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Presidents Message from The Lime Association of Texas

The Lime Association of Texas members are happy to report on research recently approved by the National Lime Association Board of Directors, of which each of us are members. The research will involve a more comprehensive testing of lime in asphalt.

The project will cover a two-year period and will quantify increases in pavement life resulting from the addition of hydrated lime to hot-mix asphalt. The tests will be conducted under the supervision of Dr. Peter Sebaaly of the University of Nevada at Reno and Dr. Dallas Little of Texas A&M University, who are renown for their expertise in asphalt research.

The study will include results from untreated asphalt, lime-treated asphalt and liquid-treated asphalt mixes and will evaluate pavement distress modes including moisture damage, fatigue cracking, permanent deformation (rutting), thermal cracking and oxidative age hardening.

Test results will be translated into quantitative estimates of increases in pavement life. Two goals of this study are to improve public agency acceptance of lime-treated asphalt and to elevate credibility of past research regarding the use of lime in the mix.

Our association is also participating in a lab study that will more accurately reflect field conditions comparing lime and cement-based stabilization of high-plasticity

soils. The Texas Transportation Institute was chosen for the study and testing is under way. Preliminary test results have been received and the final report is due this summer.

The Transportation Research Board has issued compilations of key papers from the annual TRB meeting in a series of "Transportation Research Record" reports. In the TRR 1952 reports titled "Geomaterials," articles of interest include: "Evaluation of Chemically Stabilized Clay Soils Embankments Using Accelerated Pavement Testing," Romanoschi, et al; and "Recommendations for Stabilization of High-Sulfate Soils in Texas," Harris, et al; among numerous other papers.

TRR 1962 entitled "Bituminous Materials and Nonbituminous Components of Bituminous Paving Mixtures" includes one paper addressing lime titled "Determination of Lime in Hot Mix Asphalt," Arnold, et al. These papers and others not mentioned are available on the TRB Web site at <http://trb.org>.

The Lime Association of Texas expresses our deepest gratitude to Mike Behrens, PE, employed for 37 years by the finest highway department in the world and devoted the past seven years as executive director of TxDOT.

Mike has fought for us in the Legislature, made significant progress in building new highways in the state with declining tax dollars and improved the education of the department and the public regarding construction issues. We will be forever



grateful for his dedication and look forward to working with his successor.

We have spent the better part of the past 12 months providing educational workshops to agencies of the state, counties, cities, engineering firms and associations and others, so be sure to contact us at <http://limetexas.org> to receive additional information on our association or set up a free workshop for the latest information on lime in roadway construction.

Sincerely,

Oscar Robinson, President
The Lime Association of Texas



The Importance of the Public Sector Partnering With Industry

The City of San Antonio has long understood the importance of working with our many industry partners to help deliver the best critical public infrastructure to serve our residents.

We have recently worked closely with the lime industry through the Lime Association of Texas (LAT). This is a relationship that has developed over the past 30 years through Texas Chapter of the American Public Works Association (TPWA) educational opportunities.

LAT, TPWA and San Antonio embarked on a project to demonstrate the state of the art in municipal street rehabilitation for the American Public Works Association Congress to be held in San Antonio in Sep-

erative effort by public employee, contractor, supplier and industry representatives.

The estimated value of the demonstrations is well over \$150,000. We have been fortunate to have Larry Peirce, executive director of the LAT, to lead this effort and keep it on track with all of the various private and public sector participants.

There has been a continued focus on improving the quality of the critical infrastructure in San Antonio, the seventh largest city in the United States. Elected officials, management and residents are concerned and interested in improving the condition of public infrastructure in the city.

The city has made significant investments in infrastructure over the last 10



Message From Thomas Wendorf
Director of Public Works
City of San Antonio

Elected officials, management and residents are concerned and interested in improving the condition of public infrastructure in the city.

tember. The APWA Congress will host an estimated 5,000 public works professionals from across the nation.

The demonstrations will include lime stabilization of highly expansive clay, installation of asphalt emulsion black base and utilization of warm-mix asphalt for the final riding surface. The demonstrations will be a coop-

years, including \$115 million in general obligation bonds, \$110 million in stormwater revenue bonds and recent approval by the voters of \$550 million in general obligation bonds, of which \$460 million is directed toward streets and drainage.

