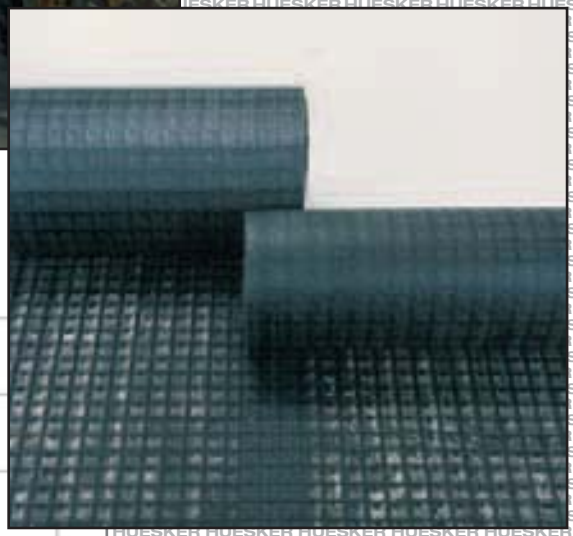
HaTelit®

Asphalt Reinforcement



HUESKER

Engineering with geosynthetics

HaTelit®

- the answer to reflective cracking in asphalt surfacing

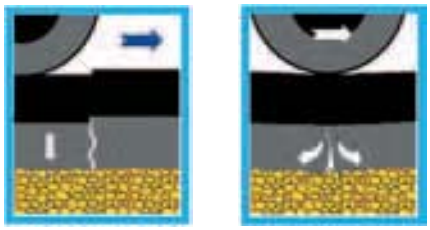
- resulting in considerably extended maintenance intervals

Asphalt is an almost ideal material for road construction, but reflective cracking in new asphalt layers is becoming an increasing problem. This type of cracking is mainly the result of thermally- or traffic-induced fatigue of the asphalt.

Thermal stress

Reflective cracks can form in asphalt laid over concrete carriageways through the horizontal movements of individual concrete slabs when they expand and contract as a result of daily or seasonal temperature fluctuations. These movements create high tensile strains in the asphalt, which can lead to cracks forming directly above the joint in the concrete.

When a wheel load passes over a crack in the road construction, bending and shear stresses are induced in the overlying asphalt layer. The degree of stress depends on the thicknes of the bituminous overlay and existing asphalt surfacing, the bearing capacity of the subgrade and the amount of interlock at the crack. If the asphalt overlay is subjected to traffic load as well as a continuous cyclic movement, the strength and stiffness of the overlay are reduced by each loading event until reflective cracking occurs.



Shear stress Bending stress

By using flexible **HaTelit®** reinforcement grids you can delay or even completely prevent this type of damage in asphalt layers.

HaTelit® provides highway engineers with the right answer to reflective cracking.

Effective reinforcement of asphalt layers

Scharreler Damm road, Germany 1990, before resurfacing

Condition of the road, 2003

Asphalt has a low tensile strength, which can be exceeded even at quite small strains. The resulting asphalt cracks lead to a reduction in the serviceability and life of the bituminous road structure.

HaTelit® reinforcement grids fulfil two important roles in an asphalt layer:

- by increasing its tensile strength

- by accommodating a considerable proportion of the horizontal tensile forces in the asphalt and ensuring an even stress distribution over a larger area, thereby reducing the peaks of tensile stress and associated risk of overload.

The effect of **HaTelit®** can be impressively demonstrated by comparative tensile tests on samples of reinforced and unreinforced sections of two-layered asphalt. The results of the tests show that:

- the failure load of the reinforced material is 50 % higher than that of the unreinforced

- the extension at break of the reinforced sample is approximately 65% greater

The failure mode of the unreinforced material took the form of a single, wide crack, whereas the reinforced samples exhibited fine-pattern cracking due to the load-distributing effect of the reinforcement.

The load-distributing effect of **HaTelit®** also reduces rutting in areas subject to high traffic loads. In addition, a reinforced asphalt layer has higher dynamic load capacity and a higher fatigue resistance.

