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★ Improves Stability	★ Economic Recycling of In Place Roadways	★ Reduces Rutting
★ Provides Solid Platform		★ Reduces Premature Aging
★ Efficient, Permanent Strength Gain		

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Austin White Lime Company
Chemical Lime Company
Texas Lime Company



Message From **Mike Behrens** – **TxDOT Executive Director**



The state of Texas is big. Nobody can argue with that. With this vast space are the challenges of dealing with the many geologic features found in our sub-grade soils. We have everything from rock at the surface to sand, silt and some of the most ferocious swelling clays in the country.

Originally, the Texas Highway Department, then the State Department of Highways and Public Transportation and now the Texas Department of Transportation, has for decades addressed these varying subgrades by selecting the right treatment for the right situation to ensure the foundation of our pavement structures are sound.

When it comes to dealing with high PI clays, TxDOT and the lime industry have had a long relationship. Texas is proud to be one of the pioneers in lime stabilization of soils. Over the last 50 years, millions of tons of lime have been successfully used by the department to change these problem soils into a material that can be counted on as a consistent and stable part of the pavement structure.

Hydrated lime has also been a staple in many of our hot-mix-asphalt pavement designs as an effective anti-stripping agent. Just as our sub-grades vary, so do the types of aggregates that are used in our asphalt mixes. Limestone, siliceous gravel and even some igneous rock are utilized depending on location and source availability. Hydrated lime has been used, at times, in all of these aggregate types.

TxDOT and the Lime Industry in Texas have worked together for many years to the benefit of the traveling public.

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Presidents Message

July 2004

Dear Participants in the Texas Road Construction Industry,



Lime has been used successfully in highway construction in Texas for more than 50 years and is our largest market.

Members of the Lime Association of Texas, Austin White Lime, Chemical Lime and Texas Lime are proud to be part of the road construction industry in Texas.

Our mission is to promote the uses of lime in soil stabilization and Hydrated Lime in asphalt through partnerships with the Texas Department of Transportation, Texas Public Works Association, American Society of Civil Engineers, Texas Good Roads Association Texas Association of County Engineers and Road Builders, National Lime Association, private industry and many other distinguished organizations. We strive to achieve our mission in a variety of ways including presenting full-day and half-day seminars and workshops, brown-bag luncheons, investing in research projects and disseminating information relating to the construction industry. We have a full time executive director, Larry Peirce, to coordinate activities and respond to you, our customers.

Our desire is to provide a high-quality product that meets all specifications for use in the soil stabilization and asphalt markets, and provide technical support to maintain the high level of construction practices in our industry—one that other states can envy. Lime has been used successfully in highway construction in Texas for more than 50 years and is our largest market. We are continuing to expand our interests in recycling of existing roadbeds to save natural resources and improve our environment.

Members of the Lime Association of Texas will continue to provide high-quality lime products and service to you, our customers, and expand our production to meet your future requirements.

Sincerely,

Oscar Robinson, President
Lime Association of Texas

Modification or Stabilization

— Know What You Are Getting

By Larry Peirce

I became executive director of the Lime Association of Texas in June 2003. During the past year, I have traveled throughout the state on numerous projects and endeavors. One of the important aspects of these travels is to meet with specifiers, owners and engineers to find out what they expect from lime and to understand what we can do as an association to help them.

An issue that keeps popping up consistently is the frequent confusion between "what is modification and what is stabilization." These are two different treatments, both of which have their place in construction. It is important to know the difference between them, and to select the right application for the intended purpose.

Modification: Lime modification of clay soils refers to improving the workability and constructability of existing or borrowed material through the addition of a small amount of lime. There are numerous

purposes for modifying a soil. The most common are: To aid compaction by drying out wet areas, to bridge across underlying poor soil, to provide a working table for construction equipment to travel on and/or condition soil for additional treatment. The important thing to keep in mind is that modification does not insure permanent strength gain or permanent change in the material. The chemical reaction needed for this usually will not be achieved. Modification is a good application for many situations, but has limitations.