The city also recently adopted a five-year, \$220 million Infrastructure Management Program, of which planned maintenance to streets is a key component.

San Antonio has many different sub-grade conditions that range from limestone rock, which provides a great foundation for

construction, to highly expansive clay, which is challenging for long-term maintenance of streets. It is in these poor soils where lime allows us the ability, when properly designed, to create a strong and durable platform on which to build our subsequent pavement layers.

The city is committed to designing the best streets possible, and lime can be counted on as one of the essential tools in our municipal street rehabilitation "toolbox."

We look forward to a long and continued relationship with the Lime Association of Texas. We have found that public, private, industry and professional association partnerships are a key to successfully improving infrastructure in San Antonio. ■



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**Message from Jeff Seiders
TxDOT Director of Materials and Pavements**

The Texas Department of Transportation Materials and Pavements (M&P) Section of the Construction Division is located in Cedar Park, a suburb of Austin, and is responsible for overseeing the various materials used in the construction and maintenance of our highways.

TxDOT M&P works closely with its many industry partners to ensure quality construction materials are used and innovative new products are monitored for their possible use in the highway industry. As such, M&P has worked closely with the lime industry in Texas for many years. Lime has been successfully used by the department for nearly 60 years in the stabilization of clay soils and for over 30

years as an anti-strip in hot mix asphalt.

Throughout this time, the production of lime has been carefully controlled and the specifications required by TxDOT have been upheld.

The lime industry, primarily through the Lime Association of Texas, has worked closely with TxDOT for many years to improve specifications and to educate industry and TxDOT on proper applications and best practices when constructing lime-treated pavement layers. The Lime Association of Texas is a strong advocate of properly designing the percentage of lime needed to successfully treat materials rather than following the one-shoe-fits-all mentality.

Association members take pride in producing a product that is consistently of high quality. Their efforts have earned the industry the reputation of being a technically competent and conscientious partner with the department.

Lime holds a place as one of the tools in the TxDOT "tool box" of materials. It is an excellent product when used in the right application and when designed and constructed properly.

In the coming years, TxDOT has to make our construction dollars stretch farther than ever before, and we look forward to continuing our strong relationship with the Lime Association of Texas as we face these challenges. ■



LIME ASSOCIATION OF TEXAS

***The Many Uses of
LIME: The Versatile Chemical***

SUBGRADE SOILS

- ★ Dries Wet Soils
- ★ Reduces Plasticity
- ★ Improves Stability
- ★ Provides Solid Platform
- ★ Efficient, Permanent Strength Gain

BASE MATERIAL

- ★ Enhances Poor Material
- ★ Increases Strength Without Causing Cracking
- ★ Economic Recycling of In Place Roadways

HOT MIXED ASPHALT

- ★ Combats Moisture
- ★ Eliminates Stripping
- ★ Reduces Rutting
- ★ Reduces Premature Aging

Contact the Lime Association of Texas

www.limetexas.org



City of San Antonio Prepares for APWA Street Reconstruction Demonstration

**By Larry Peirce, Executive Director,
Lime Association of Texas**

One Friday afternoon in April 2006, after an early planning meeting for the 2007 APWA congress, an idea was born and a plan hatched to reconstruct a street that would become a live demonstration for interested attendees at the congress.

The city of San Antonio along with the Lime Association of Texas worked together to discuss what and who would be needed to ensure that the different processes demonstrated would be both relevant and innovative for the attendees. The trick would be to demonstrate all the different layers being reconstructed at the same time, a tall order indeed.

The only way to pull this off would be to simultaneously construct the different treatments within the pavement structure on three different streets so the attendees could be “moved” from one process to the next,

thus seeing each of the different pavement layers being reconstructed at the same time. That is exactly what will be done in September during the congress.

Reconstruction of municipal roadways presents numerous challenges to public works professionals. Balancing limited dollars with the need for successful long-term pavement performance is critically important during both the design and construction phases. Building high-performance streets and achieving longevity that matches the intended design life is the ultimate goal.

This demo will show the various phases of a complete street reconstruction project from the subgrade layer up through the pavement base and surface layers. The subject streets will exhibit poor subgrade soils that will be lime stabilized. The engineering testing and design requirements for proper lime stabilization will be discussed and demonstrated.

