of safety against creep.

## Service Life and Durability

Underground, URETEK materials are intended to last 100 years. "The service life of URETEK material can be relied on to exceed 50 years . . . and can confidently be expected to be considerably longer."<sup>2</sup> In addition to low thermal conductivity, it is stable and durable.<sup>3</sup>

## Ageing Underground

URETEK materials are exclusively used underground. Intensive testing on such materials buried for 10 years indicated no significant loss in density, compressive strength or dimension, relative to control samples aged indoors.<sup>4</sup>

## Environment and Ground Water

URETEK material is inert and will not leach into ground water nor affect the environment.<sup>5</sup>

## Moisture Resistance

Unique hydro-insensitive resin is used in wet

conditions, including below water table level, to ensure structural quality material.

## Fungi and Bacterial Resistance

Fungi, bacteria and mould do not decay URETEK material.<sup>6</sup>

## Insect Resistance

URETEK materials do not nourish insects or rodents.

## Biodegradation

URETEK material will not be subject to biodegradation, even when buried underground.<sup>7</sup>

## Stability in Sunlight and UV

Surfaces exposed to sunlight will discolour and embrittle but are then likely to shield underlying layers. Because URETEK material is exclusively used underground, UV exposure is generally not relevant.

## Stability & Chemical Resistances

URETEK materials are thermoset polymers. Thermoset polymers are those that change irreversibly during their formation reaction into a material that is infusible and insoluble. The stability of polyurethanes is well documented and a table of chemical resistances is given on Page 31.

## Creep under Dynamic Stress

Long term performance is mandatory. According to highway research, "Resin layers should not exhibit any creep deformation under normal traffic loads".<sup>8</sup>



# URETEK - TECHNICAL DATA

## Site Management

Following URETEK treatment, attention to continuing site maintenance is recommended and falls to the responsibility of the owner/occupier. There are numerous publications to assist with this and we are pleased to supply a copy on request.<sup>9</sup>

## Warranty

URETEK materials injected below concrete have been specifically engineered to resist shrinkage or deterioration causing significant settlement, and as such are warranted by URETEK in strict accordance with the product durability requirements of the applicable Local, State or National Building Code.

## Specifications

Engineering specifications for, and further explanation of, the various applications of URETEK are available upon request.

- <sup>1</sup> SOCOTEC Report No. 03.043.
- <sup>2</sup> Dossier No. FX2639 BaySystems - R&D manager, Dr. ir. Allard van der Wal. 07-02-09
- <sup>3</sup> Thermal insulation materials made of PUR/PIR, BING, October 2006
- <sup>4</sup> Delaware study by Dupont
- <sup>5</sup> Chemical/toxicological tests on the dual-component polyurethane system designated Geoplus A/Geoplus B, Hygiene Institut des Ruhrgebiets, 30-01-2004
- <sup>6</sup> Determining the resistance of a synthetic polymeric material to fungal and bacterial growth, March 2009, University of Wageningen.
- <sup>7</sup> What happens to polyurethane foam in a Landfill: study by Carnegie-Mellon University's Department of Biological Sciences, (William E. Brown).
- <sup>8</sup> Institut DR.-Ing Gauer Ingenieur-GmbH. Test report No. 7037-B1-A dated 23.04.2007.
- <sup>9</sup> CSIRO publication BTF18. Foundation & Footing Performance.

## Chemical Resistance of URETEK Materials

URETEK materials are very stable and are resistant to a wide range of chemicals but have a low resistance to aggressive acids such as concentrated Nitric, Hydrochloric & Sulphuric and solvents such as Methyl Ethyl Keytone and Acetone.

The following examples of chemical resistance are from 28 day Industry standard immersion tests:-  
Excellent resistance ..... loss of volume < 3%  
Good resistance ..... between 3% and 6%  
Poor resistance ..... over 6%

Brine (saturated)	Excellent
Diesel	Excellent
Ethyl Alcohol	Poor
Jet A1	Excellent
Kerosene	Excellent
Methanol	Poor
Mineral oil	Excellent
Petrol/Benzene	Excellent
Toluene	Excellent
Turpentine	Good
Water	Excellent
<b>Acids and Bases</b>	
Ammonium Hydroxide	Good
Ammonium Nitrate	Excellent
Hydrochloric acid (10%)	Excellent
Nitric Acid (10%)	Poor
Sodium Hydroxide	Excellent
Sulphuric Acid (10%)	Excellent

**CHEMICAL RESISTANCES**





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