

## Current focus of action and perspectives

What is the meaning of underground infrastructure? Which requirements are to be observed? What do participants have to do? Which technical solutions are suitable? These are some of the questions that the IKT - Institute for Underground Infrastructure jointly pursues with more than 150 members of both IKT-Association of Network Operators and of Industry and Service in research, testing, consultancy and product test projects. Focal points currently lie in sewer and pipeline construction.

### Underground assets

The replacement value of public underground infrastructure in Germany, the supply utilities via sewage systems up to the traffic tunnels, amounts to more than 600 billion Euros. Approximately 550 billion Euros more are spent on the supply and disposal networks for gas, water, and sewage, with network lengths much more than 1 million kilometres. The largest share is taken by the sewage system with approx. 330 billion Euros replacement value, i.e. more than half of the public underground network asset consists of sewage systems. It is apparently extraordinarily costly to lay many kilometres of large pipes in considerable depths, mostly in the middle of the street. Annually, approximately 4 billion Euros are allotted to sewage investments so that utilization duration of up to 100 years is not rare.

The municipal underground, however, is not only the location for supply and disposal lines. Furthermore, other bearers of public and private matters use it. Architects erect their buildings on it, road contractors and traffic planners see it as an extensive support structure, open-space-planning offices design it as substrate for the municipal green and water associations and use it for rainwater farming. In the underground

in cities, it is usually therefore congested and obscure. Besides technical innovations, comprehensive goals and strategies are called for at municipal level. This is the prerequisite for appropriately shaping the underground infrastructure in technical regard.

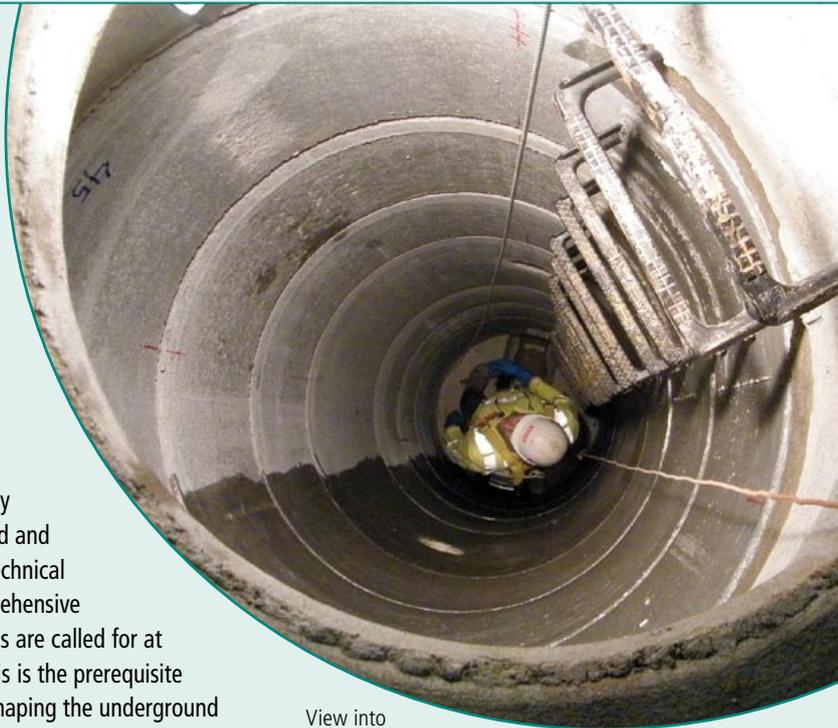
Technical developments thereby enhance the latitude for the objectives and choice of new concepts. In the following, current developments in sewer and pipeline construction are described, which are processed in manifold IKT projects with network operators and partners from trade and industry. The focal points are

- Soil and components
- Products, materials and procedures
- Consumer protection
- Risk analyses
- Construction of the sewer technology
- Innovations and markets

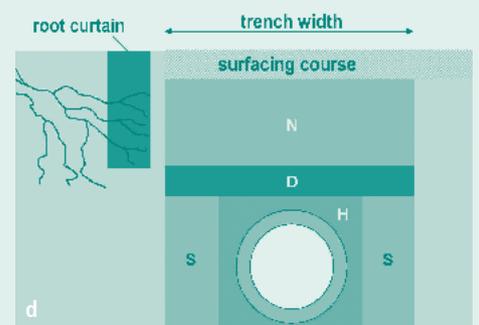
All these focal points are at disposal for the participation by interested partners.

### Soil and components

Underground sewer and pipeline networks are more than just stringing together pipes and manholes. The engineering structural utility trench consists - similarly to building construction - of foundations, support rack, and slab. The development of novel bedding and filling materials starts here. Flow-capable self-compacting filling materials [1] and innovative bedding cushions, for example made of EPS [2], secure the laying quality and can assume many other functions, for example, as vegetation substrate, barrier layer, thermal insulation or drainage body (cf. [3], [4]).



View into 6 meter deep test manhole



a) Use of coarse-grained material in plant pits for rainwater farming, from [4]; b) Installation of flowable self-compacting filling materials in narrow trench width; c) EPS bedding cushions as cover zone; d) Utility trench with multifunction trench zones: N – Utilization, D – Cover layer, S – Side filling, H – Cover zone.

## Products, materials and procedures

The technical development of new products, materials, and procedures demands also new concepts for quality assurance. Innovative measuring systems for pipe-jacking, permits, for example, already during the jacking, to record structural stresses of pressure transmission means and detect risks in advance [5]. The acceptance of in-situ-quality of curing products on the spot such as tube liners and textile cladding can be supported through non-destructive testing procedures [6]. The construction, and third party monitoring of the construction and rehabilitation firms is to be questioned as well, (cf. [7], [8], [9], [10], [11], [12], [13], [14], [15], [16], [17]). IKT quality reports will further pursue quality development and activate improvements on the market [18]. For the special area of the estate draining, training and further training measures are offered [19].