Stabilization: Lime stabilization is a permanent chemical change in the soil that results in measurable enhanced engineering properties. Stabilized material provides a structural benefit that can be included in the overall pavement design. The amount of lime to be used is determined by laboratory testing which should include pH determination and strength improvement. Lime reacts with water and the silica and/or alumina compounds in the soils to create a material that is less dense and more able to accept water without exhibiting large volumetric changes. This is called a pozzolanic reaction and must be achieved if the material is to be permanently changed. To ensure this reaction will occur, it is recommended that ASTM C-977 is used to determine the prop-



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er amount of lime needed. ASTM C-977 outlines the Eades-Grim method of verifying the proper lime percentage by preparing a series of samples with increasing amounts of lime in each one. The increments are generally a 1 percentage point increase for each sample. When the sample yields a soil with a pH of 12.4, the amount of lime needed for stabilization has been determined. Figure 1 shows

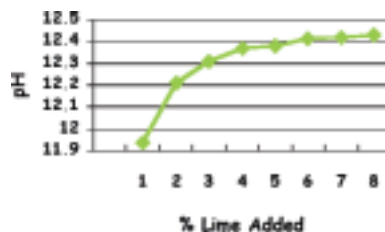


Figure 1. Eades-Grim Method to Determine Amount of Lime Needed.

that 6 percent lime would be needed to stabilize the tested material. For application in the field, it is wise to add .5 to 1 percent extra to compensate for variability between lab and field construction conditions.

I have heard on numerous occasions during the last year that "we stabilized the soil but lime did not last," or "we always use 5 percent to stabilize" or "the consultant said in order to stabilize we needed to reduce the PI to 15, which required 5

percent." Sometimes these assumptions may work out because the amount of lime used is sufficient, but the only way to know is to test. Checking for pH levels in the lab is quick and inexpensive. The equipment needed costs less than \$500.

The point the lime industry wants to emphasize is that one size does not fit all. If you're trying to dry up an area so you can drive a dump truck over it then modification may be what is needed. If the goal is to build

a working table for construction equipment and additional material placement, modification can handle it. If you want to add strength to the subgrade and keep the moisture from wreaking havoc on the overlying layers on a 20-year design, you must do the proper testing and apply the right amount of lime. If you intend for the subgrade to become a sub base and provide any structural value, you must use the right amount of lime required to stabilize the soil. I like the phrase that Eric Berger, a researcher and engineer for Chemical Lime Co, in Fort Worth says: "One test is worth a thousand expert opinions." Figure 2 is a great example of the strength and benefit a properly lime-treated layer can provide.

The Lime Association of Texas is committed to providing any assistance necessary to any entity that desires to know more about the proper use of lime. The member companies are dedicated to quality and have directed the Lime Association of Texas to carry out their mission of promoting the proper and high quality use of one of man's most important chemicals.



Figure 2. Proper stabilization provides a durable, long-term material as evidenced by this base layer bridging a washed out area.

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Education Is The Key

The Lime Association of Texas

kicked off its educational efforts this year with two workshops in April held in the Rio Grande Valley (in the city of McAllen) and in Houston. Both were very well received and achieved their intended purpose of technology transfer and training related to the use of lime in roadway construction.

The LAT board of directors identified education as one of the primary efforts to be implemented by the association. The response to these workshops has been outstanding. McAllen had 50 attendees and Houston had 135.

The day-long workshops offered a broad range of information related to lime stabilization and roadway construction. Topics ranged from the importance of subgrade preparation for proper pavement performance to the basics of lime, design

considerations and quality control and inspection procedures. Speakers participating in the program included industry professionals, TxDOT engineers, testing lab/consulting engineers, equipment manufacturers and university professors. The LAT is especially fortunate to have Eric Berger, P.E., of Chemical Lime Co. and Dr. Dallas Little, P.E. of Texas A & M University as lecturers. Both Mr. Berger and Dr. Little are renowned experts in the use of lime for soil stabilization and have made themselves available for this important training effort.

Additional workshops are planned for the remainder of 2004. The locations are Dallas and Fort Worth, slated for late summer and East Texas and Austin, planned for the winter. The LAT will offer at least six a year going forward. By tailoring each workshop to meet the needs and interests specific to the respective area, attendees are assured that the information put forth is relevant to their needs.

In addition to our 1 day workshops, the LAT also conducts short "brown bag" sessions for agencies and consulting firms. They are usually held during a lunch hour or prior to the beginning of the work day. Brown bag sessions are tailored to



Carlos Peralez, P.E., Laboratory Director for TxDOT Pharr District at the McAllen Workshop.

the specific requests of the firm or agency, and have proven to be an effective avenue for technology transfer.

The LAT is ready to schedule a seminar or brown bag session for you! To arrange your session, contact Larry Peirce at either 512-633-1130 or lwpierce@austin.rr.com

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Versatile Lime Serves Important Role in Successful Pavement System

Lime is one of the oldest and most important chemicals known to man. The countless number of uses for lime would surprise even the most educated person. The improved constructability of poor soils and the enhancement of hot mixed asphalt are two areas where the use of lime has dramatically improved the pavement construction industry in Texas. A heavy-duty pavement project being constructed on the nation's leading NAFTA trucking route exemplifies the importance of the use of lime.

