

EPOXY ASPHALT CONCRETE

EPOXY ASPHALT MODIFIED BINDERS FOR BRIDGES & STRATEGIC ROADS

TECHNICAL DATA SHEET

Description

From the mid-1960s, Epoxy Asphalt Concrete pavement has demonstrated proven durability in one of the toughest flexible pavement applications, providing the surfacing for long span bridges with orthotropic steel decks. There are many examples of high traffic bridges in North America with Epoxy Asphalt pavements in service 35-50 years. Until recently, due in part to Epoxy Asphalt's unique reactive nature and higher cost, road and motorway owners have seldom specified it despite its performance and durability benefits because there are many low cost flexible pavement binder alternatives. Today, Epoxy Asphalt's super durability, high renewable raw material content and low extended life cycle costs are highly desirable features for sustainable roads. For overweight axle loads in hot climates, the non-melting binder used neat stops rutting, shoving and raveling.



Strategic Roads

With increased focus on safety, cradle-to-grave life cycle costs, sustainability and the social costs of frequent rehabilitation cycles, transportation officials in developed and developing countries are seeking more durable materials to construct and maintain longer lasting roads. Starting from parallel goals, the International Transport Forum (ITF), as a part of the multinational Organization for Economic Co-operation and Development (OECD) recently completed a three-phase study searching for innovative long life (>40 years of service) wearing course materials for pavements on heavily trafficked strategic roads. Epoxy asphalt performance was thoroughly evaluated with state-of-the-art binder and mixture testing methods and carefully monitored on roads in several countries including the UK and New Zealand. The OECD/ITF report concludes that epoxy asphalt pavements offer superior performance in overlay applications compared to standard or polymer binders in critical life cycle metrics including permanent deformation, moisture damage, aging (oxidation resistance), low temperature and fatigue resistance and capability to meet a service life goal of 40 years.

Epoxy Asphalt Binder (100%) Specifications

PARTS A AND B COMBINED AND CURED (NEAT)		
PROPERTY	METHOD	VALUE
Weight Ratio, % A/B		19.38/80.62
Tensile Strength @ 23°C. mPa, min.	ASTM D638	6.0
Elongation at break @ 23°C. % min.	ASTM D638	270
Viscosity increase to 1000 cP @ 121°C, minutes, min.	See Testing	55
Thermoset Property @ 300°C	Sample placed on hot plate	Shall not melt

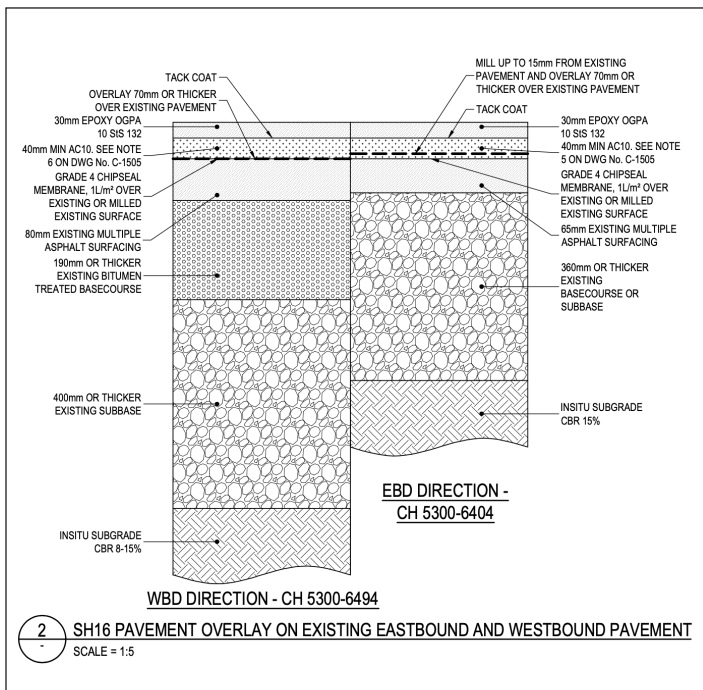
Epoxy Asphalt Concrete Properties, Type IX (Neat), 9 mm Dense Grade

