Special DI Edition 2009

THE U FACTOR

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Concrete Rehabilitation Made Interesting

STRENGTHENING WEAK SOIL UNDER PAVEMENTS

URETEK's Deep Injection Technology:

"At Depth" look aiming to solve America's ailing roads & bridges

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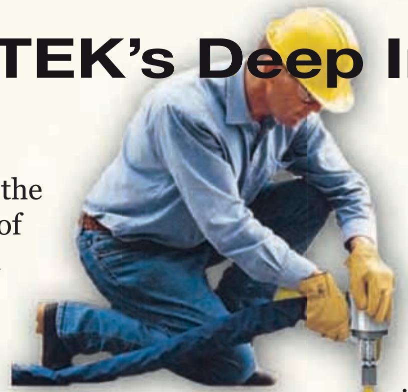
URETEK's Deep Injection Technology:

The Answer to Americas Ailing Infrastructure



Since the early days of modern civilization, road builders and building construction contractors have understood the relationship between stable ground and the roads, bridges, and structures that lie on that ground. When weather conditions produce rain, snow, or severe temperature shifts, underground problems such as voids, fissures, and water pockets can be created that in turn, destabilize road surfaces, highways and building foundations. The result - cracks, potholes, and sink holes that can wreak havoc on public assets such as roadways, sewers, pipelines, bridges and overpass supports, as well as private buildings and structures.

Even though work crews can seal the cracks, fill the potholes, lay down new asphalt, or rebuild the damaged infrastructures, it only masks the underlying problem, requiring that a similar round of maintenance is needed again after the next season of severe weather. The key to having quality road surfaces and public structures that last longer and require less frequent maintenance is having stable base soils. The materials that are used to repair base soils play an important role in correcting problems on a permanent basis.

In the past, several materials were widely used to fill underground voids: From seashells and wood chips, to combinations of lime which have varied anywhere from seashells and wood chips, to combinations of lime, fly ash, cement, and concrete slurry. However these products which somewhat filled the voids failed to drive out and seal them from the entry of surface water back into the base soils.

Many municipalities and commercial businesses are now placing a greater emphasis on preventative measures designed not only to seal but also to strengthen these underground soil strata. By increasing the density of compromised sub-surface soils repairs are longer lasting and the asset is better protected.

Benefits of Expanding Polymers

These outdated base mixtures complicated the repair effort by adding significant cement-base mixtures complicate the repair effort by adding significant amount of weight to an already base strata. In addition, since the quality of cement materials is compromised by hydration, any standing water in these void areas diluted the mixtures, decreasing effectiveness. Finally, the low tensile strength of cement based materials make their usage under heavy load or vibration conditions (such as highways) susceptible to early and predictable short life and in-service failure.

The use of carefully selected high density expanding resin offers clear and proven advantages. The application of expanding polymers material will fill, densify, and stabilize low-density compressible soils up to depths of 30 feet and beyond. It is ideal for highways, bridge approaches/departure slabs as well as taxiways, runways and tunnels that have settlement problems caused by a poor sub-base and soil compaction. Expanding polymers are also specially formulated to be fast acting and hydro-insensitive, ensuring that they are unaffected by any water or wet soil that may lie under the surface pavement.

Long Lasting – URETEK's Expanding Polymers have a high degree of compressive and tensile strength, extending longevity guaranteed for 10 years against any loss of dimensional stability or deterioration.

Fast Acting - With our expanding polymers injection, maintenance times are reduced to hours instead of the days or weeks required for other traditional techniques. As a result, the transportation asset can be restored to full use by the general public more quickly, minimizing disruption and customer frustration.

Hydro-Insensitive – For heavily saturated, wet soil conditions, the unique chemistry of URETEK expanding polymers stops weak cross-linking at the time the material is injected. Our proprietary system assures strong high quality material even in wet environments. The material is excellent for sealing underground pipes by surrounding and sealing the leaking joint or damaged area.

Expansive – When its two base chemicals are combined and injected into the void, the polymer material expands up to 20 times its original liquid volume. Because of these unique expansive capabilities, the polymer material fills all voids or fissures while further compressing and densifying the underground soils in the process. URETEK often doubles or triples the strength of base soils.

