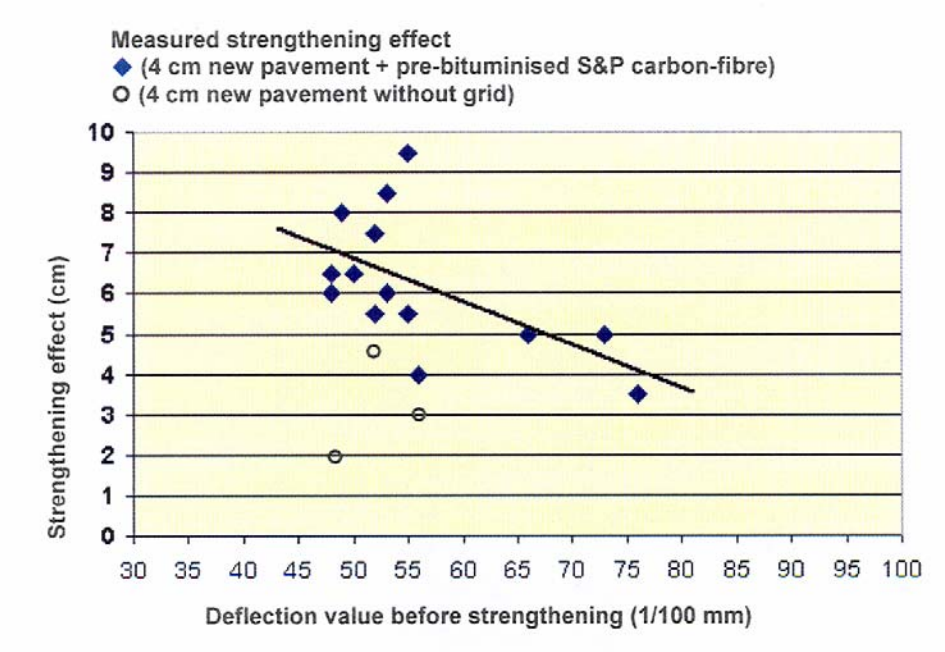
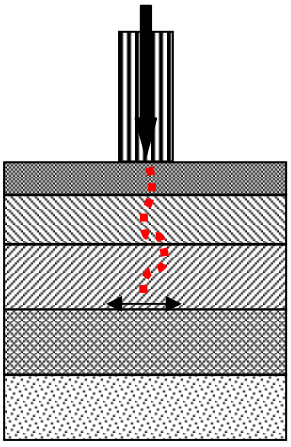


Figure 14: Lacroix results

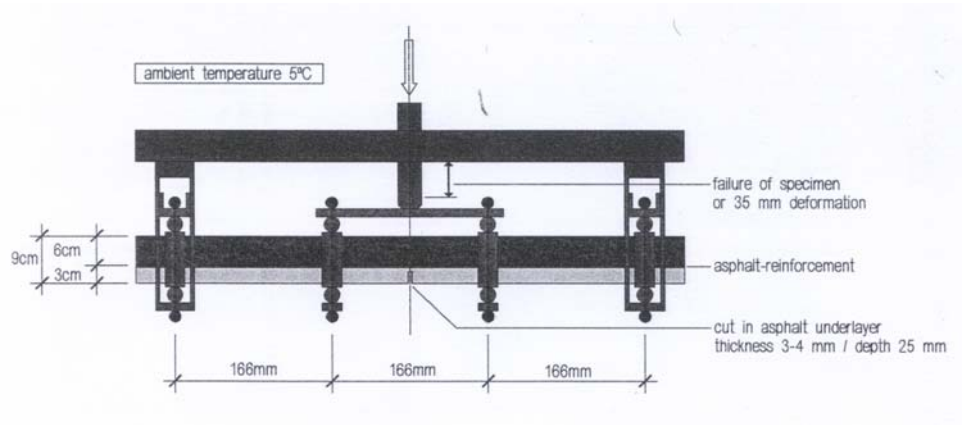
The effect of the carbon-fibre grid (S&P Carbophalt) is equivalent to that of a 3-4 cm thick new pavement layer. The definite influence of the S&P carbon-fibre grid on the load bearing capacity is verified.

10. Investigations at NPC (Netherland Pavement Consultants)
“Asphalt reinforcement against fatigue cracks“

Fatigue cracks in the bituminous pavement layer occur as a result of stress exertion (wheel loads).



Graphic 15: Typical crack formation from bottom to top



Graphic 16: NPC test configuration

The type of fatigue crack depends on the tyre type and pressure. Crack propagation typically occurs from bottom to top (*Graphic 15*). New tyre types and high load cycles also lead to crack propagation in the reverse direction. Netherlands Pavement Consultants (NPC) conducted a series of tests to evaluate the resistance of grid interlayers to fatigue cracks under subjection to cyclic loading on the four-point-bending beam.

A two-layer pavement sample with a total thickness of 9 cm (3 cm + 6 cm) is loaded cyclically via a four-point bending beam with a span of 500 mm (Graphic 16). During the test, the ambient temperature is maintained at 5 °C. Cyclic loads (simulating vehicle wheel loads) are applied at a frequency of 29.3 Hz and controlled at the load of 50–4'500 N. The selected range simulates wheel loads occurring typically on roads. The bending of the test beam until breakage of the asphalt or until an irreversible sample deformation of 35 mm is ascertained as a function of the load cycles.

