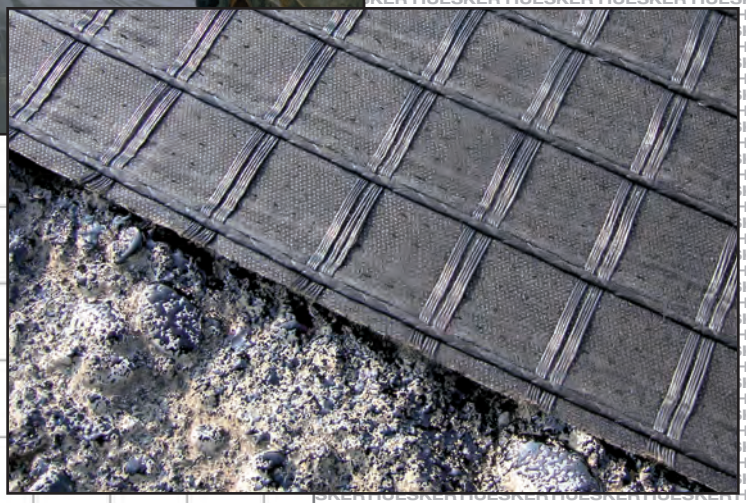
HaTelit®

Asphalt Reinforcement



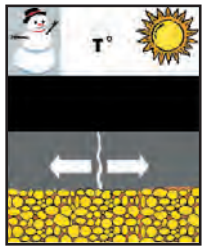
HUESKER

Ideen. Ingenieure. Innovationen.

Long-term retardation of reflective cracking

Asphalt is in most respects an ideal material for road construction. Yet asphalt layers exhibit only a low tensile strength, which may be exceeded even at relatively small strains. As a result, the action of traffic and temperature fluctuations frequently leads to the formation of cracks in the asphalt.

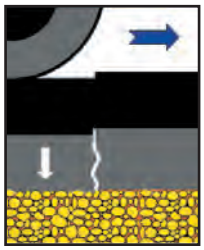
Over time, these cracks will penetrate the entire asphalt pavement structure, thereby reducing its serviceability and lifespan.

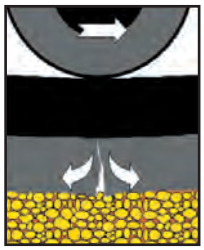


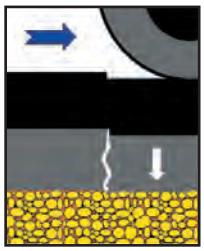
Temperature change

Typically, the first step in reinstating asphalt pavements involves milling off the asphalt surface course or sometimes the surface and binder courses. The resulting base is then overlaid with new asphalt courses.

As soon as wheel loads are imposed on to any cracks which still exist in the lower asphalt layers, bending and shear stresses are induced in the new asphalt layer.


Shear action (-)


Bending action


Shear action (+)

The magnitude of these stresses exceed the tensile strength of the overlying layer so that they cannot be accommodated.

Hence, due to the constant cyclic loads imposed by traffic and temperature fluctuations, any cracks in the lower asphalt layers will soon propagate to the surface. These so-called "reflective cracks" always cause major problems after a pavement rehabilitation.

HaTelit® asphalt reinforcement adopts the high stresses developing at the crack tips in the lower asphalt layers and distributes them over a larger area. Through this action **HaTelit®** permanently counteracts reflective cracking.

HaTelit® offers highway engineers an effective remedy to the problem of reflective cracking in asphalt.


Reflective crack in an asphalt surface course

High-performance reinforcement of asphalt layers

Installation of **HaTelit®** in Ochtrup, Germany, 1996

Road condition in 2009

Resurfacing of asphalt pavements

By adopting a high proportion of the horizontal tensile forces in the asphalt and ensuring a uniform stress distribution over a larger area, **HaTelit®** reinforcement grids increase the tensile strength of asphalt layers.

Local stress concentrations and the associated risk of overload are also significantly reduced. The performance and durability of **HaTelit®** therefore counteracts the formation of reflective cracks.

