



IKT LinerReport 2020

# CIPP liners meeting target values at six-year low

One liner sample in eight did not meet its target value for at least one of the four test criteria

*by Roland W. Waniek,  
Dieter Homann  
and Barbara Grunewald*

For the 17th consecutive year, IKT - Institute for Underground Infrastructure presents its annual LinerReport. This LinerReport for 2020 considers the short-term test results from a total of 2,613

cured in place pipe (CIPP) liner samples that the Institute tested during the calendar year. This total is eleven percent more samples than were submitted in 2019 – which may also be an indication that the CIPP lining rehabilitation industry was still in demand last year, despite the pandemic.

In order to be included in the LinerReport, a re-

habilitation company must have had tested at least 25 samples of the same CIPP liner system, obtained from at least five different installation sites. These criteria were met by 27 rehabilitation companies from seven different European countries. Between them, they installed ten different CIPP lining systems.

## 2020 test results weaker than 2019

Although the liner test results for 2020 are at a good level overall, it cannot be overlooked that some of them are lower than in the previous year. Overall there is a downward trend for all four test criteria (see info box for details of the tests), for both glass fibre liners and needle felt liners. On average, the pass rates across all four tests were lower than 2019: by -1.6 percentage points (%P) for water tightness, by -1.5%P for modulus of elasticity, by -1.1%P for flexural strength and even by -2.9%P for wall thickness (Table 1).

### All four test criteria must be fulfilled

It makes little sense to consider the test criteria individually for a CIPP liner sample. Rather, it is important to a network owner that for each sample all four test criteria are fulfilled, according to the declared or designed target value for that installed liner. Only then can they be very certain that the liner that was delivered and installed actually achieved the material characteristics promised.

### One in eight liners below target values

In 2020, only 87.5% of the CIPP liner samples passed all four test criteria at the same time, and 12.5% did not. In other words: every eighth installed CIPP liner sample tested was below the stated target value for at least one of the four required material parameters. This is the lowest level in the past six years. In the previous year, the comparative value was 93% and in 2016 it was 95% (Figure 1).

**Table 1: Test results in 2020 compared with the previous year**

Liner type	Water tightness watertight in % of tests			E-modulus Target value* met in % of tests			Flexural strength Target value* met in % of tests			Wall thickness Target value* met in % of tests		
	2020	2019	+/-	2020	2019	+/-	2020	2019	+/-	2020	2019	+/-
Mean values of all samples	97.0	98.6	- 1.6 ↓	96.4	97.9	- 1.5 ↓	97.1	98.2	- 1.1 ↓	94.6	97.5	- 2.9 ↓
GRP	96.9	98.5	- 1.6 ↓	96.2	97.9	- 1.7 ↓	97.2	98.3	- 1.1 ↓	93.4	97.2	- 3.8 ↓
NF	97.4	99.6	- 2.2 ↓	97.1	97.9	- 0.8 ↓	96.7	97.5	- 0.8 ↓	99.3	100	- 0.7 ↓

GRP: Glass fibre carrier material  
NF: Needle felt carrier material

\* Target values according to DIBt approval (or KOMO certificate and QUIK guideline) or client specifications (static calculation or as stated on sample submission form).

## IKT LinerReport 2020 data base

- Number of CIPP samples: 2,613
- of which: 2,195 were GRP liners and 418 needle-felt liners
- Number of pipe liner systems: 10
- Number of rehabilitation companies: 27
- Minimum quantity: 25 liner samples of one CIPP liner system, from at least five different installation sites per rehabilitation company
- Sample submitters: 74% sewer owners and 26% rehabilitation companies
- Countries of origin: Belgium, Czech Republic, France, Germany, Great Britain, the Netherlands, Switzerland

### Info box: Overview of testing criteria

Sewer liner samples are taken at installation sites and examined in the laboratory under the following four short-term test criteria. The values determined from the tests are compared with the target values expected from the technical approvals for the product or the client's specifications. A test is passed when the target value is achieved.

