

## Lime for better pavements

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**A**sphaltic (Bitumen + Aggregates) pavements are a crucial part of our nation's transportation network. Asphalt construction is fast and relatively simple, it is economical, and the materials used for it are widely available.

Asphaltic pavements generally fail due to: Stripping of the aggregates (Stripping occurs when the bond between the asphalt cement and the aggregate breaks down due to the presence of moisture, and the binder separates from the aggregate), Due to rutting (Rutting is permanent deformation of the asphalt, caused when elasticity is exceeded), Cracking due to weathering (weathering occur over time to generate a brittle pavement).

Asphaltic concrete can be optimised in many ways to create high performance pavements. Hydrated lime (lime produced by just adding enough water to quicklime to slake it), is one of the modifiers that improves performance of asphaltic pavement to overcome the above shortcomings.

Hydrated lime is the most effective anti-stripping agent available, and is universally used to deal with serious stripping problems. Certain types of aggregates are particularly susceptible to stripping. When lime is added to hot mix, it reacts with aggregates, strengthening the bond between the bitumen and the stone, while it treats the aggregate, lime also reacts with the asphalt itself. Lime reacts with highly polar molecules that can otherwise react in the mix to form water-soluble soaps that promote stripping.

The hydrated lime is able to make an asphaltic mix stiffer and resistant to rutting. Hydrated lime significantly improves the performance of pavement in this respect. Lime is a chemically active filler. It reacts with the bitumen, removing undesirable components at the same time that its tiny particles disperse throughout the mix, making it more resistant to rutting and fatigue cracking. The addition of the lime will not, however, cause the mix to become more brittle at lower temperatures. At low temperatures the hydrated lime becomes less chemically active and behaves like any other inert filler.

Another benefit that results from the addition of hydrated lime to many asphalt cements is a reduction in the rate at which the asphalt oxidises and ages. This is a result of the chemical reactions that occur between the calcium hydroxide and the highly polar molecules in the

bitumen. If left undisturbed in the mix, many of those polar molecules will react with the environment, breaking apart and contributing to a brittle pavement over time.

Hydrated lime combines with the polar molecules at the time that it is added to the asphalt and thus, they do not react with the environment. Consequently, the asphalt cement remains flexible and protected from brittle cracking for years longer than it would without the contribution of lime. hydrated lime also reduces asphalt cracking that can result from causes other than aging, such as fatigue and low temperatures.

Synergistic benefits also accrue when lime is used in conjunction with polymer modifiers. In some situations lime and polymers used together can produce improvements greater than each of them used alone.

Generally 1 per cent hydrated lime by weight of the mix is used, and is added to the drum at the same time as the mineral filler. The hydrated lime comes in contact with the aggregate itself, directly improving the bond between the bitumen and the stone, while the balance enters the bitumen. This method is called "dry method" and is the simplest to implement.

Alternatively, lime is applied to damp aggregate in order to insure more complete coverage of the stone than is achieved using the dry method. Lime that does not adhere to the stone is dispersed throughout the mix where it will contribute to the other improvements that have been described and is called "dry on damp" method and is also relatively simple, but driving off the additional water required by the process uses additional fuel and may slow down plant production to some degree.

Lime slurry (mixture of lime and water) that is also applied at a metered rate to the aggregate, insuring superior coverage of the stone surfaces. After the slurry is applied, the aggregate can either be fed directly into the plant or marinated in stockpile for some period of time, allowing the lime to react with the aggregate. Because the lime is bound to the stone, it is also the method that results in the least dispersion of the lime throughout the rest of the mix.