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

Condition of the road, 2003

Custom-made reinforcement grids: HaTelit®

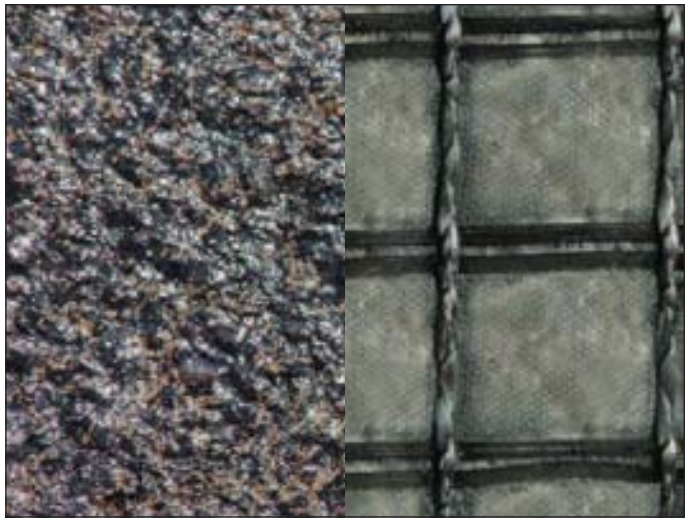
HaTelit® is a flexible reinforcement grid incorporating a nonwoven to ease installation. It consists of a high-quality polyester reinforcement grid and an ultra-lightweight nonwoven. Both the reinforcement grid and the nonwoven have a bitumen-based coating. The nonwoven merely serves to make installation straightforward and ensure a continuous bond between the layers.

The choice of polyester as the material for the reinforcement grid is based on the high compatibility of its mechanical behaviour with the modulus of elasticity of asphalt. To this can be added the optimum properties of polyester under dynamic load.

The overall coating has a bitumen content of over 60% and ensures a good bond with the asphalt layers. Only by achieving optimum bond between the layers is the reinforcement grid capable of taking up and distributing tensile stresses; thus increasing the service life of a new asphalt layer.

HaTelit® is always installed between two asphalt layers.

Optimum bond between layers with **HaTelit®**



URBANSKI · INGENIEURBÜRO
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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.

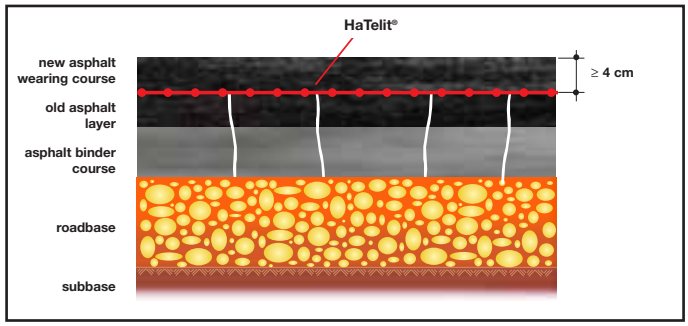
Processed by
Sachbearbeiter
Dipl.-Ing.
Civil engineer

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

Results of bond tests

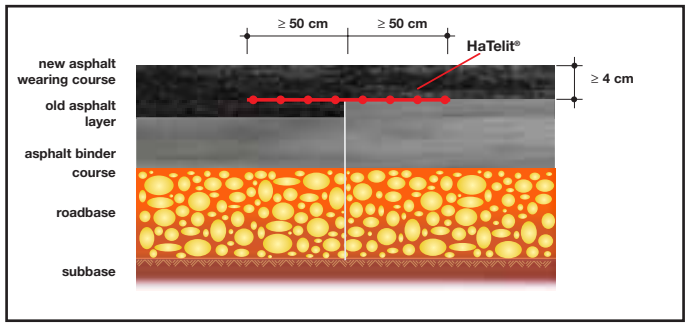
HaTelit® applications

HaTelit® reinforcement grids are installed in asphalt layers in roads and airfields as well as in bituminous paving in hydraulic engineering works. The grids take up the horizontal tensile forces and prevent the propagation of reflective cracks from the existing pavement into the new wearing course. Resurfacing is often done by installing reinforcement grids over the full area. There must be anchorage lengths of at least 500 mm on both sides of a crack.



