

The URETEK Method Drives More Effective Road and Highway Maintenance
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Introduction

America is on the move in their automobiles every day and the nation's interstate highways are the very backbone of that transportation system. Each state Department of Transportation (DOT) is interested in finding new ways to keep the traffic on these interstates moving in as efficient and effective a manner as possible. Many states are now finding several disturbing trends with regard to their highway maintenance efforts that are severely impacting their ability to meet these transportation objectives. These include: Budget constraints; Repair methods; and Time frames.

The first issue concerns state budgets. Many states are faced with a declining tax base that is eating away at state and county funds normally set aside for roadway repairs. This results in fewer scheduled maintenance projects leading to declining road and highway conditions. The case of Boone County Missouri provides a classic example of a situation that is taking place in many states and counties across the country. The county is already spending a bigger slice of its budget for road maintenance than it predicted seven years ago. Since 1997, the county promised to spend half of its tax revenue on maintenance. But since the late 1990's, maintenance expenses have risen from 47 percent of the public works department revenue in 1999, to 60 percent last year. *"We are not going to do any new projects next year"*, Southern District Commissioner Karen Miller indicated. *"We have no choice but to do repairs. Once that is taken care of, you can go back to doing new roads"*.¹

The second issue deals with existing maintenance methods. Many states have used asphalt resurfacing over an existing concrete or roadway base as an inexpensive way to solve highway quality problems and create smoother roads. Unfortunately these pristine conditions don't last long and as a result, many DOTs are finding these surfaces degrading much more rapidly than was originally anticipated. The root cause can be traced to changing temperatures between summer and winter months combined with the ongoing punishment to the road surface caused by higher traffic volumes. This combination often results in the underlying base or sub-base spewing out dirt and water at the slab joints, a situation commonly referred to as "pumping". Pumping promotes the formation of subsurface voids which result in potholes and uneven road surfaces, where one concrete slab may be higher or lower than another section. This in turn creates that familiar "washboard" effect, presenting disturbing and potentially dangerous road conditions. The traditional method that was usually employed focused exclusively on the surface layer of the problem. Even though work crews could seal the cracks, fill the dips, and lay down new asphalt, it only masked the underlying problem, requiring subsurface maintenance on the same patch of highway to be re-addressed again at a future date.

The third issue deals with the time available to conduct the maintenance projects. Because of high traffic volumes and longer rush hour traffic patterns, the amount of time available to conduct traditional resurfacing,

¹ Columbia Daily Tribune, July 13, 2004.

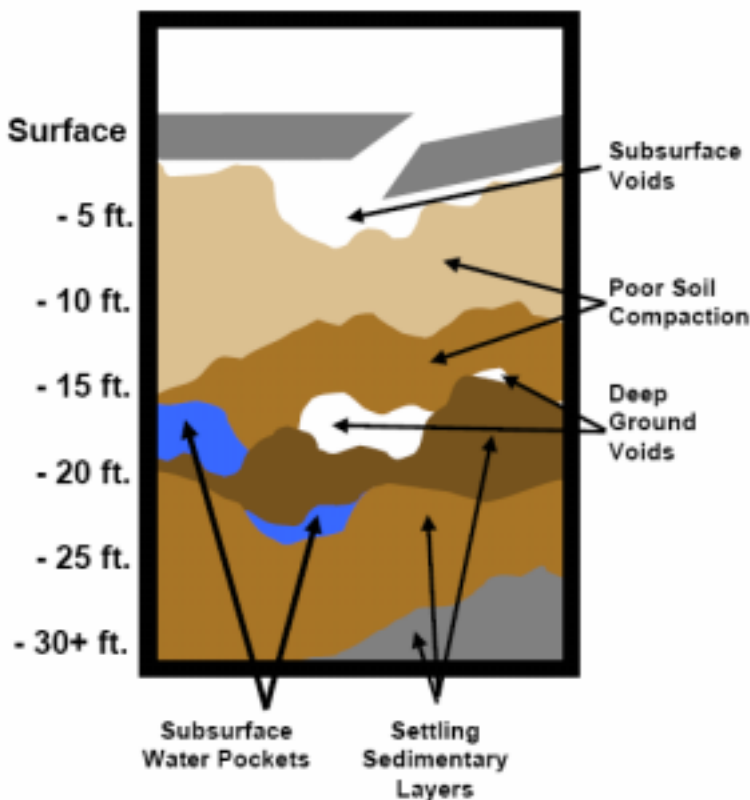
repair, and road maintenance has been shortened. In most circumstances, these jobs now typically start late at night and last into the early morning hours. This increasingly shorter window of availability results in longer repair schedules and increased maintenance costs before the project can be fully completed. With the tight operating budgets of many states, this situation has forced many DOTs to seek alternative methods.

