



# Roxeler Baustoffprüfstelle

Baustoffprüfung  
Baugrundgutachten  
Bauwerkserhaltung



**Roxeler Ingenieurgesellschaft mbH**  
Otto-Hahn-Straße 7 · 48161 Münster

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32351 Stemwede

Bauaufsichtlich anerkannte  
Prüf-, Überwachungs- und Zertifizierungsstelle (PÜZ)

Notifizierte Zertifizierungsstelle gemäß  
Verordnung (EU) Nr. 305/2011

Privatrechtlich anerkannte Prüfstelle nach RAP Stra  
für bituminöse und mineralische Baustoffe

Durch die DAkkS nach DIN EN ISO/IEC 17025  
akkreditierte Prüfstelle.

Die Akkreditierung gilt für die  
in der Urkunde aufgeführten  
Prüfverfahren am Standort Münster.



## Test Report

**No. 040068-09 (CDF)**

Object of the Test: Determination of the freeze-thaw and de-icing agent resistance of sample objects made from concrete and fireproof sealant "Tendonol"

Test: Determination of the freeze-thaw and de-icing agent resistance (CDF test) based on the data sheet *Frost Resistance Tests for Concrete*, 2004 edition, published by the Bundesanstalt für Wasserbau (BAW)

Date of Contract: 16.06.2009

Project Manager: Dipl.-Ing. Christian Möller [Graduate Engineer]

Date of the Copy: 10.09.2009

Copy No.: pdf

The test report consists of 10 pages  
including annex(es): 2 pages  
Copy: 1 copies + pdf

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Content

1	General .....	3
2	Determination of the freeze-thaw resistance .....	4
3	Assessment .....	7
4	Annex: Test objects before and after the freeze-thaw and de-icing agent resistance test .....	9

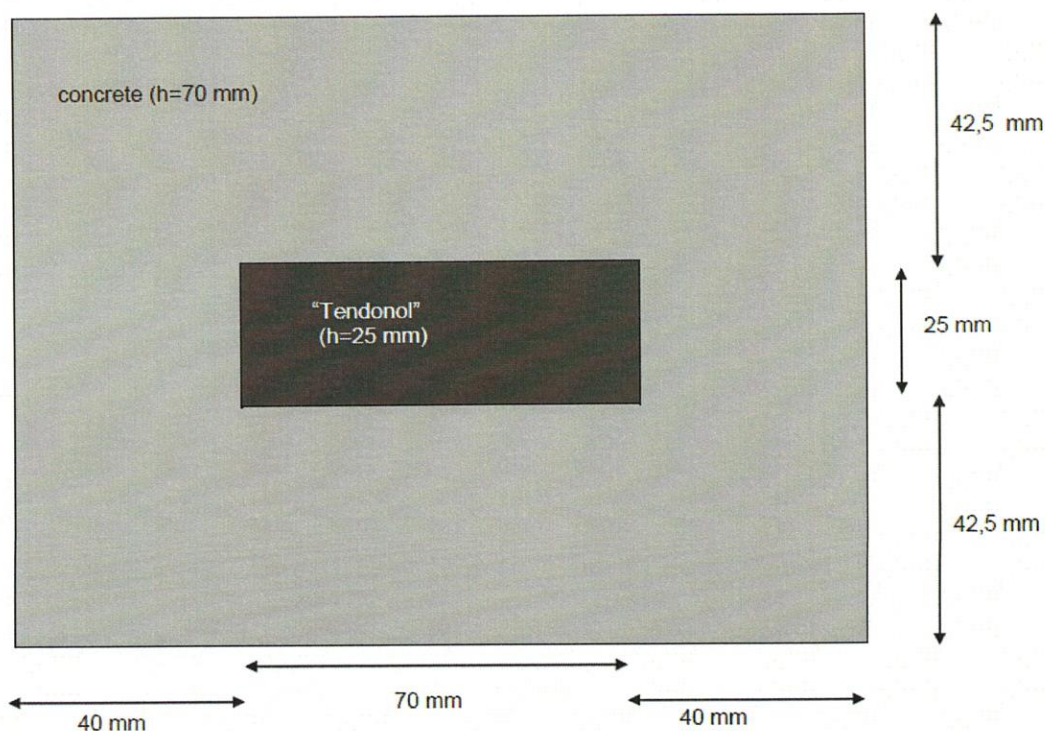
## 1 General

The Construction Materials Testing Institute of the Roxeler Ingenieurgesellschaft mbH, Otto-Hahn-Str. 7 in 48161 Münster, was commissioned by Mr. Schulze, Vario Baustoffsysteme GmbH, Dielinger Straße 60 in 32351 Stemwede, on 16.06.2009, to test the freeze-thaw and de-icing agent resistance of the sample objects made of concrete and fireproof sealant "Tendonol".