ASTM D1559, Marshall Method

PROPERTY	VALUE
SPECIMENS, CURED	
Stability at 60°C, kN	60, min.
Flow Value at 60°C, mm	2.0, min.
Recovery, %	60%, min.
Compressive Strength, ASTM D695, mPa, @ 25°C	30
Air Voids, ASTM D3203	3.5% max.
Relative Density, ASTM D2726	2.4 min.
Composite Beam Fatigue Life Cycles to failure for 50 mm pavement on 12 mm steel plate at 23°C. Center point load applied at 10 Hz on 300 mm span using Instron E10000 dynamic tester.	25 million at 5 kN load 5 million at 6.5 kN load
Permeability, AASHTO T259, (<0.003% wt CI-/wt concrete)	0, (non-detect)
SPECIMENS, UNCURED	
Stability as 60°C	6.8 KN, min.
Flow Value	2.0 mm, min.
Air Voids, ASTM D 3203	3.5% max.

Modified (diluted) Epoxy Binders for On-Grade Roads

New Zealand, in 2007 as a participant in the OECD research, trialed epoxy asphalt binder in motorway open graded surfaces. In 2012, NZTA added (locally sourced) diluted epoxy asphalt binder to their OGPA (open graded permeable asphalt) motorway national standard where it replaced SBS modified binders for this low noise, high friction pavement design. NZTA durability test models predict epoxy modified OGPA surfacing lifespans of several decades or more. More recently, the Netherlands has installed epoxy modified binders in both SMA (stone mastic asphalt) and open graded pavements in both urban and motorway applications. Within the EU, the Netherlands is a leader in quantifying and implementing sustainability criteria for transportation materials.



NZ motorway as built drawing

Universities and road authorities of several countries (including China, Korea, Ethiopia and U.S.) are now collaborating to install urban road and motorway tests of epoxy modified binders for dense graded, SMA and OGFC overlays. With the superior oxidation resistance of epoxy modified binders, permeable mix designs can last two or three times longer than standard or polymer modified binders. Dense and SMA epoxy mix designs are often preferred if the roadway will be subject to substantial quantities of severe overweight axle traffic.

For road applications, many owners select a 20-30% diluted Epoxy Asphalt binder to reduce upfront costs. Commonly, the two epoxy components represent 20-30% of the binder weight with the remaining portion comprised of a locally sourced asphalt. The local diluting asphalt is often a light PG 64 or a PG 58 or a with a 50-80 pen binder. A wealth of comparative international test data between polymer modified binders and diluted epoxy binders supports the use of diluted epoxy binder.

A critical performance advantage of Epoxy Asphalt is its superior resistance to oxidative aging, so many of these comparison tests are conducted after 20-40 days of accelerated heat aging at 80-85°C. After heat aging, the tensile, fatigue, raveling and cracking test results are demonstrably better in epoxy modified than comparable mix design standard and polymer modified asphalt pavements. Epoxy Asphalt modified OGFC mixtures (20-30% diluted) show reduced Cantabro loss, increased indirect tensile (IDT) strength, and increased IDT fracture energy (Gf) results, indicating improved raveling resistance, tensile strength, and fracture resistance compared to SBS modified and standard binder mixes.



Features

- Energy Saving
- Record-Setting Stability, no rutting
- Oxidation Resistance
- Renewable Raw Materials
- Fatigue Resistance
- No Raveling, Delamination or Stripping

Typical Uses

- Orthotropic Steel Deck Bridges
- Overlays on Concrete
- On grade surface courses
- High speed motorways