Lightweight - Expanding Polymers are extremely lightweight, weighing less than 5% of a comparable quantity of cement/concrete based grouts. As a result, a minimal amount of additional overburden weight is introduced into the already distressed sub-grade soil environment.

Safe - The cured polymer material is inert, environmentally neutral, and does not contribute to soil or water contamination, leaching, or pollution. In comparison, other soil densification procedures such as cementitious materials are not environmentally friendly. URETEK's unique expanding polymers are the direct result of our technical research and 85,000 successful projects worldwide. These advantages are there for you.

URETEK Polymers:
a responsible choice for our environment.

URETEK
SAFETY & ENVIRONMENT

Rigid polyurethane is a thermoset polymer reduced from the reaction of the polymetric MDI and a polyfunctional alcohol. Thermoset polymers are those that change irreversibility during the reaction into a crosslinked, thermally stable network. Rigid polyurethane foams are resistant to oils and gasoline and most solvents. Polyurethane's are widely used in the construction industry for such purposes as insulating pipe for use below grade, in-situ barriers in ditches to prevent erosion and other uses where the material may be buried.

In a DuPont publication (BA-13) from the mid 1980's, polyurethane foams were tested under a variety of conditions. One of the tests involved burial of rigid polyurethane foam for a period of 10 years and then evaluating the sample. After ten years' exposure, there was a small change in size of the buried samples, however the foam itself was found to be in good condition.

In the book, Polyurethane Handbook, Gunter Oertel discusses the environmental impact of polyurethane waste products through dumping in a disposal site. Polyurethane rigid and flexible foams were tested at a disposal site and evaluated after three and five years. The polyurethane, other than discoloration had not changed their structure. Analysis of the leachate water did not show a noticeable deviation in its composition from leachate water derived from waste without the plastic material in it.

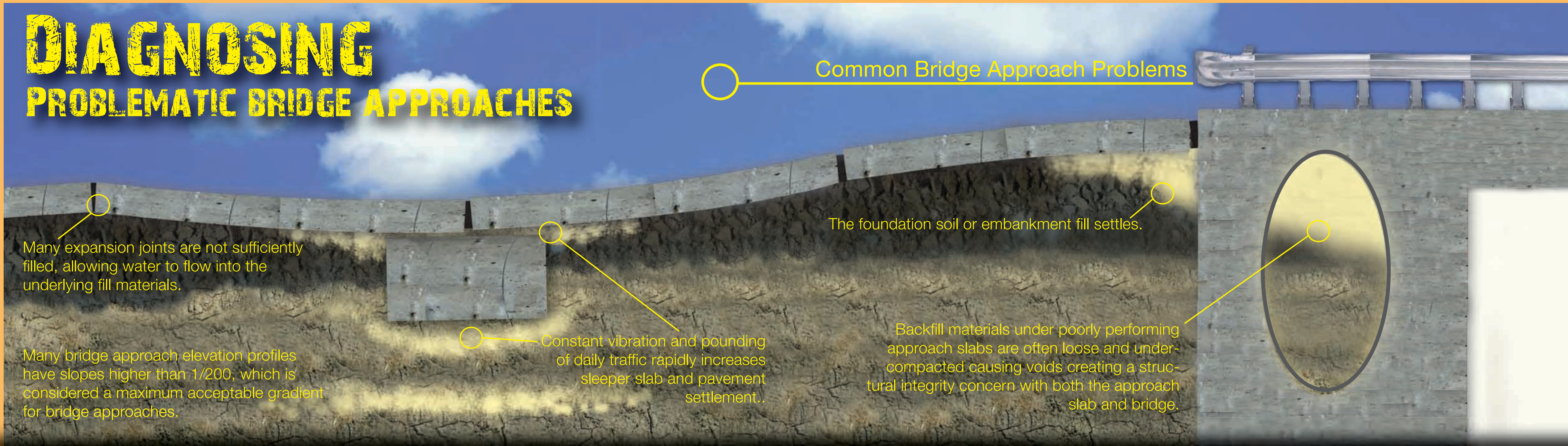
To the best of our knowledge, rigid polyurethane foams do not have any detrimental effect on the environment due to decomposition or degradation of the polymer.