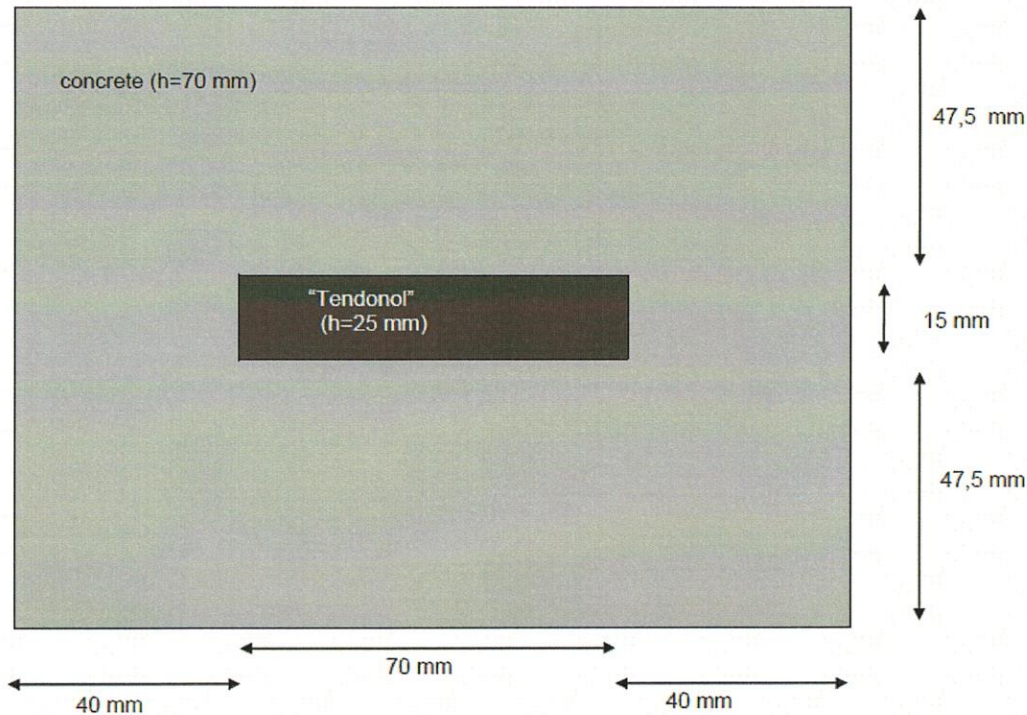
The purpose of the test is to demonstrate the freeze-thaw and de-icing agent resistance of the "Tendonol" fire prevention sealing compound and the "Tendonol" joint in concrete. The level of adhesion of the "Tendonol" on the concrete along the edges, as well as the visible properties of the "Tendonol" before and after the test were agreed upon as the assessment criteria.

The test is carried out based on the CDF test procedure in accordance with data sheet *Frost Resistance Tests for Concrete*, 2004 edition, published by the Bundesanstalt für Wasserbau (BAW). The test objects were produced from concrete with a freeze-thaw and de-icing agent resistance based on the above test provisions. A total of 6 test objects were produced in accordance with the following schematic sketches. The joint/recess was produced using a high-pressure water jet and filled with "Tendonol" (batch no. 28955-09-08) to a depth of 25 mm on 02.07.2009.

### 1.1 Sketch: Test object no. 1.1 to 1.3 (joint width 25 mm)



### 1.2 Sketch: Test object no. 2.1 to 2.3 (joint width 15 mm)



## 2 Determination of the freeze-thaw resistance

The freeze-thaw and de-icing agent resistance of the concrete was determined in accordance with data sheet *Frost Resistance Tests for Concrete*, 2004 edition, published by the Bundesanstalt für Wasserbau (BAW). The abovementioned test objects were used which deviates from the data sheet.

