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IG-PARLS

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INTEREST GROUP OF PUBLICLY APPOINTED AND REGULATED LIBERAL SURVEYORS

UTILITY CADASTRE SYSTEMS

Paving the way to Smart Society

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IG-PARLS, the Interest Group of Publicly Appointed and Regulated Liberal Surveyors, operating under the auspices of the European association Comité de Liaison des Géomètres Européens (CLGE). Our dedicated focus within this umbrella organization is on addressing challenges and advancements in the field of Property Surveying.

IG-PARLS comprises European private surveyors collaborating under CLGE to advocate for the interests of Property surveyors. Our efforts extend to individual activities and services related to land and built property. As part of our initiatives, we work into various Property Surveying issues and execute specialized projects.

In the past, we produced a highly regarded Compendium on Condominium ownership. Recently, we've been working on a new project. This one is all about understanding Utility Cadastral systems in Europe. This project is focused on legislative aspects, organizational structures, digitization processes, data completeness, accessibility, and the role of Property Surveyors in establishing and maintaining such systems. The culmination of this effort is another Compendium featuring national presentations from IG-PARLS member countries.

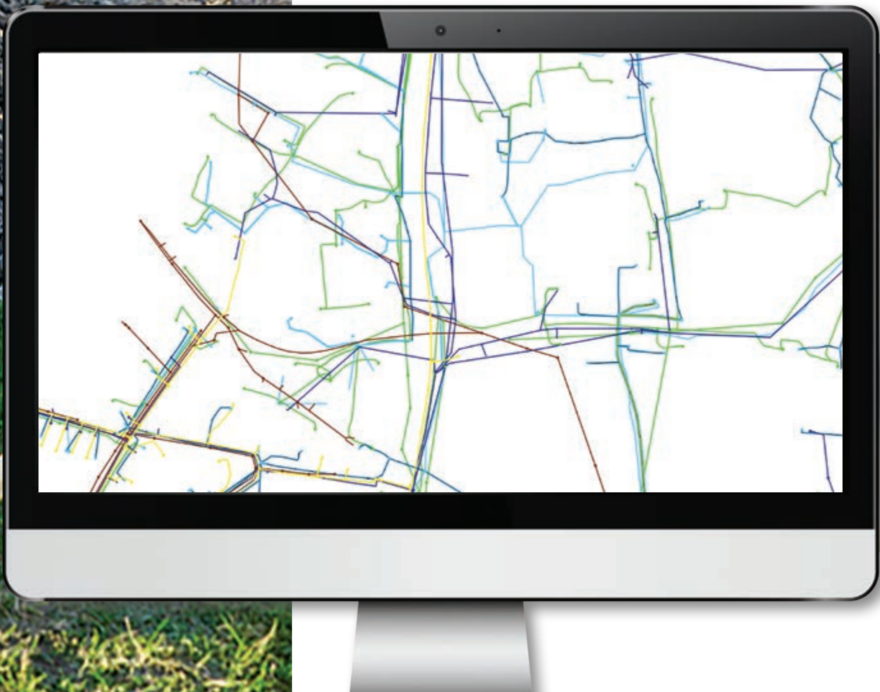
This book is a helpful guide. It shares details about utility cadastral systems and why Property Surveyors are so important in making them work. Feel free to explore and learn more!

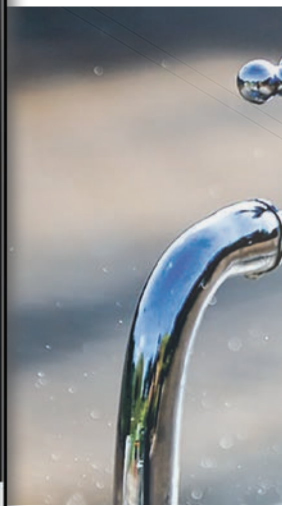
Matjaž Grilc

Chair of CLGE – IG-PARLS

UTILITY CADASTRE SYSTEMS IN EU

As a member of the public, you interact with utility infrastructure on a daily basis through the provision of essential services like electricity, water, and telecommunications. Yet for most people the vast networks of pipes, cables, and lines that crisscross cities and countries remain largely invisible and poorly understood. Utility cadastre systems aim to change that by creating comprehensive digital records of utility assets and networks. In recent years, the European Union has supported initiatives to develop utility cadastre systems to gain a clearer understanding of what lies beneath our streets and gain greater control over management of these critical infrastructure networks. For citizens, the development of utility cadastre systems means greater transparency, accountability, and reliability of the services we depend on each day.





WHAT IS A UTILITY CADASTRE?

As a utility cadastre refers to an official register containing information about public infrastructure assets, including their location and characteristics. These assets typically include utility networks such as those for water, sewerage, electricity, gas, and telecommunications. Some cadastres may also include information on roads, bridges, and tunnels.

A comprehensive utility cadastre provides an array of benefits to both public and private entities. For public agencies and utility companies, it facilitates infrastructure planning, development, and management. With precise location data and details on existing utilities, new infrastructure can be designed to avoid damage or interference to what is already in place. This helps minimize unnecessary costs and delays.