More than fifty years ago TxDOT, then known as the Texas Highway Department, successfully conducted its first trial job to evaluate the use of lime in the stabilization of clay sub-

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Lime Slurry Being Applied to Subgrade on Interstate 35 Project in LaSalle County, N. of Laredo

grade soils. Fine grained soils, and gravelly soils with high concentrations of fine materials, present a number of problems when attempting to build a strong, durable pavement structure. They are typically moisture sensitive, causing the potential for shrinkage and swelling. They exhibit poor pavement support due to low resilient modulus values and poor unconfined compressive strength characteristics. They also possess a host of con-

structability problems because they are difficult to work and compact. Hydrated lime reacts with these soil types, and depending on the amount used and application process utilized, the soil can be dried to allow better workability, modified to provide a stable working platform or stabilized to permanently add strength and control plasticity. Since that first trial job conducted many years ago, the use of lime has grown considerably to the benefit of the

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Motor Grader Working Lime Slurry into Subgrade

construction industry. Lime modification and stabilization of soils are now standard procedures for building quality pavements.

Once the subgrade soils have been taken care of, attention must be turned to the proper design and construction of the top pavement layers. HMA pavement surfaces have provided years of successful, quality service on more than 90 percent of Texas roadways. Recently, TxDOT embarked on the construction of heavy-duty, perpetual pavement systems that will provide 50 years or more of life with routine, cost effective surface maintenance. Following the lead of states such as Georgia, that have implemented similar designs with great success, TxDOT is building full-depth HMA pavements that use the latest technolo-

gies in aggregates and asphalt binders to achieve these new and improved pavement designs.

It is no surprise that for the first perpetual pavement constructed in the Laredo District on Interstate 35, NAFTA's most heavily truck traveled highway in the country, lime plays an important role in the entire pavement structure from the subgrade all the way up to the very last surface layer of HMA.

Sixty miles or so north of the border city Laredo, near the small town of Cotulla, Interstate 35 has been punished for years by the steady

increase of tractor trailers moving freight north from the border to destinations throughout the U.S. and beyond.

The pavement design called for lime treatment of the subgrade soils prior to placement of the four different types of HMA layers. The construction of the project was in the capable hands of Gilbert, Texas Construction. For the subgrade, 220,000 sq. yds. were treated with lime. The lime slurry was placed with a gravity dump, then worked or ripped in place with a motor grader. A D-4 bull dozer was used after the motor grad-



Subgrade Leveling Begins after Lime is Worked In

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er to continue working the lime into the subgrade.

The addition of lime played an important role in stabilizing the subgrade, allowing for the creation of a strong, consistent foundation on which the asphalt pavement layers could be constructed.

The Laredo District of TxDOT also requires that all HMA produced on state projects use 1.5 percent hydrated lime by volume. Hydrated lime has been used for many years to help waterproof the aggregates to combat stripping caused by moisture damage, a potential problem that can wreak havoc on a pavement—particularly when heavy trucks pound the structure. It also resists rutting by stiffening the mix, another benefit for pavements subjected to heavy loading. Add to these benefits hydrated lime's ability to slow down aging and promote healing as recent studies are beginning to show, and it becomes obvious

why many specifiers want to see it used in their asphalt.

The HMA pavement structure on the Laredo District project called for the use of a rich Superpave bottom layer, followed by two layers of TxDOT's new stone-filled Superpave design (one layer with .75-inch maximum aggregate size and the other with one-inch maximum aggregate size). The final surface course is a heavy duty stone matrix asphalt layer that is excellent for withstanding the traffic loading expected in this area. Each layer and design type utilizes 1.5 percent hydrated lime as a component for this innovative pavement structure.

During a Federal Highway Works Administration workshop in Laredo to showcase the project, Fitzgerald Sanchez, director of construction for TxDOT's Laredo District, indicated the district's confidence in the project. When considering the quality of design, material selection and personnel involved, Mr. Sanchez's confidence is easily understood. Utilizing lime in the subgrade and HMA layers helps to insure the long-term success of this stretch of IH-35.

Dorothy Warren: Profile of a Lime Legend



What can be said about a person who has more than 50 years experience in the lime industry in Texas? Well, a whole lot can be said when considering that this person is still going strong and serves as an important part of a busy company and as the chairperson of the Lime Association of Texas. Of course, we're talking about Dorothy Warren of Austin's White Lime Company.

Dorothy was dubbed "Mrs. Versatile" in 1968 by the Round Rock Lime Company, her employer at the time. Like the chemical she has worked with and sold for so many years, she has remained a versatile and interesting part of the lime industry landscape for more than five decades.

