

Underground space: Utilisations in harmony

Numerous utilisations in urban areas are reflected in the underground zone, in the form, for instance, of drains, sewers, cables, other conduits, foundations, road and street formations, root systems, transport routes and (water) storage facilities. A state of “tolerated chaos” prevails.

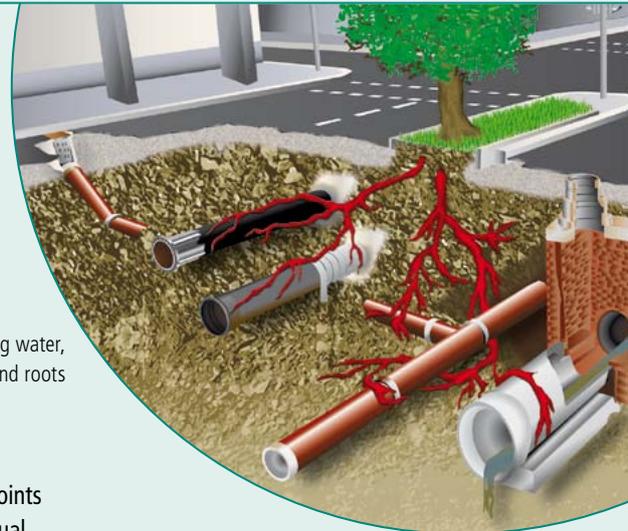
This “tolerated underground chaos” causes conflicts in the planning, construction, operation and renovation of systems, and restricts the adaptability of the infrastructure as a whole. Climate and demographic change, and also the need for space for energy and telecommunications links, necessitate permanent flexibility, however. The usual co-ordination of current construction projects is, alone, not sufficient here. Supra-sector long-term strategies for utilisation of underground space are needed, in order to ensure that, in the future, too, all infrastructural facilities have the space they need, possess the necessary adaptability, and contribute to the quality of human life in a manner that makes efficient use of the available resources. In short, harmonised solutions for the underground space must be found.

The “Underground Space” research alliance
The IKT - Institute for Underground Infrastructure, in co-operation with its long-established partner institutions from a range of disciplines, has now founded the “Underground Space” research alliance. The principal aim of this interdisciplinary organisation is that of identifying interactions and synergies in the context of utilisation of the underground space, and of promoting and enhancing understanding of the relevant correlations on a supradisciplinary basis. The research alliance identifies specific needs for

research/development and then initiates joint projects, with the aim of drafting conceptual solutions, strategies and products for utilisation of the underground space. The alliance flourishes from its holistic and interdisciplinary orientation; the IKT is responsible for the co-ordination, chairmanship and strategic alignment of the research alliance. The following scientific institutions are participants in the “Underground Space” research alliance:

- IKT – Institute for Underground Infrastructure, Gelsenkirchen
- The Ruhr University, Bochum, Faculty of Civil and Environmental Engineering – Chair of tunnel construction, pipeline construction and construction management
- The Ruhr University, Bochum, Faculty of Civil and Environmental Engineering – Chair of Urban Water Management and Environmental Engineering
- The Ruhr University, Bochum, Faculty of Biology and Biotechnology – Chair of Evolution and Biodiversity of Plants
- Leibniz University of Hanover, Institute for Geotechnical Engineering (IGtH)
- Technical University of Kaiserslautern, Department of Construction Management
- Bergische University of Wuppertal, Department of Soil and Water Management, Wuppertal
- Bauhaus University of Weimar, Department of Urban Water Management and Sanitation, Weimar
- Ruhr West University of Applied Sciences, Institute of Economics, Mülheim/Ruhr
- Bundeswehr University, Munich, Institute of Hydro Sciences, Chair of Sanitary Engineering and Waste Management

“tolerated chaos”: gas, drinking water, sewage, stormwater and roots



The work of the research alliance receives significant support from the IKT-Association of Network Operators – a group of more than one hundred and thirty towns/cities, municipalities, municipal service organisations and water boards - and from the Municipal Network for Private Sewerage Systems, with its sixty-five members, in order to assure, in particular, the practical orientation of this work. The IKT-Association of Industry and Service – a grouping of innovative companies from the building and other industries – is also a strategic partner, contributing content, providing products for solutions, and pursuing product developments where necessary.

