Benefits
of adding hydrated lime to asphalt

Prevents moisture-induced damage

Moisture-induced damage of pavements occurs when the physical bond between the bitumen and the aggregate is weakened by the infiltration of moisture, or by the formation of water-soluble soaps. This results in a wide variety of pavement failure symptoms such as stripping, ravelling, pothole, etc. When hydrated lime is added to asphalt mixtures, it reacts with the aggregate, strengthening the bond between the bitumen and the stone. Additionally, hydrated lime reacts with polar molecules in the bitumen, blocking the formation of water-soluble soaps. Instead, hydrated lime promotes the formation of insoluble calcium-based salts that leave water out of the system.

Aggregate stripping as a consequence of moisture induced-damage.

Improves resistance to rutting

Rutting is defined as the permanent deformation of the asphalt mixture, occurring when stresses on the pavement exceed the material's plastic limit. Heavy loading situations, such as truck traffic and busy intersections can exacerbate rutting damage. Unlike most mineral fillers, hydrated lime is porous. When hydrated lime is dispersed throughout the mix, its porosity is filled with bitumen, making the overall asphalt mixture stiffer at high temperature. This results in an asphalt mix that is more resistant to rutting. At low temperature, this effect disappears and hydrated lime behaves more like a traditional, inert mineral filler, which means that the high temperature stiffening is not associated to a low temperature embrittlement.

Rutting in an asphalt mixture.

Reduces the rate of oxidation

Asphalt oxidation and ageing occurs over time and generates a more brittle pavement. In particular, polar molecules in the bitumen react with the environment, causing the mix to stiffen and to be less able to recover from cumulated loads. Cracking and rough riding pavements are two symptoms seen in aged pavements. Heavy traffic loads increase the threat of pavement damage in these weakened pavements. Hydrated lime reduces the rate of asphalt pavement ageing by slowing down the oxidation of bitumen. This is because hydrated lime reacts with the polar molecules in the bitumen, slowing the oxidation kinetics. Consequently, the pavement remains more flexible over time, and is protected from brittle cracking for years longer than it would without the contribution of hydrated lime.

Oxidation in an asphalt mixture.

Reduces cracking

As pavements age, cracking often begins with the formation of micro-cracks, which in turn, coalesce to form macro-cracks. As described above, cracking can result from traffic-induced fatigue as the pavement weakens and becomes more brittle over time. However, cracking can also occur from environmental conditioning, such as temperature induced stresses (low temperature, large temperature swings) causing expansion and contraction of the pavement. Hydrated lime particles act as crack arresters and are able to intercept and deflect micro-cracks as they begin to form. Additionally, as a chemically active filler, hydrated lime reduces the oxidative ageing of the bitumen, and therefore the embrittlement of the mixture. Both elements contribute to improve the resistance of the asphalt mixture to cracking.

Fatigue cracking (= alligator cracking) in an asphalt mixture.

HYDRATED **LIME**

A PROVEN ADDITIVE FOR DURABLE ASPHALT PAVEMENTS

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EuLA

More than ever, transportation authorities are challenged to **get better financial return** from their pavement investments and **minimize the public inconvenience** that results from the repair and maintenance of pavements that fail prematurely. To maximize, or to extend the life of their pavement investments, these authorities are looking at **reliable and proven solutions**.

A multi-functional asphalt modifier
for an increased durability of 25%

For more than 50 years, hydrated lime has proven to be the worldwide reference among asphalt mixtures modifiers to mitigate moisture damage. However, as hydrated lime's use has grown, other benefits have been identified and quantified, both in the laboratory and on the field.

As a result, road agencies now regard hydrated lime as a multi-functional asphalt modifier whose benefits lead to an **increased durability of 25%**, allowing to:
- **strongly increase financial returns** from pavement investments,
- **restrict the environmental footprint** and **reduce public inconvenience** of jobsites by reducing the frequency of maintenance operations.

EuLA

In 2011, the European Lime Association (EuLA) gathered the existing knowledge on the modification of Hot Mix Asphalts by hydrated lime in an extensive bibliography including more than 100 references coming from the 5 continents.

"HYDRATED LIME: A PROVEN ADDITIVE FOR DURABLE ASPHALT PAVEMENTS – critical literature review" is available for download on the European Lime Association's website www.eula.eu

Methods of adding hydrated lime to asphalt

Hydrated lime can be added to Hot Mix Asphalt by several methods. The most commonly used methods of addition are as follows:

Drum addition method
Worldwide, hydrated lime is primarily added in its pure dry form, but can also be mixed with fine limestone to produce an active filler (mixed filler). Depending on the Hot Mix Asphalt production technology used, hydrated lime is either added to the drum along with mineral fillers, or is blended with other fines in batch processing.

Dry lime on damp aggregate method
This method involves metering hydrated lime onto a cold feed belt. Typically, hydrated lime adheres to the wet aggregate surface.

Lime Slurry method
This method utilizes a lime slurry, a mixture of lime and water, that is applied to the aggregate at a metered rate. This method insures a superior coverage of lime on the stone surface. After the slurry is applied, the aggregate can either be fed directly into the plant or can be marinated in stockpile for a period of time, which allows the lime to react with impurities (such as clay) on the surface of the aggregate.

Specifying hydrated lime in asphalt

Hydrated lime has been used for many decades in the USA where it is currently added to approximately 50 million tons of asphalt mixtures per year. In some regions, hydrated lime addition is compulsory.

In Europe, hydrated lime has also been used for many years. New research is establishing that lime creates multiple benefits for hot, warm and cold asphalt mixtures, as well as for cold in-situ recycling. The addition of hydrated lime prevents premature failures and enhances pavement durability by up to 25% [1], [2], [3], [4], [5], [6].

Hydrated lime is **defined** according to **EN 459**: Building lime. Hydrated lime can be **specified**:
- as an **additive** according to **EN 13108**: Bituminous mixtures - Material specifications,
- as s a **mixed filler** according to **EN 13043**: Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas

Following years of research, some European countries have made the use of hydrated lime in asphalt mixtures compulsory in their national regulations for their local and national roads and highways.

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