Dorothy began her career in the lime industry in March 1950 with the Round Rock Lime Co. as the United States was putting World War II behind it and moving forward to a new era. She learned how lime was manufactured from limestone, and started in the clerical area learning about customers and railroad freight rates for shipping lime. A quick learner, she assumed full accounting responsibilities in 1952. Dorothy became a certified professional secretary in 1962, a very rare distinction considering there were only 3000 in the country at the time. She was named secretary of the year in 1968.

During the 1960s, Dorothy began specializing in sales, contracts and order processing (remember versatility!). She was involved in the devel-

opment of a bulk truck-rate tariff in 1961 for transporting bulk lime in Texas, which was used for many years prior to deregulation.

Dorothy exhibited a knack for the promotional side of the industry, much to the benefit of all involved in Texas. She began working with the National Lime Association's promotional committees and was able to learn much from many distinguished folks like Bob Boynton and Harry Frances. In Texas the Lime Association of Texas people she has worked with include Ed Bluestein, P.E., Charles Baxter, P.E. Billy Neeley, P.E. and currently Larry Peirce, the present executive director.

Dorothy has participated in and attended hundreds of seminars, workshops and conferences throughout the state in her promotional activities. If you ask her, she will tell you she "was taught about the many applications of lime from the most knowledgeable and best leaders and educators in the industry." Given the handful of names listed above, her claim is indisputable.

Some of her achievements include: Employee of the year, Austin White Lime 1994; Chairperson of the Lime Association of Texas since 1996; Person of the Year, Southwest Association of Rail Shippers; and the Texas Public Works Association Award for the Lime Association of Texas' sponsorship of the Lime Breakfast and continuous support for 30 consecutive years.

One of Dorothy's best characteris-

tics is her true enjoyment of meeting people and the many people who know and respect her around the state. Recently, Lime Association executive director Larry Peirce attended a couple of conferences that Dorothy could not make due to scheduling conflicts and was inundated by individuals asking, "When is Dorothy getting here?"

"I enjoy meeting people in person with whom I have had many telephone contacts throughout the years," Dorothy says. "I feel fortunate to have learned so much about lime and to have a great place to work to share my knowledge with our customers. I love to talk about lime and its many uses and applications."

Dorothy resides in Pflugerville, where she is actively involved in her church. She enjoys traveling, especially in Texas, big band and polka music, working in the yard, making floral arrangements and playing Texas 42. Her newest hobby is genealogy.

Dorothy married her high-school sweetheart, Lester "Collie" Warren, in 1948. They have two children, four grandchildren and one great-grandson. Family is very important to Dorothy.

On behalf of the Lime Association of Texas, thank you to Dorothy Warren for all you have done and continue to do.

LIME ASSOCIATION OF TEXAS

In the mid-90s the National Lime Association, through its Texas members, commissioned the writing of an excellent book by Dr. Dallas Little, P.E. of Texas A&M University titled, "Stabilization of Pavement Subgrades and Base Courses With Lime."

The Lime Association of Texas now possesses the copyright to this book and has made it available to all interested parties. This comprehensive handbook, which is 219 pages and is presented in a handsome blue hardback, was created to assist engineers and pavement construction professionals in the technically advanced uses of lime for stabilization and modification of pavement subgrades and base courses.

"Stabilization of Pavement Subgrades and Base Courses With Lime"

is designed to provide a comprehensive reference on:

Mechanisms of reaction between lime and soil

- Mixture design
- Engineering properties derived as a result of lime stabilization of soils and aggregates
- Pavement thickness design considerations
- Construction and quality control considerations
- Life cycle cost analysis

"Stabilization of Pavement Subgrades and Base Courses With Lime" begins by introducing you to lime, including definitions of pertinent terms, a description of the types and forms of lime available for roadbed stabilization, a discussion of practical and important physical and chemical



properties of quicklimes and hydrated limes as well as a brief introduction to the production of lime.

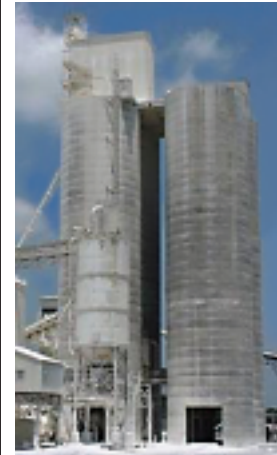
Insightful chapters feature:

- The important role of stabilized soil subgrade layers and/or the stabilized aggregate base layers in the pavement structure
- Discussions on the fundamental considerations involved in mixture design
- Pavement structural thickness considerations, quality control, and studies of engineering properties
- Many, many visual references such as diagrams, tables and photos



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