The pre-storage period was beginning on 22.07.2009 after the "Tendonol" had been given 20 days to set (60°C in drying cabinet). The freeze-thaw and de-icing agent resistance test started on 05.08.2009 at 11:00 am. The tables 2.1 to 2.4 summarise the results of the CDF test in accordance with the abovementioned test provisions. The figures 2.1 to 2.3 illustrate the graphic evaluation. The test objects before and after the freeze resistance test are in the annex on the figures 1 to 12.

Table 2.1: Dimensions of the test object

Test object	1.1	1.2	1.3	2.1	2.2	2.3
Weight (g)	2460.4	2484.7	2496.7	2506.5	2485.1	2611.8
Height (cm)	7.15	7.15	7.30	7.05	7.05	7.30
a (cm)	15.00	15.00	15.00	15.00	14.95	15.10
b (cm)	11.20	11.20	11.20	11.20	11.20	11.10
Test surface Concrete in m <sup>2</sup>	0.0151	0.0151	0.0151	0.0158	0.0157	0.0157

Table 2.2: Weathering in g/m<sup>2</sup>

FTC	1.1	1.2	1.3	2.1	2.2	2.3	Medium value	Standard deviation
0	0	0	0	0	0	0	0	0
4	37	41	34	51	38	48	42	7
10	94	113	103	168	118	172	128	34
14	157	212	167	269	192	282	213	52
18	214	281	238	364	281	394	295	70
24	295	380	333	498	420	509	406	87
28	355	439	394	572	493	612	478	101

The 95% quantile of the test series after 28 FTC amounts to 602 g/m<sup>2</sup>.

Table 2.3: Moisture absorption n mass %

time in d	1.1	1.2	1.3	2.1	2.2	2.3	Medium value	Standard deviation
-14	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
-12	2.65%	2.76%	2.64%	3.06%	3.07%	2.99%	2.86%	0.20%
-7	3.49%	3.40%	3.48%	3.61%	3.75%	3.84%	3.59%	0.17%
0	3.63%	3.50%	3.69%	3.73%	3.85%	3.99%	3.73%	0.17%
2	3.83%	3.71%	3.90%	3.94%	4.12%	4.21%	3.95%	0.19%
5	4.09%	3.86%	4.09%	4.10%	4.31%	4.33%	4.13%	0.17%
7	4.18%	3.92%	4.16%	4.16%	4.36%	4.39%	4.20%	0.17%
9	4.22%	3.95%	4.20%	4.20%	4.40%	4.43%	4.23%	0.17%
12	4.27%	3.98%	4.25%	4.22%	4.45%	4.44%	4.27%	0.17%
14	4.29%	4.00%	4.26%	4.24%	4.48%	4.45%	4.29%	0.17%

Table 2.4: Change of the relative dynamic e-module

FTC	1.1	1.2	1.3	2.1	2.2	2.3	Medium value	Standard deviation
0	100%	100%	100%	100%	100%	100%	100%	0%
4	102%	100%	101%	99%	100%	97%	100%	2%
10	101%	100%	105%	98%	101%	97%	100%	3%
14	105%	101%	106%	102%	103%	98%	102%	3%
18	103%	100%	106%	102%	103%	98%	102%	3%
24	105%	99%	106%	103%	103%	98%	102%	3%
28	104%	99%	102%	101%	102%	100%	101%	2%