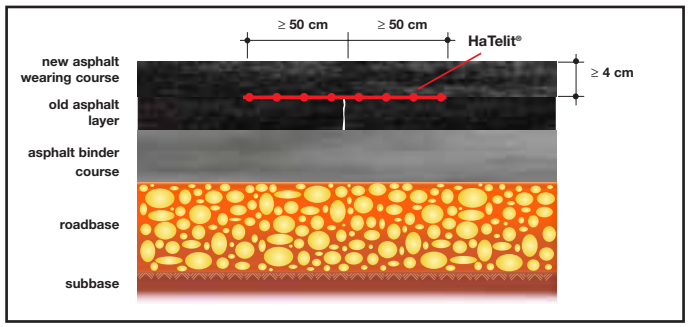
resurfacing, using full-area reinforcement

Where reinforcement is omitted in **carriageway widening,** at least one longitudinal crack can result, forming at the transition between the old carriageway and the widening. This failure can be effectively prevented, by reinforcing the area around the longitudinal joint.



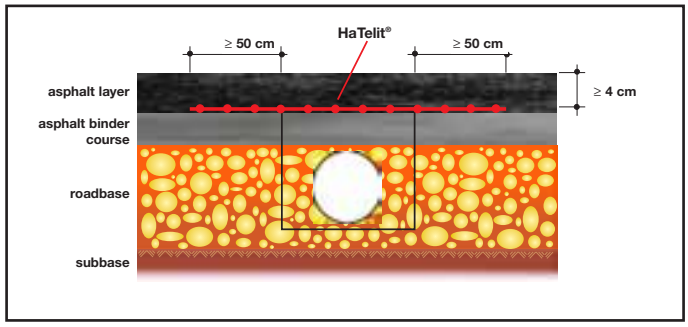
reinforcement strips above the binder course in a **carriageway widening**

Open **joints in an old wearing course** represent a high-risk zone for cracking of the resurfacing asphalt. In such a situation it is sensible to reinforce the area around the old joint with **HaTelit®**.



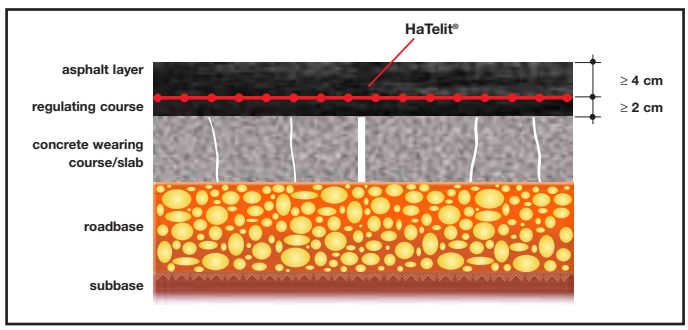
reinforcement of wearing course above an old wearing course joint

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 of two-layer surfacing over a **trench reinstatement**

Where concrete airport runways or **concrete roads** are overlaid with asphalt surfacing, the differential expansion between the concrete and asphalt due to temperature changes can lead to cracks forming above the movement joints in the concrete. These cracks can be prevented with **HaTelit®**.