Cadastres also support emergency response by providing critical information in crisis situations. Knowing the exact position and attributes of gas or power lines, for example, helps responders address issues like leaks or outages as quickly as possible. Some countries legally recognize cadastre data, allowing it to settle disputes over utility locations or responsibility.

Developing and maintaining a utility cadastre, however, can be challenging. It requires collecting and integrating data from various sources, keeping information up to date as infrastructure changes, and coordinating between different utility providers and government agencies. Historically, cadastres were paper-based, but today digital formats like GIS and BIM predominate, enabling the creation of advanced digital maps and 3D models.

A fully comprehensive, nationwide utility cadastre is still rare, though some countries have implemented robust systems. The Netherlands' KLIC, for instance, is a national

registry providing data on the location of cables and pipes to prevent excavation damage. Elsewhere, there are often separate systems for individual utility types that local or regional entities manage. Improving integration and coverage remains an ongoing goal to maximize the benefits of utility cadastres.

Geodetic surveyors play an instrumental role in developing and maintaining cadastres. Their responsibilities include collecting and analyzing infrastructure data, integrating it with existing GIS or CAD resources, updating information, ensuring data quality, providing consultation, and collaborating with other professionals. By providing this expertise, geodetic surveyors help enable the safe, efficient, and sustainable development of infrastructure.

KEY COMPONENTS OF A UTILITY CADASTRE

As a utility infrastructure owner or operator, maintaining an accurate cadastre of your utility assets is crucial for operational efficiency, risk mitigation, and compliance. A utility cadastre refers to a comprehensive registry of the location and details of public utility infrastructure.

For a utility cadastre to be useful and effective, there are several key components to consider:

- Accurate and up-to-date data: Regular data collection and updates are needed as infrastructure is built, upgraded or decommissioned. Modern tools like GIS and ground-penetrating radar can help capture precise location and attribute data.
- Integration of data: Disparate data sets from various utility types (water, gas, telecom, etc.) and sources must be integrated into a single system. Data standards and interoperability are important for achieving this.
- Digital and scalable format: Digital maps, 3D models and databases are preferable over paper-based systems. The cadastre needs to handle large amounts of data that can be analyzed, shared and updated efficiently.
- Access control and security: While utility data must be accessible to certain stakeholders, sensitive infrastructure details also need to be protected. User authentication and data encryption are important security measures.
- Long-term data preservation: Utility infrastructure has a long lifespan, so data in the cadastre may be retained indefinitely. The system needs to ensure data remains available, secure and usable over long time periods.

Developing and maintaining an effective utility cadastre is not without challenges. Cost, lack of standards, siloed data, and technology issues can pose barriers. Close collaboration between utility providers, government agencies, and technology partners is key to overcoming these obstacles and achieving the benefits of a comprehensive utility cadastre. With prudent management and the right tools and partners, a utility cadastre can become an invaluable asset.

BENEFITS OF A COMPREHENSIVE UTILITY CADASTRE

A comprehensive utility cadastre that includes detailed information on all utility infrastructure within a region or country offers significant benefits.

Accurate data on the location and attributes of utilities allows for improved infrastructure planning and development. Planners can design new infrastructure while avoiding damage or disruption to existing utilities. This reduces unnecessary costs from emergency repairs or project delays.

Emergency responders also rely on utility cadastre data to quickly locate and shut off utility lines in crisis situations. Knowing the precise position of gas, water or electrical lines can save lives during disasters like fires, floods or earthquakes.

Both public and private utility companies utilize the cadastre to efficiently manage their systems. They can schedule predictive maintenance, plan upgrades, and install new infrastructure with full knowledge of potential impacts. This coordination between utilities is essential for sustainable urban development.

Legal disputes regarding utility responsibilities or damage claims can be resolved objectively based on the official records in a comprehensive cadastre. The data provides an authoritative account of utility locations, ages, materials and ownership.

Fully integrating data from various sources into a single digital system enables a holistic perspective of the utility landscape. This allows users to analyze relationships between different infrastructure systems and model the cumulative impacts of proposed changes. Advanced technologies like GIS, BIM and 3D modeling software facilitate these complex analyzes.

While creating and maintaining a comprehensive utility cadastre presents challenges, the benefits to public safety, urban planning, utility provision and economic efficiency are substantial. With new tools and increasing collaboration between stakeholders, more regions are achieving this goal and realizing the many advantages of integrated utility data management.

CHALLENGES IN DEVELOPING A CENTRALIZED UTILITY CADASTRE

The development of a centralized utility cadastre system encompassing all utility infrastructure within a country or region presents various difficulties that must be addressed.

Cost is a significant factor, as creating and maintaining an extensive digital database requires financial investment in technologies like GIS, as well as human resources. Accessing accurate data on existing utilities from various providers can also be challenging, especially if records are incomplete or paper-based. Regular updates to account for changes and new installations demand ongoing costs.

Technological changes may require transitions to new systems, converting data and retraining staff. Different providers may use incompatible formats, necessitating translation or reformatting to integrate data.

Coordination between public and private utility companies, government agencies, and other stakeholders is essential but can be difficult to achieve. Varying priorities, restrictions on sharing information, and disagreements over system requirements are potential obstacles. Legal issues regarding data ownership, privacy, and liability must also be resolved.