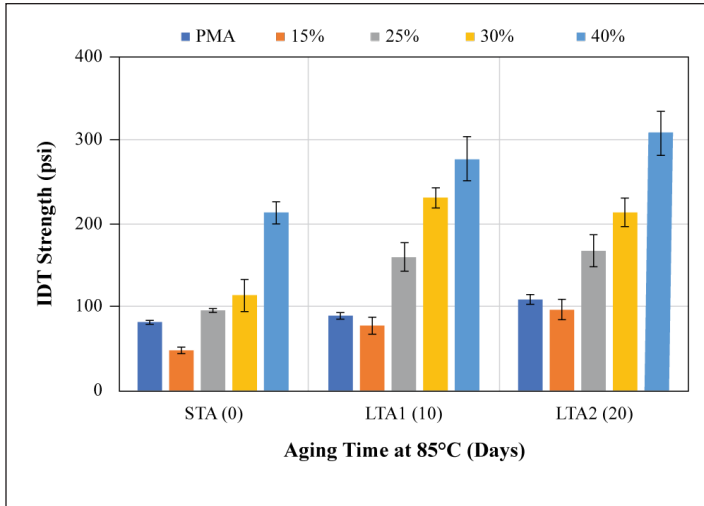
Pavements

- Open Graded Pavement (OGFC)
- Dense Graded
- Gap Graded
- Stone mastic (SMA)

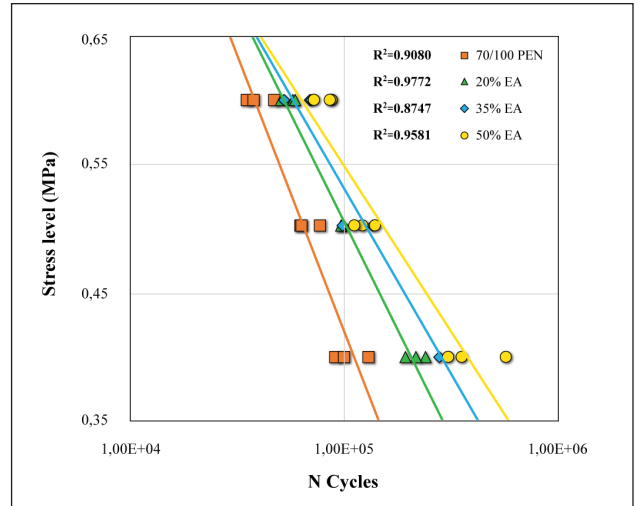


Diluted Epoxy Binder vs. SBS Polymer Modified

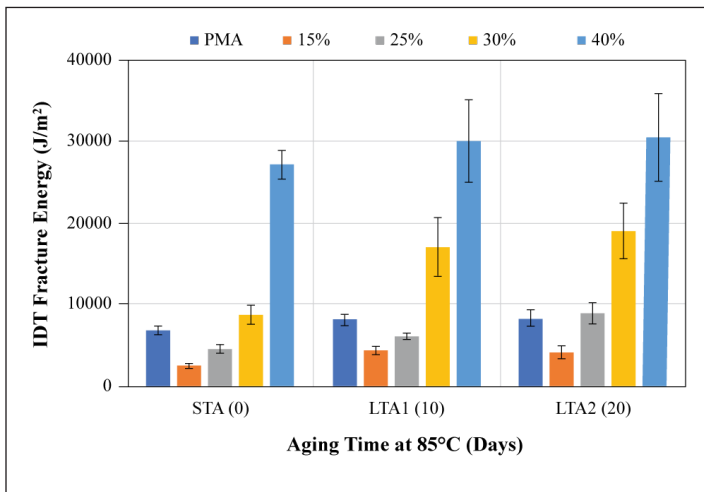
The following charts from 3rd party sources illustrate performance differences between (diluted) epoxy modified binders and standard or SBS asphalt binders. Most of this comparative data is based on open graded, permeable pavement design.