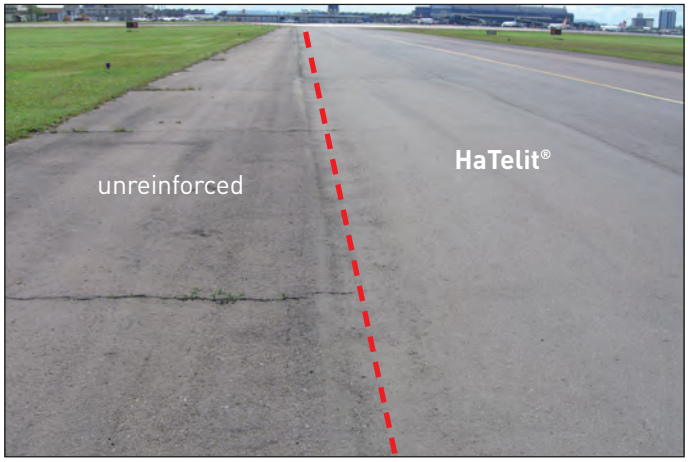
The load-distributing action of **HaTelit®** also reduces the formation of rutting in areas subject to high traffic loads. Reinforced asphalt layers also exhibit a higher dynamic load capacity and a higher resistance to fatigue.

Resurfacing of concrete pavements

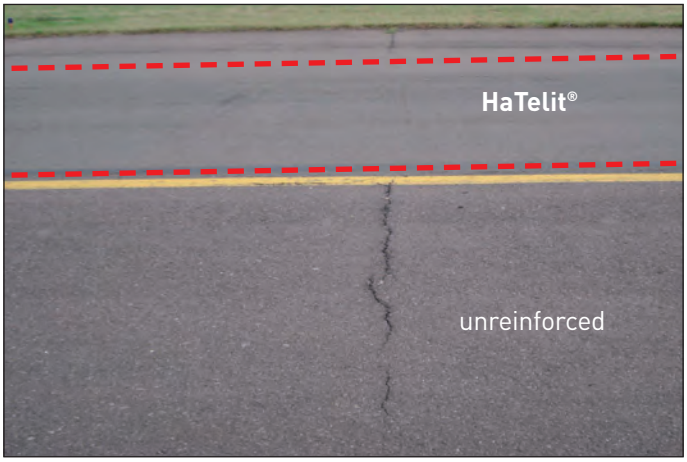
Existing concrete pavements overlaid with asphalt are subject to the same risk of reflective cracking within a short time of completion. Here, the daily and seasonal temperature fluctuations cause the concrete slabs to expand and contract.

This movement leads to high strains in the asphalt layer directly above the joints in the concrete slabs, which can then induce initial cracks. Due to the external action of traffic and temperature fluctuations these cracks will rapidly propagate to the surface again. Reflective cracking is thus primarily attributable to thermally or traffic-induced fatigue of the asphalt.

Performing the rehabilitation of concrete pavements with asphalt, **HaTelit®** also ensures a long-term retardation of reflective cracking.



Concrete pavement overlaid with 50 mm asphalt
Condition after 7 years, reinforced – unreinforced



Concrete pavement overlaid with 50 mm asphalt
Condition after 7 years, reinforced – unreinforced

Custom-made reinforcement grids: HaTelit®

HaTelit® is a flexible, composite reinforcement grid comprising high-modulus polyester grid combined with an ultra-thin nonwoven geotextile (< 20g/m²). The sole purpose of the nonwoven is to simplify installation and, if properly installed, it does not impair the bond between the asphalt layers.

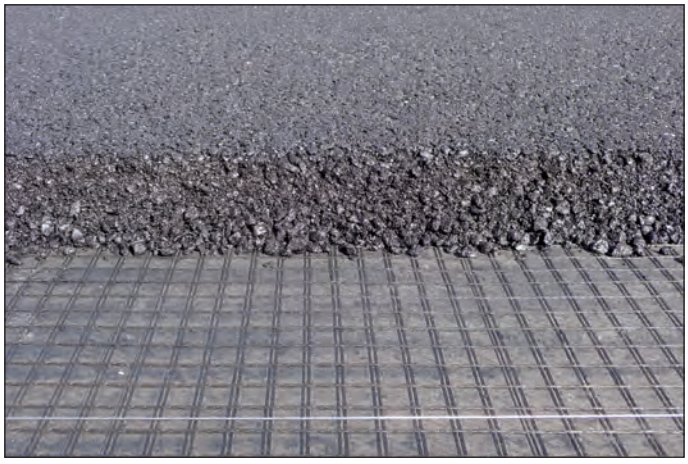
To ensure a good bond with and between the asphalt layers, both the grid and geotextile backing are given a bituminous coating (bitumen content > 60%). A strong bond between layers is essential for the proper absorption of the tensile stresses by the reinforcement grid and consequent lengthening of the service life of the new asphalt course.