#### Modulus of elasticity (E-modulus or short-term flexural modulus)

- CIPP liners must be capable of bearing loads such as groundwater, road traffic, and soil pressure
- The modulus of elasticity is an indicator of load-bearing capability
- Stability may be endangered if the modulus of elasticity is too low
- Test method: three-point bending test in accordance with DIN EN ISO 178 and DIN EN ISO 11296-4

> Results: see Table 2

#### Flexural strength

- (Flexural stress at first break = short-term ofb)
- This denotes the point at which the liner fails due to excessive high stress
  - The liner may rupture before the permissible deformation is reached if flexural strength is too low
  - Test method: Increase of load up to failure in the three-point bending in accordance with DIN EN ISO 178 and DIN EN ISO 11296-4

> Results: see Table 2

#### Wall thickness (average composite thickness)

- Excessively low wall thickness can endanger stability
- Minimum values are specified in structural analysis calculation
- Wall thickness and modulus of elasticity jointly determine the stiffness of the liner
- Test method: with precision calliper, average composite thickness is measured in accordance with DIN EN ISO 11296-4

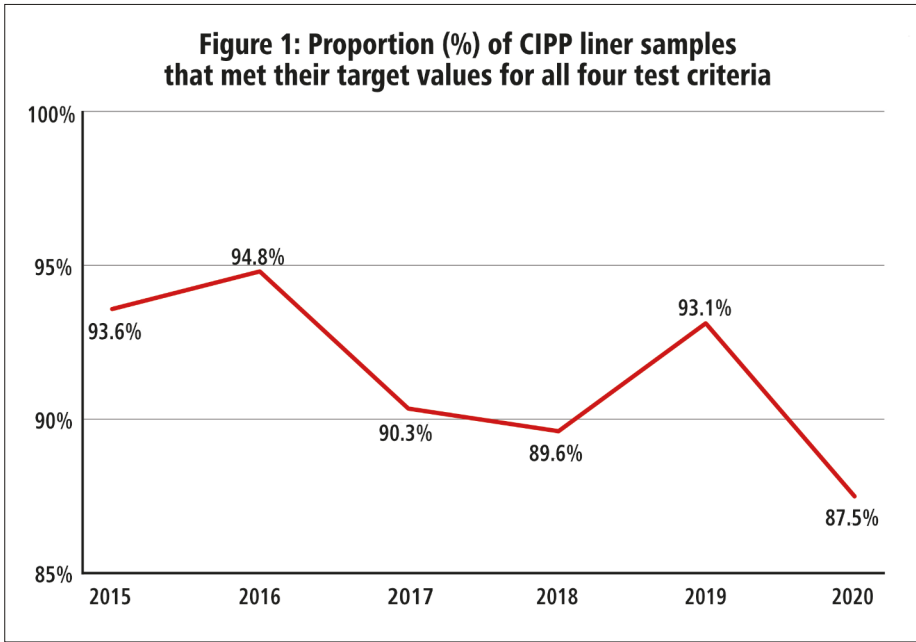
> Results: see Table 2

#### Water tightness

- The inner liner is cut if it is not an integral component of the liner
- Any outer film is removed if it is not an integral component of the liner
- Water containing a red dye is applied to the inner surface
- A 0.5 bar partial pressure is applied to the external surface
- The liner is "not tight" if water penetrated through
- Test duration: 30 min

> Results: see Table 2

A detailed description of these tests can be found on the IKT website: [www.ikt.institute/cipp-liner/](http://www.ikt.institute/cipp-liner/)



These percentages refer only to those samples for which target values were provided for all four criteria. They represent three quarters of all samples, i.e. 1,978. For a quarter of the samples (= 635), the target value for at least one test criterion was not provided to the Institute, or one or more of the four tests were not commissioned by the contractor or sewer network owner that submitted the sample for testing. Of the samples for which all four target values were provided for all four tests:

- < 0.1% passed only one test criterion
- 1.2% passed only two test criteria
- 11.3% passed three test criteria
- 87.5% passed all four test criteria

### Rehabilitation contractors and liner systems matter

Table 2 shows the individual results of the 27 rehabilitation companies. Six of them appear more than once, as they submitted two or three different CIPP liner systems. The other 21 appear with one type of CIPP liner system. The six companies with multiple CIPP liner systems achieved differing test results with different liners. For example, Swietelsky-Faber Kanalsanierung GmbH succeeded in achieving similarly good test results with the Brandenburger liner 2.5 and the SAERTEX liner. However, these

are better than those of the iMPREG liner, which it also used. In some cases, the iMPREG results are 12 percentage points lower than those of the other two liners.