In order to address these trends, states are now exploring new ways to maintain their roads and highways that can yield shorter maintenance periods while providing a higher quality of work that will last longer. One of the areas being re-examined is to put a greater emphasis on the maintenance and repair of the sub-surface layer of the highway. By reinforcing the underlying soil of a highway in advance of its re-surfacing, highway repairs can be minimized and last longer, resulting in lower overall maintenance costs.

The URETEK Deep Injection Method

The key to having quality road surfaces that last longer and require less frequent maintenance is having a good underlying foundation on which these road materials lie. Due to weather conditions, such as rain, snow, or severe temperature changes, the underlying surface layer of a road can create voids, fissures, or expansion resulting in the shifting of the soil bed. This instability will ultimately result in cracked roads and material separation. (See Figure 1).

Figure 1: Elements of a Shifting/Unstable/Damaged Underground Base



Departments of Transportation, Departments of Public Works, Bridge/Tunnel/Port /Airport Authorities now have a highway, roadway and runway repair solution that requires minimal maintenance downtime to these high traffic assets.

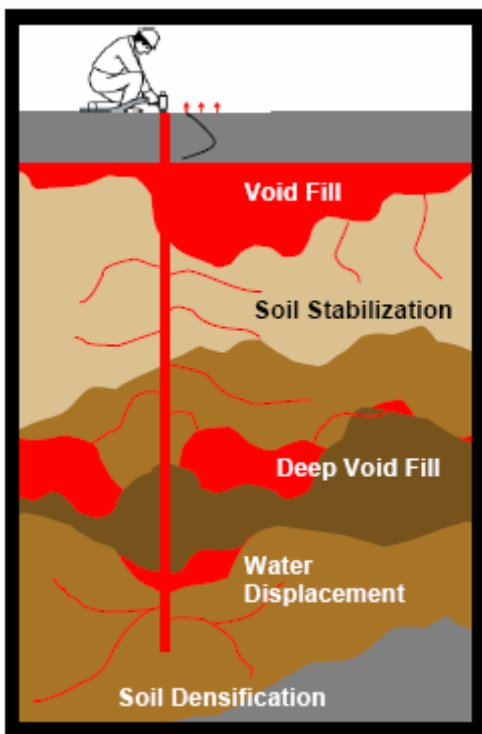
URETEK USA provides a non-disruptive, cost-effective, long lasting solution for: sunken or pumping highways; roads and runways; water ponding in roads; and misaligned bridge approach or departure slabs. The solution is the URETEK Deep Injection Method which provides a quick and effective solution allowing you to maintain and control a project in the time period you designate, reducing or eliminating

shutdown/revenue loss.

The URETEK Deep Injection Method remediates common subsurface soil issues for depths of 18 inches up to 20 feet and beyond. Utilizing the most advanced technologies, injection methods, and URETEK 486, one of the denser polymers available, this patented material and process drives out water, fills underground voids, and increases the density of the subsurface base soils. It is also highly effective at repairing and leveling broken or sloping pavement situations and has been utilized in over 75,000 projects worldwide.

One of the primary advantages of the URETEK Deep Injection Method is its ability to allow transportation asset authorities to handle their repairs on a more effective and lower cost basis as compared to traditional methods such as "rip and replace" excavation or mud jacking. Equipment, labor, and material costs are significantly reduced because there is no need to take transportation or infrastructure elements out of service during peak use periods. As a result, significant traffic interruptions are minimized, which leads to additional cost savings.