A centralized cadastre demands high data quality standards to be useful, but verifying accuracy and resolving discrepancies at a large scale is complicated. Ensuring data is comprehensive, current, and consistent across the system poses organizational difficulties.

While a centralized utility cadastre confers many benefits, developing and operating such a system is an intricate process requiring substantial investments of time, money, and effort to overcome the challenges involved. With political will, technological advancement, and cooperation between stakeholders, countries can work to implement centralized cadastres to gain the advantages they offer.

INNOVATIONS IN UTILITY MAPPING TECHNOLOGY

Innovations in mapping technology have enabled significant improvements in utility cadastre systems. Advancements in geographic information systems (GIS), global positioning systems (GPS), and remote sensing have allowed for more precise location and visualization of underground infrastructure. These technologies, combined with increased computing power and data storage, have paved the way for the development of comprehensive digital utility cadastres.

GIS integrates geographic data with information about utility networks to create interactive maps. It allows users to visualize, analyze, and model utility infrastructure in both two and three dimensions. GIS-based utility cadastres provide a common platform for integrating data from various sources, enabling coordinated management of utilities. GPS uses satellite signals to determine the precise location of utility infrastructure, supporting accurate field data collection and updates to digital maps.

Remote sensing techniques like ground-penetrating radar can detect underground utilities without the need for excavation. Lidar (light detection and ranging) sensors on aircraft or drones use laser pulses to create 3D models of above-ground infrastructure. Photogrammetry uses overlapping images from cameras to construct 3D models and topographic maps. These technologies allow for non-invasive data collection over large areas.

Advancements in mobile computing and wireless communications have enabled field data collection via handheld GPS receivers, tablets, and smartphones. This allows geodetic surveyors and utility workers to collect and update data in real time, synchronizing field observations with central databases. Emerging technologies like augmented reality can overlay the locations of underground utilities onto the view of the real world, improving safety and efficiency.

The rapid pace of technological change presents challenges in developing and maintaining utility cadastre systems. However, new tools also provide opportunities to gain more accurate and up-to-date knowledge about utility infrastructure, enabling evidence-based decision making and smart management of resources. With the support of innovative mapping technologies, utility cadastres can fulfill their potential as vital tools for the planning and operation of infrastructure and the delivery of services on which communities depend.

EMPOWERING SUSTAINABLE FUTURES: HOW UTILITY CADASTRE SYSTEMS CAN HELP ACHIEVE THE SDGS

To achieve this vision, Utility Cadastre Systems emerge as pivotal tools, steering societies towards smart and eco-friendly development. These systems, meticulously

crafted by geodetic experts, serve as the backbone for managing crucial infrastructure data. From the intricate web of utility lines to the depths of underground networks, Utility Cadastre Systems provide the spatial intelligence necessary for informed decision-making.

In this regard, the significance of these systems becomes even more pronounced in the context of the Sustainable Development Goals (SDGs) outlined in the 2030 Agenda. The SDGs call for universal action, addressing global challenges such as poverty, inequality, and climate change. Efficient management of infrastructure, facilitated by Utility Cadastre Systems, plays a vital role in meeting these ambitious goals.

By ensuring the accurate documentation and strategic planning of utility networks, these systems contribute directly to SDGs related to sustainable cities, clean water, affordable and clean energy, industry innovation, and climate action. For example, in Singapore, Utility Cadastre Systems help optimize the use of land and resources, reduce carbon emissions, and enhance the quality of life for its citizens1. Smart cities, driven by comprehensive infrastructure data, become catalysts for achieving multiple SDGs simultaneously.

In essence, Utility Cadastre Systems not only empower societies with the necessary information for sustainable development but also act as enablers for meeting the global milestones set forth in the SDGs. As we navigate the complex landscape of the 21st century, these systems stand as guardians of progress, facilitating the fulfillment of the 2030 Agenda and fostering a future where sustainability is not just a goal but a way of life. How can we harness the power of Utility Cadastre Systems to create a more sustainable world?

CONCLUSION

As utility and infrastructure systems in Europe continue to expand and become more complex, utility cadastre systems are increasingly vital tools for effective management and governance. By providing detailed spatial and legal information on utility networks across countries and regions, these systems enable improved planning, reduced costs, increased efficiency, and better risk management. With consistent standards and data models, utility cadastre systems have the potential to transform how critical infrastructure is designed, monitored, and maintained. Though implementation requires significant investment, the long term benefits to both governments and utility companies are substantial. Overall, utility cadastre systems are essential mechanisms for optimizing critical infrastructure in the 21st century.

NEXT-GEN CHALLENGES IN INFRASTRUCTURE VISUALIZATION

Today's utility cadastral systems are at the forefront of digital innovation, incorporating 3D technology that enables remarkable visualizations of infrastructure and the use of cutting-edge augmented reality (AR) systems. These advancements have revolutionized the way we manage and interact with the complex networks of resources that underpin modern society.

Utility cadastres are essential databases that contain detailed information about public and private utilities, including water pipes, gas lines, electrical cables, and telecommunications networks. Traditionally, these records were maintained in two-dimensional maps and plans, which could be difficult to interpret and often lacked the dynamic detail required for precise planning and management.