Pipe-jacking: IKT online measurement of pipe offset; above: Radio controlled capsule in on-site use; below: Measuring system setup; from [5]

## Consumer protection

Underline current legal changes (cf. [20]): „Integral water economy starts on the plot“. That applies to leaky sewage pipelines just as to the handling of incorrect connections, rainwater

uncoupling as well as little drinking water usage. Measures in the private area demand that the community also takes measures for consumer protection, up to the consultation obligation. Members of the IKT-Association of Network Operators have established the municipal network for estate draining (KomNetGEW, see [www.komnetgew.de](http://www.komnetgew.de)). Concepts for handling estate draining, materials for civil information, monitoring for experts of water-tightness test as well as consultation and training in all technical aspects of estate draining are central network services.

IKT product tests as neutral and independent product and procedure comparisons offer further consumer protection. More than one hundred network operators were previously involved in these tests and contributed in financing them. Product tests for the restoration of estate draining are concluded (see page 45). Further tests on decentralised rainwater farming are in preparation.

## Risk analyses

External boundary conditions for construction, operation, and rehabilitation of the networks are characterised among others through demographic and city structural developments as well as consequences of possible climate change. For network operators, the question is which risks and imponderability cases are expected and how are the operation, maintenance and investment strategies to be accounted for in future. Risk analyses should recognize need for action and propose meaningful immediate measures. Mostly, damage risks can already be excluded with simple means. Backwater risks are an example from strong rain events with obvious immediate measure of coordinated installation of backwater safety devices in private plants.

Long-term risks must also be included in the life cycle strategy. Which binding durations for technical solutions are reasonable? Which flexibility is called for? The IKT intends to develop adapted and well-balanced approaches to the evaluation of utilization period, durability magnitudes, and financing ties.

## Construction of the sewer technology

With the conclusion of the first coverage of sewage systems, the special constructions such

as sewer manholes shafts, precipitator, rain basin, and culvert move into the consideration field of view. That nationally acknowledged test body for flow measurements of the IKT supports selection, maintenance, and evaluation of measuring instruments and offers the operating personnel special expertise training on calibration of throttling devices. The effectiveness of cleaning and rinsing devices as well as sieves and rake on rain basins is investigated in experience exchange and joint projects of the network operator. Further operational questions involve explosion protection, reliability of climbing aids, the ease of handling of tools and the cleaning and structural assessment of pressurized lines.

Structurally, procedures and materials for concrete and masonry restoration are becoming more important in the sewage sector. This relates especially to seals, coating, and cladding procedures, which are investigated in detail in an in-house research and test.



Foam pigs in the IKT test: above: PU/Foam scraper with location transmitter; below: Removal of larger pushing and shoving quantities with foam pigs



Manhole rehabilitation:

above: Investigations in the IKT large scale test facility on 21 sewer manholes,

below: View into 6 meter deep test manhole

### Innovations and markets

Ideas that are already transferred into new products, services or procedures and that also find actual successful use or that have even penetrated into the market can be designated as an innovation. Here, the IKT offers the connection between the IKT-Association of Network Operators and IKT-Association of Industry and Service.

In close contact to the IKT-Association of the network operators, bottlenecks of present technologies are recognized and are concretised as an innovation requirement. A current example is the reliability of water-tightness tests and monitoring of new bedding and filling materials.

Technology trends are set as a rule in highly innovative sectors such as medicine and telecommunication. These trends are to be evaluated for the underground sewer and pipeline

construction. Examples are new camera systems for building monitoring and application areas of new materials.

The launch of innovative products and procedures is supported by technical proofs and standards. Continuing goal is the inclusion of innovative technologies into the requirements profiles of the network operator.

### Outlook

The functionality of underground supply and disposal networks contributes substantially to the quality of life in our cities. Nevertheless, it remains further congested and obscure in the underground of the cities. In order to reduce an „aimless disorder“ of different bearers of public concerns in the underground, the overall goals of urban development must first be determined at the municipal level. The technical developments in the sewer and pipeline construction thereby increase the freedom of action and identified focal points show much promising perspectives. The IKT – Institute for Underground Infrastructure pursues this further and appeals to network operators and industry, to always contribute new ideas, concepts and technical solutions for joint projects.

### Author



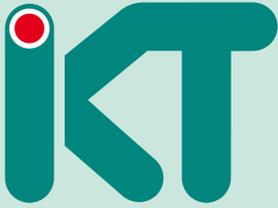
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neutral  
independent  
non-profit institute



IKT - Institute for Underground Infrastructure

# ABOUT IKT



**IKT - Institute for Underground Infrastructure** is a research, consultancy and testing institute specialized in the field of sewers. It is neutral and independent and operates on a non-profit basis. It is oriented towards practical applications and works on issues surrounding underground pipe construction. Its key focus is centred on sewage systems. IKT provides scientifically backed analysis and advice.

IKT has been established in 1994 as a spin-off from Bochum University, Germany.

The initial funding for setting up the institute has been provided by the Ministry for the Environment of the State of North-Rhine Westphalia, Germany's largest federal state.

However, IKT is not owned by the Government.

Its owners are two associations which are again non-profit organizations of their own:

- a) IKT-Association of Network Operators:**  
Members are more than 120 cities, among them Berlin, Hamburg, Cologne and London (Thames Water). They hold together 66.6% of IKT.
- b) IKT-Association of Industry and Service:**  
Members are more than 60 companies. They hold together 33.3% of IKT.

You can find information on projects and services at:

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



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