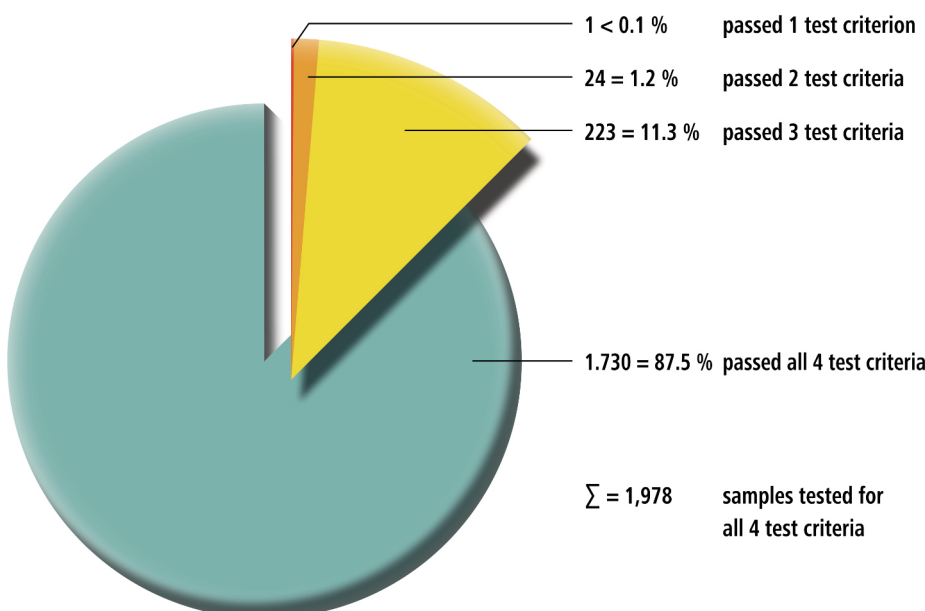
This shows that the success of the remediation depends not only on the rehabilitation company, but also on the CIPP liner system used. Table 3 shows the test results by CIPP liner system.

### Water tightness testing with and without an intact inner foil layer

For the water-tightness criterion, the results for rehabilitation companies vary between 63.6% and 100% of samples meeting their target values. The lower value is explained by the fact that some network owners required the samples from Aarsleff Rohrsanierung GmbH (with PAA SF Liner) to be tested strictly according to the APS guideline. This includes cutting into the inner foil on the liner. However, according to DIBt approval, this is not mandatory for this type of liner. Without cutting into the foil, the Aarsleff samples passed the test in 100% of the cases. The situation is similar for GMB Riolerings-technieken B.V. with their Insituform liner: without cutting into the inner foil, the samples passed 100% of the time, with cutting into the foil only 75% of the time.

If these two cases are disregarded, the range of variation in the test results for water tightness is much smaller: it then lies between 82% and 100%. Fourteen rehabilitation company-liner combinations managed to pass the water tightness test for 100% of their samples.

**Figure 2: Liner samples by numbers of tests passed**



### Outliers for flexural strength and wall thickness

The modulus of elasticity criterion was passed by 96.4% of all samples. The range of results lies between 71.9% and 100% for different rehabilitation companies. Thirteen company-liner combinations succeeded in passing with all their samples. The target values for flexural strength were met for 97.1% of all samples, which is the best performance among the four test criteria in 2020.

Eighteen company-liner combinations managed 100%. The lowest rate was 73.3%. Overall, the wall thickness results are the lowest among the four test criteria. The average was 94.6% of samples meeting target values. The range was from 56.7% to 100% with thirteen company-liner combinations passing this test for all their samples.

