

Hilti HIT-RE 500

Use of Hilti HIT-RE 500 injection adhesive in asphalt base material

Miscellaneous:

Asphalt is not a solid base material from a fastening perspective.

It flows / creeps under load. This base material and holes for fasteners deform under a sustained or a periodical load.

This behaviour even worsens at elevated asphalt temperatures, as is normally the case in summer.

In view of this asphalt behaviour, the transfer of sustained loads from anchors to this base material is **critical**. The result depends on the anchoring system used, i.e. whether it is a chemical or mechanical anchor.

The main fastenings in asphalt are lane separation barriers made either of rubber or of concrete, lane separation signs, etc.

In order that we would be able to provide some guidelines for these types of applications, we tested HIT-RE 500 injection adhesive in asphalt base material.

The main question to be answered during these tests was '**Does HIT-RE 500 cure properly in asphalt base material?**'

We carried out two test series to answer this question and to evaluate some technical data to give us a guide:

Tensile loading test:

Test conditions:

- Grade of asphalt: unknown
- Asphalt thickness: approx. 120 mm
- Anchor type: HAS M12; steel grade 10.9
- Hammer drilling with TE 24
- Anchorage depth: 90 mm
- Hole diameter: 14 and 18 mm
- Hole cleaning: as specified in the instructions for use
- Asphalt temperature: approx. 15° to 20°C when setting anchor, curing and pulling out
- Curing time: approx. 2 days (46 h)
- No. of anchors: 5 set for each hole diameter

The anchors were pulled out using the Hilti Minipull test equipment (see fig. 1).
The diameter of the support ring was 80 mm.

Test results:

The ultimate pull-out values measured were in the range of 20 to 30 kN.

There was no significant difference in mean ultimate loads obtained with holes from 14 to 18 mm diameter. In each case, the failure mode was breaking the asphalt (see figs 2 and 3).

On each pulled-out anchor, there was a layer of approx. 1 to 2 mm of asphalt around the outside of the annular ring of cured HIT-RE 500 adhesive (see figs 3 and 4).

In each case, the anchor adhesive had cured fully and properly.

Bonding test:

Test conditions:

- Same asphalt as described above
- Asphalt surface cleaned using a wire brush
- Dust blown away using Hilti HIT blow-out pump
- Bonding surface of fastening disc sand-blasted and cleaned with acetone just before setting
- Cone of HIT-RE 500 dispensed onto asphalt
- Fastening disc then placed on top of adhesive cone
- Asphalt temperature about 15° to 25°C when setting anchor, curing and testing
- Curing time 1 day (24 h)
- 5 discs set; disc diameter 50 mm / 2"
- See fig. 5 for bonding test equipment

Test results:

- The asphalt base material failed with all 5 discs (see fig. 6).
- The ultimate bond strength was between 0.8 and 1.3 N/mm² with a coefficient of variation of 20%.

Based on these test results, a characteristic bond strength of 0.35 N/mm² (5% fractile) was determined. Taking into account the necessary safety factor and some important influencing factors like...

- grade of asphalt,
- surface preparation,
- temperature, especially higher temperatures and
- asphalt behaviour under a sustained load,

we recommend the use of a **permissible bond strength** of **0.1 N/mm²** in your calculations.

Fastening recommendations:

The main fastenings made in asphalt are for the installation of lane separation barriers made either of rubber or concrete, lane separation signs, etc.

In view of the good bonding performance of HIT-RE 500, we recommend the following solution for these types of applications:

- Mill a groove into the asphalt. The depth and size of the groove depends on the anchor / fastener to be set. The groove configuration should be such that the shear load from fastener will be transferred mainly by the keying action in the asphalt.
- Bond the rubber strips / barriers into these grooves using HIT-RE 500 injection adhesive. Take care that the bonding surfaces of the asphalt and the fasteners rough and clean, i.e. no oil or grease or other agent which will impair the bond.
- We recommend 0.1 N/mm² as the permissible bond strength.
- To provide additional security, anchor rods are also used for some of these applications. In view of the asphalt behaviour, these fasteners should be regarded as additional safety measures.