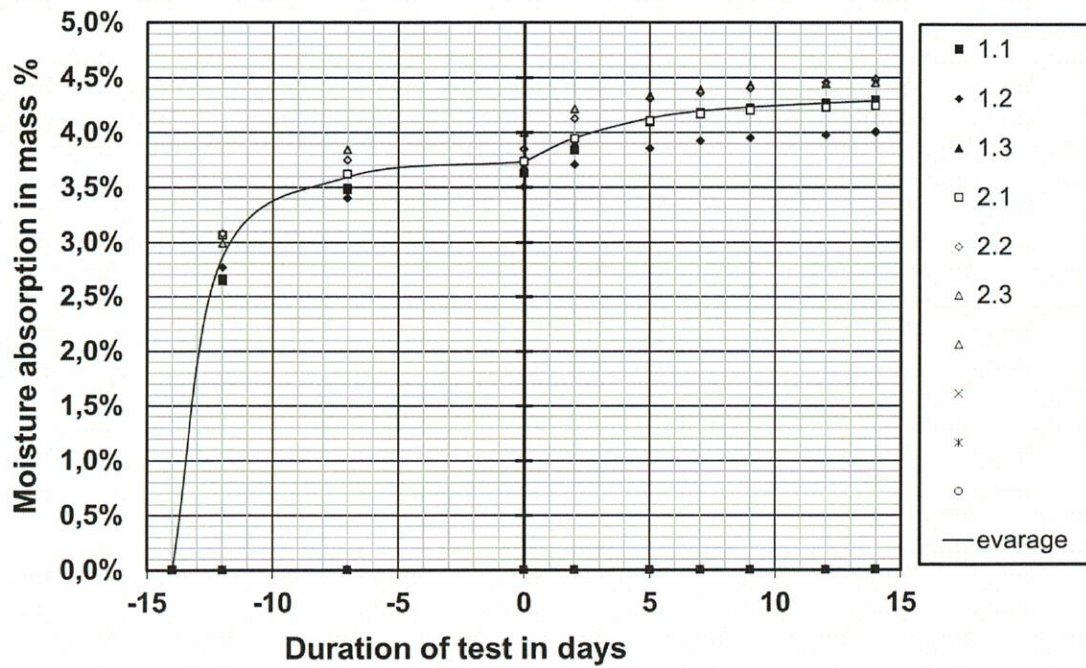


Figure 2.1: Moisture absorption in mass % over the duration of the test.