Table 2: Test results IKT LinerReport 2020

Restructuring company	Liner system	Water tightness		E-modulus		Flexural strength		Wall thickness		Tests commissioned by sewer owner
		Number of samples	Waterproof in % of exams	Number of samples	Target* met in % of exams	Number of samples	Target* met in % of exams	Number of samples	Target* met in % of exams	
Bluelight GmbH (D)	PAA-F-Liner	25	100	25	100	25	100	25	100	0
Hamers Leidingtechniek B.V. (NL)	Alphaliner	62		62		62		62		100
Jeschke Umwelttechnik GmbH (D)	Alphaliner	130		130		130		68		64
Kanaltechnik Agricola GmbH (D)	Brandenburger Liner 2.5	32		32		32		32		0
Umwelttechnik und Wasserbau GmbH (D)	Brandenburger Liner 2.5	33		33		33		17		49
Aarsleff Rohrsanierung GmbH (D)	iMPREG liner	107	96.3	106	100	106	94.3	105	98.1	99
Aarsleff Rohrsanierung GmbH (D)	PAA SF Liner	292** 22	100 63.6	314	99.7	314	100	312	99.0	100
Aarsleff Rohrsanierung GmbH (D)	PAA-G-LINER	52	100	52	98.1	52	100	50	96.0	96
AKS Umwelttechnik GmbH (D)	Brandenburger Liner 2.5	65	93.8	64	96.9	64	96.9	-	-	100
Arkil Inpipe GmbH (D)	Berolina Liner	148	100	148	100	148	98.6	104	69.2	100
Arkil Inpipe GmbH (D)	iMPREG liner	30	96.7	30	80.0	30	73.3	25	96.0	100
Axeo TP (F)	Alphaliner	36***	100	36	91.7	36	97.2	32	100	100
Diringer & Scheidel Rohrsanierung GmbH & Co. KG (D)	SAERTEX liner	70	98.6	69	88.4	69	98.6	52	100	84
Fretz Kanal-Service AG (CH)	iMPREG liner	45	100	45	97.8	45	93.3	45	97.8	100
Geiger Kanaltechnik GmbH & Co. KG (D)	Alphaliner	58	98.3	57	71.9	57	98.2	24	83.3	79
GMB Rioleringsstechnieken B.V. (NL)	Insituform liner (NL)	67** 12	100 75	79	86.1	79	82.3	79	100	67
GMB Rioleringsstechnieken B.V. (NL)	SAERTEX liner	260	95.0	258	97.3	258	96.5	260	98.5	47
ISS Kanal Services AG (CH)	Alphaliner	108	97.2	108	99.1	108	100	108	89.8	10
Kanaltechnik DF-ING GmbH (D)	iMPREG liner	28	82.1	28	96.4	28	100	22	95.5	100
KATEC Kanaltechnik Müller und Wahl GmbH (D)	Alphaliner	77***	100	76	98.7	76	97.4	70	94.3	100
KTF GmbH (D)	iMPREG liner	35***	97.1	61	85.2	61	91.8	63	100	2
LTS - Lilie Tief- und Straßenbau GmbH (D)	SAERTEX liner	46	95.7	46	100	46	100	45	100	70
M.J. Oomen Leidingtechniek B.V. (NL)	SAERTEX liner	29	93.1	29	93.1	29	100	29	89.7	100
McAllister Group (GB)	iMPREG liner	33	100	30	93.3	30	100	30	56.7	0
Rainer Kiel Kanalsanierung GmbH (D)	SAERTEX liner	69	95.7	69	97.1	69	98.6	26	92.3	96
Renotec N.V. (B)	Alphaliner	-	-	30	83.3	30	76.7	30	80.0	0
Renotec N.V. (B)	SAERTEX liner	23	91.3	72	90.3	72	95.8	72	94.4	32
Rohrsanierung Jensen GmbH & Co. KG (D)	Alphaliner	35	97.1	35	97.1	35	100	35	94.3	100
SKS-Servicecenter für Kanalsanierung GmbH (D)	Brandenburger Liner 1.0	40***	92.5	40	100	40	100	-	-	100
Swietelsky-Faber Kanalsanierung GmbH (D)	Brandenburger Liner 2.5	37	97.3	37	100	37	100	13	100	100
Swietelsky-Faber Kanalsanierung GmbH (D)	iMPREG liner	109	87.2	107	94.4	107	91.6	101	91.1	100
Swietelsky-Faber Kanalsanierung GmbH (D)	SAERTEX liner	126	99.2	127	100	127	99.2	65	100	83
TKT GmbH & Co. KG (D)	Alphaliner	60	100	60	100	60	100	16	75.0	77
TRASKO BVT, s.r.o. (CZ)	Alphaliner	33	97.0	33	100	33	100	33	84.8	0
Umwelttechnik und Wasserbau GmbH (D)	Alphaliner	69	97.1	67	98.5	67	100	43	100	77
<b>Mean value</b>			<b>97.0</b>		<b>96.4</b>		<b>97.1</b>		<b>94.6</b>	<b>74</b>

\* Target values according to DIBt approval (or KOMO certificate and QUIK guideline) or client specifications (structural analysis or stated on sample data sheet).