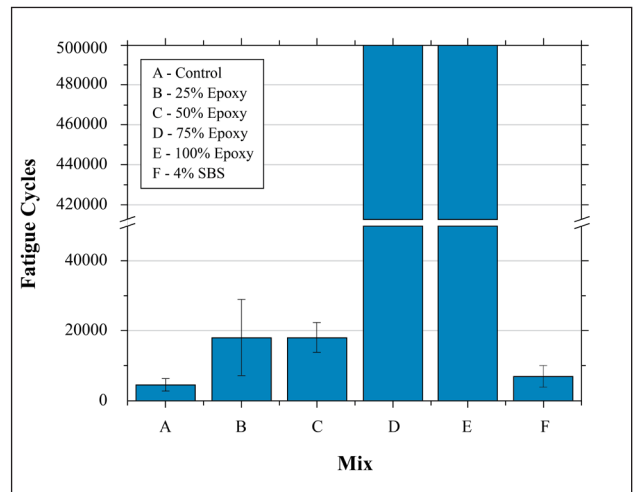
Various epoxy asphalt dilutions compared to SBS Polymer Mod. Binder NCAT report, for Florida DOT contract BE702 (July 2021)



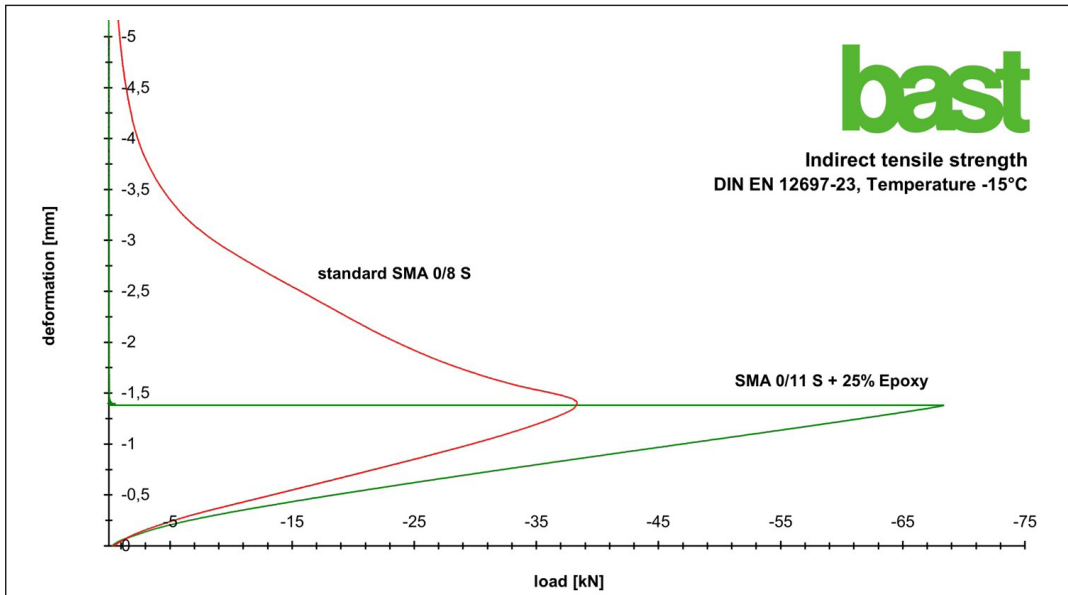
TU Delft Netherlands fatigue comparison, G. Pipintakos thesis. (2018)



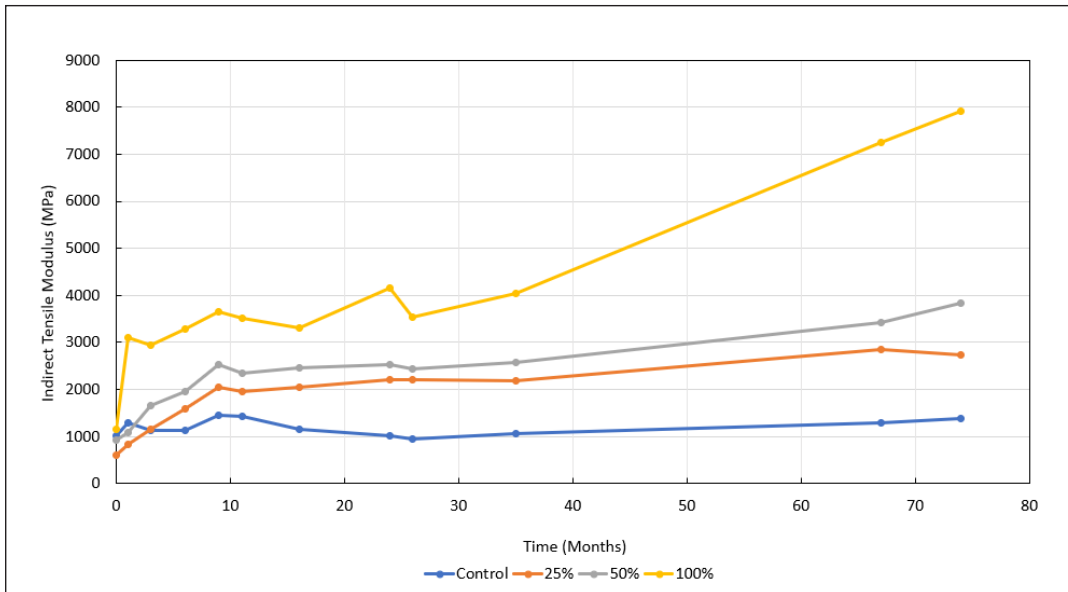
Various epoxy asphalt dilutions compared to SBS Polymer Mod. Binder NCAT report, for Florida DOT contract BE702 (July 2021)



