

Winter-damage in Porous Asphalt

Designing a binder solution using Kraton™ polymers

A Delft University of Technology study concluded that two factors are critical to prevent winter damage:

- ▶ Limited binder stiffness at low temperature, particularly after ageing;
- ▶ Binder stress relaxation at these low temperatures.

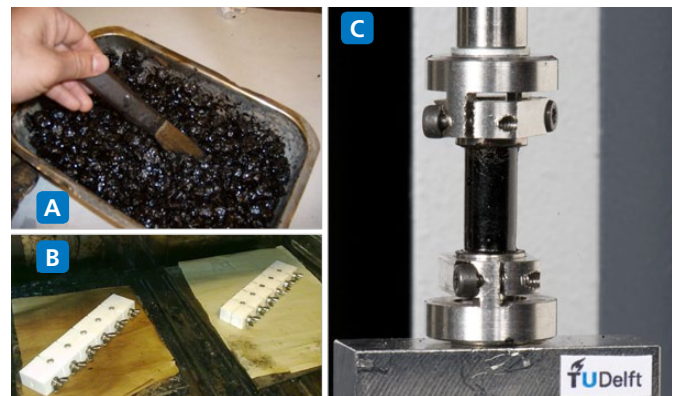
A few cold winter nights can cause years' worth of ravelling damage to a road when stresses due to traffic loads and day to night temperature variations reach the binder's breaking point.

Mortars of long-lasting, porous asphalt roads were compared in the lab to those from early-failure roads. A Finite Element model, that predicted the asphalt mix response based on the mortar properties, confirmed actual road performance and generated these conclusions.

Delft University of Technology in The Netherlands and Kraton Performance Polymers, Inc., headquartered in the USA, used proven knowledge of SBS polymers to tune and enhance the binder's visco-elastic properties over a wide temperature range to formulate a superior, winter-damage resistant binder. Delft University of Technology aged and tested four different Kraton binders and modelled their winter performance, all showing a dramatic improvement in particular in ravelling resistance. The Kraton polymer modified binders demonstrated exceptional performance in the winter and equal performance under summer conditions.

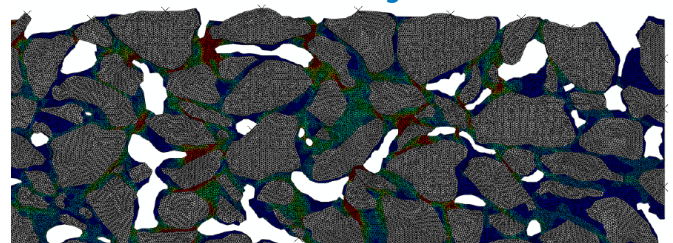
Highly modified binders for porous asphalt have a 20 year track record of durability in Japan with SBS levels typically at 8%, but as high as 11% in the coldest parts of the country. This evaluation reinforces that experience and highlights how to optimize formulations to eliminate winter ravelling damage.

Testing



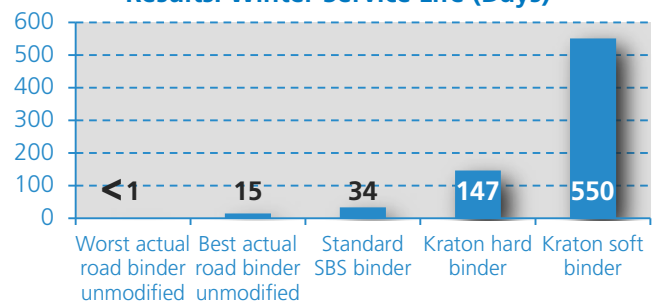
Mortar testing: Material Response parameters, obtained from Dynamic Mechanical Analysis [C] on mortar [A] samples [B], were used as an input for the Finite Element Model.

Modeling



Porous Asphalt Modeling: Modelling of a pavement under dynamic loading.