For lower-grade or temporary fastenings, the anchor / fastener can also be installed without milling a groove. In this case, the adhesive has to carry the shear loads.

Wish you every success when selling HIT-RE 500 injection adhesive for all types of applications.

Regards

Hilti Anchor Development, Kaufering
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Fig. 1: Tensile testing of HAS M12 anchor rods fastened with Hilti HIT-RE 500 injection adhesive in asphalt base material using the Minipull test equipment.



Fig. 2: Tensile testing of HAS M12 anchor rods fastened with Hilti HIT-RE 500 injection adhesive in asphalt base material. The failure mode of all anchors was breaking out of the asphalt.



Fig. 3: A layer of asphalt approx. 1 to 2 mm thick is bonded to the HIT-RE 500 adhesive.



Fig. 4: The HIT-RE 500 injection adhesive is fully cured and bonded to the asphalt surrounding the adhesive.



Fig. 5: Test arrangement for bonding test with HIT-RE 500 on asphalt; Test disc 50 mm / 2" in diameter

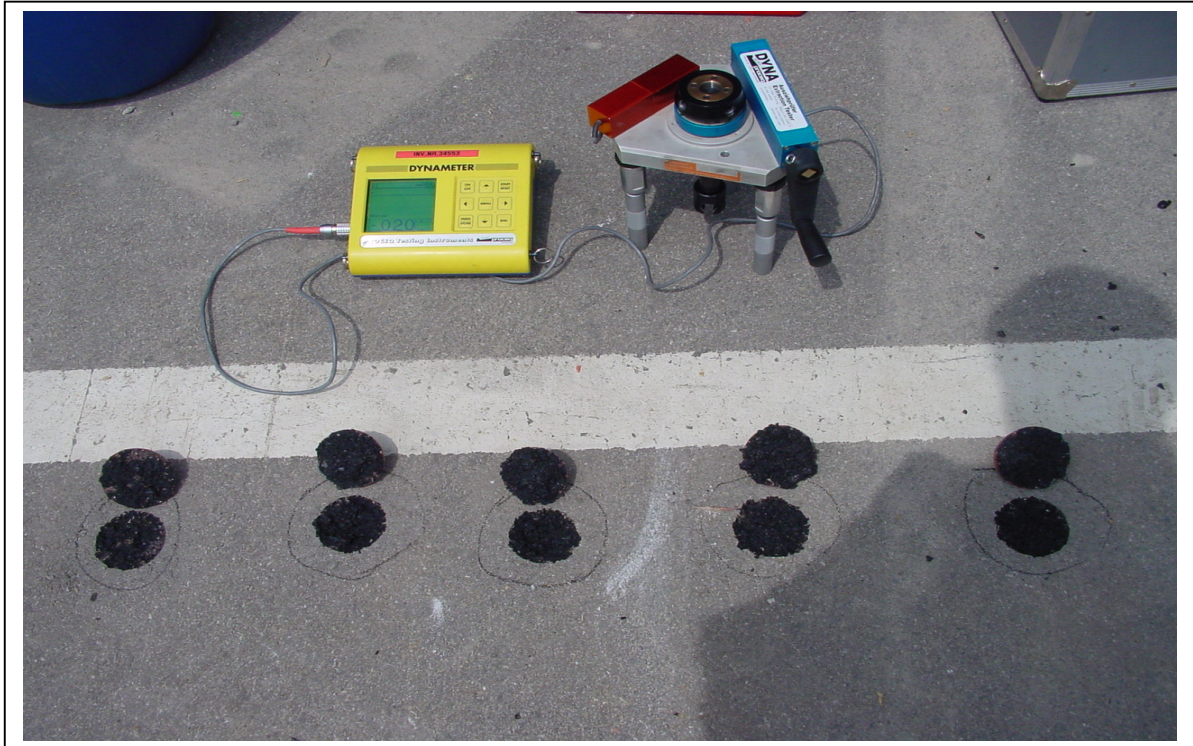


Fig. 6: Test results of bonding test with HIT-RE 500 on asphalt.
Failure mode in each case: asphalt failure