The integration of 3D technology into utility cadastres has transformed these databases into multi-dimensional models that accurately represent the spatial relationships and elevations of utility networks. This leap from 2D to 3D provides a more intuitive and comprehensive understanding of infrastructure layouts, allowing for better planning, maintenance, and emergency response.

Augmented reality takes this further by overlaying these 3D digital models onto the physical world through AR devices. With AR, engineers, planners, and maintenance personnel can see the exact location and depth of underground pipes or cables in real-time, simply by looking through a smartphone, tablet, or specialized AR glasses. This hands-free, interactive approach not only improves the accuracy of on-site work but also enhances safety by reducing the risk of accidental damage to hidden utilities. Several commercial AR solutions have emerged as mature solutions in the field of underground utility visualization, including well-known examples like Trimble SiteVision, vGIS, AVUS, and V-Labs, offering innovative ways to interact with and visualize underground utilities.

In addition to AR visualization, another 3D technology–namely, the use of reality capture solutions that often employ photogrammetry reconstruction captured with smartphones–is gaining traction in utility surveying and mapping. Examples include SmartSurvey from IT34 and Pix4Dcatch, solutions that demonstrate the growing adoption of photogrammetry-based methods in the

industry. These technologies offer new workflows and perspectives for utility surveying, promising to simplify the data capture process, they lower the barrier to entry, enabling a broader range of personnel to conduct field operations effectively.

Following the increased use of reality capture solutions, a new notable application of AR for underground infrastructure has emerged, focusing on the visualization of 3D reconstructions or reality capture data of open utility trenches. This provides contractors and utility locators with a comprehensive view of underground infrastructure, becoming increasingly relevant as more utility companies adopt 3D capture methods for documenting open trenches.

AR in utility cadastral systems also facilitates public engagement and education. For instance, city planners can provide immersive visualizations of proposed infrastructure changes to stakeholders and the general public, fostering a transparent decision-making process. Moreover, training programs for utility workers can incorporate AR to simulate real-world scenarios, leading to better-prepared teams that can effectively tackle complex tasks.

In conclusion, the digitalization and 3D modeling of utility cadastral systems, combined with the application of augmented reality, represent a significant leap forward in the management and visualization of essential infrastructure. These technologies not only improve operational efficiency and safety but also open new avenues for public interaction and professional education within the realm of utility services. As these systems continue to evolve, we can expect even more innovative applications that will further enhance our ability to sustainably manage the vital networks that support our daily lives.

Image source: vGIS

NATIONAL PRESENTATIONS

Austria (AT)

An intricate system of utilities including electricity, gas, water, sewage, and telecommunications is hidden from view, supplying essential services to businesses and homes across the country. To effectively manage this critical infrastructure, Austria set up the supply cadastral system based on the state real estate cadastre and on the fixed point field. Understanding how this system came to be and how it functions today provides insight into Austria's progressive approach to infrastructure management in the 21st century.

Overview of Austria's Decentralized Utility Cadastre System

Austria has a decentralized system comprised of federal, state, and local levels of government, each maintaining their geographic information systems (GIS). The utility cadastre includes data on essential infrastructure like water, sewage, power, gas, roads, and railways, which are collected, documented, and updated by the responsible companies.

At the federal level, national agencies govern information on nationwide networks such as highways, railways, and power lines and maintain the property cadastre as a database and reference frame. The nine states each operate independent GIS platforms covering spatial planning, zoning, and all regional infrastructure provided it is generally and freely available. Major cities run systems for municipal services including water, sewage, district heating and waste management, etc.

The utility cadastre for local pipelines and cables follows Austria's decentralized model. Data is gathered and updated by the concerning organizations (eg. telecommunications) that build and operate this infrastructure. Information may vary in completeness and accuracy but aims for 98% coverage and 0.1- 0.5 (in seldom cases 5) meter precision.

Much of the data is freely available online, though some sensitive records require demonstrating a legitimate interest. Digital datasets can incur minor fees. Surveyors play a significant role, responsible for over 90% of data collection where in the interests of the company and legally mandated.

While technical data is often in 3D graphics, legal records are typically 2D. Attributes supplement graphics, tailored to the subject and ranging widely in number. Data accuracy depends on the collection date, though records are assumed technically correct when entered, within defined parameters, and updated if necessary.

Completeness and precision improve over time, though 100% coverage remains elusive due to constant infrastructure changes. Austria's decentralized utility cadastre ultimately provides a comprehensive overview of the country's essential networks and services.

What still needs to be improved is the legal component, the documentation, and entry of servitudes, ie spatially limited easements, in the land register.

Completeness and Accuracy of the Utility Cadastre Data

The utility cadastre data entered into Austria's geographic information system (GIS) can be assumed to have a high degree of completeness and accuracy within defined parameters. According to estimates, the completeness of the data is around 98% overall.

Some utility cadastre data possesses legal standing, concerning property boundaries and/or zoning specifications. As data is constantly added and updated to account for new infrastructure or changes to existing features, 100% daily current completeness will likely never quite be achieved. However, data providers are responsible for ensuring their data is updated to meet standardized accuracy requirements.

