CARMEUSE®
NATURAL CHEMICALS

Lime for Full Depth Reclamation

LIME

Recycle Asphalt Pavement Economically with Lime Kiln Dust:

Saves Time

Lowers Material Costs

Reduces Total Costs

Easy Procedure

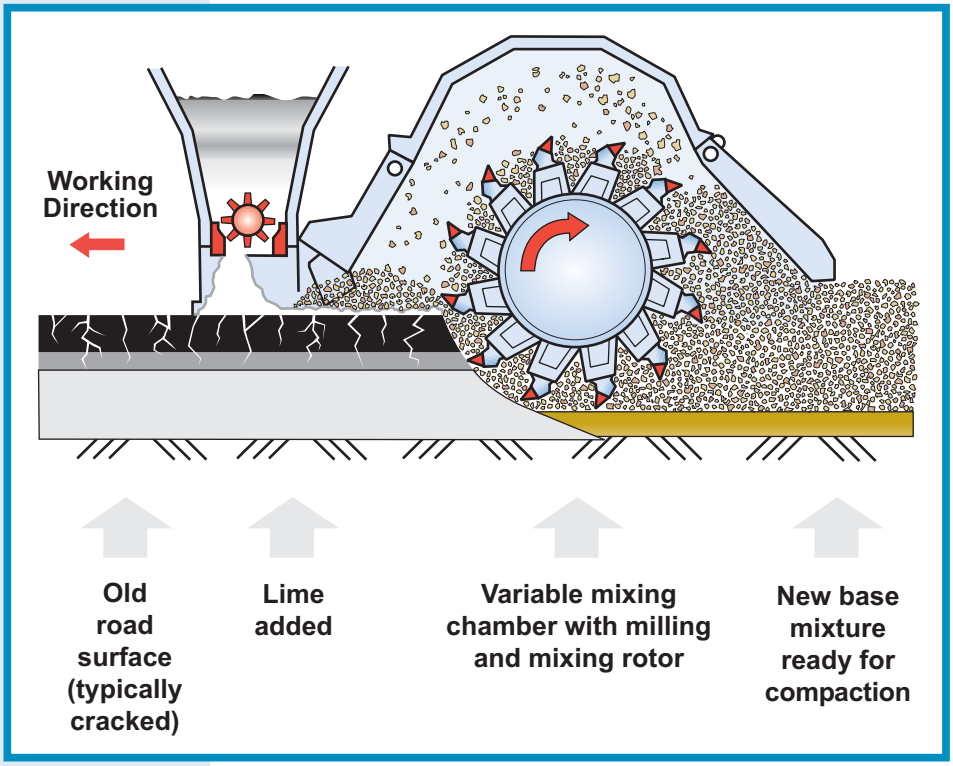
Full Depth Reclamation (FDR) is a maintenance process by which the full flexible pavement section consisting of asphalt, base, sub-base, and a pre-determined portion of the underlying soil subgrade are uniformly pulverized and blended with Lime Kiln Dust (LKD), resulting in a stabilized base course.

- *Ideal where base has structurally failed, and / or granular base is no more than 6 inches.*
- *Lower cost means more miles of roads and streets per the annual maintenance budget.*
- *Achieve greater strength and durability than with alternative products.*
- *Achieve optimum moisture and strength of sub-base and subgrade even under very wet conditions or high clay content.*

FACTS about Lime and LKD:

- The application of lime based LKD is a widely accepted and commonly used construction practice. As a highly effective and economical, cementitious reagent, LKD is often used for new construction subgrade beneath roadways, airports, and parking lots, by which the component of lime is known to substantially increase subgrade soil stability, load bearing capacity, and long-term durability.
- Lime is typically specified as the agent of choice to enhance the bonding of asphaltic cement to an aggregate. This use makes lime and LKD even more practical and common for many construction jobs.
- The FDR process of recycling the combined layers of asphalt pavement, the base, and the subgrade is similar to soil mixing, making it an easy and familiar process to most contractors.
- More than one million tons of lime are used annually in the U.S. for soil modification and stabilization.
- ***Since 1998, Ohio and Pennsylvania municipal and county engineers and geotechnical consulting engineers have successfully applied LKD as an effective and economical cementitious reagent for full depth reclamation of worn-out or failed secondary roads and parking areas.***

Lime, the Proven Solution!