The strategic and thematic orientation is linked, at all times, with higher-level (urban) civil-engineering and environmental policy questions. For this reason, the research alliance maintains close contacts with representatives of the German “Bundesstiftung Umwelt” environmental foundation, and with the Federal Office for Building and Regional Planning.

Root penetration in a pipe



Underground space

Initial framework-defining research project planned

A number of members of the "Underground Space" research alliance are now planning a major interdisciplinary research project on the subject of "UNTERRA: Underground space - harmonised utilisations", to be conducted under the overall leadership of the IKT.

This planned joint project focuses on essential aims of the research alliance, exploring them in more detail:

- Detection of interactions and conflicts;
- Attainment of transparency and
- Drafting of technological, conceptual and organisational proposals for solutions.

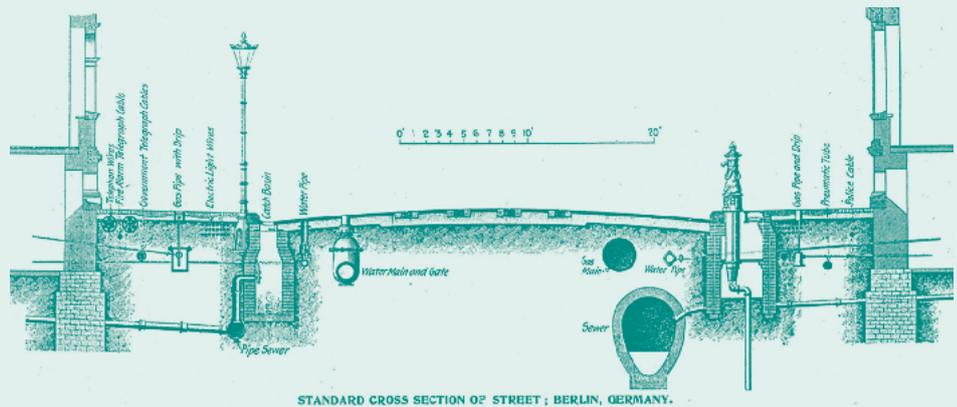
A total of thirteen institutions active in the fields of science, administration and business are participating in the UNTERRA joint project, which simultaneously provides the framework for further R&D projects by the "Underground Space" research alliance; technical and conceptual sub-questions identified in the context of the framework project are, for instance, to be investigated by workgroups.

A corresponding project proposal for the framework project has been drafted in co-ordination with the participating institutions, and has already been submitted to an initial source of subsidies. Further such sponsors will be contacted if necessary, in order, also taking account of specific sub-aspects, to secure appropriate sources of financing.

Interdisciplinary solution concepts

A cross-section of a Berlin street in 1896 proves the point: conditions in the underground infrastructure were a topic even in those days. It was necessary, for example, to find space for gas and water supply conduits, waste-water drains, and a range of different telegraph and electrical cables in the cross-section under the street.

Technical progress, increasing urbanisation, an ever greater need for space underground, and future challenges, such as climate and demographic change, and also the necessity to protect the soil and the groundwater, underline yet again the necessity of mutual consultation and co-ordination in underground matters.