Figure 2: URETEK Deep Injection Method
Reconstitutes Shifting/Unstable/Damaged Underground Base



The URETEK Deep Injection Method involves two critical components that ensure its effectiveness: the unique injection method and the URETEK 486 polymer compound (See Figure 2). This System injects the high density expanding polymer compound into the base soil to compact the weaker soils and lift the upper pavement whenever necessary.

Finding the Voids

The first step in the process, when addressing longer stretches of road or interstate highway, uses a state of the art Hyper Optics Void Detection System to determine void locations. Mounted in an enclosed mobile detection vehicle, a 12 foot wide section of pavement can be scanned while the vehicle is in motion - at speeds of up to 55 mph. The scan provides the technical data needed to determine the size and location of voids, making the resulting repair process easier, faster and

more precise. The URETEK USA Hyper Optics (HO) Void Detection System (See Figure 3) locates and quantifies voids under the pavement, produces fast and non-invasive Geo Intelligence, delivers pinpoint accuracy using advanced GPS techniques, and eliminates lane closures and traffic disruptions that would normally occur under traditional methods.

Figure 3: The URETEK Hyper Optics Void Detection System



When the Hyper Optic Void Detection System is unavailable or inappropriate, a dynamic cone penetrometer can be used to conduct a series of tests to measure the density of the underlying soil across multiple locations of the repair area. This information is used to identify and determine the specific areas that have a weaker soil base or stratum and helps in determining the exact locations where the injections need to take place.

Fixing the Voids

URETEK's special probe drills are used to pattern drill the sections of the pavement that are involved. Each injection location is measured, drilled, and then monitored as the polymer material is injected (See Figure 4). The URETEK 486 polymer material is a fast acting expansive polymer which is also hydro-insensitive, ensuring that the expansive polymer will be unaffected by any water or wet soil that may lie under the surface pavement.

Once the URETEK Deep Injection Method is complete, an asphalt hotmix can be laid down on top of the restored surface to create a higher quality ride experience. The result is a quicker, longer lasting, and less expensive way to improve roadways. In fact, the resulting repair often provides a quality and durability in excess of the original construction specifications.

Figure 4: Injection Process using the Patented URETEK 486 Polymer Material



Case Study #1: Texas DOT - State Hwy 358 - Corpus Christi to North Padre Island

An example of stabilizing and restoring a 100% asphalt highway

In 2001, URETEK completed a major asphalt repair project for the Texas Department of Transportation (TxDOT) in Corpus Christi. The eleven lane mile section of Texas Highway 358 connects the city of Corpus Christi with North Padre Island. The original highway project was built over a sand and gravel based sub-surface material and the repaired stretch has remained maintenance free.

Highway 358 is a heavily traveled road and repetitive problems had existed with regard to base material porosity and sub-surface voids which resulted in the settlement of pavement on most sections of the highway. The bridge approach and departure slabs of four overpasses had settled as much as six inches in some places. Because of voiding in the base material, and interior consolidation from water runoff penetration, some of the reinforcing sidewalls of the highway had settled and moved from their vertically constructed positions.

TxDOT wanted to repair the problems and resurface the roadway using 12" thick concrete pavement, but the cost to rebuilding the highway from the ground up was prohibitive. According to John Hernandez, project manager for TxDOT, *"The costs that we would have to incur as a result of the length of the proposed project and the resulting traffic delays made this option unfeasible in our opinion".*

The URETEK Deep Injection Method was perfectly suited for the Highway 358 project. Most of the repairs were made at consistent depths down to 6 feet, although some of the bridge areas required densification at depths down to 20 feet.

According to Mr. Hernandez, *"The foam injection process provided by ...URETEK ...provided us with a more feasible and cost effective solution as compared to our original plans. The foam injection solution saved us in the neighborhood of several million dollars as compared to other maintenance alternatives."*

Because state highway 358 is a major thoroughfare, it is often heavily congested. A quick repair operation and roadway availability were critical TxDOT requirements on the project. With the patented URETEK process, lane areas completed each day were open and made available to traffic that same afternoon and lane closures only occurred during off peak hours.