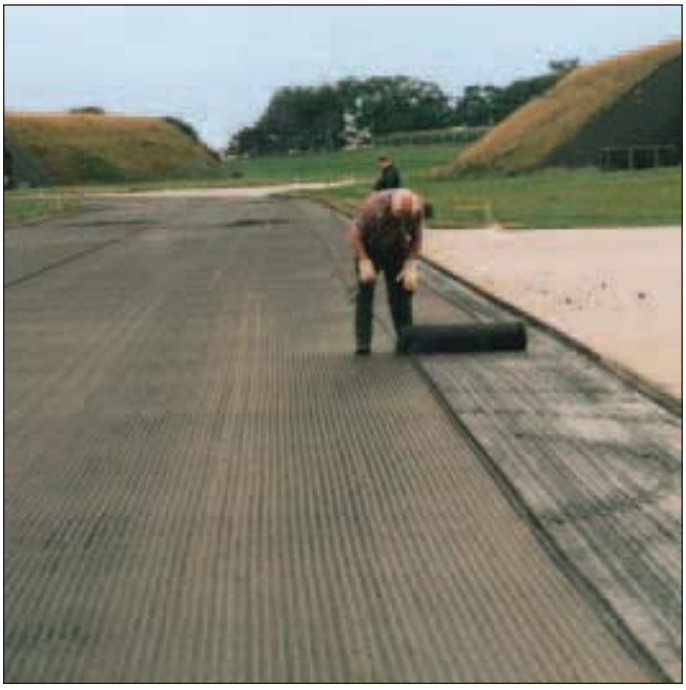


full-area reinforcement of an asphalt overlay on an old **concrete wearing course**

HaTelit® in airport construction

Traffic loading on airport pavements is generally high and, added to which, it is difficult or almost impossible to close runways for repairs, even for short periods.
On most occasions there is only very limited time available to repair a cracked asphalt surface or resurface an old concrete pavement. This restriction applies especially to runways, but taxiways and aprons are also critical.

London Luton Airport 1988 and 1992 (UK)



Jagel Military Airport (Germany 1998)

In most cases the repair method chosen is an asphalt overlay, because it can be constructed in the shortest time. The use of flexible reinforcement grids is recommended in order to prevent the formation of reflective cracking in the new asphalt overlay and to extend the maintenance interval.

HaTelit® has been used successfully on numerous civil and military airports.
Experience shows that **HaTelit®** has proved itself under heavy traffic loads and the harshest weather conditions.

Please ask for our list of previous projects.

Posen-Lawica Airport (Poland 2002)

Roads without cracks: HaTelit®

The reasons for the need to reconstruct roads are symptoms of an aging road network and the increasing load resulting from traffic growth as well as higher permissible axle weights. It is obvious why low-cost and effective resurfacing techniques are always in demand for roadworks.

Installation of **HaTelit®** southern Spain 1999

The use of **HaTelit®** reinforcement grids in asphalt layers represents an effective method of preventing reflective cracking. Practical experience with **HaTelit®** after more than 35 years' use shows that **the service life** of an asphalt layer and thus the maintenance interval can be **extended by a factor of 3 - 4.** This applies equally to cold, temperate or hot climate zones.

A road reinforced with suitably designed and properly installed **HaTelit®** reinforcement grids will remain crack-free for many years.

Installation of **HaTelit®** Libya 1989

No special measures are required when it comes to reconstruction of a polyester-reinforced asphalt layer. Reinforcement grids are easily planed. **HaTelit®** is an environment-friendly and resource-saving material.

HaTelit® under test

Stresses in the asphalt and local stress concentrations over existing cracks in the asphalt result mainly from

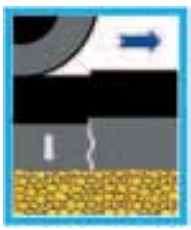
- dynamic loads from traffic (shear stress A and bending stress B)
- thermal stress C arising from temperature changes and different coefficients of thermal expansion (e.g. concrete and asphalt)

The effect of reinforcement on these loads as applied in practice was investigated in laboratory tests on reinforced and unreinforced asphalt samples.