Much data in the utility cadastre is freely available online and can case by case be accessed digitally for a small fee or for free. Offline data requests may require demonstrating a legitimate interest in the information. Licensed surveyors are relied upon to collect legally required data in areas where it is mandated.

While most data in the utility cadastre is available in 2D, some data, especially that which is legally significant, may also incorporate 3D elements.

Overall, Austria has achieved a useful balance of decentralized data management with standardized accuracy and completeness targets in its utility cadastre system. By providing public access to the majority of this data, the system promotes transparency and enables evidence-based decision-making around infrastructure.

Accessibility and Cost of Austria's Utility Cadastre Data

Most of Austria's utility cadastre data is freely available for most citizens to access online. Only certain datasets require demonstrating a legitimate need to obtain the information. Digital data can also typically be purchased for a nominal fee.

The utility cadastre system is decentralized, with each utility provider responsible for collecting and updating their data. Data accuracy depends on when it was collected but is generally quite precise, within 0.1 to 0.5 meters. Completeness of datasets varies but is typically around 98%. Data are available in both 2D and 3D formats.

Much of the data contained in Austria's utility cadastre system is legally binding, including property boundaries and zoning information, but also spatially limited easements. The data is collected and maintained primarily by surveyors.

In addition to the technical quality (completeness, accuracy), the legal quality (entry in the land register is always only based on a servitude plan) should also be given greater attention in the future.

Belgium (BE)

Overview of Belgium's Utility Cadastre System

Belgium does not have a centralized utility cadastre at the national level. Instead, utility data is managed by the three regions of Belgium - Flanders, Wallonia, and the Brussels Capital Region. Within these regions, there is a collaboration between different utility providers and regional governments.

In these three regions, there is a digital platform designed to collect and disseminate information about the location of underground cables and pipelines. In Flanders, this platform is called KLIP[1], in Wallonia and the Brussels Capital Region you have KLIM-CICC[2]. Before starting excavation work it is mandatory to make a request to this platform to receive information about the utilities which are present in the working zone. KLIP and KLIM-CICC collect information from the different network operators and telecom companies and share this information with the applicant for a small fee. The aim is to provide a digital plan with all the underground infrastructure present in the area of your plan request. This service is available for KLIP, while KLIM-CICC refers to the utility companies requiring them to upload their data. Currently, these data are not harmonized but in the near future, this should be done.

In the three regions, there is also a digital platform that allows municipalities and other relevant authorities to coordinate and manage activities such as roadworks, construction projects, events, and other interventions in the public domain more efficiently. In Flanders, this platform is called GIPOD[3], in Wallonia PoWalCo[4], and the Brussels Capital Region Osiris.

1 Kabel en Leidingen Informatie Portaal

2 Kabels en Leidingen Informatie Meldpunt – CICC: Point de Contact fédéral d'Informations Câbles et Conduites

3 Generiek InformatiePlatform Openbaar Domein

4 Portail Wallon de Coordination des chantiers

The above-ground networks are also monitored and managed by three different authorities, according to the three regions.

The Flemish region's Geopunt portal provides free access to utility data like the Grootschalig Referentie Bestand (GRB). The Walloon region's geoportal offers open data on utilities through the Projet Cartographique de Cartographie Continue (PICC). Brussels' UrbIS portal publishes utility data for the capital region.

Established in 2004, these various regional portals offer data on roads, railways, waterways and buildings in addition to underground utilities. Accuracy ranges from 5 to 30 cm depending on the measurement method used and object type. Data is freely available for non-commercial use.

In summary, Belgium lacks a nationwide utility cadastre system. However, the regional portals provide access to utility data and plans to enable the safe planning and execution of construction works while avoiding damage to existing infrastructure. Continuous cooperation between regions and across borders remains key to developing a comprehensive national utility cadastre.

Belgium's Legal Framework for Utility Mapping

Belgium’s legal framework for utility mapping consists of federal and regional laws governing data collection and sharing. Following the Ghislenghien disaster in 2004, stricter laws led to improved mapping of high-risk utilities.

The legal framework for utility mapping in Belgium primarily revolves around ensuring safety, efficiency, and coordination in construction activities that involve underground infrastructure. At the federal level, several laws and decrees apply to cables and pipelines, such as the electricity law, the gas law, and the electronic communications law.

Regional and local governments in Belgium have spatial planning regulations that often include provisions for utility mapping and coordination. These regulations aim to ensure that construction projects take into account existing underground infrastructure to prevent damage and ensure safety.

KLIP and KLIM-CICC operate under the legal framework established by the Federal Platform for Underground Networks (FED-net). While not a law in its own right, its operation is guided by agreements and regulations that govern data sharing, access, and usage by stakeholders.

Utility mapping in Belgium adheres to technical standards set by various organizations and industry bodies. These standards cover aspects such as data formats, accuracy requirements, and mapping methodologies to ensure consistency and reliability in utility data.

In Flanders, the information from different Utility companies is merged into one single plan, based on the IMKL format (a format based on the INSPIRE Utility Services). The same harmonization is currently performed by KLIM-CICC for the other Regions.