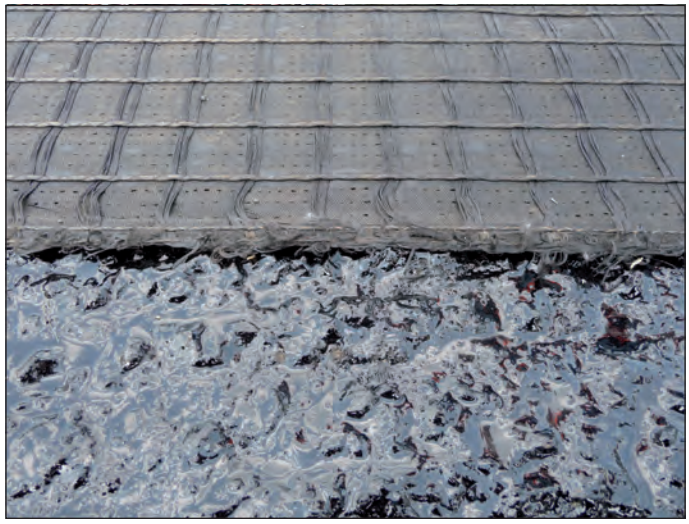
Polyester was selected as the reinforcement grid's raw material due to the high compatibility between its mechanical behaviour and the elastic modulus of asphalt. Polyester and asphalt also have very similar coefficients of thermal expansion. This allows the successfull integration of **HaTelit®** in the asphalt pavement structure while maintaining very low levels of internal stress. **HaTelit®** does not act as a foreign material between the asphalt layers.

The function of polyester grid reinforcement in asphalt cannot be compared to that of the reinforcement found in concrete. Asphalt reinforcement is designed to prevent the occurrence of stress peaks over a cracked base and avoids their subsequent transmission into the overlying layer. By thus eliminating the risk of overload in the asphalt, reflective cracking can be effectively retarded.

Polyester also exhibits outstanding properties under dynamic loading coupled with a high resistance to damage during installation.

It is essential to ensure that **HaTelit®** is always installed between two asphalt layers. This may necessitate the placing of an asphalt regulating course.





URBANSKI · INGENIEURBÜRO
FÜR GEOTECHNIK UND BAUSTOFFPRÜFUNG GMBH & CO.KG
48165 MÜNSTER-HILTRUP · UNCKELSTRASSE 3 · TEL. (0 25 01) 44 83-0 · FAX (0 25 01) 44 83 21

ASPHALT BETON

Urbanski-Geotechnik • Postfach 48416 • 48081 Münster

Huesker Synthetic GmbH & Co.
Fabrikstraße 13-15

48712 Gescher

Durch Erlaß des MWMTV NRW - 626 - 30-05/48.12 - vom 10. April 1999 nach RAP Stra für Eignungs-, Fremdüberwachungs-, Kontrollprüfungen und Schiedsuntersuchungen an natürlichen Mineralstoffen, industriellen Nebenprodukten, künstlichen Mineralstoffen, Recyclingbaustoffen und Asphalt (RG Min, TLG Asphalt) sowie für Eignungs-, Kontrollprüfungen und Schiedsuntersuchungen an Böden, einschließlich Bodenverbesserungen und hydraulisch gebundenen Gemischen, einschließlich Bodenverfestigungen (ZTVE - StB, ZTVT - StB) anerkannt.

Prüfstellenleiter: Dipl.-Ing. H.-W. Urbanski
Vertreter: Dipl.-Ing. N. Versmold

Processed by A/2/V
Date 18.06.98

TEST REPORT AsS 21/98/1578

EXAMINATION OF ASPHALT DRILLING CORES / DETERMINATION OF THE ADHESIVE BOND

Sample received on:	29.05.98
Construction project:	Jagel airfield
Construction component:	Bit. fortification on old airfield fortification
Sample material:	4 asphalt drilling cores Ø 15 cm
Supplier:	Not specified
Installation company:	Not specified
Delivery from:	Spring 1998
Sampling site:	Construction site
Sampling date:	Not specified
Sampling:	Huesker Synthetic / construction company
Tested according to:	TP D-StB 89, ZTV Stra 91/Erg.97, DIN 1996 T 7
Test material:	Returned to client following examination