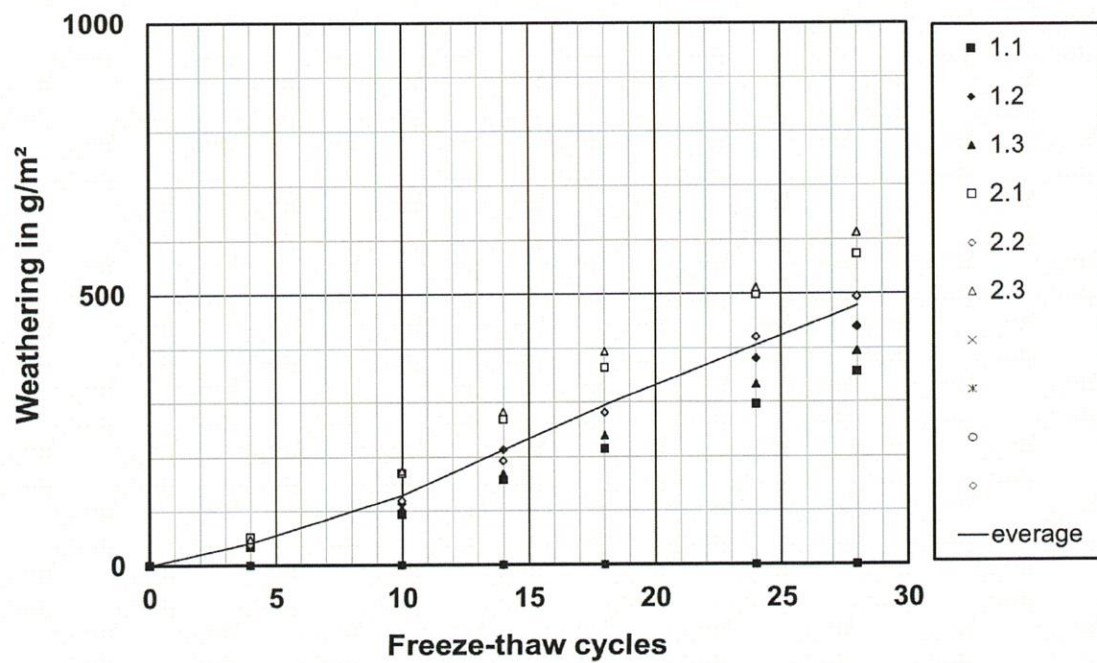


Figure 2.2: Weathering of the test objects depending on the freeze-thaw cycles

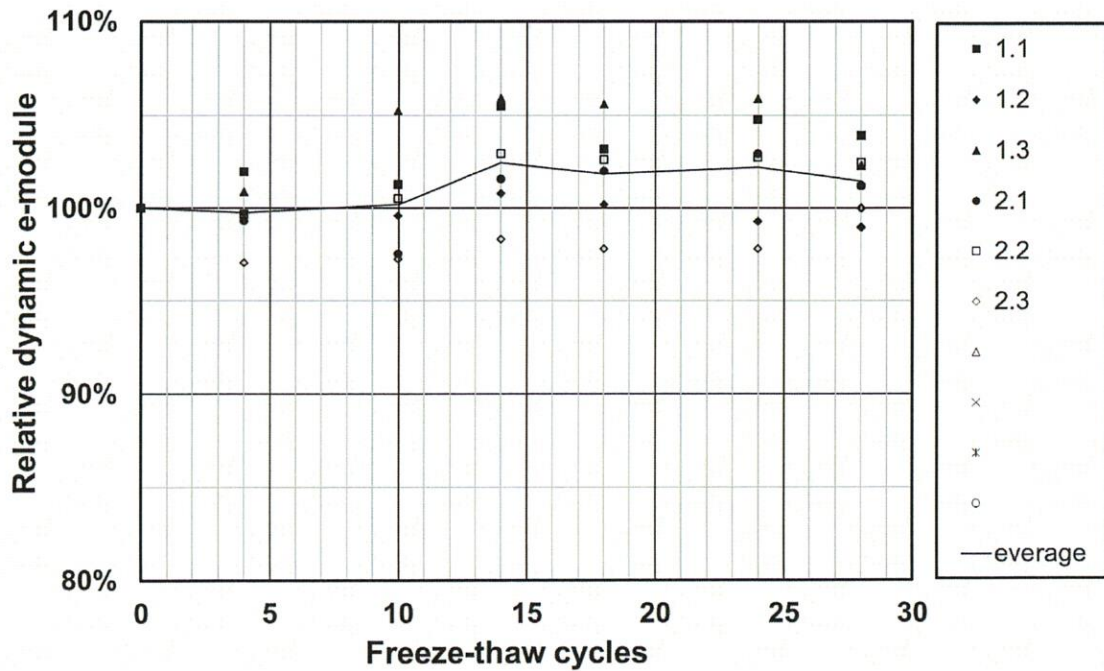


Figure 2.3: Change of the relative dynamic e-module depending on the freeze-thaw cycles

### 3 Assessment

In accordance with data sheet *Frost Resistance Tests for Concrete*, 2004 edition, published by the Bundesanstalt für Wasserbau (BAW), the assessment of the freeze-thaw and de-icing agent resistance on the concrete is carried out via the assessment of the weathering measured.

The acceptance criteria for the freeze-thaw and de-icing agent resistance of the concrete are listed on the following table, table 3.1.

Table 3.1: Acceptance criteria for the weathering

	Suitability, quality and structural tests
Medium value of the test series	≤ 1500 g/m <sup>2</sup> after 28 freeze-thaw cycles
95% quantile of the test series	≤ 1800 g/m <sup>2</sup> after 28 freeze-thaw cycles

In accordance with data sheet *Frost Resistance Tests for Concrete*, 2004 edition, published by the Bundesanstalt für Wasserbau (BAW), and in consideration of the deviating test objects / test surfaces, the freeze-thaw and de-icing agent resistance of the concrete can be confirmed as a result.

On the basis of this confirmation test carried out on the concrete, the freeze-thaw and de-icing agent resistance test of the "Tendonol" fire prevention sealing compound and, in particular, the "Tendonol" joint adhesion can be assessed.

The assessment criteria set down, the level of adhesion of the "Tendonol" on the concrete along the edges as well as the visible properties of the "Tendonol" were also examined concurrent to the test. During and after the freeze-thaw and de-icing agent resistance test, no changes (e.g. hardening, efflorescence, dissolving, cracks, weathering) with the exception of the absorption of water by the "Tendonol" and no detachment of the "Tendonol" from the concrete could be determined.