BaySystems
North America

URETEK
SAFETY & ENVIRONMENT

At URETEK, having earth-friendly materials and processes is not just a fad, it's been our material's DNA make up since the beginning. We have always respected our surroundings and have provided the least disruptive, most earth-friendly, concrete lifting and soil stabilization materials and processes in our industry for over two decades.

URETEK was Green When Green wasn't Cool...


DIAGNOSING
PROBLEMATIC BRIDGE APPROACHES
Common Bridge Approach Problems
Many expansion joints are not sufficiently filled, allowing water to flow into the underlying fill materials.
The foundation soil or embankment fill settles.
Constant vibration and pounding of daily traffic rapidly increases sleeper slab and pavement settlement..
Backfill materials under poorly performing approach slabs are often loose and under-compacted causing voids creating a structural integrity concern with both the approach slab and bridge.
Many bridge approach elevation profiles have slopes higher than 1/200, which is considered a maximum acceptable gradient for bridge approaches.


SOLVING
PROBLEMATIC
BRIDGE APPROACHES
URETEK's Pavement & Bridge Approach Solutions
URETEK's Deep Injection Process for sunken pavement and bridge approach/departure slabs takes a fraction of the time that traditional repair methods take.
The URETEK Method lifts and supports sunken pavement along with void filling and undersealing weak slabs.
High density, lightweight URETEK polymers surgically realign approach slabs and densify weak soil strata.
The patented Deep Injection process compacts loose soil soil strata at depths where the strata is weakest.
URETEK's patented expanding polymers have a hydro-insensitive element that drives out water from soils with a high moisture content.
URETEK

Deep Injection Process

Steps to Success

Step 1 – The Investigative Phase

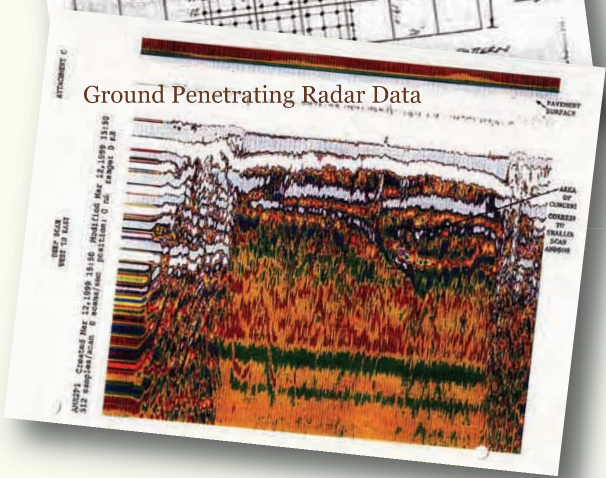
Prior to any material injection, a series of preliminary tests are conducted to identify and determine the specific areas that have a weaker soil stratum, and to find the specific locations where the expanding polymer material is needed. The tests are performed using a dynamic cone-penetrometer, a metal rod (with conical tip) that is driven into the ground to measure the density of the ground soil. The rod is marked in 10-centimeter increments and is used as an indication of soil strength. This measurement process is accomplished through a series of "blow counts" that are administered by dropping a specific weight from a certain distance onto the top of a penetrometer rod to drive it into the ground. The number of blows that are necessary to send the rod 10 centimeters into the soil are counted and measured. For example, a high number of blows would be indicative of a more dense soil, while a lower number of blows would indicate a weaker soil condition. Typically, weak soils register a low value, typically 1 to 5 blows, while denser soils register a higher blow count above 10, 20 or higher.

Penetromter Test

Step 2 – The Preparation Phase

Once the penetrometer tests have been completed, the specific locations and depths of weaker soil strata are logged. Using this information, special probe drills are used to measure and drill an injection pattern in the form of a grid that includes a series of 5/8" to 3/4" holes encompassing the entire identified area. The injection grid will direct the locations for the expanding polymers injections which will strengthen the soil directly underneath the structure as well as the surrounding area. To further enforce the target areas, injection holes are drilled at a variety of depths depending on the soil condition.