V. ADHESIVE BOND:
The sectional diagram of the drilling cores made it clear that a geotextile had been installed between the old and the new bitumen reinforcement in drilling cores I/III/IV; the adhesive bond was to be tested here. In addition, the adhesive bond between the old and the new bitumen reinforcement was tested in an area which contained no geotextile. The tests which were carried out revealed the following values:

Drilling core No.	**Shearing force kN**
I	**38,42**
II	**30,17**
III	**37,48**
IV	**36,72**

In drilling cores I/III/IV, a geogrid with a mesh aperture of 40/40 mm had been applied onto old bitumen reinforcement. Whilst testing the adhesive bond, the new bitumen reinforcement came loose from the geotextile fabric. The geotextile fabric adhered to the old bitumen reinforcement. In the case of drilling core II, no geo - textile was present between the old and the new bitumen reinforcement.

The values required for the adhesive bond were not known to the test centre. The adhesive bond of bituminous layers mut be tested in accordance with Para. 5.2.4.7.6 of ZTV Stra 91/Erg.97. On testing the drilling core Ø 15 cm

≥ 15,0 kN between surfacing and binder layers
≥ 12,0 kN between other bituminous layers

The adhesive bond values demanded in accordance with ZTV Stra 91/Erg.97 were achieved in the case of all drilling cores.

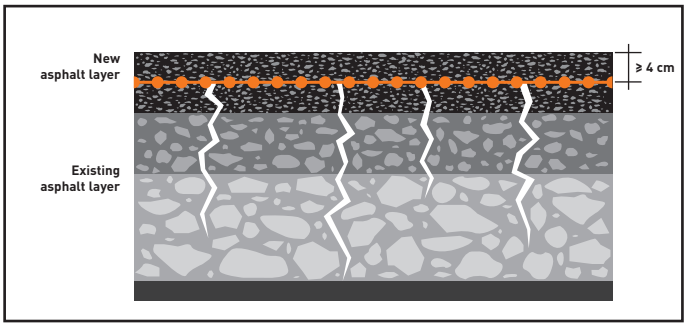
Processed by
Sachbearbeiter
Dipl.-Ing.
Civil engineer

Head of Institute / Test centre
Instituts-/Prüfstellenleiter
Civil engineer

HaTelit® applications

HaTelit® reinforcement grids are mainly installed in asphalt layers in roads and airport pavements.

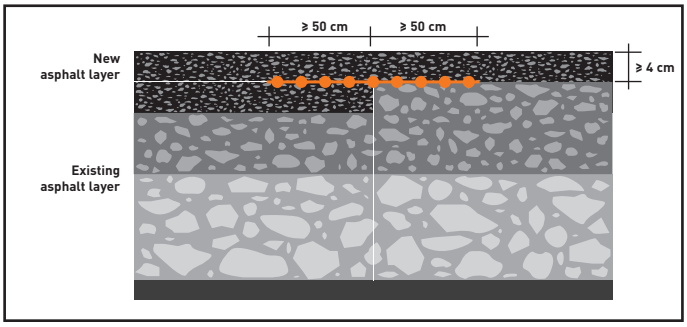
They take up horizontal tensile forces and effectively retard the propagation of reflective cracks from the existing base into the new asphalt layers. In the course of resurfacing, reinforcement grids are often installed over the entire pavement area.



Full-area reinforcement

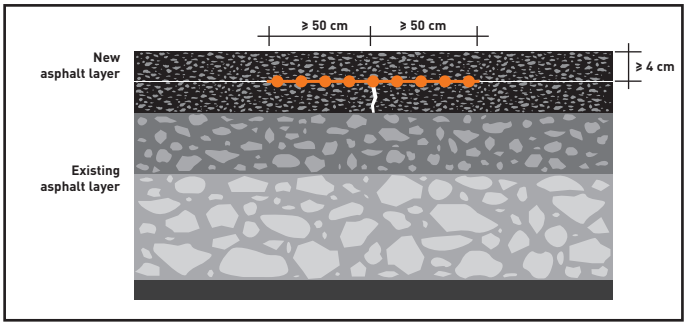
With carriageway widening schemes, the omission of reinforcement may rapidly lead to the formation of a longitudinal crack at the junction between old and new pavement sections. This type of failure can be successfully prevented by means of local reinforcement in the area of the longitudinal joint.

A minimum anchorage length of 50 cm either side of the crack is required.