\*\* without cutting into the inner foil

\*\*\* from 4 installation sites

- Not evaluated, as there were too few liner samples provided with target value information

Table 3: Test results by liner type 2020

Liner system	Carrier material	Water tightness		E-modulus		Flexural strength		Wall thickness	
		Number of samples	waterproof in % of exams	Number of samples	Target* met in % of exams	Number of samples	Target* met in % of exams	Number of samples	Target* met in % of exams
PAA-F-Liner	NF	25	100	25	100	25	100	25	100
PAA-G-LINER	GRP	52	100	52	98.1	52	100	50	96.0
PAA SF-Liner	NF	292** 22	100 63.6	314	99.7	314	100	312	99.0
Brandenburger Liner 2.5	GRP	167	97.0	166	98.8	166	98.8	62	100
Berolina Liner	GRP	148	100	148	100	148	98.6	104	69.2
Brandenburger Liner 1.0	GRP+PFM	40	92.5	40	100	40	100	-	-
Insituform liner (NL)	NF	67** 12	100 75.0	79	86.1	79	82.3	79	100
SAERTEX liner	GRP	623	96.1	670	96.1	670	97.8	549	97.6
Alphaliner	GRP	668	98.8	694	96.0	694	98.4	521	93.1
iMPREG liner	GRP	387	93.5	407	93.9	407	92.4	391	93.1
Mean value			97.0		96.4		97.1		94.6

greater than or equal to mean  
 below mean value

\* Target values according to DIBt approval (or KOMO certificate and QUIK guideline) or client specifications (static calculation or stated in sample data sheet)

\*\* without cutting into the inner foil

- Not evaluated, as there were too few liner samples with target value information

NF: Needle felt substrate  
 GRP: Glass-fibre substrate  
 GRP+PFM: Glass-fibre/polyester fleece mat substrate

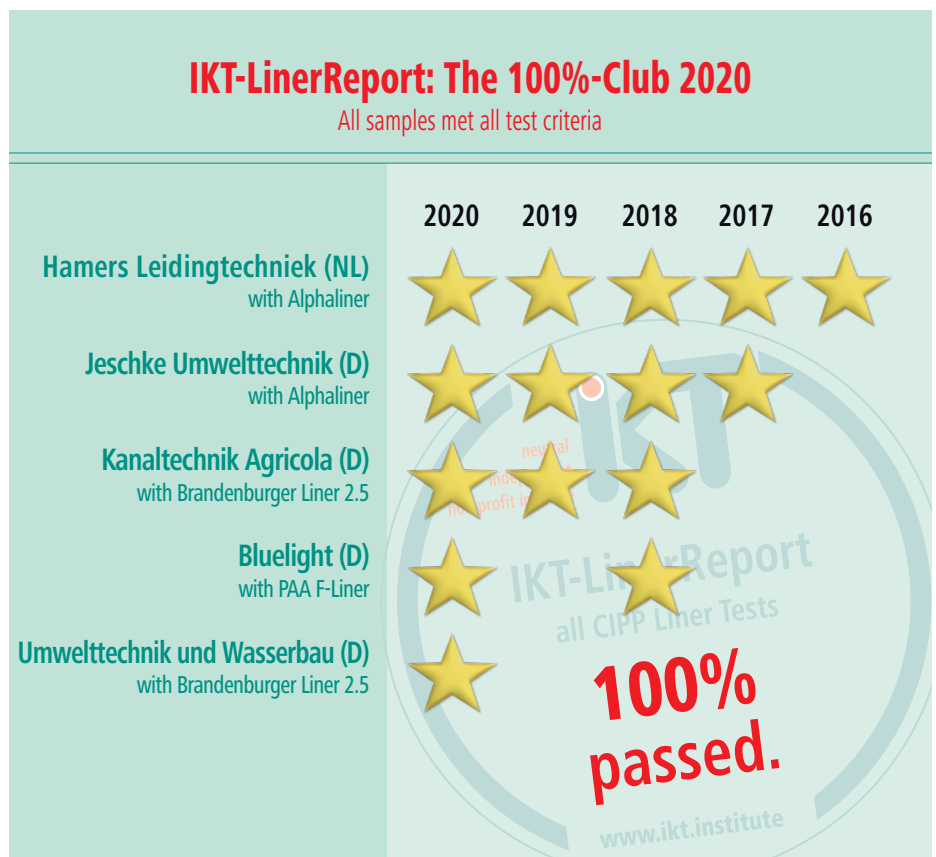
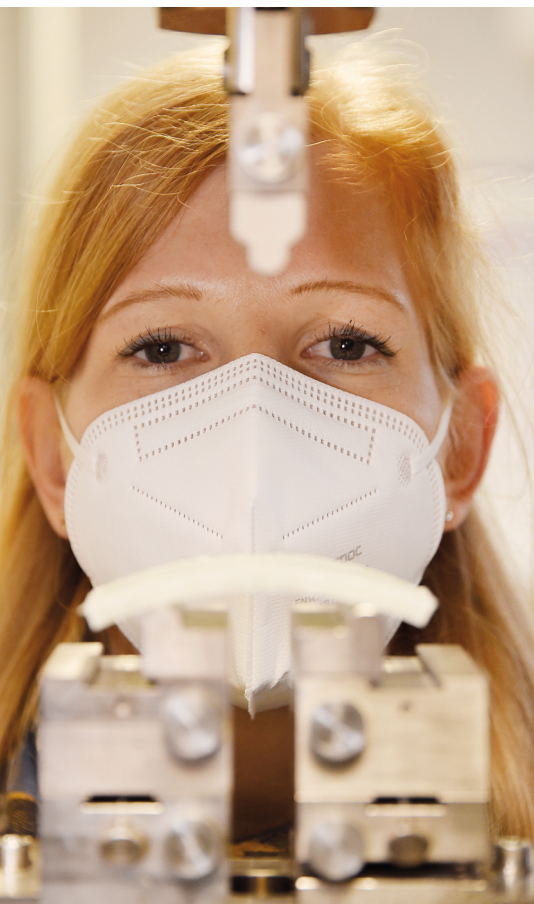