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Technical Discussion

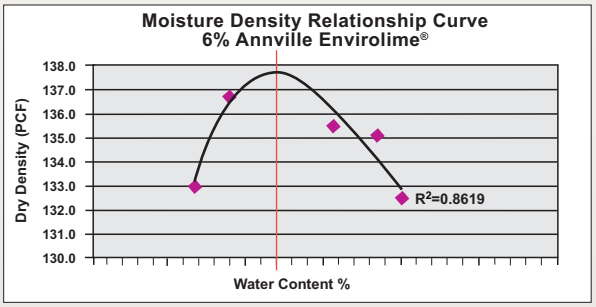
What is LKD, Envirolime®, and Calciment®?

LKD, which is also known by brand names Envirolime® and Calciment®, is collected during the calcination of limestone to quicklime (calcium oxide) in a rotary kiln. It is a dry, fine grain material that meets size gradation requirements making it ideal as mineral filler with dynamic bonding and cementitious qualities. Containing quicklime, silica and alumina material, LKD is highly conducive to cementitious reaction.

Three Basic Steps of a Mix Design:

1) Sampling: Samples are taken from actual jobsite in order to evaluate depth profile, particle size distribution, optimum moisture determination, strength properties

2) Analysis of Data: The Optimum Moisture Content (procter analysis) determines the moisture content needed for maximum density.



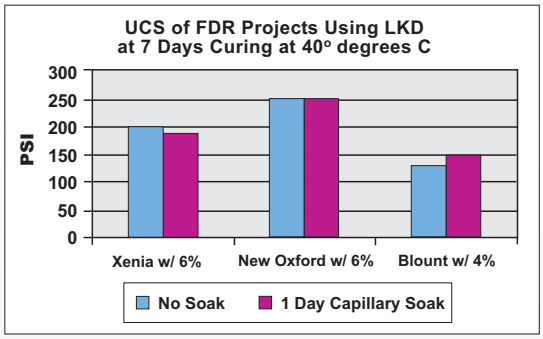
3) Strength and Durability Testing: UCS and CBR specimens are made with LKD added to confirm the strength and durability of the cementitious reactions:

Results

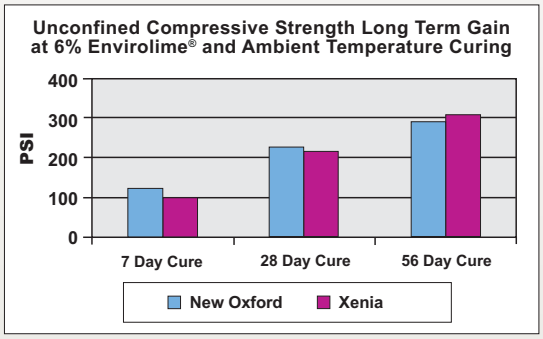
Performance Data from 3 FDR Cases.

Strength and moisture resistance is described below using respective tradenames for LKD product: Envirolime® in PA and GA, and Calciment® in OH.

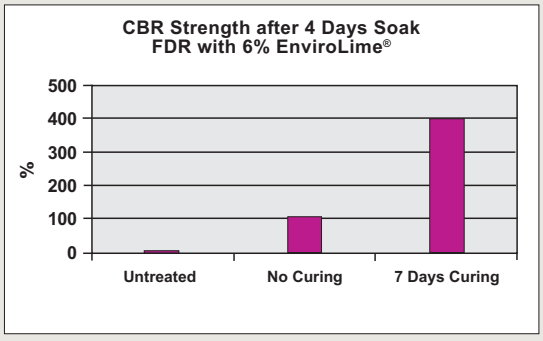
A) High Resistance to Moisture Damage:
Unconfined compressive strengths using lime kiln dust gain enough strength to resist moisture damage. Subjecting the cylinders to 1 day of capillary soaking did not impair their strength.



B) Long-Term Strength Gain:
Unconfined compressive strengths using 6% lime kiln dust show a significant gain from 7 to 28 to 56 days, cured at ambient room temperature.



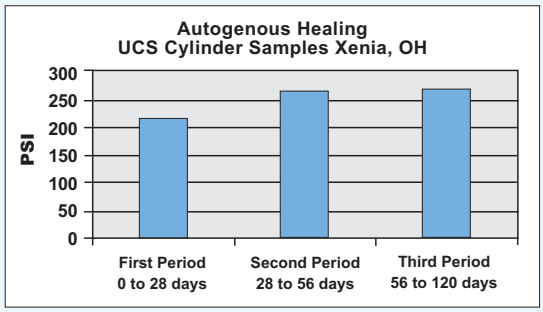
C) Load Bearing Capacity is Greatly Increased:
California Bearing Ratio (CBR) improves after the 4 day soaking even without curing time. At Xenia, the CBR was 400% with 7 days curing time, followed by the 4 day soak.