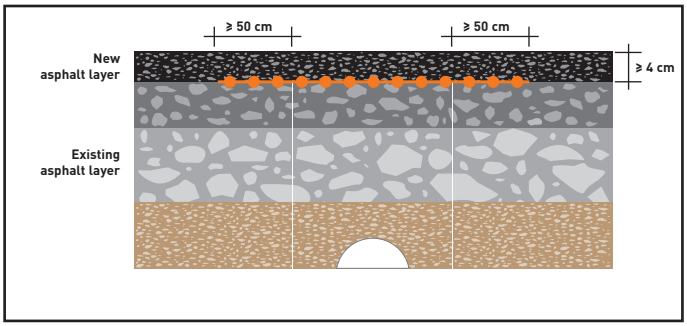
Local reinforcement for carriageway widening

Open joints in old surface courses are particularly liable to cause cracking in the resurfacing asphalt. Local reinforcement with **HaTelit®** in the area of the joint offers a useful solution in such cases.



Reinforcement at joint between paver passes

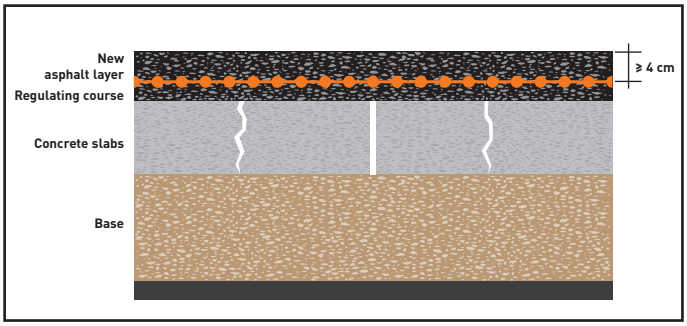
As with carriageway widening, cracks can occur in the asphalt at the edges of a carriageway excavation or a services trench reinstatement. The use of **HaTelit®** reinforcement grids prevents or reduces the formation of these cracks.



Reinforcement over reinstated road excavation

When concrete airport runways or concrete roads are surfaced with asphalt, cracks are liable to form above the expansion joints in the concrete due to the external action of traffic and temperature fluctuations. These cracks can be effectively delayed through the use of **HaTelit®**.

The installation of **SamiGrid®** directly on the concrete surface may offer an alternative solution in some cases. (Further details are available at www.huesker.com.)



Resurfacing of concrete pavement

HaTelit® in airport construction

The high volume of traffic handled by most airports makes it very difficult to close such facilities even temporarily for performance of the necessary remedial works, e.g. to runways.

On most occasions, only a very tight construction window is available for the repair of cracked asphalt courses or old concrete pavements. While also complicating works to aprons and taxiways, the constraints are particularly severe for take-off and landing strips.

London Luton Airport (UK)

Valletta Airport (Malta)

Due to the short construction time, placement of an asphalt overlay is the usual repair method adopted for airport runways and taxiways. The incorporation of flexible reinforcement grids is advisable in such cases as a precaution against reflective cracking in the asphalt overlay and as a means of extending the maintenance interval.

HaTelit® has been successfully installed at numerous airports around the globe. Experience has shown **HaTelit®** to perform outstandingly, both under heavy traffic loads and under the harshest weather conditions.

Please contact us for a list of our references in this field.

Posen-Lawica Airport (Poland)

Roads without cracks: HaTelit®

The need for pavement resurfacing works is fuelled by a combination of two factors: the ageing road network and the increasing loads imposed by growing traffic volumes and higher permissible axle weights. Not surprisingly, these trends have triggered a strong demand for low-cost, high-performance resurfacing techniques.

The use of **HaTelit®** reinforcement grids offers an effective solution for the retardation of reflective cracking in asphalt layers. Boasting a 40-year-plus track record of practical application, **HaTelit®** has proved its ability to **prolong the service life** of asphalt layers and thereby extend the associated maintenance intervals **by a factor of 3-4**. **HaTelit®** performs equally well in cold, temperate and hot climate zones.
A road reinforced with properly installed **HaTelit®** grids will remain crack-free for many years.

Installation of **HaTelit®** in Germany

Installation of **HaTelit®** in the Netherlands

No special measures are needed when it comes to the reconstruction of a polyester-reinforced asphalt layer. **HaTelit®** reinforcement grids are millable and recyclable.

HaTelit® is an environment friendly and resource-saving material.