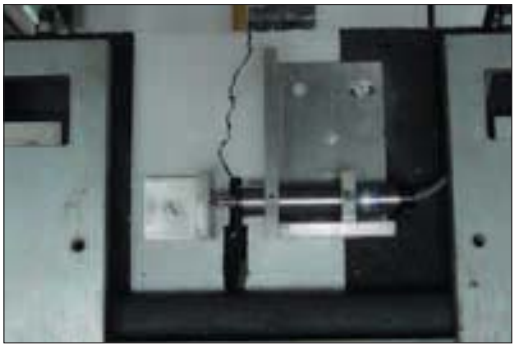
Dynamic fatigue tests

An asphalt wearing course was applied over an existing crack in a detailed series of tests. Samples of unreinforced material and reinforced with **HaTelit®** were dynamically loaded in shear and in bending (stress types A and B). The results confirmed that a **HaTelit®**-reinforced construction considerably delayed the through-penetration of cracks. Compared to the unreinforced material, the **HaTelit®**-reinforced asphalt layer was subjected to up to 6.1 times the number of dynamic loading cycles before a crack reached the surface. The crack pattern clearly shows that the reinforcement takes up and distributes the tensile forces.

The following pictures show the state of an unreinforced asphalt sample and one reinforced with **HaTelit®**, and the number of load cycles.



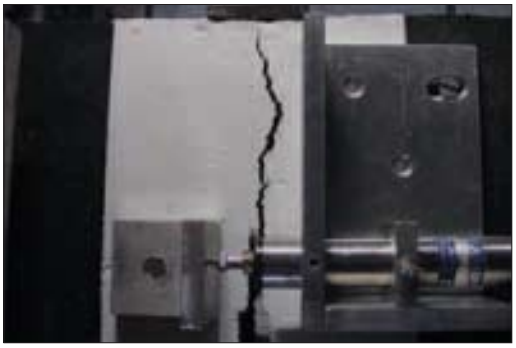
A
Shear stress



Unreinforced sample: shearing after 90,000 cycles

HaTelit®-reinforced sample: shearing after 570,000 cycles

B
Bending stress



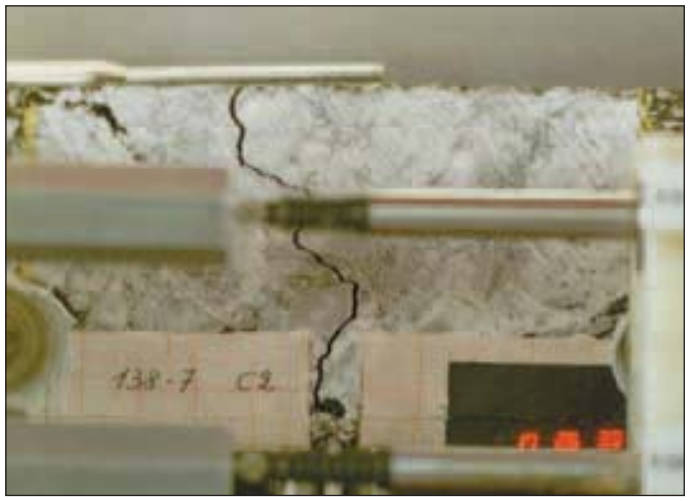
Unreinforced sample: bending after 80,000 cycles

