

Managing the Crowded Underground

Who is responsible for our streets and roads? Who is entitled to lay pipelines, sewers and cables throughout our cities? Where in general do we find these pipes in the first place? After all, who is responsible for planning, construction and operation of our infrastructure?

Claims for underground space

There are many players claiming space in the underground, all with viable needs (figure 1). In German cities, for example, the supply lines and cables are usually placed under the sidewalks, be it for gas, drinking water, electricity or data transmission. In the middle of the road, in greater depth, we find sanitary and storm water sewers or combined systems. Sometimes the larger supply mains and district heating lines are placed there also. As a consequence pipe trenches serve as foundations for roads and sidewalks. Hence, the soil has to meet many

requirements; it's the bedding for the pipe as well as a base for the road. Moreover, the soil may also be used as a substrate for plants. Every tree has roots that need part of the underground space.

And finally, the underground can be regarded as a complex hydrological body. Soil absorbs, contains, purifies and stores water. Sometimes the groundwater level can even be above our pipeline system.

Against this background we must ask: Who manages our underground space? Who feels responsible for our infrastructure? Basically, we can distinguish three groups of players (figure 1):

- First the asset owner - the one who keeps all the assets such as roads, pipelines, manholes and pumps on account.

Tolerated chaos in the underground space
Source: Tracto Technik, moderated

- Secondly, the asset manager - the entity who is handling and operating the network and is responsible for construction, operation and maintenance with a fee for these services. It is often the so called "municipal utilities" who are doing this job, many utilities being a public asset themselves.
- Finally - the service providers who render their assistance to utilities and industry, from sewer cleaning to construction and accounting.

But what are the topics those players are mainly interested in? Once again we can set three flags:

- The owner by nature is interested in securing his asset values. Owning the assets and making these assets available results in profits.
- The owner and the manager are both interested in the capacity and output of the network. For water and gas e.g., that's the very basis for charging the customer.
- Moreover, quality is crucial. Drinking water has to be hygienic and palatable. Data networks must serve around the clock and gas pipes need safety constraints.

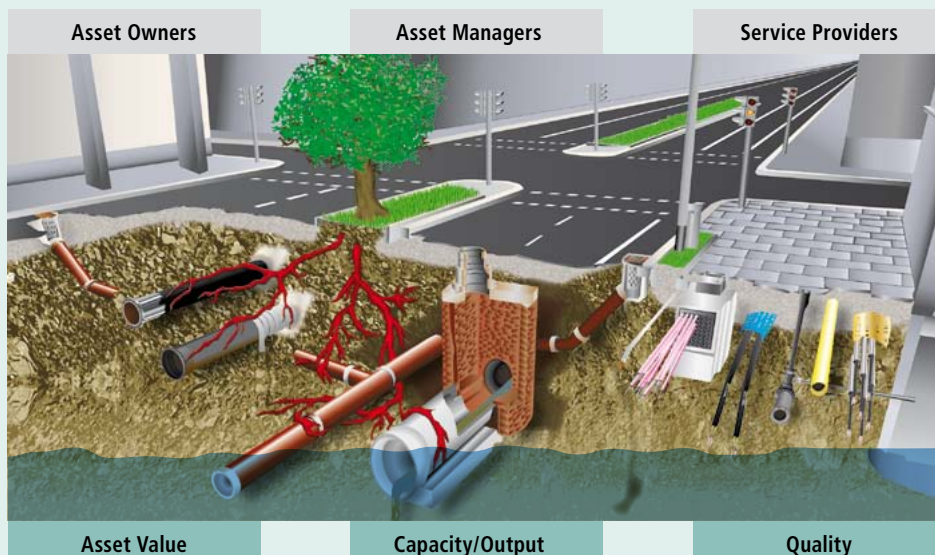


Figure 1: Many players claiming space in the underground
Source: Tracto Technik, moderated

Underground space



Figure 2: pipelines criss-crossing the underground
Source: Heidelberger Versorgungs- und Verkehrsbetriebe GmbH

As we can see, all parties have multiple tasks. To achieve these they need the means and the room to act. We all know they will take what they need. Pipelines are everywhere in our cities, criss-crossing the underground (figure 2). Those who want to repair or rehabilitate their pipes can only hope that they are on top of the knot or that they can use trenchless techniques. On CCTV those conflicts become even more obvious. Roots grow into pipes (figure 3) and some piercing techniques were not only used to pierce the ground, but also to pierce other pipelines as well (figure 4).