When the underlying test provisions and the assessment criteria are considered, this allows the freeze-thaw and de-icing agent resistance of the "Tendonol" fire prevention sealing compound and the "Tendonol" joint in the concrete to be confirmed.

Münster, 10.09.2009  
ROXELER INGENIEURGESELLSCHAFT MBH  
Baustoffprüfstelle



Dr.-Ing. S. Kordts

(Qualified Graduate Engineer)



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#### 4 Annex: Test objects before and after the freeze-thaw and de-icing agent resistance test

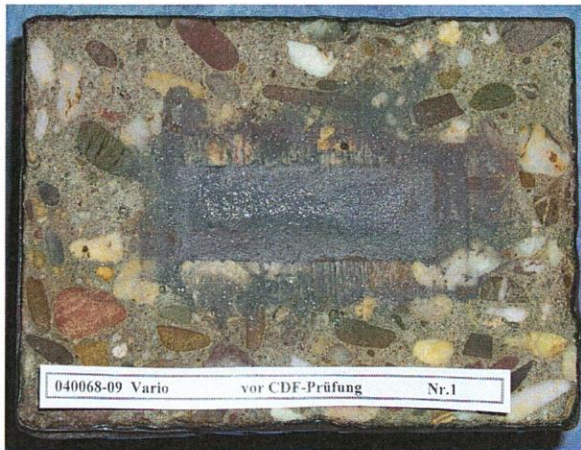


Figure 1: Test object 1.1 before CDF test

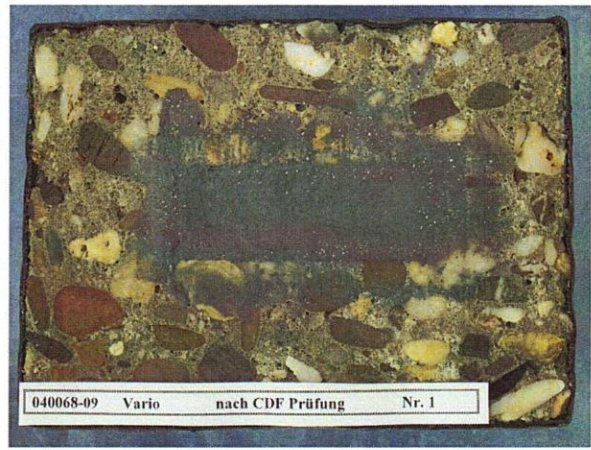


Figure 2: Test object 1.1 after CDF test



