HIT-RE 500 V4 injection mortar

Test report

Injection mortar system

Information covered

HIT-RE 500 V4 and Reinforcing bar (rebar)	Natural stone as base material

Hilti Test report HIT-RE 500 V4

Disclaimer

All test results itemized in this test report are based upon the test constellation and its respective parameters described in this test report and the principles, formulas and safety factors set out in the Hilti technical instructions, the operating manuals, the setting manuals, the installation manuals and other data sheets. These test results are only valid for applications done in accordance with the test constellation as described herein. The test results exclusively refer to the tested items defined in this test report.

Any deviation from the test constellation as described in this test report (especially local characteristics) may lead to different results. Therefore, we recommend performing on-site testing to determine performance at any specific site.

This test report is only valid in its entirety and, therefore, may only be handed on or copied unchanged.

Hilti does not accept any liability for any damages in connection with any test constellation not corresponding with the one described in this test report or because of the use of parts of this test report only.

This test report is originally issued in English language. If translated into other languages, the original English version of the test report shall prevail.

Scope

This report is a test report of pull-out tests with HIT-RE 500 V4 used for anchoring in natural stone. The task of the performed tests was to **generate an initial opinion** of the performance of HIT-RE 500 V4 in natural stone as base material.

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Preliminary notes
This test report describes the behavior of HIT-RE 500 V4 in the specific test situation.

Many aspects have not been addressed by testing but may be relevant for application cases.
These aspects are e. g.:

- Functioning under permanent loads
- Failure under increasing temperature (fire)
- Corrosion resistance of rebar
- Functioning under freeze / thaw conditions
- Installation safety in wet rock conditions
- Sizes of the fasteners and embedment depth
- Long term stability and durability
- Safety concept

Hilti is not familiar with design for rock anchoring applications. Especially the behavior of the base material e. g. cracks of clefts is dependent on local situations and can't predicted by Hilti. Therefore, it is **recommended to consult specialists** (geologist and geotechnical engineers) for the design of rock anchoring.

Additional notes:

- Rebar connections in rock material are not covered by any code or regulation.
- The following data only concerns the bond at the interface between the reinforcing bars and the natural stone.
- Other failure modes than bond failure related to natural stone itself may occur, therefore it is the sole responsibility of the design engineer to ensure the transfer of the forces into the surrounding natural stone according to the principles of rock mechanics.

Test plan, test setup and test conditions

Test plan					
test series	natural stone	type	rebar diameter [mm]	drill hole diameter d_0 [mm]	setting depth h_{ef} [mm]
1	Gneis	n. a.	25	32	75
2	Granite	n. a.	25	32	75
3	Gabbro	Bengal Black	25	32	75
4	Basalt	Indian Black	25	32	75

Test setup
Confined condition (narrow support) to provoke bond failure of the mortar and avoid cone failure of the base material

Test condition	
Test series 1 to 4	• Hammer drilling • Bore hole cleaning (CAC: compressed air cleaning) as specified in the installation instruction supplied with the Hilti injection mortar • Mortar injection as specified in the installation instruction supplied with the Hilti injection mortar • Room temperature during pull-out test

Test results

Summary of test results						
test series	natural stone	f_{um}[1)] [N/mm²]	number of tests n [-]	mean failure load [kN]	CoV [%]	failure mode[2)]
1	Gneis	145	5	166	7,7	Po
2	Granite	180	5	152	10,7	Po
3	Gabbro	340	5	211	5,2	Po
4	Basalt	310	5	173	19,6	Sp

1) mean compressive strength f_{um} of the natural stone has been determined on cored cylinders with h = 100 mm and d = 100 mm

2) Po: Pull-out; SP: Splitting

Test samples during or after testing with Hilti HIT-RE 500 V4			
Pull-out test setup with Gneiss	Drill hole before mortar installation in Granite	Rebar after tests; pull-out failure in Gabbro	Natural stone plate after testing; splitting failure of Basalt