Mr. Hernandez went on to add, *"The foam injection appears to be working as expected and was in line with our discussions before the work operations began. Overall, I would have to say that we were very happy with the results that we experienced with URETEK."*

Case Study #2: New Mexico DOT - Twenty Four Miles of Interstate I-25 near Albuquerque, N.M.

An example of stabilizing and restoring a concrete over asphalt highway

This 30-year old, 24-mile section of interstate was called one of the worst sections in New Mexico by one District Engineer. The concrete pavement looked good on the surface, but the sub-surface had destabilized and voids developed underneath the roadway. Years of constant traffic pounding had misaligned many concrete slabs on the highway and the joints didn't match any more. The resulting ride was extremely annoying and dangerous to the vehicles traveling over them.

URETEK Crews Void Fill and Underseal Interstate I-25



The New Mexico State Highway Transportation Department (NMSHTD) put off the repair of this stretch of highway for some time due to financial limitations. They considered their only option to be complete removal and replacement of the entire 24 mile section of highway. A job this size would have cost \$25 million and taken nine months to complete, with major traffic disruptions incurred throughout that time frame. The URETEK Method® offered New Mexico a way to improve the rideability and extend the life of the highway, without the \$25 million price tag.

Over a three month period, 24 lane miles of pavement were completely void-filled and under sealed. Rideability improved, literally, over night. With multiple crews working during off peak, nighttime hours, disruption was negligible. Albuquerque citizens were mostly unaware work was being done, just that the road had improved. By 5:30 each morning, all four lanes were back in use for rush hour traffic. This job was finished in about three months, when it would have taken around 12 to 18 months to accomplish a project of this size using traditional methods.

The main benefits to New Mexico were in cost and time savings. The total project cost using the URETEK Method was \$6.5 million, yielding a savings of \$18 million. Total project time was three months, as opposed to the nine months that would have been required for the rip and replace method. NMSHTD anticipates the road improvements will last another 20 years, almost doubling its design life.

NMSHTD noted, "When we discovered the effectiveness and evaluated the cost of using The URETEK Method on this project, we discovered that we were basically restoring this roadway, gaining another 20 years of life and only incurring one fourth of the cost at the same time."

Summary

Densification of sub-surface base soils is an important criterion necessary to stabilize and reinforce highway asphalt surfaces that can lead to longer lasting roadways with less frequent maintenance requirements. Using URETEK 486 high density polyurethane to stabilize the sub-surface base of a roadway is a more cost effective and efficient method as compared to more traditional procedures, such as patch and fill or mud jacking. Deep polymer injection also answers the problem faced by many of today's state and county governments that have limited budget resources.

URETEK USA puts customers in control of their pavement lifting and soil stabilization problems, reducing repair cost, time, and disruption, through their patented, safe, and predictable URETEK Deep Injection Method combined with the patented URETEK 486 polymer compound.

To summarize, the URETEK Deep Injection Method delivers benefits to state DOTs and county/city/ municipality Departments of Public Works for their highway, roadway, street and infrastructure maintenance projects in the following ways:

- **Time Savings:** Up to 95% reduction in the amount of time required for product insertion, curing, and cleanup. The injected URETEK 486 polymer material is ready for traffic within 15 minutes.
- **Cost Effective:** Up to 75% lower cost than traditional replacement maintenance methods.
- **Predictability:** URETEK methods and materials deliver consistent results, project after project. The URETEK 486 Polymer material achieves up to a 20:1 free rise material expansion ratio.
- **Long Lasting:** The patented hydro-insensitivity of the URETEK 486 polymer material ensures its effectiveness, even in water-related soil conditions.
- **Safe:** URETEK delivers fewer physical elements, fewer days on the project, fewer hours per day along with no open excavations. All this adds up to environmental safety and decreased liability exposure.

For more information on The URETEK Deep Injection Method, go to www.uretekusa.com to find your local URETEK USA representative.