Hilti HIT-RE 500

Use of Hilti HIT-RE 500 Injection Adhesive in Base Material „Asphalt“

In general:

Asphalt is not a solid base material in view of fastenings.
It flows under load and this base material/bore holes will be deformed under permanent as well as under periodical load.
This behaviour even get worse at elevated asphalt temperatures which happens normally in summer time

Due to the behaviour of asphalt **it is critical** to transfer permanent loads from anchors into this base material.
This is independent from the anchoring system used – chemical or mechanical anchors.

The main applications for fastenings on asphalt are the installation of slow-down barriers either made of rubber or of concrete, line separation barriers, line separation signs, etc.
To give some guideline information for these types of applications we tested HIT-RE 500 injection adhesive at the base material asphalt.
Main question of these tests was: **does HIT-RE 500 cure properly in the base material asphalt ?**
To answer this question and to evaluate some technical data for orientation we performed two test series:

Tension Test:

Test conditions:

- Asphalt quality unknown; Asphalt thickness was approx. 120 mm.
- Anchor type: HAS M12; quality 10.9
- Hammer drilling with TE 24:
- Embedment depth: 90 mm
- Bore hole diameters: 14 and 18 mm
- Bore hole cleaning as specified in the „instruction for use“
- The temperature of asphalt was about 15 to 20°C during anchor setting, curing and pull-out.
- Curing time was approx. 2 days (46 h).
- 5 anchors have been set for each bore hole diameter

The anchors have been pulled using the Hilti Minipull test equipment (see picture 1)
Diameter of support ring was 80 mm.

Test results:

Ultimate pull-out values were measured in the range of 20 to 30 kN.
There is no significant difference in mean ultimate loads between 14 and 18 mm bore hole diameters.

Failure mode in each case was breakage of the base material asphalt (see picture 2 and 3)
At the pulled anchors a layer of approx. 1 to 2 mm of asphalt was on top of the cured HIT-RE 500 mortar ring. (see picture 3 and 4).

In each case the anchors cured properly to full cure.

Bonding Tests:

Test conditions:

- Same asphalt as described above
- Cleaning of the asphalt surface using a wire brush
- Blowing dust away using Hilti HIT blow-out pump
- Gluing surface of fastening disc was sand-blasted and cleaned using acetone just before setting
- A cone of HIT-RE 500 was dispensed to the asphalt
- Fastening disc was than installed on top of the mortar cone
- The temperature of asphalt was about 15 to 25°C during anchor setting, curing and testing.
- Curing time was 1 days (24 h).
- 5 discs have been set; disc diameter 50 mm / 2”
- Bonding test equipment: see picture 5

Test results:

- All 5 discs showed failure of the base material asphalt (see picture 6)
- The ultimate bond strength was between 0,8 and 1,3 N/mm^2 with a variation coefficient of 20%

Based on these test results the characteristic bond strength (5% fractal) is 0,35 N/mm^2.
Taking into account necessary safety factor and some important influencing factors like

- asphalt quality
- surface preparation
- temperature influence, especially higher temperatures
- behaviour of base material asphalt under permanent load

we recommend an **allowable bonding strength** for your calculation **of 0,1 N/mm^2** .

Application recommendations:

The main applications for fastenings on asphalt are the installation of slow-down barriers either made of rubber or of concrete, line separation barriers, line separation signs, etc.

Due to the good bonding performance of HIT-RE 500 we recommend following solution for these type of applications:

- Mill a grove into the base material asphalt. Depth and size of the grove will depend on the elements to be fastened. The grove should be designed in such a way that the shear load from the elements fastened will be transferred mainly by keying effect to the asphalt.
- Glue the rubber stripes/barriers into these groves using HIT-RE 500 injection mortar.
  Take care that the bonding surfaces of the base material and the elements to be fastened are rough and clean (no oil or grace or other agent which will disturb the gluing).
- For allowable bond strength of the gluing we recommend 0,1 N/mm^2 .
- For additional securing anchor rods are also used for some of these applications. Due to the asphalt behaviour these anchors should be treated as additional safety measures.

For lower grade fastenings or temporary applications the fastening element can also be installed without milling of a grove. In this case the mortar has to carry the shear loads.