HaTelit® in the laboratory

Dynamic fatigue testing

Stresses that occur in the asphalt as well as local stress concentrations over existing cracks in the material mainly result from the dynamic loads imposed by traffic (shear and bending stresses) as well as the thermal stresses caused by temperature fluctuations.

To investigate the benefits of the reinforcement on the type of loads experienced in practice, laboratory tests were performed on reinforced and unreinforced asphalt specimens.

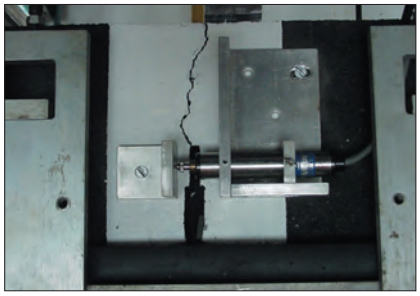
In a detailed series of tests, an asphalt surface course was applied over a predetermined crack.

Unreinforced and **HaTelit®**-reinforced test specimens were then subjected to dynamic shear and bending loads, above this crack location.

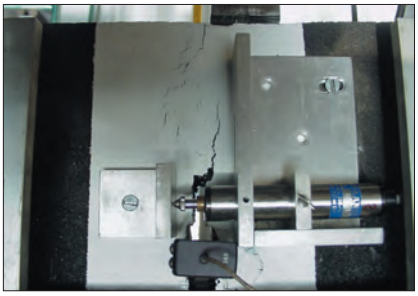
The results confirmed that crack propagation was significantly retarded by the **HaTelit®**-reinforced set-up. The **HaTelit®**-reinforced asphalt layer endured up to 6.3 times more dynamic load cycles than the unreinforced material before a crack appeared on the surface. The crack pattern clearly showed the distribution of the tensile forces by the reinforcement.

The pictures below show the condition of the unreinforced and **HaTelit®**-reinforced asphalt specimens upon completion of the tests.

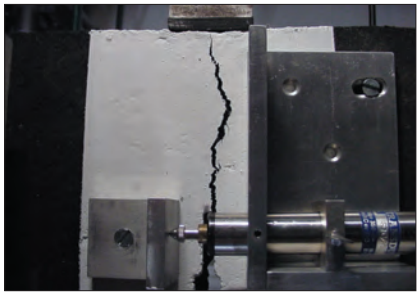
When tested in shear, the unreinforced test specimen underwent only 90,000 load cycles before the crack reached the surface. The **HaTelit®**-reinforced specimen, on the other hand, endured approx. 570,000 load cycles – some 6.3 times more than the unreinforced material.



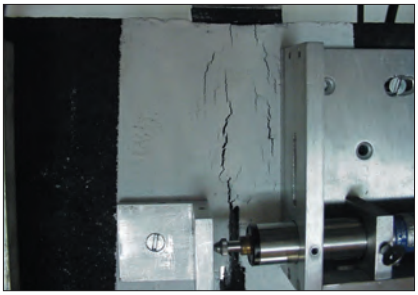
Unreinforced specimen: shear failure after 90,000 cycles



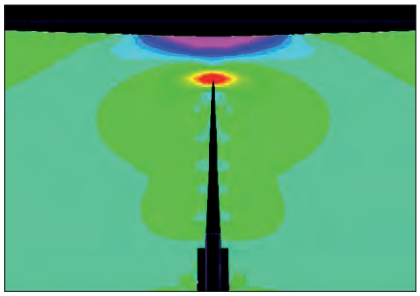
HaTelit®-reinforced specimen: shear failure after 570,000 cycles



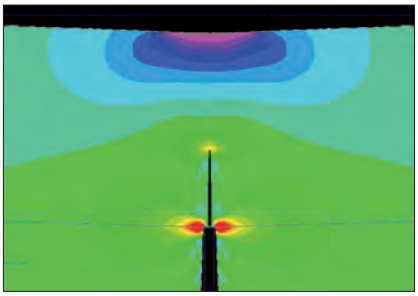
Unreinforced specimen: bending failure after 80,000 cycles



HaTelit®-reinforced specimen: bending failure after 490,000 cycles



FEM results: without reinforcement



FEM results: with **HaTelit®**

When tested in bending, the unreinforced test specimen withstood around 80,000 load cycles before the crack reached the surface. Enduring some 490,000 load cycles, the **HaTelit®**-reinforced specimen this time achieved a roughly 6.1-fold improvement.