Figure 3: Excavated pipe penetrated by roots

In the Netherlands e.g. the foundation RIONED has just recently collected and evaluated the available data from such conflicts [1]. The data collected for this region of about 17 Million inhabitants gave an impressive number of 4000 piercings of sewers and pipelines, all caused by other boring activities. Per year 250 new cases are expected. Even the Dutch Parliament discussed the problem in detail [2]. Now everybody is wondering how they can improve the situation. Some initial ideas are a new monitoring and reporting system as well as restrictions for pipe laying activities.



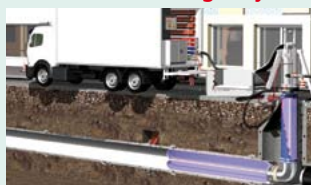
Figure 4: Piercing techniques piercing other pipelines

Motivation and Strategies

This leads us to a fundamental question: what are the general strategies to improve the situation? To address this issue we start from a well-known psychological approach for describing the motivation of individuals, and expand it to our world of the underground, including asset owners and managers (figure 5, cp. [3]).

The first base line is connecting two poles: individuality and society. The second base line is defined between continuity and change. In this scheme we can define four strategies as a part of infrastructure management. We start with the options in the two quadrants on the left of figure 5.

Maintenance / Single System



Source: Insituform

Continuity

General Solution



Source: Delft University

First quadrant

The first quadrant, down and left, is a combination of continuity and society. We can call it a "general solution". It means that "once for all" and "all together" we decide how to proceed, and all infrastructures and utilities are included. Nobody is left behind. In a technical sense we talk about large collectors for all kinds of pipelines and infrastructure. In this example even the traffic ways, trees and shopping areas are integrated in the system, each possessing its defined zone in the ground.

Second quadrant

In the next quadrant, we stay with the idea of continuity. However, now we want to preserve the freedom of each player to find his own way, to preserve the individuality of his network. We call this maintenance or rehabilitation of a single system. Trenchless Technology is the keyword; these techniques allow us to work without disturbing other carriers in the crowded underground.

One good example is CIPP lining. In this case it is possible to use the space that has already been occupied by the network itself. A new pipe is installed within the old pipe without any disturbance of the soil or other structures close by. However, the capacity remains unchanged, although it was often planned for requirements of the last century.