Wish you good successes in selling HIT-RE 500 injection mortar for all type of fastening applications.

Regards Hilti Development Anchors, Kaufering

H. Ginter

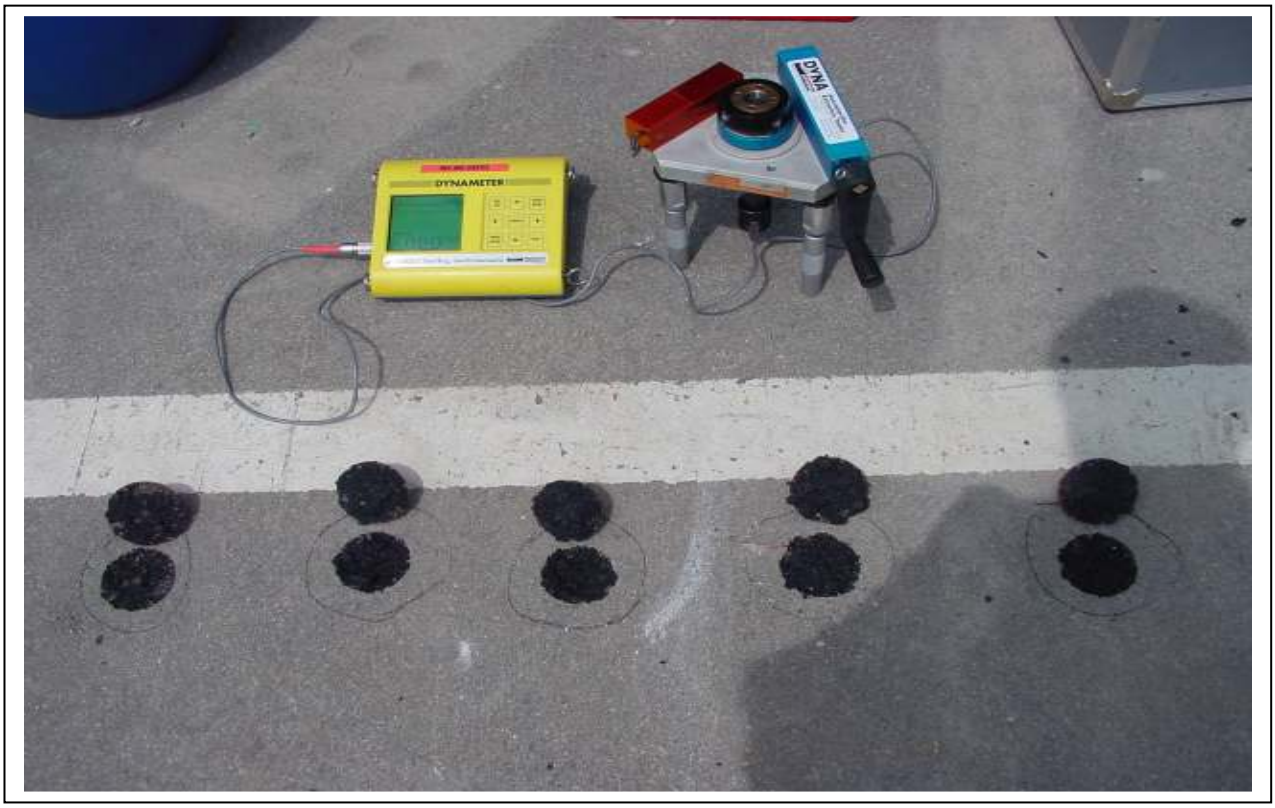
Picture 1: Tension test of anchors HAS M12 fastened with Hilti HIT-RE 500 injection mortar in base material asphalt using the Minipull test equipment.

Picture 2: Tension test of anchors HAS M12 fastened with Hilti HIT-RE 500 injection mortar in base material asphalt. Failure mode for all anchors: asphalt failure

Picture 3: A layer of approx. 1 to 2 mm of asphalt is bonded to the HIT-RE 500 mortar

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

Picture 5: Test arrangement for bonding test of HIT-RE 500 on asphalt. Test discs with ∅50mm / 2”



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