The results from the laboratory tests were then verified by finite-element method (FEM) computations. These clearly show how, under load conditions, a crack propagates through an unreinforced asphalt pavement structure due to the high stresses at the crack tip.

The computations for the **HaTelit®**-reinforced specimen, by contrast, demonstrate the mechanism behind the asphalt reinforcement: here, the high stress peaks at the crack tip are taken up by the **HaTelit®** grid and distributed over a larger area.

This process retards the crack propagation and therefore the formation of reflective cracks.

HaTelit® - technical details

Effective tensile strength

According to EN 15381 "Geotextiles and geotextile-related products – Characteristics required for use in pavements and asphalt overlays", it is essential for the tensile strength of asphalt reinforcement to be tested on the finished product.

For **HaTelit®**, the associated tests are conducted in accordance with EN ISO 10319 "Geosynthetics – Wide-width tensile test".

The ascertained value is termed the "short-term" tensile strength as it makes no allowance for various factors that determine the definitive or "effective" tensile strength in the asphalt pavement structure.

To accommodate the effective tensile stresses, the asphalt reinforcement must, among other things, be sufficiently robust during installation.

During installation numerous activities take place e.g. wheel and track loads from the paver and asphalt delivery trucks as well as the compaction of the asphalt once placed. All these activities subject the reinforcement to varying degrees of damage, with a loss of tensile strength as a consequence.

EN 15381 acknowledges the occurrence of "installation damage" during the placement, overlaying and compaction of asphalt. This is where **HaTelit®** comes into its own.

Thanks to its robust properties, **HaTelit®** suffers very little loss of tensile strength under the loads imposed during installation.

It is even possible to install **HaTelit®** directly over milled surfaces.

Milling & recycling

Even the best asphalt reinforcement cannot guarantee asphalt pavements an infinite lifespan. To demonstrate that **HaTelit®** grids are both millable and recyclable, a variety of tests have been performed on several occasions.

One investigation established, among other things, that the asphalt reinforcement in no way impairs milling operations.

It is, however, essential that several asphalt layers be milled together: at least 4.0 cm of asphalt above and at least 1.0-2.0 cm below the reinforcement must be milled in conjunction with the reinforcement itself.

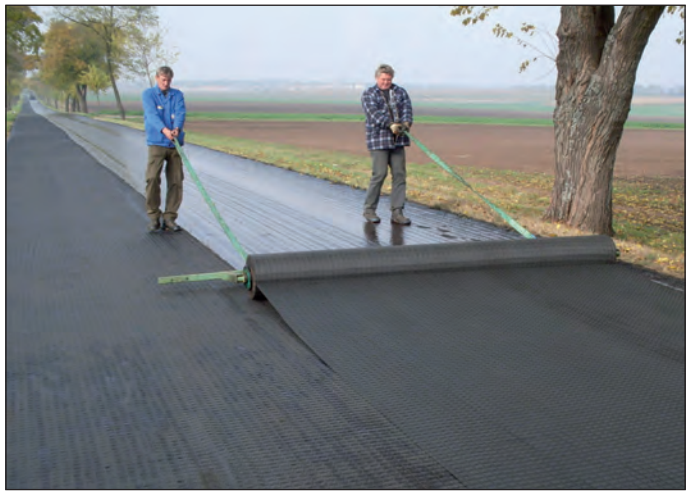
Small quantities of **HaTelit®** fibre residue in milled asphalt

Advice on installing HaTelit®

After spray application of a tack coat comprising approx. 0.6-1.2 kg/m² bitumen emulsion (with 70% bitumen content, depending on surface conditions) the reinforcement grid is unrolled flat and without folds onto the base. Where several sheets are laid, these should be lapped by 25 cm in the direction parallel to the pavement centreline and by 15 cm in the perpendicular direction.

HaTelit® is unrolled with the help of a simple system, operated either manually or, for larger widths, by vehicle.

The reinforcement grid must be covered with an asphalt layer of at least 40 mm thickness (in the compacted state).



Manual installation with simple device

Mechanical installation using large unrolling device

The placing of reinforced asphalt layers is, in principle, subject to the normal technical requirements for asphalt road construction. When used, **HaTelit®** must always be installed between two asphalt layers.

It is essential to comply with the detailed instructions set out in the **HaTelit®** Installation Guidelines, which are available on request.

Any folds or waves in the reinforcement grid must be flattened out. Slight waves ahead of the paver will not, however, impair the performance of the reinforcement.