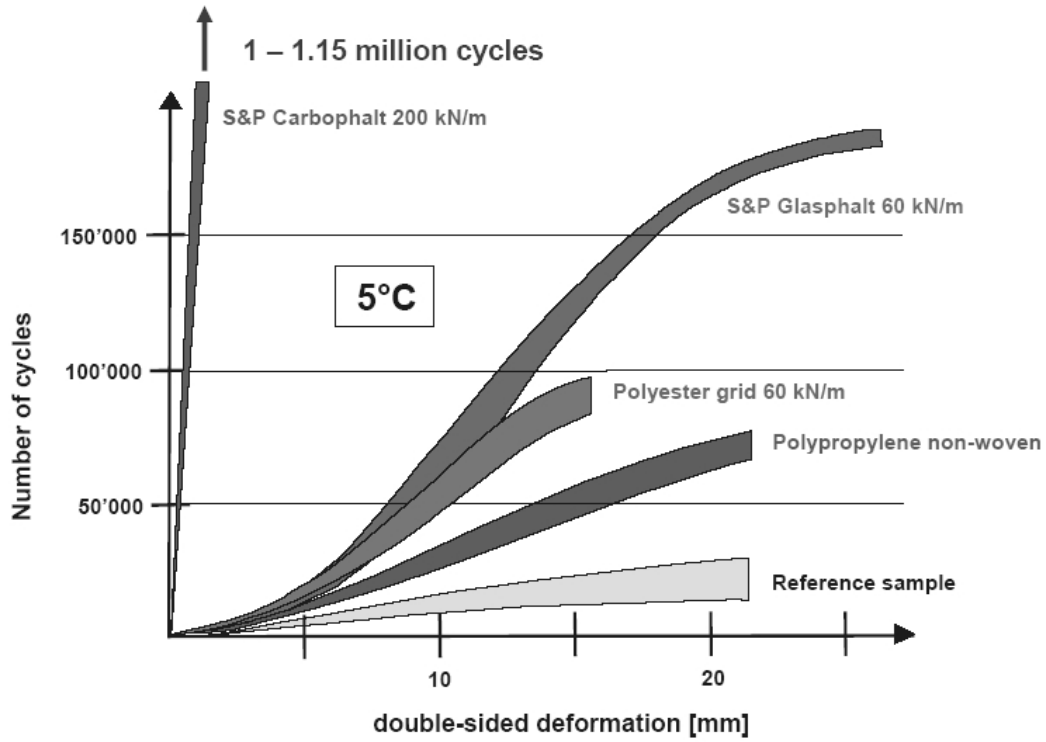
Formation of fatigue crack as a result of cyclic loading is recorded. The starting point of the fatigue crack is defined as a notch cut in the bottom of asphalt beam sample.

During the test, the non-reinforced, two-layer pavement sample was compared with various, reinforced pavement samples of the same thickness (Table 13). The grid or non-woven interlayers were installed between the two pavement layers according to the manufacturer's specifications.

1	Reference sample	*Without interlayer*
2	Non-woven	*Polypropylene, 140 g/m²*
3	PES grid	*Polyester 60 kN/m (longitudinal and transverse)*
4	Pre-bituminised „S&P Glasphalt G“	*Glass grid 120/120 kN/m (longitudinal and transverse)*
5	Pre-bituminised “S&P Carbophalt G“	*Glass fibre, 120 kN/m (longitudinal)* *Carbon fibre, 200 kN/m (transverse)*

Table 13: Overview of samples

Test results:
The tests were used to compare the retarding effect of the asphalt reinforcement on crack propagation (*Graphic 17*). Penetration of cracks through the new pavement layer ultimately leads to irreversible deformation or breakage of the pavement sample. The results accordingly provide information on the fatigue resistance of pavement under cyclic loads.



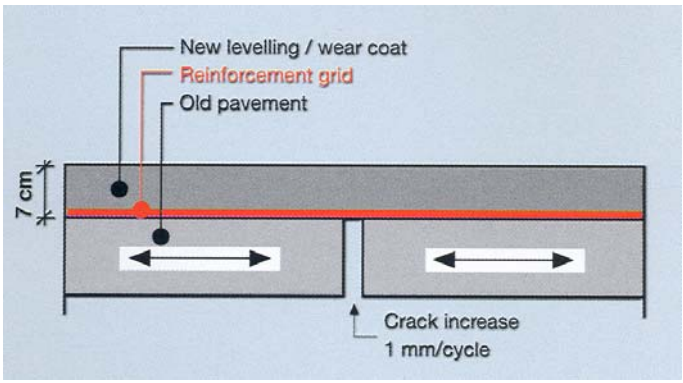
Graphic 17: Overview of test results

The pavement samples reinforced with *S&P Carbophalt G* exhibited extremely high resistance to crack propagation under cyclic loads.

11. Investigations at BRRC (Belgian Road Research Centre) „Asphalt reinforcement against thermal crack reflection“

Existing cracks in the old pavement layer reflect through the new asphalt layer because of the daily temperature fluctuations during winter months. With the pre-bituminised S&P grids, existing cracks are covered before the new pavement layer is applied *(Image 9).*

Image 9: Application of S&P Carbophalt G



Graphic 18: Test set-up, Road Research Centre