



MANAGING THE **CROWDED** UNDERGROUND SPACE

A psychological look at asset management strategies

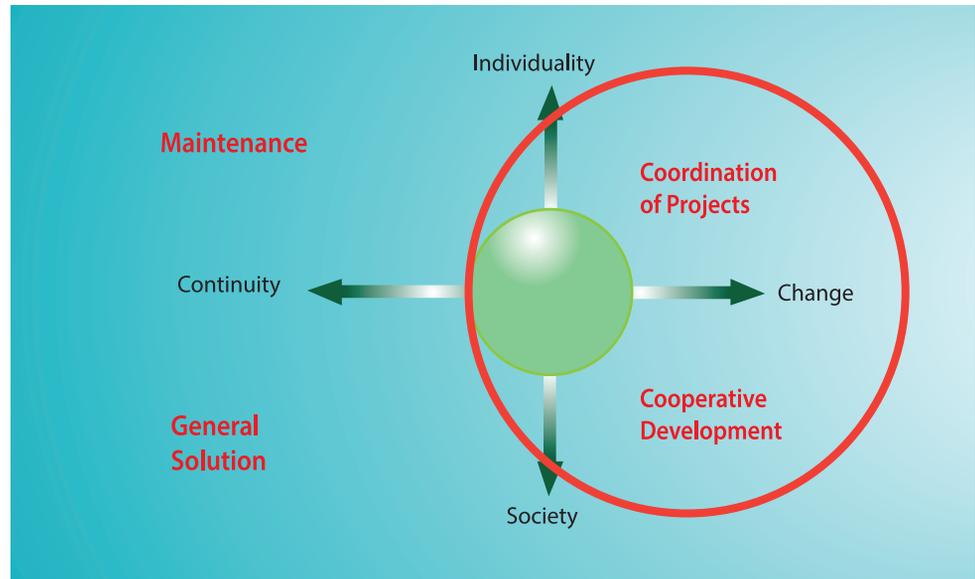
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With so many players claiming space in the underground, all with viable needs, questions often arise when planning for an underground utility. Who is responsible for our streets and roads? Who is entitled to lay pipelines, sewers and cables throughout our cities? How do we locate these pipes in the first place? And who is responsible for planning, construction and operation of our infrastructure?

In German cities, the supply lines and cables are usually placed under the sidewalks, be it for gas, drinking water, electricity or data transmission. Pipe trenches serve as foundations for roads and sidewalks, and 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 as well.

Beyond the space requirements, the soil must meet many requirements, as it is 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 require part of the same underground space. Soil absorbs, contains, purifies and stores water. All in all, the underground can be regarded as a complex hydrological body.

Figure 1: Infrastructure Management Model



Taking on the Responsibility

Against this backdrop, we must determine who manages our underground space and who is ultimately responsible for our infrastructure. Basically, we can distinguish three groups of players. First, there is the asset owner, the one who keeps all the assets such as roads, pipelines, manholes and pumps on account. Second is the asset manager, the entity who is handling and operating the network and is responsible for construction, operation and maintenance, as well as establishing and collecting fees for these services. The municipal utilities often do this job, as many utilities are considered a public asset themselves. The third group comprises the service providers who render their assistance to utilities and industry, from sewer cleaning to construction and accounting.

By nature, an owner is interested in securing his asset values. In essence, owning the assets and making these assets available are what result in profits. Both the owner and the manager are interested in the capacity and output of the network since utilities like water and gas will use these criteria in determining a customer's charges. Moreover, quality is crucial. Drinking water must be hygienic and palatable. Data networks must work around the clock, and gas pipes require essential safety constraints.

As we can see, all parties have multiple responsibilities. To achieve these, they need the means and the room to act. Pipelines are everywhere in our cities, criss-crossing the underground. 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. Roots grow into pipes and some piercing techniques used in laying trenchless pipes end up not only piercing the ground, but accidentally piercing other pipelines as well.

Rioned, the national center of expertise in sewer management and urban drainage in the Netherlands, recently collected and evaluated the available data from such underground conflicts. The data collected for the Netherlands and its 17 million inhabitants revealed 4,000 total accidental piercings of sewers and pipelines, all caused by other boring activities. It is expected

that 250 new cases will occur each year. These staggering numbers leave everybody wondering how to improve the situation, including the Dutch Parliament, who has also been discussing the problem in detail. Some initial ideas include new monitoring and reporting systems, as well as restrictions for pipe-laying activities.