Figure 3: The 2020 "100% Club"



## Top performers: the "100% Club"

A high-quality liner must fulfil all four test criteria simultaneously. In most cases, the target values against which test results were compared derive from declared values in a product approval and in a few cases they were provided by the site-specific static calculations from the customer's specification. In 2020, five out of 27 rehabilitation companies achieved the target values in all four test criteria for all their samples (the previous year it was three out of 23), so they meet the quality requirements in full at each of their 5+ installation sites.

This "100% Club" of 2020 comprises:

- Bluelight GmbH (D) with the PAA-F-Liner
- Hamers Leidingtechniek B.V. (NL) with Alphaliner
- Jeschke Umwelttechnik GmbH (D) with Alphaliner
- Kanaltechnik Agricola GmbH (D) with Brandenburger Liner 2.5
- Umwelttechnik und Wasserbau GmbH (D) with Brandenburger Liner 2.5

In Figure 3, these companies receive a star for each year that they have been in the "100% Club", to highlight their achievements.

## Conclusions

The overall test results for 2020 are the lowest in the past six years. One in eight CIPP liner samples did not achieve its expected target value for at least one test criterion. However, the requirement is clear and unambiguous: all four test criteria must be met simultaneously by a sample. In 2020, this was achieved in only 87.5% of samples.

But, even when looking at the four test criteria individually, the 2020 results are the lowest in six years. In 2018, the mean results for wall thickness were slightly lower than in 2020; otherwise, all the mean results from 2015 to 2019 were better than those of 2020.

As a testing institute, we can only report the findings, but cannot speculate about the reasons for these developments, as we are unable to interpret them in an evidence-based manner.

One thing is clear, however: despite the very high technological develop-

ment of the CIPP lining method, despite its position as the leading renovation method and despite intensive staff training, an ever-higher level of samples meeting target values in tests is not a given. On the contrary, it has been shown that these can also go down. Therefore, strict application of quality controls continues to be necessary, both on the rehabilitation sites and in the testing laboratory.

## Contacts

Iain Naismith, PhD

T: +44 (0) 7983 605219

E-mail: [naismith@ikt.institute](mailto:naismith@ikt.institute)

Barbara Grunewald, M.Sc.

T: +49 (0) 209 17806-40

E-mail: [grunewald@ikt.institute](mailto:grunewald@ikt.institute)

IKT - Institute for Underground Infrastructure

non-profit limited liability company

Exterbruch 1, D-45886 Gelsenkirchen

[www.ikt.institute](http://www.ikt.institute)

neutral  
independent  
non-profit institute



IKT - Institute for Underground Infrastructure