HaTelit®-reinforced sample: bending after 490,000 cycles

HaTelit® under test

Thermal crack propagation

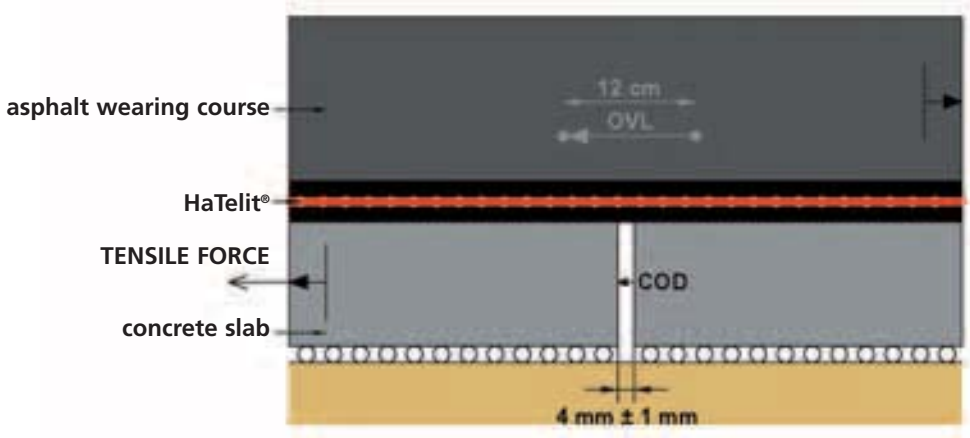
C
Thermal stress



In an extensive series of tests the effect of **HaTelit®** on the prevention of crack propagation caused by thermal stresses was investigated (thermal stress C). **HaTelit®** was installed over a 4 mm wide joint between two concrete blocks and overlaid with 50 mm of asphalt. The joint was then opened by 1 mm and closed again to its original width. This cycle was continuously repeated. The propagation of cracks in the unreinforced material was compared with that in the samples reinforced with **HaTelit®**. The unreinforced samples were already cracked through after the first opening cycle, whilst all the **HaTelit®** reinforced samples had not failed after the completion of the tests (100 hours, approx. 38 cycles).
By effectively mobilising the tensile forces and its excellent system compatibility, **HaTelit®** is highly effective in dealing with the stresses and strains arising from a cracked road.

Practical experience confirms that the maintenance interval can be considerably extended by the use of HaTelit®.

We would be pleased to supply you with complete details of all the tests we have performed.



COD = crack opening dimension
OVL= movement in the wearing course

Advice on installing HaTelit®

The reinforcement grid is rolled out using a simple unrolling device, either manually or with the aid of a vehicle when placing wider widths.

No tensioning or special measures are required to place **HaTelit® C 40/17**. Installation is therefore considerably easier and more cost-effective.

When constructing a reinforced asphalt layer, the normal technical requirements for bituminous road construction must be observed. The following points are to be taken into account when using **HaTelit®**:

HaTelit® is always installed between two asphalt layers.

The reinforcement grid must be laid free of folds and waves. However, if a slight wave builds up in front of the paving machine, this will not detrimentally affect the performance of the reinforcement. Joints in the old asphalt pavement must not coincide with overlaps in the rolls of reinforcement grid. The current technical requirements for the compaction of asphalt layers must be observed when using **HaTelit®**.

The reinforcement grids are rolled out flat and without folds onto the substrate. The rolls should be overlapped 150 mm transversely and 250 mm longitudinally to the road centre-line.

If a paving machine is used, the reinforcement grid must be covered with a minimum thickness of 40 mm of asphalt (40 mm in the compacted state).

Please ask for our **HaTelit®** installation instructions for further information.

HaTelit® – assured quality

HaTelit® has been used successfully for the reinforcement of asphalt layers in many countries for over 35 years.

The continuously high standard of quality is ensured by an uncompromising in-house inspection system and third party inspection, provided by an independent materials testing laboratory accredited to DIN 18200. Identification of the product on site is in accordance with EN DIN 10320.

All technical product data presented in data sheets are based on ISO or/and EN standards.


TÜV CERT

CERTIFICATE

The TÜV CERT Certification Body for QM-Systems of RWTÜV Systems GmbH

hereby certifies in accordance with TÜV CERT procedure that

HUESKER

has established and applies a quality system for

RWTÜV


Deutschen AkkreditierungsRat

Accreditation

Like all geosynthetics from HUESKER Synthetic, **HaTelit®** is subject to strict quality control to ensure a consistently high standard of quality. 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 range of tests on geosynthetics.

Patented: US-Patent No. 6,503,853; No. 6,780,798
European-Patent No. 0 956 392

HaTelit® is a registered trademark of HUESKER Synthetic GmbH.

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

Fornit® – a biaxial geogrid for subbase reinforcement

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

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

Geosynthetics made by HUESKER
-reliability by experience!

HUESKER

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