Benefits of adding hydrated lime to asphalt

- Prevents moisture-induced damage

Moisture-induced damage of pavements occurs when the physical bond between the binder 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 peeling, swelling, asphalt out, etc. When hydrated lime is added to asphalt mixtures, it reacts with the aggregate, strengthening the bond between the binder and the stone. Additionally, hydrated lime neutralizes polar molecules in the binder, 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.

- 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, the 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.

- Reduces the rate of oxidation

Asphalt oxidation and aging occurs over time and generates a more brittle pavement. In particular, polar molecules in the binder 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. Exposed lime reduce the rate of asphalt pavement aging by slowing down the oxidation of binder. This is because hydrated lime reacts with the polar molecules in the binder, 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.

- Prevents moisture-induced damage

- 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-related stresses (low temperature, large temperature swings), causing separation 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, a chemically active filler, hydrated lime neutralizes the oxidative aging of the binder, and thereby the embrittlement of the mixture. Both elements contribute to improve the resistance of the asphalt mixture to cracking.

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Hydrated lime – a proven additive for durable asphalt pavements

In 2011, the European Lime Association (EuLA) gathered the existing knowledge on the utilisation of various lime additives in the production technology used, hydrated lime is either added to the mix along with mineral fillers, or is blended with other fillers in batch processing.

Methods of adding hydrated lime to asphalt

Dry lime on drum aggregate method

This method involves spraying hydrated lime on the aggregate. Typically, hydrated lime is added to the mix aggregate surface.

Lime Slurry method

This method involves spraying a lime slurry, a mixture of lime and water, that is applied to the aggregate at a measured rate. This method improves the water resistance of the asphalt surface. After the slurry is applied, the aggregate can either be fed directly into the drum or can be stored in stockpiles 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 failure and enhances pavement durability by up to 25%.

For more than 50 years, hydrated lime has proven to be the worldwide reference among asphalt mixtures modifiers to mitigate moisture damage. However, hydrated lime had no effect on other failures that 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 have been identified and quantified, both in the laboratory and on the field.

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

In order to achieve the best performance, hydrated lime is added in its pure dry form, but can also be mixed with fine limestone to produce an active filler (mixed filler). Depending on the specific asphalt production technology used, hydrated lime is either added to the mix along with mineral fillers, or is blended with other fillers in batch processing.

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