Safety regulations for construction activities often include provisions related to utility mapping. Contractors and construction companies are typically required to obtain information about underground utilities before commencing excavation work to prevent accidents and damage to infrastructure.

Regional governments also legislate data sharing, with the GDI ensuring the availability of geographic data. Regional geoportals, Geopunt for Flanders, PICC for Wallonia, and Urbis for the Brussels Capital Region provide free access to utility data.

In summary, the legal framework for utility mapping in Belgium encompasses a combination of spatial regulations, technical standards, safety requirements, and collaborative agreements. Continued improvements in mapping high-risk infrastructure aim to ensure public safety and the proper management and protection of underground infrastructure. A mix of federal and regional laws govern responsibilities, with surveyors and geoportals facilitating data collection and availability.

Content and Accuracy of the Utility Cadastre

The utility cadastre in Belgium contains data on both underground infrastructure like cables and pipelines as well as above-ground utilities such as buildings, parcels, roads, and railways. The accuracy and completeness of the data vary between the different types of utilities.

Data on cables and pipelines is available through KLIM-CICC and KLIP, the Regional Contact Point for Cable and Pipeline Information. This platform allows users to request

information on underground infrastructure in the vicinity of a proposed construction site to ensure safe and coordinated work. However, the data on older utility systems may be less precise, with an accuracy ranging from 0.3 to 3 meters or unknown.

In contrast, data on above-ground utilities like public infrastructure is highly accurate, with a precision of 0.05 to 0.3 meters. This data is freely available through regional platforms, including Geopunt in Flanders, the Projet Cartographique de Cartographie Continue (PICC) in Wallonia, and UrbIS in the Brussels Capital Region. These platforms provide complete and precise data on roads, railways, buildings, and parcels.

While KLIM-CICC is managed by a non-profit organization of utility companies and infrastructure managers, the regional platforms are run by the respective regional governments. The role of licensed surveyors is primarily in supporting data collection and ensuring accuracy for the regional utility cadastres. Overall, Belgium lacks a centralized national utility cadastre but has a mix of regional systems and a federal platform focused specifically on underground infrastructure. With varying levels of accuracy and an array of access platforms, navigating utility data in Belgium can prove challenging without local knowledge and expertise.

While surveyors are not required to map all infrastructure, they are involved in creating official as-built plans for some utilities. Their role depends on regional and federal laws, with surveyors producing over 90% of legal property data. Most technical data is available in 3D, though legal data is typically only in 2D.

The Role of Surveyors in Belgium's Utility Cadastre

The role of surveyors in Belgium's utility cadastre system is limited. For cables and pipelines, surveyors are not required to be involved. The owners of the infrastructure determine whether or not to employ surveyors. However, for other utilities like buildings, parcels, roads, and railways, surveyors generally help maintain the free geoportals, though they are not necessarily authorized property surveyors.

Surveyors play little role in documenting underground cables and pipelines in Belgium. There is no mandate for surveyors to map these utility lines. The information that does exist is provided through KLIP or KLIM-CICC, an internet platform enabling contractors to identify any subterranean infrastructure around a construction site. This data is only available upon paying a small fee and is provided in a downloadable format for use in GIS software.

While Belgium's utility cadastre system provides a wealth of information on public infrastructure, the role of surveyors is limited, especially regarding underground cables and pipelines. There is room for surveyors to contribute more, particularly in transitioning more of the data to 3D and in applying AI for improved accuracy and insights. Overall, Belgium's utility cadastre, though not comprehensive and accurate, provides a helpful overview of the country's infrastructure.

Conclusion

Overall, Belgium's utility cadastre system is an innovative solution to optimize underground infrastructure management and prevent costly damages. This advanced digital mapping system provides transparency and accessibility to utility network data for both utility companies and external stakeholders. With an accurate visualization of underground pipes and cables, utility companies can better plan maintenance and new connections. External parties executing groundworks have access to essential information to avoid hitting utility infrastructure. While the initial investment to set up a utility cadastre is significant, the long-term benefits to the economy and society are substantial. Utility cadastres pave the way for smart cities with sustainable, well-organized infrastructure.

Croatia (HR)

As a utility infrastructure professional in Croatia, you have a wealth of geodata at your fingertips thanks to the development of the Utility Cadastre. Through the coordinated efforts of the State Geodetic Administration, Croatia now has a centralized platform for documenting and managing utility networks across the country. The establishment of the Utility Cadastre Application System provides you access to comprehensive records for infrastructure ranging from electric power lines to water supply networks. With a few clicks, you can view survey plans, coordinates, technical specifications, and more for any registered utility.

The Creation of Croatia's Utility Cadastre

To create a complete and consistent utility cadastre, the State Geodetic Administration (SGA) developed the Utility Cadastre Application System (SKI). This system has both private and public sections, making it easy for different users to access and manage data efficiently.

The development of this system was a project that began in 2014 and finished in 2020.

The private section of SKI is meant for SGA employees to input and approve data, such as digital geodetic reports with survey plans, coordinates, and technical drawings. Once approved, this data gets imported into the SKI database. On the other hand, the public section, accessible through the Unique Information Point, allows utility managers, certified geodetic engineers, and the general public to search and view utility records.