Seams between paver passes in the existing pavement must not coincide with any laps between reinforcement grid sheets.

The current technical requirements governing the compaction of asphalt layers must be observed even when using **HaTelit®**.

Min. 40 mm asphalt overlay

HaTelit® - guaranteed quality

HaTelit® has been used successfully for the reinforcement of asphalt layers in many countries for more than 40 years.

The consistently high quality standards are upheld by means of an uncompromising internal control system in conjunction with external surveillance provided by an independent materials test laboratory accredited to DIN 18200. Provision is made for identification on site in accordance with DIN EN ISO 10320.

All described product characteristics are based on the official, certified benchmarks specified in ISO and/or EN standards.

CERTIFICATE TÜV NORD

Management system as per
DIN EN ISO 9001 : 2008

HUESKER

HUESKER Synthetic GmbH
Fabrikstraße 13 - 15
48712 Gescher
Germany

with the locations according to the annex

Development, manufacture, inspection, sales and applications support of geosynthetics and technical textiles

IAF

DAP Deutsches Akkreditierungssystem Prüfwesen GmbH

Unterzeichner der Multilateralen Abkommen von EA und ILAC zur gegenseitigen Anerkennung

vertreten im

Deutschen AkkreditierungsRat

Akkreditierung

Die DAP Deutsches Akkreditierungssystem Prüfwesen GmbH bestätigt hiermit, dass die

HUESKER Synthetic GmbH

Fabrikstraße 13-15
48712 Gescher

die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in den Bereichen

mechanisch-technologische und thermoanalytische Untersuchungen an Textilien, technischen Textilien, insbesondere Geotextilien (Geosynthetics) und geotextilverwandten Produkten

gemäß den in der Anlage aufgeführten Prüfverfahren auszuführen. Die Anlage ist Bestandteil der Urkunde und besteht aus 3 Seiten.

Die Akkreditierung ist gültig vom 2009-04-22 bis 2014-04-21.

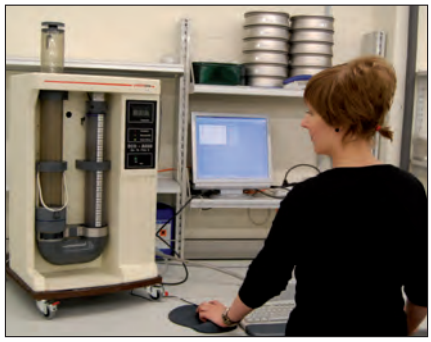
DAR-Registriernummer: DAP-PL-3226.00

Berlin, 2009-04-22

Like all other geosynthetics produced by HUESKER Synthetic GmbH, **HaTelit®** is subject to a stringent quality control system that ensures the achievement of consistently high standards. The continuous chain of quality checks begins with the raw material and ends with the finished product.

HUESKER Synthetic GmbH is ISO 9001:2000 accredited.

The HUESKER test laboratory is accredited (DIN EN ISO/IEC 17025:2000) for a wide range of tests on geosynthetics.



HUESKER Synthetic GmbH is certified by:

HUESKER offers a wide range of technically demanding solutions relying on our many years' experience. Our solutions are economical, reliable and up-to-date and used in:

Earthworks and foundation engineering, landfill construction, hydraulic engineering, road construction

Technical assistance, planning, support - worldwide

Reliable and advanced techniques characterise our products in many applications:

Fortrac® - a flexible, high modulus and low-creep geogrid for soil reinforcement

HaTelit® – a flexible, high-modulus and temperature resistant grid for asphalt reinforcement

Stabilenka® – a high-modulus polyester woven for reinforcement and separation of soils

Robutec® – a very high-modulus and alkali-resistant woven for reinforcement and separation of soils

Fornit® – a biaxial geogrid for subbase reinforcement

Comtrac® – a geocomposite for reinforcement, separation and filtration of soils

DuoGrid® – a geocomposite made of biaxial high-modulus flexible geogrid and a nonwoven

NaBento® – geosynthetic clay liner for sealing

Incomat® – a concrete- or sand-mat for sealing and erosion control

Ringtrac® – geotextile tube for reinforcement and soil containment

HaTe® – wovens and nonwovens for separation, filtration, drainage and protection

SoilTain® – systems for hydraulic engineering and dewatering

HUESKER

Ideen. Ingenieure. Innovationen.

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