Cross-section through a Berlin street in 1896

Bild: www.sewerhistory.org

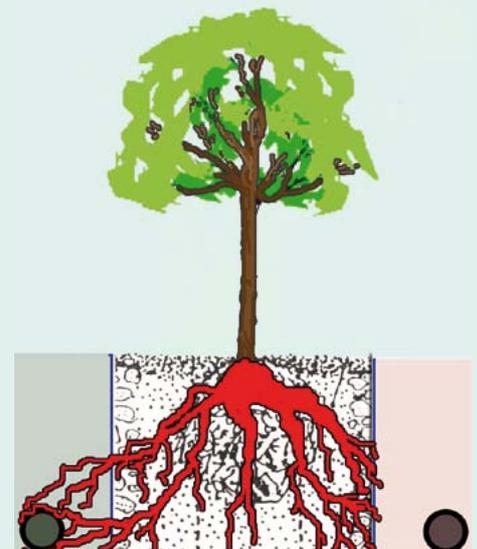
Not only the classical supply and disposal conduits, but also other infrastructural facilities, need adequate space underground, including, for example, new conduits for the separate conveyance of rainwater and sewage, storm drains, energy and fibre-optics cables, community-heating transmission pipes and also conduits for the use and/or distribution of geothermal heat and heat recovered from waste-water.

New and topical questions, many not a subject of discussion in the technical world only a few years ago, also arise concerning the interaction between vegetation and infrastructural facilities in the urban underground.

One example: root growth and its interactions with, for example, waste-water conduits and sewers. Interdisciplinary research projects have made it possible in recent years to gain important knowledge concerning the causes of the ingrowth of roots into sewers, etc., and concerning possible preventative provisions. The IKT played an important role in research into these causes.

It also became apparent, however, that suitable solutions for the joint use of underground space by both trees and underground conduits, etc., can be drafted only on the basis of consultation with all those persons affected. In 2006, the topic was taken up again on the basis of new discoveries, and placed on a broader foundation, with the setting-up of the supra-association "Tree sites, sewers and other conduits", by the DVGW (German Technical and Scientific

Association for Gas and Water), DWA (German Association for Water, Wastewater and Waste) and FGSV (German Road and Transportation Research Association). All the disciplines affected, such as supply and disposal technology, underground civil-engineering, landscape development, landscaping, biology and parks and amenities planning were involved in the drafting of the new DWA M code 162, The "Trees, underground conduits and sewers" code is a brilliant example of successful interdisciplinary co-operation for the attainment of conceptual solutions capable of achieving supradisciplinary consensus.



Root growth in a pipe trench.
right: root-proof bed,
left: root infiltration in the bed material

Prospects

The complex structures of the urban underground necessitate new and generally interdisciplinary conceptual solutions. Current examples include:

- the use of multifunctional soils as a load-bearing soil-mechanical structure, hydrogeological conductor/reservoir, ecological buffer medium, substrate for vegetation and thermal conductor/barrier;
- modification of conduit (etc.) structures (e.g. pipe and cable ducts for compact installation and management of supply and disposal conduits, cables enclosed in sewers, etc.);

- functional conversion of existing structures (e.g. combined system intercepting sewers used as seepage water drains);
- the use of new infrastructural elements for sustainable rainwater management (e.g. blind drains, seepage-capable paving systems);
- the use of conceptual and organisational control models and tools for supra-disciplinary co-ordination during the planning, construction, operation and renovation of the underground infrastructure.

Supra-disciplinary and harmonised solutions are needed for the underground space, in order to master the challenges of the future.

The "Underground Space" research alliance focuses on these topics, identifies the need for Research & Development on a practically oriented basis, and endeavours to accelerate the pace of innovation.

The authors

Dipl.-Ing. Thomas Brüggemann

Dipl.-Ing. Christoph Bennerscheidt

PD Dr.-Ing. Bert Bosseler

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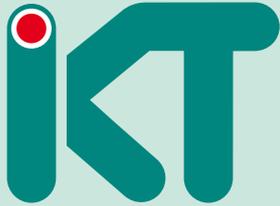


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IKT - Institute for Underground Infrastructure

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



IKT – Institute for Underground Infrastructure

Exterbruch 1
45886 Gelsenkirchen
Germany

phone: +49 209 178060
fax: +49 209 17806-88
email: info@ikt.de

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International Airport.

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