Identifying Viable Solutions

To address this important issue, we start with a basic psychological approach used by the famous German psychologist Fritz Riemann for describing the motivation of individuals, and we expand it to our world of the underground.

In the infrastructure management model (Figure 1), the vertical baseline connects individuality and society. The horizontal base denotes the difference in 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 left quadrants.

1st Quadrant

The first quadrant, bottom left, is a combination of maintaining continuity while focusing on the needs of society. It is considered a general solution where everyone together decides how to proceed. Every infrastructure and utility is included, and no entity is left out of the process. For example, with a large pipeline project, even the traffic ways, trees and shopping areas are integrated in the system, each possessing a defined zone in the ground.

2nd Quadrant

In the next quadrant, top left, we stay with the idea of continuity. However, now we want to preserve the freedom of each party to find its own way and safeguard the individuality of its network. We call this maintenance or rehabilitation of a single system. Trenchless technology is a good example, as it allows us to work without disturbing other carriers in the crowded underground.

Cured-in-place pipe liners make it 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 nearby structures. However, while the capacity remains unchanged, the requirements likely date back to the last century.

The two solutions on the left side of Figure 1 relate to technical optimization. The management question occurs if we look at the right side. There, it is about coordination of projects and cooperative development. We are ready for change, be it within each network or for the infrastructure as a whole.

3rd Quadrant

The third quadrant shows what municipalities and utilities in Germany imagine they are already doing - coordination. However in reality, each utility cares only for its own network and assets, so the investments are still planned separately and independently. Two or four times a year, all current activities are



Pipelines criss-crossing the underground.



An excavated pipe penetrated by roots.



Piercing techniques can pierce other pipelines.

reported to a coordination 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 rather about harmonizing the ongoing activities.

4th Quadrant

Finally, the fourth quadrant demonstrates an attitude that is open for change and a desire to do this as a member of society, feeling responsible for the public good. We call this cooperative development. Municipalities and utilities are going to act in a flexible way and remain 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 good is never that simple. Usually, in a democracy, it is the political leadership that is responsible for such things. Municipal councils and mayors decide on long-term strategic developments for a city, and the potential impact on society. As a consequence, it is the political system and the people in this system that counts. And there are many complex rules and regulations like laws, contracts, easements and covenants to follow, all of which indeed seem 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 coming decades.

Attaining the Goal

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?

Returning to the baseline helps us to find the answer. We have realized that there are many ideas on how to act in this complex environment. Also, we have seen that any solution that 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 to extremes but maintains a clear focus on the center, municipalities as well as asset owners and managers will need 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.

Trends and Challenges in Technology

Strategies and methods to obtain cost-effective and reliable solutions are currently being discussed worldwide. During the Institute for Underground Infrastructure's (IKT's) asset management webinars, international experts from Europe and North America provided an overview of cutting-edge research and practical experience. While the focus of previous webinars was on wastewater infrastructure issues, many of the ideas presented can be adapted for other underground networks as well. The second series of webinars will focus on energy networks for gas and oil as well as power lines and district heating.

As part of its 20th anniversary celebration, the IKT held an international conference in September that covered many new practical and future-oriented topics related to asset management. Starting with workshops on trends and challenges and vegetation and infrastructure, this conference offered a

unique opportunity to exchange knowledge and ideas about state-of-the-art topics that impact asset management. A summary of the conference topics will be presented in upcoming issues of Right of Way Magazine.

Conclusions and Outlook

In our cities, there are a lot of claims for underground space with regard to road foundations, the bedding of pipelines, space needed for plant roots and growth, and rainwater interflow, retention and infiltration. All of these activities take place in a stressful environment that is often filled with conflicts between individuality and society and between continuity and change.

Through it all, utilities and municipalities face a broad range of requirements. Technological and quality issues need to be resolved and innovative solutions must be developed. The focus of an integrated asset management strategy is about balancing the available opportunities and solutions in a feasible and economical way.

How to accomplish this and cull the benefits of an integrated approach in practice has been the focus of IKT's asset management activities since 2013. IRWA has partnered with IKT in these efforts, and the affiliate relationship has proven to be a mutually beneficial one. Working together with our members and partners, we will continue to seek solutions. 🌟



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