Pre-Injection Locations



Ground Penetrating Radar Data

Step 3 – The Primary Injection Phase

Once all of the injection holes are drilled, a length of tubing is placed into each hole to accurately position the expanding polymers material. The polymer, which is based on a combination of two different chemicals, is warmed prior to its injection into the ground to facilitate the injection process. The weaker locations closest to the surface, comprising depths between 3 to 9 feet receive the first injection. When the injection has been completed, the polymer material reaches its maximum density very rapidly.

As the synthetic polymer material is placed into selected strata, it begins to quickly expand. It will grow to over 20 times its original liquid volume, filling any void or fissure it encounters in its expansion path. As this occurs, soils are also compacted by the material. Since the polymer is hydro-insensitive, any ground water that the polymer encounters in its expansion path is pushed aside. This property allows for deep injections to occur under any type of ground condition, including heavily saturate-soils. Expansion of the polymer is over within one minute reaching 90 percent of its strength within 15 minutes.

Step 4 – The Secondary Injection Phase

Once the upper stratum is densified, lower levels can be addressed. Depending on the condition of the underground soil, and the depths that are required, there can be additional deeper injection locations. This second round of deep injections encompasses the entire soil support area necessary for the overbearing structural load. Each injection continues up to a point of minimum lift registered at the surface, indicating the sufficiency of densification. This assures a sufficient radial compaction from each point of injection.

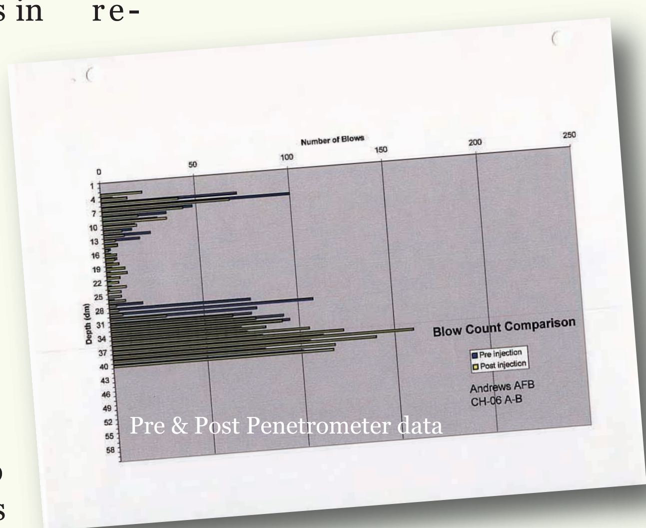
As this final portion of polymer expands, the surrounding sphere of influence compacts and densifies the soil to affect a controlled lift of the bearing loads. These movements are precisely monitored and controlled by the laser level measuring devices on the surface. By proceeding in this manner, these injections guarantee an adequate increase of the bearing capacity of the weight bearing systems. Once this final injection phase has been completed, the road or structure can be returned to normal operation within 15 minutes. This results in dramatically reduced costs and minimizes the downtime for use of the asset.

Step 5 – The Validation and Testing Phase

Given the variances that are inherent with any underground environment, it becomes imperative to test the reinforced area after the injections have been applied to ensure that the process has accomplished the densification goals. After the injection phases have been completed, a series of post-injection penetrometer tests are completed in close proximity to the injection locations. Proof of specific soil strata strength is accomplished and logged. A report is generated and given to the client to validate the changes that have taken place in

Excavated Polymer Between Strata

the ground density and show the improvements that have been made in re-



Pre & Post Penetrometer data

storing the surface elevation, and also increasing the bearing capacity of the foundation soils.

Using deep injected expanding polymers provides a cost effective, fast, and safe solution for soil stabilization problems, as well as delivering a "no disruption" cure for highways, roads/bridges, runways/taxiway repair problems, deep soil densification, and sealing underground leaks. With this process, many of today's state, county, and municipal governments can make the most cost effective use of limited budget resources while dramatically improving the quality and longevity of their existing infrastructure investments.

The patented Deep Injection Process is available from URETEK USA, who has been performing deep polymer injection for public and private institutions across the country for over 20 years. Visit either of our websites for more information: www.uretekusa.com for roads, bridges, and highway applications or visit www.uretekicr.com for industrial, commercial, and manhole/wastewater applications.

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