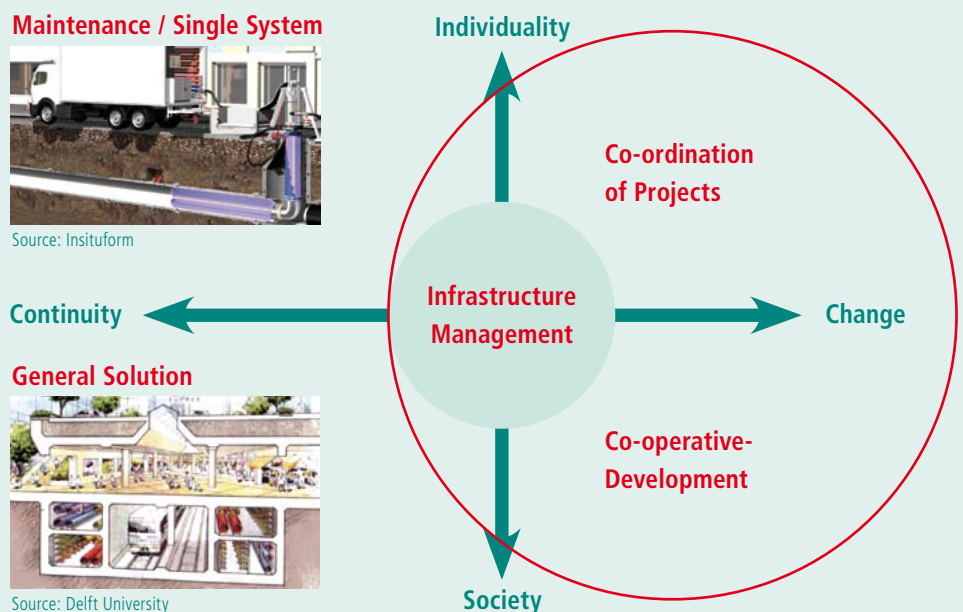


Figure 5: Motivation and Strategies

Apparently, those two solutions on the left side of figure 5 relate lot to technical optimization. The management question occurs if we look at the right side. There, it is about co-ordination of projects and co-operative development. We are ready for change, be it within each network or for the infrastructure as a whole.

Third quadrant

Quadrant three shows what municipalities and utilities, at least in Germany, pretend to already do: co-ordination. However, each utility still cares only for its own network and assets, so the investments, too, are still planned separately and independently. At regular intervals, two or four times a year, all current activities are reported to a co-ordination group which is set up by the utilities and the city. This group then discusses how to minimize conflicts during construction and maybe even how to combine some measures to reduce costs. Thus, it is not a long-term strategy, but it is rather about harmonizing the on-going activities.

A famous German Standard, the DIN 1998 [4], underscores this idea of trustful co-operation. Figure 6 shows a graphic from one of the first issues of this standard. It is a standardized cross section of underground space beneath a road. The road and every line are placed where they

should be, that is in a defined and permitted zone. However, in daily practice, things might be different (cp. figure 2 and 3).

Fourth quadrant

Finally, against this background, quadrant four seems even more interesting. We are open for change, but we want to do this as a member of society, feeling responsible for the public good. We can call this "co-operative development". Municipalities and utilities are going to act in a flexible way open for change, but they have a clear strategic vision of a greater good, of society and of long-term developments and responsibilities.

However, what might sound great and easy is not that simple. Usually, in a Democracy, it is the political leadership which is responsible for such things. The municipal council and the mayor decide on long-term strategic developments of a city, with impact on society. As a consequence, it is the political system that counts and the people in this system. And, there are many complex rules and regulations like laws, contracts, easements and covenants to follow and these seem indeed to be a hindrance for a true strategic management of our infrastructure. The political task to align all these regulations is enormous. Moreover, most municipalities have lost their

freedom of choice already as many concessions, agreements and contracts have already been stipulated in the past and are still valid for the next decades.

Thus, at first look, the major questions remain unsolved: What can we do in general to improve the situation? How can we attain the higher goal of integrated infrastructure management?

To find an answer let us return to our base lines. We have realized that there are many ideas on how to act in this complex environment. Also, we have seen that any solution which focuses on one quadrant only seems out of place or full of limits. Like in psychology, where a sound and healthy person may be attracted by the poles but always has a clear focus on the center, municipalities as well as asset owners and managers have to look for a balanced overall strategy. This way, the advantages of all four of the above opportunities can be used without approaching a single extreme.

Conclusions and Outlook

In our cities, there are a lot of claims for underground space with regard to e.g. road foundations, the bedding of pipelines, plants needing space for roots and growth, and rainwater interflow, retention and infiltration. Against this background utilities and municipalities face a broad range of requirements. Technological and quality issues have to be resolved and innovative solutions have to be developed. All this happens in a stressful environment full of conflicts between individuality and society and between continuity and change. Apparently, the focus of [Integrated Asset Management Strategy](#) is about balancing the available opportunities and solutions in a feasible and economical way.