Both registered and unregistered users can access the public section. Unregistered users can browse the system and search for data, particularly for information on ongoing or upcoming construction projects.

Registered users have additional privileges. They can distribute infrastructure cadastre data, receive notifications

about construction works, manage these notifications, enter studies through the JIT, prepare data for download into the working part of SKI, conduct analysis and statistical reporting, and perform system administration tasks.

The implementation of SKI has greatly enhanced infrastructure management in Croatia. By consolidating records from various local offices and utility companies into one system, SKI reduces costs and damages from construction activities and increases the use of infrastructure. The streamlined data submission and approval process also saves time and resources.

As of January 2024, SKI has been established in 17 counties, with preparations underway for its deployment in the remaining counties.

Although SGA has gathered a lot of data on utility lines through surveys over the years, not all of it has been incorporated into the system yet. This is a complex and time-consuming task, and it's uncertain when it will be completed. However, once fully implemented, the system will offer comprehensive infrastructure records, leading to improved efficiency, cost savings, and transparency nationwide.

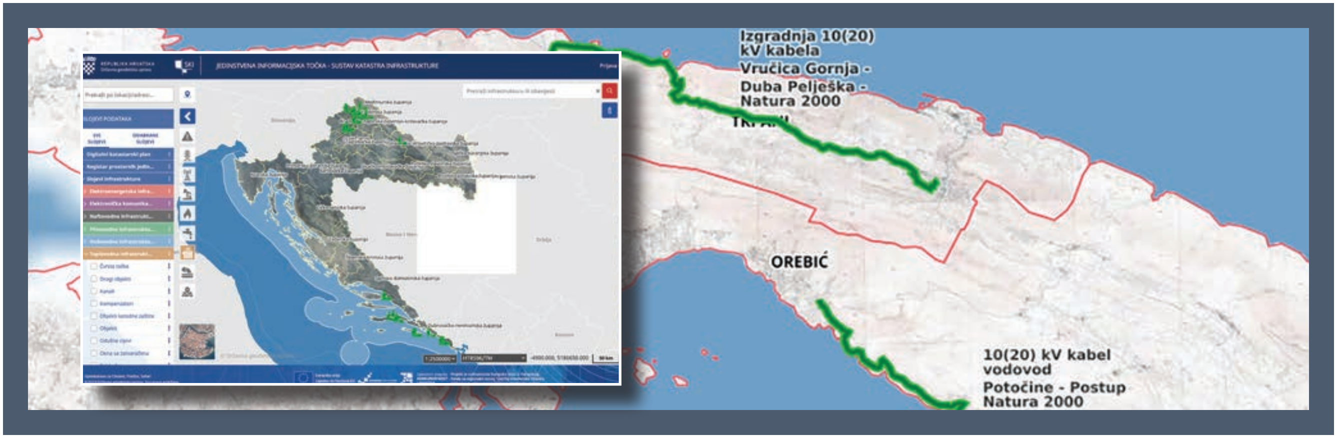
Overall, the Utility Cadastre project has played a crucial role in setting up an efficient infrastructure documentation system that adheres to international standards. SKI underscores SGA's commitment to enhancing geodetic services through technology and data sharing.

Digital Geodetic Reports: Structuring Data for the Utility Cadastre

To support the Utility Cadastre, certified geodetic engineers meticulously prepare structured digital reports containing vital information about utility infrastructure. These reports, submitted through the Unique Information Point (JIT) and reviewed by the State Geodetic Administration (SGA), form the basis for populating the Utility Cadastre Application System (SKI) with data.

The digital geodetic reports include:

- Survey plans depicting the location and attributes of infrastructure
- Lists of coordinates precisely documenting the position of infrastructure
- Technical reports with specifications about materials, dimensions, and other characteristics.



By standardizing the capture and sharing of infrastructure data, these digital geodetic reports enable efficient management of utilities throughout Croatia. Once approved, the SGA imports the data into the SKI system, where it is integrated with existing records. Over time, this process will lead to the development of a comprehensive nationwide utility cadastre.

With a consistent approach to documenting various types of infrastructure, ranging from electricity networks to water supply systems, the Utility Cadastre offers a centralized access point for crucial information. This helps reduce costs and damages during construction, enhances the efficient utilization of existing infrastructure, and facilitates data exchange among stakeholders. Overall, the introduction of digital geodetic reports and the SKI system represents a significant advancement in infrastructure management for Croatia.

Role of Surveyors

Chartered geodesy engineers are essential to the Utility Cadastre system. Only licensed geodesy engineers are authorized to conduct geodetic surveys of the infrastructure and produce geodesic reports. These reports are then submitted to the SGA for review and eventual implementation into the system. Licensed geodesy engineers uphold the accuracy of the collected and presented data, ensuring its reliability for all other users who may require it.

Benefits and Ongoing Development: Improved Efficiency and Accessibility

The introduction of the Utility Cadastre has significantly improved infrastructure management in Croatia. By creating a centralized database of utility information, the system has boosted efficiency, cut costs, and enhanced accessibility.