For the overlying base layers, a reclaimed

asphalt emulsion stabilized base will be constructed using existing surface and base materials milled up from the original roadway. The pavement surface will be an innovative type of asphalt pavement known as “warm-mix asphalt.”

Warm-mix asphalt technology is gaining popularity worldwide as a means to produce pavement materials utilizing less energy than traditional hot-mix asphalt. This is important as cities seek ways to reduce emissions from vehicles and factories and struggle to avoid nonattainment status.

All of the technologies used in this demonstration tour will be thoroughly explained during a technical session prior to observing the operations in the field.

The end result will be to demonstrate how, through the use of thorough testing and design methods coupled with innovative materials and construction techniques, a city can ensure peak performance and a successful long-term project.

The city of San Antonio and the Lime Association of Texas pulled together an impressive list of “industry partners” for this unique undertaking. The city will provide the workers and equipment for construction of all three pavement layers. The Lime Association of Texas member companies will provide the lime for the subgrade stabilization and technical assistance as well as overall project coordination.

Chemical Lime Co. in particular will provide the lime slurry and deliver it to the site. Ergon Asphalt will provide the asphalt emulsion for the reclaimed base as well as the process for the warm-mix technology.



Photo 1: Milling of Existing Roadway on Maryland Street



Vulcan Materials Co. will be producing the warm-mix asphalt. Valero Asphalt will be providing the asphalt cement, and the Asphalt Institute will be providing technical support for both the base and surface layers. Engineering and construction testing services will be provided by Fugro Engineering Consultants Inc.

All of these willing industry partners are contributing their materials, time and expertise at no charge to the city for this demonstration project.

Early on, the team recognized that if it rained on the day of the demo during congress, the whole operation would be for naught. With this in mind, the team decided that a “dry run” would be needed to be built using all the processes near the demo location, and that a comprehensive video would be produced to document the processes.

That way, in the event of rain, the attendees could still attend the technical session and then see a video of the various treatments. Maryland Street was selected and has now been completed and filmed. The following documents what was done on the street.

Maryland Street is a residential drive just east of downtown San Antonio. The existing asphalt surface and black base sit directly on top of a highly expansive clay subgrade, which has caused many problems with performance ultimately leading to premature failure.

Although the street was completely reconstructed less than 12 years ago, nothing was done to the existing expansive clay subgrade, and no matter what you design or build, your street is only as good as the foundation it sits on.

The three different treatments described above were implemented to completely reconstruct this pavement while using the existing materials to save money and

expedite construction. The existing problematic expansive clay subgrade was lime stabilized using an amount of lime engineered to permanently change it into a strong and stable foundation layer.

After the lime-stabilized layer, the former hot-mix and asphalt base material that was milled up and stockpiled was brought back to the site, laid down and mixed with an asphalt emulsion to create a strong yet flexible base layer. The final surface was completed with the warm-mix asphalt described previously.

City forces used their milling machines to remove the asphalt surface and base material. This material was hauled off to a remote location where it was stockpiled until the subgrade treatment was completed, at which time it was brought back to the jobsite and treated with asphalt emulsion and reused. The milling was done at a depth to the top of subgrade, and care was taken to keep the expansive clay material from being milled up into the material that was to be used later.

Prior to any subgrade stabilization work Fugro Consultants, a pavement research, design and geotechnical firm, performed modulus testing on the untreated native subgrade soil. This is done with a handheld device called a “light-weight deflectometer.” The LWD imparts a load onto the test location and measures the ensuing deflection with two seismic deflectometers. The information is stored and the strength or modulus of the natural subgrade layer is calculated. Data is collected at numerous tests points throughout the project limits. This process is also repeated on the lime-stabilized subgrade after treatment in the same test locations as before the treatment and also is performed on the completed asphalt emulsion base layer prior to final surfacing. The outcome of this testing pro-



Photo 2: Clods of Highly Expansive Clay Found in Subgrade on Maryland St.

vides strength information about each layer in the pavement system.

For the highly plastic subgrade, stabilization is a must to ensure that the pavement will have any chance of living its intended life. Lime Stabilization has been used extensively in Texas for over 50 years. Lime is made from limestone, and the resulting product called calcium oxide (CaO) has a natural chemical affinity to react with the chemical components found in clay. As you can see in Photo 2, the native clay is dense, sticky and hard to work with. It exhibits all the qualities you DO NOT want for construction purposes.