Results: Winter Service Life (Days)

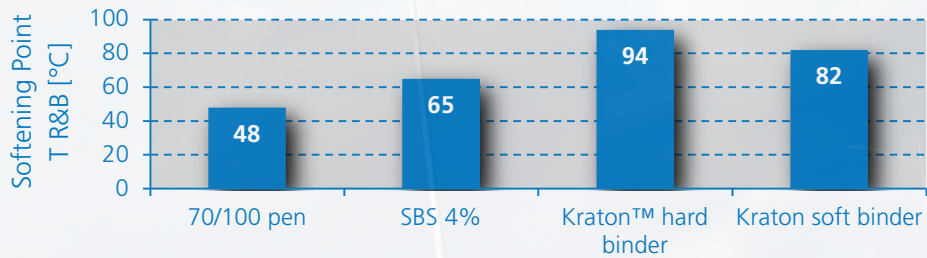


Results: Days of winter service life. Computer modelling results of winter damage of extracted lab tested actual road binders and formulated aged binders at -10 °C (average temperatures and a day and night variation of 6 °C).

Varying performance of porous asphalt roads

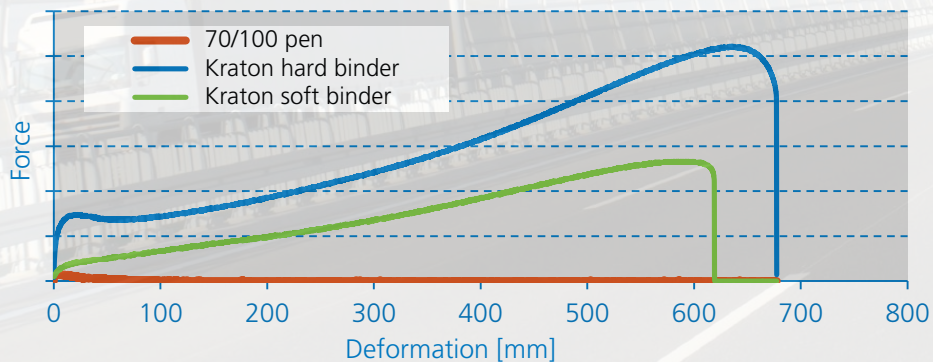


Excellent high temperature performance



Kraton polymer based winter damage resistant binders do not compromise on high temperature performance.

Binders with exceptional breaking energy



Force Ductility [25 °C] measurements showing the dramatic difference in cohesive strength and resilience between unmodified binder and Kraton hard (100 pen base) and soft (300 pen base) binders.

Kraton Performance Polymers, Inc. (NYSE:KRA)

Corporate Headquarters:
15710 John F. Kennedy Blvd., Suite 300
Houston, Texas 77032
Tel: +1-800-4-KRATON (572866)

Europe/Middle East/Africa:
John M. Keynesplein 10
NL – 1066 EP Amsterdam
The Netherlands
Tel: +31 (0)20 201 7697

Asia Pacific:
Rm 1601-03, Plaza 66, Phase 2
1266 West Nanjing Road
Shanghai 200040, China
+86 21 6289 6161

South America
Av. Roberto Simonsem, 1500
13140-000 - Paulinia – SP, Brazil
+55 19 3874 7270

Legal Disclaimer:

We believe the information set forth above to be true and accurate, but any recommendations, presentations, statements or suggestions that may be made in the foregoing text are without any warranty or guarantee whatsoever, and shall establish no legal duty on the part of Kraton Performance Polymers, Inc. or any of its affiliates. Furthermore, nothing set forth above shall be construed as a recommendation to use any product in conflict with any existing patent rights. Kraton Performance Polymers, Inc. expressly disclaims any and all liability for any damages or injuries arising out of any activities relating in any way to this publication.

Kraton and the Kraton logo are registered trademarks owned Kraton Performance Polymers, Inc. Giving Innovators Their Edge is a registered service mark owned by Kraton Performance Polymers, Inc.