Figure 3: Test object 1.2 before CDF test

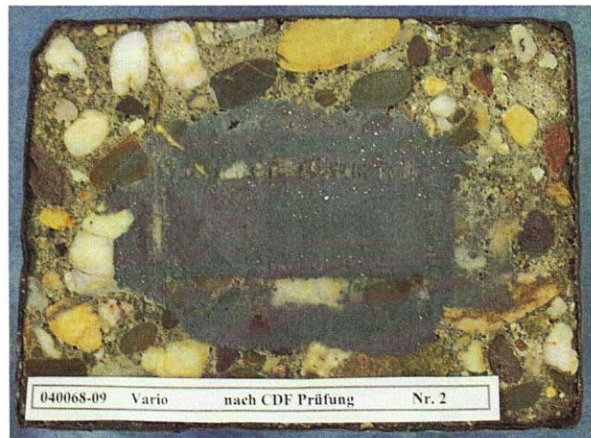


Figure 4: Test object 1.2 after CDF test



Figure 5: Test object 1.3 before CDF test

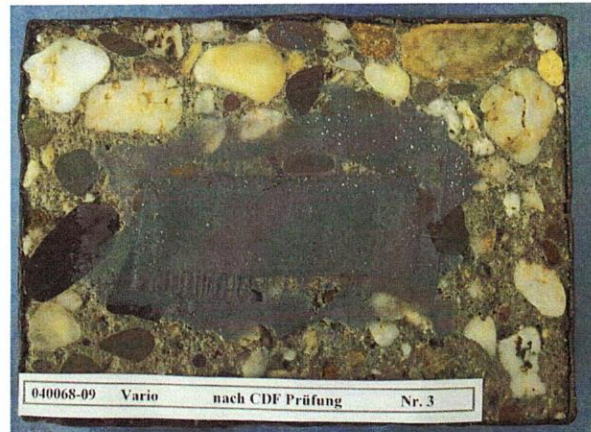


Figure 6: Test object 1.3 after CDF test

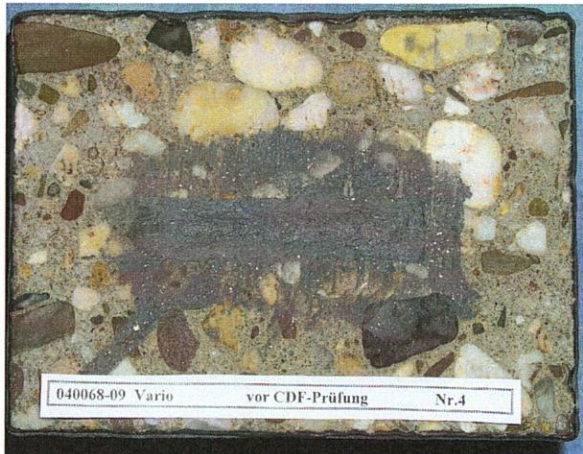


Figure 7: Test object 2.1 before CDF test

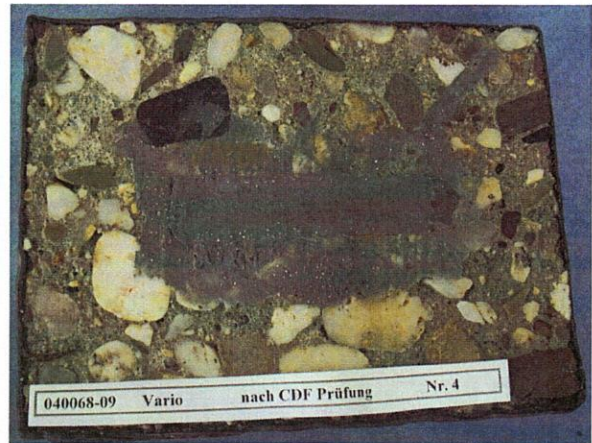


Figure 8: Test object 2.1 after CDF test



Figure 9: Test object 2.2 before CDF test

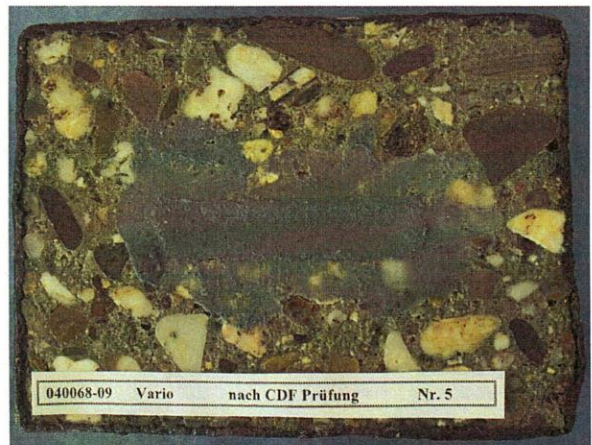


Figure 10: Test object 2.2 after CDF test



Figure 11: Test object 2.3 before CDF test

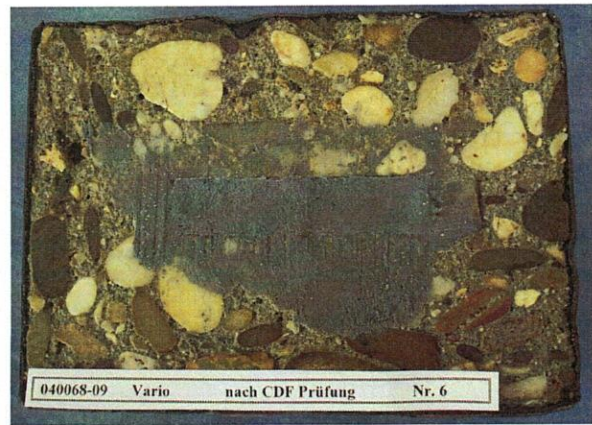


Figure 12: Test object 2.3 after CDF test