NZ test data (after heat aging), "Long term durability of epoxy modified open-graded asphalt wearing course" Wu, et al. (2017)



BAST is German federal paving authority,
OECD/ITF long-life surfaces or busy roads (2008)



Change in IDT with aging at constant 23°C
"Optimizing long life, low noise porous asphalt"
D. Alabaster, et al. (2014)



Limited Warranty: Please read all information in the General Guidelines, Technical Data Sheets, Guide Specifications and Safety Data Sheets (SDS) before applying material. These products are for professional use only and preferably applied by professionals who have prior experience with ChemCo Systems materials or have undergone training in application of ChemCo Systems materials. Published technical data and instructions are subject to change without notice. Contact your local ChemCo Systems representative or visit our website for current technical data, instructions, and project specific recommendations.

ChemCo Systems warrants its products to be free of manufacturing defects and that they will meet ChemCo Systems' current published physical properties. Seller's and manufacturer's sole responsibility shall be to replace that portion of the product which proves to be defective. There are no other warranties by ChemCo Systems of any nature whatsoever expressed or implied, including any warranty of merchantability or fitness for a particular purpose in connection with this product. ChemCo Systems shall not be liable for damages of any sort, including remote or consequential damages resulting from any claimed breach of any warranty whether expressed or implied. ChemCo Systems shall not be responsible for use of this product in a manner to infringe on any patent held by others. In addition, no warranty or guarantee is being issued with respect to appearance, color, fading, chalking, staining, shrinkage, peeling, normal wear and tear or improper application by the applicator. Damage caused by abuse, neglect and lack of proper maintenance, acts of nature and/or physical movement of the substrate or structural defects are also excluded from the limited warranty. ChemCo Systems reserves the right to conduct performance tests on any material claimed to be defective prior to any repairs by owner, general contractor, or applicator.

Disclaimer: All guidelines, recommendations, statements, and technical data contained herein are based on information and tests we believe to be reliable and correct, but accuracy and completeness of said tests are not guaranteed and are not to be construed as a warranty, either expressed or implied. It is the user's responsibility to satisfy himself, by his own information and test, to determine suitability of the product for his own intended use, application and job situation and user assumes all risk and liability resulting from his use of the product. We do not suggest or guarantee that any hazard listed herein are the only ones which may exist. Neither seller nor manufacturer shall be liable to the buyer or any third person for any injury, loss or damage directly or indirectly resulting from use of, or inability to use, the product. Recommendations or statements, whether in writing or oral, other than those contained herein shall not be binding upon the manufacturer, unless in writing and signed by a corporate officer of the manufacturer. Technical and application information is provided for the purpose of establishing a general profile of the material and proper application procedures. Test performance results were obtained in a controlled environment and ChemCo Systems makes no claim that these tests or any other tests accurately represent all environments. ChemCo Systems is not responsible for typographical errors. © 2022 ChemCo Systems. All rights reserved. Revision 20221101.EA