

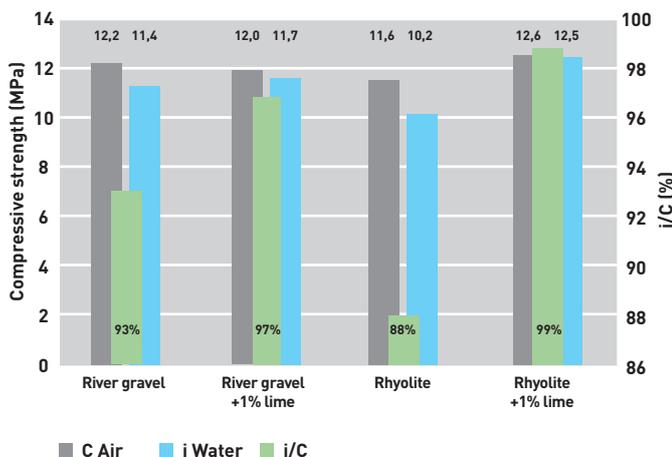
How does Asphacal® H improve the durability of asphalt mixtures?

Asphacal® H is a mixed filler with hydrated lime which interacts with both bitumen and aggregate, improving the performance of asphalt mixtures, creating more durable pavements.

Improving the bitumen/aggregate adhesion:

Test results: resistance to moisture damage

(Influence of the addition of hydrated lime to the moisture resistance of various types of asphalt mixtures)

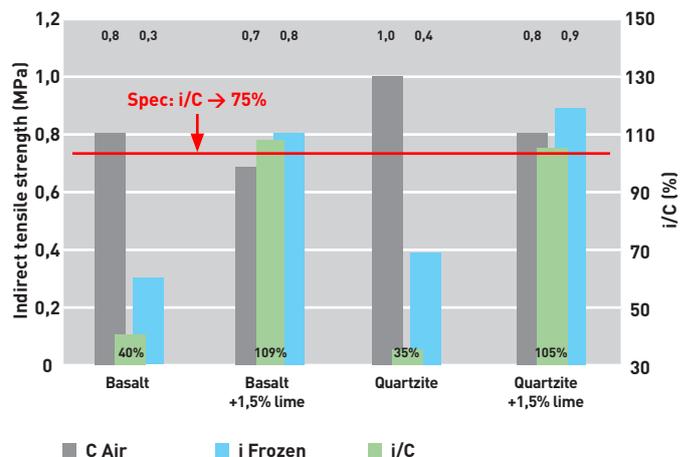


C = compressive strength in air
i = compressive strength after immersion in water
i/C = water sensitivity

Validation through Duriez test EN 12697-12 test on AC 10 surf 35/50 BBSG
Source: Ecole Spéciale des Travaux Publics, du Bâtiment et de l'Industrie (ESTP, French Engineering School) 2010 study

Test results: resistance to freeze-thaw cycles

(American Lottman test on asphalt mixtures with hydrated lime)



Source: McCann & Sebaaly (University of Nevada), ASCE 2006

During the standard Lottman test (AASHTO T 283), a set of samples is conditioned for 16 hours at -18°C after moisture saturation then for 24 hours at 60°C, while a second set is kept dry at 25°C. The moist/dry strength ratio is then calculated using the indirect tensile strength measurements. This conditioning allows to detect mixtures that would be rapidly degrade in the case of severe winter conditions.

Mechanisms:

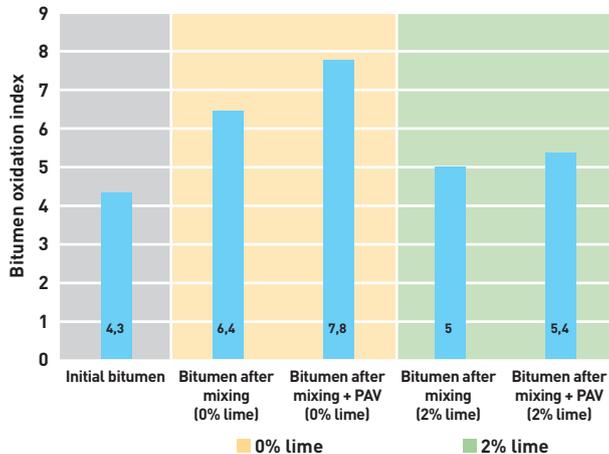
These results stem from the chemical interactions between the bitumen, the aggregate and Asphacal® H:

- Asphacal® H neutralises the most hydrophilic anionic surfactants in the bitumen by creating water-insoluble salts.
- Asphacal® H modifies the surface of aggregates by forming calcic compounds, increasing the adhesion of the bitumen onto the aggregate.

Reducing the bitumen age-hardening:

Test results: oxidation level after PAV

(Oxidation index (measured by infrared spectrometry) of 35/50 bitumen extracted from an AC 10 surf 35/50 BBSG with or without hydrated lime after mixing and/or accelerated ageing (PAV))



Carbonyl is a functional group whose concentration increases as a consequence of bitumen oxidation. The oxidation index measures the ratio of carbonyl-absorption areas over other absorption areas as measured by infrared spectrometry. So, the higher the ratio, the greater the oxidation of the bitumen. Source: French Central Laboratory of Roads and Bridges (2001)

Mechanisms:

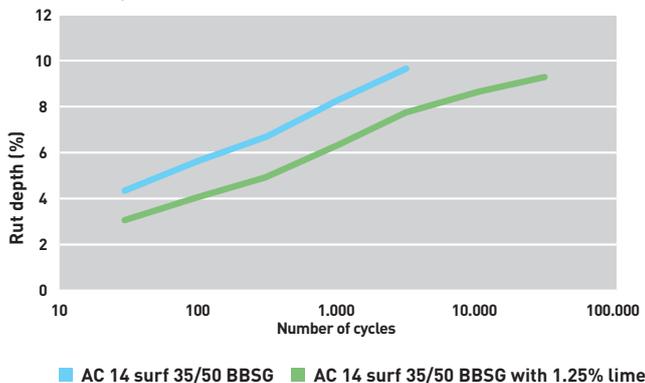
Here again, the effect is explained at the microscopic level.

- Asphacal® H neutralises the most oxidisable chemicals in the bitumen (carboxylic acids, quinoline, anhydrides, etc.), by forming insoluble calcium salts.
- Short-term (during mixing) and long-term (on the road) oxidation are thus slowed down and the bitumen retains its viscoelastic properties for much longer.

Increasing the resistance to rutting :

Test results: resistance to rutting

(Rutting test on AC 14 surf 35/50 BBSG with and without hydrated lime)



Source: French Central Laboratory of Roads and Bridges (1999)

Mechanisms :

Asphacal® H is highly porous, twice as much as traditional mineral filler. This gives it a stronger stiffening effect at typically 1.5% (weight) and above, in the mixture. Resistance to rutting is significantly increased.



Asphacal® H increases the resistance of asphalt mixtures to rutting without making them more brittle at low temperature, because the stiffening effect decreases with temperature.

Reducing binder drainage and bleeding:

For the same reason as above (high porosity):

- stiffens the mastic by absorption of the bitumen, thus limiting binder drainage and the risk of bleeding



At the usual amounts of 1 to 2% by weight of the aggregate, in substitution of the same quantity of mineral filler, the workability of the mixture remains essentially unchanged after adding Asphacal® H.



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