It expands greatly when wet and contracts when dry, causing problems for any pavement material placed on top of it. It is difficult to compact and is a poor foundation material. But when mixed with sufficient quantities of lime and water, the clay soil changes into a much more useful material. One that is a granular type of soil that is easier to compact and can accept fluctuations in moisture without swelling and shrinking like it did in its former state. The lime is being placed in a slurry form. This means that at the plant it is loaded as a dry material into a special slaker tank that blends the lime with water to form a “lime-slurry” with an approximately 38% solids content. It is then loaded into special trail-



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Photo 3: Lime Slurry Placement on Clay Subgrade



Photo 4: Notice Change in Soil after Lime Breaks Down the Clay and Makes it a Granular Material

ers that continue the agitation en route to the jobsite. These trucks and this lime come from Chemical Lime Co.'s New Braunfels plant about 25 mi north of the project. The lime is placed uniformly over the limits of the project in order to ensure that consistent coverage is achieved.

As you can see in Photo 3, it has the consistency of a "vanilla milkshake." Prior to the placement, the soil is scarified to break it up a little, to help the lime react and mix more easily. The depth of treatment for this project is 6 in., and through careful engineering testing, the amount of lime used is 9% by weight of soil. Normally the percentage would be slightly less, probably on the order of 6-7%, but organics present in the soil necessitated the increased percentage. The mixing of the lime slurry into the soil begins immediately after placement. The mixing machine, a Wirtgen, is powerful and is able to substantially mix the lime after just one pass. In order for the lime to work most effectively and to penetrate into the clay to create the chemical reaction that ultimately changes it into a workable material, a second pass of mixing is completed on the first day. This process is known as the initial mixing. Lime stabilization is a two-mixing-stage

process, so after the first two passes of mixing, which constitutes the first stage, the lime-soil mixture is left to "mellow." The mellowing phase requires that the soil be left in a loosely compacted state to ensure that the chemical reaction between the calcium in the lime and the minerals in the clay continues. For this project, the mellowing period is 48 hours because the clay is highly plastic. The mellowing period can often be as short as 24 hours and for a lower volume residential street such as this one, light traffic such as passenger cars can drive on it during the mellowing period in order to access driveways at night and early in the morning. Once the mellowing period has passed, the mixing machine is brought back out and it conducts the same process as it did on the first day. By this time the lime has really broken down the clay and the material looks like a sandy loam as the mixing machine processes it. For Maryland Street, the gradation requirements were easily achieved in one pass on the final mixing stage. Photo 4 shows the dramatic change evident in the soil as the lime permanently changes it.

After final mixing, compaction immediately begins. A segmented wheel or sheep's foot roller is used to achieve initial com-

paction. After the sheep's foot, a steel drum roller and pneumatic tire roller are used to "knit" the surface and create a smooth consistent surface. Laboratory testing is required to make sure that the compaction densities and optimum moisture contents are achieved. The compacted surface was moist cured for 2 days over the weekend prior to the placement of the base material.

The next process after the completion of the lime stabilization was the construction of the reclaimed asphalt emulsion base. The material that was milled up from the original pavement on Maryland Street was brought back out to the jobsite and spread evenly over the roadway. Then an asphalt emulsion was added to it and mixed in place. Basically, an asphalt stabilized base is being created that will provide an extremely strong yet nonrigid layer between the stabilized subgrade and the warm-mix surface. Asphalt emulsion stabilized base treatment is an effective way to take existing worn out materials and turn them into something new, strong and durable.

The final step in the process is the placement of the warm-mix asphalt base material. Although most warm-mix processes are still in the R & D phase, the design is similar to that of traditional hot-mix asphalt.



Warm mix can simply be added to the original design. For this demonstration, the process being used is the dispersion asphalt technology, or “DAT” method. This was developed by MeadWesvaco, a South Carolina-based company. This process injects a concentrated chemical solution directly into the liquid asphalt line feeding the mixing drum. The chemical solution is produced by Ergon, a Mississippi-based company with a strong and long presence in Texas. The chemistry allows for significant reduction in the plant production temperature required while also allowing for improved compaction on the roadway.