Autogenous Healing

Autogenous Healing of FDR Base Course

Research conducted at the University of Illinois (Thompson & Dempsey, 1969) has shown with adequate levels of lime in LKD processes, the pozzolanic reaction will continue to occur under favorable curing conditions resulting in autogenous healing of destructive cracking, i.e. from a freeze-thaw cycle. The ability to regain lost strength, or "heal with time," is illustrated by the following graph from an Unconfined Compressive Strength (UCS) tests on samples using LKD out of Xenia, OH.



The cylinders were broken three separate times in intervals of 28 days, and left to cure at ambient temperature. As the graph shows, steady strength gains were realized along with the autogenous healing of physical fractures. An additional case of LKD used in New Oxford, PA, resulted in the same outcome.

Economics and Cost Savings

Proven Cost Savings

For FDR, a typical application rate of LKD is 6%. At this rate, a depth of 8 in. and 140 lbs. per cu. ft. equates to 51 lbs. of LKD per sq. yd. Three cases from FDR work performed in a period from 2002-2004 illustrate the cost comparisons for three primary methods:

Xenia, OH:

- FDR bid was approx. $ 4.60 per square yard using Envirolime® (including milling off 5 inches of RAP to lower the grade).
- Cost of Envirolime® = $ 0.50 per sq. yd.
- Cost of Portland Cement (PC) = $ 2.50 per sq. yd.

South Carolina[1]:

- FDR process including milling, mixing, adding the chemical reagent plus a 2 inch overlay costs is one-third the cost of full depth hot mix asphalt (HMA).
- Full Depth HMA = $ 23.00 per sq. yd.
- FDR with LKD cost = $ 7.43 per sq. yd.

Texas[2]:

- Cut and replace plus reconstruction = $ 50.00 per, linear foot
- FDR cost = $ 15.81 per linear foot

1 Fisher, Christina. (July, 2002) Construction Magazine, Reed Construction Data

2 Little, Dallas N. (1995). Stabilization of Pavement Subgrades and Base Course with Lime (pp 209), Kendall Hunt Publishing Company

Carmeuse Lime Plant Locations: Eastern and Central US and Canada

For more information about a Carmeuse Lime plant near you call:

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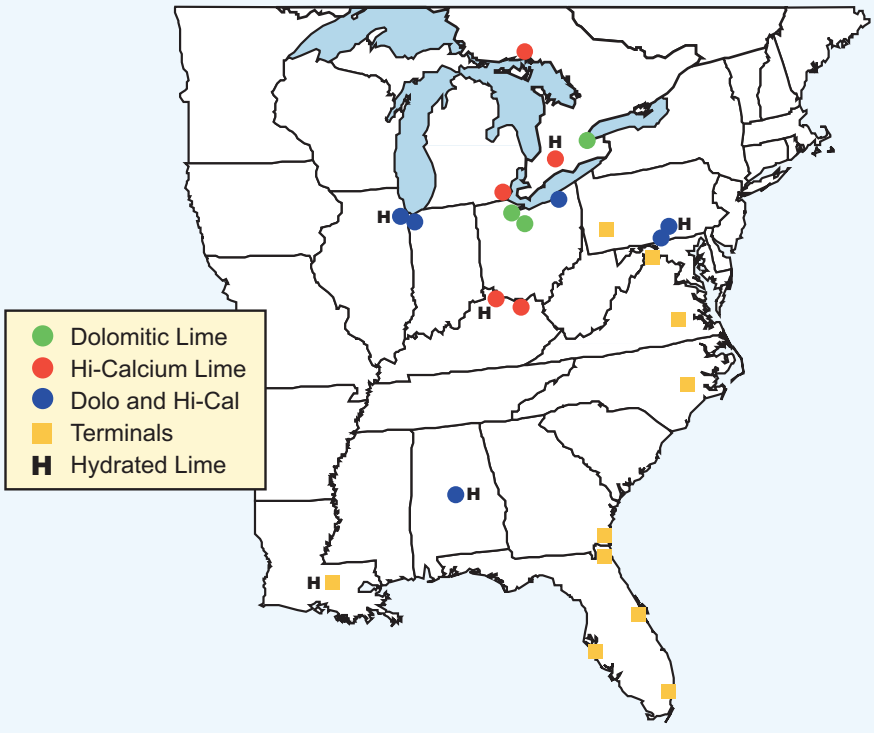

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