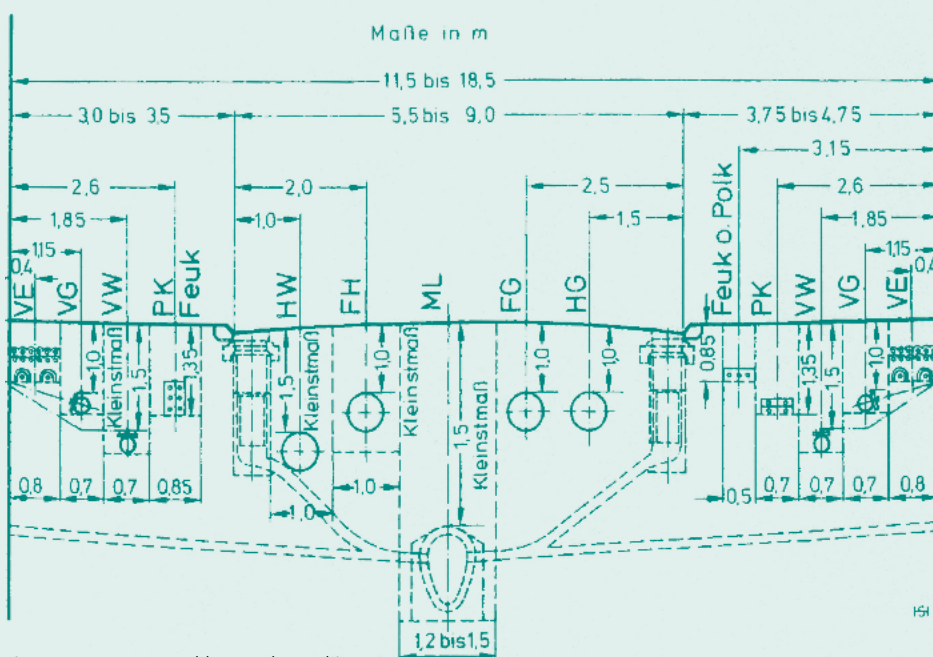


Figure 6: not a new problem: early graphic in a German Standard, DIN 1998

How this can be accomplished, and how we can cull the benefits of an integrated approach in practice has been the focus of IKT's Asset Management activities since 2013. We will continue, together with our members and partners to seek solutions. Recent and upcoming highlights are:

IKT-Webinars on Asset Management of Underground Infrastructure

Strategies and methods to obtain cost-effective and reliable solutions are currently discussed worldwide. During IKT's series of webinars an overview of cutting edge research and practical experience is given by international experts from Europe and North America, all session being supported by our partner from the US, the International Right of Way Association (IRWA, cp. [5], also see page 51). The focus of the first series 2013/2014 was on waste water infrastructure issues; however, many ideas can be adapted for other underground networks, too.

The major sessions are available via Youtube: (Keywords IKT Asset Management)



Session 1/8: www.youtube.com/watch?v=YC49yOW2JM8

Session 3/8: www.youtube.com/watch?v=ldNWTaY3Ht4

Session 5/8: www.youtube.com/watch?v=iInd7ul62vM

Session 6/8: www.youtube.com/watch?v=NKonyNQzrm8

Session 7/8: www.youtube.com/watch?v=ltovnzPDVjo

The focus of the second series of webinars in 2014/2015 will be on energy networks for gas and oil as well as power lines and district heating. Members of the IKT Network, guests and partners can still apply for a ticket.

IKT-Conference including Asset Management Workshops 16th to 18th September 2014

As part of its 20th anniversary, the IKT will conduct an international program with many new practical and future-oriented topics related to the theme of Asset Management. There will be presentations about the latest developments and experiences in Asset Management as well as workshops on "Trends and Challenges" and "Vegetation and Infrastructure". This conference offers a unique opportunity to exchange knowledge and ideas about state-of-the-art topics in Asset Management and to identify future innovations. Meet and network with attendees

coming from all industry sectors: clients, contractors, designers, consultants, suppliers and manufacturers. During this InfraTech Knowledge 2014 Conference you will be attending the IKT 20 Years Celebration and the Forum where methods, techniques and lectures will be presented. For updates and more information, see www.ikt.de/AM

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