Attendees for the upcoming APWA Congress in September will certainly have an exciting demonstration to look forward and a real “hands-on” opportunity to see these innovative technologies. ■



Photo 5: Warm-Mix Asphalt being Placed on Maryland Street





Profiles of the 3 Lime Companies of Texas

Austin White Lime Co.

When Austin White Lime Co. in tiny McNeil, Texas, in Travis County, first opened its business in 1888, its founders knew they would be marketing products with literally 1,000 or more uses.

This ancient and versatile product dates back to such historic projects as the Appian Way and the Egyptian Pyramids. Through the years, this basic chemical has evolved into the production of nearly any product you can imagine.

Austin White Lime has consistently updated its equipment throughout its history. It is the oldest registered mine operating in Texas, taking its limestone from the Edwards Plateau, located in Travis and Williamson counties.

This is a soft stone, making it ideal for calcining in rotary kilns. The quicklime (calcium oxide, CaO) and hydrated lime (calcium hydroxide, CaOH₂) produced at



Austin White Lime post office in McNeil, Texas

McNeil meets and exceeds specifications such as American Society for Testing Materials, American Water Works Association, Texas Department of Transportation and Underwriters Laboratories.

The company continues to supply customers with a full line of packaged products as well as a variety of bulk lime products delivered by Austin White Lime Transport Inc. and specialized motor carriers for hire or by rail.

For the construction industry, Austin



Austin White Lime

White Lime supplies lime for a variety of building material uses, soil stabilization of clay soils and as an additive to marginal base materials and hot-mix asphalt.

Throughout its history, the company has remained a native Texas family-owned firm with four generations of the Robinson family. The workforce is blessed to have dedicated and experienced employees from families for three and four generations. This team spirit contributes to the company's continuous operation for well over a century. ■



Chemical Lime Co.

Chemical Lime Co.

Chemical Lime Co. was founded in 1966 with the purchase of its first quarry in Clifton, Texas. By 1968, the quarry was open and producing crushed limestone, and in 1971, its first kiln was in operation.

Growth in the Dallas-Fort Worth Metroplex and construction of the DFW International airport created a strong demand in the 1970s for lime in soil stabilization, and that solidified CLC's place in the market.

In 1981, the Lhoist Group, Brussels, Belgium began investing in CLC and acquired full ownership in 1998. Today, CLC is one of the leading lime producers and marketers of lime products in the United States and a major part of the Lhoist Group, one of the largest lime companies in the world.

Important milestones in CLC's history

and growth include:

- 1983 - builds new facility in Marble Falls, Texas.
- 1986 - purchases the Houston operations of Chemlime Corp.
- 1986 - purchases Genstar Lime, the largest lime company in the western USA.
- 1989 - purchases the lime division of Allied Products.
- 1995 - constructs one of the largest "greenfield" facilities in the USA on the Mississippi River at Ste. Genevieve, Mo.
- 1997 - construction of Kiln No. 1 at the O'Neal, Ala., plant.
- 1997 - purchases the lime plant in Natividad, Calif., from National Refractories and Minerals Corp.
- 1999 - acquires APG Lime, which added four production facilities - two in

Ripplemead, Va., one in Charleston, S.C., and one in New Braunfels, Texas.

- 2007 - construction of Kiln No. 2 at the O'Neal, Ala., plant.

CLC's product range includes all products derived from the calcination of high calcium and dolomitic limestone-quicklime, hydrated lime, lime slurry-generally known as "lime."

Chemical Lime manufactures products specifically designed for water and waste-

water treatment; steel manufacturing; building construction; road and highway construction; hot-mix asphalt; mine reclamation; paper production; copper, gold and alumina processing; and flue gas desulfurization

Chemical Lime Co.'s innovative spirit has propelled it into a leadership position in today's market, and its numerous plants and terminals in North America are able to serve its customers. ■



Chemical Lime Co. Headquarters Fort Worth, Texas

Texas Lime Co.

A Long-Term Commitment to the Construction Industry

Texas Lime Co., located just south of the Dallas/Ft.Worth Metroplex, manufactures an array of lime and limestone products to meet the needs of our construction customers. The plant is located on approximately 3,400 acres, much of which contain high-quality limestone reserves in the Edwards formation.

Texas Lime produces quicklime and hydrate for soil stabilization, hydrated lime for hot-mix asphalt and ground calcium carbonate limestone for use as mineral filler in hot-mix asphalt. Type B and Type C lime slurry are also available through its affiliate, U.S. Lime Co., which has locations in Dallas and Houston.

Changing with the times

Established in 1930, Texas Lime has consistently served as one of the leading suppliers of lime and ground calcium carbonate to the construction industry. The plant and



Texas Lime Company Offices

the company have undergone significant changes over the past 75 years to meet the changing demands for product, quality and service. Since 1969, Texas Lime has been a wholly owned subsidiary of a public company, currently known as U.S. Lime & Minerals Inc.(NASDAQ: USLM)

Texas Lime has undergone the most dramatic changes over the past 10 years. In 1997, recognizing the increased demand for not only lime, but higher quality lime and better service, U.S. Lime & Minerals Inc., instituted a significant capital investment program for the Texas Lime plant, further reflecting its long-term commitment to the construction industry in Texas. In the last 10 years, more than \$30 million has been invested in Texas Lime.

The company now has a modernized plant with the best available control technology and increased silo capacity, and that has enhanced our ability to meet peak demand of the seasonal construction industry. Texas Lime not only produces a high-quality product, but is able to meet the growing demand with improved customer service.

Synergy through Affiliates

U.S. Lime & Minerals Inc. also recognized that the investment in the Texas plant was only part of the solution to provide products, service, quality and stability for the vast geographic area of the construction industry in Texas.

To address the growing demand for lime slurry from our customers in the Houston and Dallas markets, U.S. Lime Co. was formed in 2004 with the first terminal in Houston. Two additional terminals were added in the DFW area in 2006. Addressing the need to improve service and availability of product in the east and northeast Texas construction market, USLM also completed construction of a lime terminal in Shreveport (U.S. Lime Co. - Shreveport) in 2005. The terminal supplies both quicklime and hydrate to this market.

Planned for the Future

With the extensive investments in the Texas Lime plant and the addition of new terminals and products lines through its affiliates, the company will continue to extend its history of a long-term commitment to quality, service, stability and value to the Texas Construction Industry. ■



Texas Lime Product Silos



LIME ASSOCIATION OF TEXAS
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Central Texas Region Agencies Form “Capitol Area Pavement Engineers Council” (CAPEC)



The explosion of growth in the Central Texas area continues at a breakneck pace. With the construction of the SH130 toll road east of Interstate 35, the Austin and surrounding areas are seeing unprecedented development in the eastern portion of the region.

Unfortunately, pavement designers for the various public entities cannot enjoy the limestone rock for building foundations like they did in the western areas. Once you cross to the east side of IH 35, the sub-grade turns into expansive clay soil. It is no secret that these types of soils are poor candidates for a good foundation.

For many years, the three counties in the

area; Travis, Williamson and Hays, as well as the cities of Austin, Georgetown, Round Rock, Pflugerville, Buda, Kyle and others, have had individual pavement design specifications. The design variability and inconsistencies between the agencies become a big issue when dealing with areas of poor soils. Soils of this type can exploit inadequate pavement designs much more rapidly than a solid limestone rock foundation might.

To deal with the problems, a group of agency pavement designers and decision makers, engineering consultants and industry partners have formed the Capitol Area Pavement Engineers Council. The mission of CAPEC is to standardize the design, con-

struction, inspection and maintenance of the roadways in the Central Texas area.

Each governmental agency member will have an equal vote on issues of design and specifications. The group will solicit technical advice from local engineering consultants and material supplier trade associations.

Although the group is newly formed, several initiatives are under way already that members can benefit from. These include workshops for inspectors on lime stabilization.

One three-hour workshop, conducted by Larry Peirce, executive director of the Lime Association of Texas, will teach the different aspects of proper inspection from the time the lime truck arrives at the site through final compaction of the completed layer.

Another is a soil compaction and construction workshop conducted by Darrel Holmquist, PE, of CTL Thompson and Tom Benz, PE., city of Georgetown. Also available is a hot-mix asphalt placement and compaction workshop taught by Gary Fitts, PE, with the Asphalt Institute.

These early efforts will help to get CAPEC “jumpstarted” while the ultimate long-term goal-specifications that provide more uniform and better performing streets and roadways-is achieved. ■

Texas Lime ad



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and Stabilization Lime**

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