Previously, disparate records maintained by local government offices and utility companies caused duplication of data and inefficiencies. The Utility Cadastre Application System (SKI) now offers a single platform for documenting and sharing crucial information about key infrastructure, such as water supply networks, sewage systems, gas pipelines, and telecommunication equipment. Through SKI, utility managers and engineers can easily submit digital geodetic reports for swift review and approval. Approved data is then directly imported into the infrastructure database.

In the past, inaccessible utility data led to high costs from damages during construction and maintenance. The public SKI portal now allows contractors and workers to view nearby infrastructure details before starting excavation or development. This transparency helps prevent unintentional damage to utility lines and reduces costly repairs. Additionally, the SKI system lowers administrative burdens for utility managers through digital processes and centralized data management.

Previously available only upon request, infrastructure information is now accessible to the public through the SKI portal. Both registered and unregistered users can search for and view utility data, public documents, and status updates via an intuitive interface. This open access benefits citizens, contractors, engineers, and government officials alike.

Conclusion

As Croatia continues the nationwide rollout of its Utility Cadastre, infrastructure stakeholders across the country stand to benefit greatly from this centralized and standardized system. With increased data sharing, streamlined processes, and comprehensive records accessible in one place, the management and usage of utility networks can achieve new levels of efficiency and cost-effectiveness. While the transition may require initial investments of time and resources, the long-term rewards of an integrated utility infrastructure system are well worth the effort.

Denmark (DK)

A utility cadastre contains data about the location, connectivity, and technical specifications of utility networks. It provides a digital map of the underground pipes, cables, and lines that deliver services like electricity, water, sewage, district heating, gas, and telecommunications. Utility companies use cadastre information to plan infrastructure projects, detect issues, and respond to outages or emergencies as quickly as possible.

For citizens, a utility cadastre means uninterrupted access to essential services. It gives you confidence in the networks hidden beneath your feet that you depend on each and every day. Though largely invisible, utility infrastructure is the foundation for functioning societies and economies. A utility cadastre helps ensure these critical systems remain stable and secure.

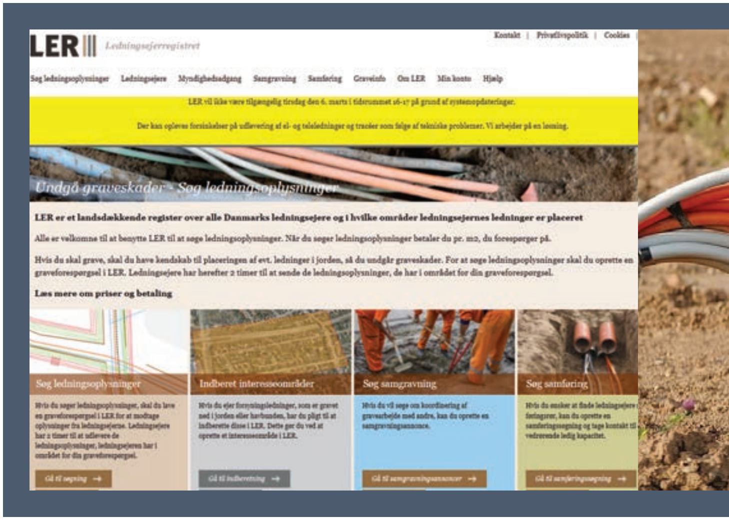
The History and Development of Utility Cadastre in Denmark

The utility cadastre system in Denmark was first established in 1980 as the LER system to digitally map and register the location of underground infrastructure. Over the 40 years since its inception, the LER system transitioned from analog to digital data and was updated to LER2 in 2022 to improve data quality, format, and access.

Originally, most underground infrastructure like water mains, sewer pipes, district heating, and natural gas lines were owned and operated by municipalities. Now, these utilities have been privatized. The LER system was created so infrastructure owners could define the location of their assets, and anyone planning to dig in an area could contact LER to identify which utilities might be impacted. Owners then had 2 weeks to provide information about their infrastructure. Users had to pay for each inquiry and might receive 3 to 10 responses of varying detail.

In 2018, Denmark passed a law requiring all utility data to be digital and formatted using a standard XML schema including both geometry and attributes. Now, when a request is submitted to LER2, owners must provide data within 2 hours to ensure safe and efficient excavation. While access to LER2 still requires payment, the system contains information on nearly all Danish underground infrastructure like water, sewage, telecommunications, electricity, gas, and district heating lines.

Data accuracy varies from 0.05 meters to 20 meters depending on the measurement techniques used, though newer data collected using modern surveying methods tends to be more precise. Three-dimensional data and artificial intelligence are emerging in utility cadastre, but are still limited. Property surveyors play a minor role in utility cadastre since data collection has become straightforward



using basic GPS equipment that infrastructure owners often operate themselves. However, some owners do contract with surveying companies for data acquisition.

LER2 has made significant progress in improving the utility data landscape in Denmark over the past 40 years. Continued investment in advanced technologies like 3D modeling and AI will further enhance this essential infrastructure system.

Key Components of the Danish Utility Cadastre

The Danish utility cadastre system contains data on a wide range of infrastructure types, including:

- Water and sewage networks
- Gas and district heating pipes
- Electricity grids
- Electronic communications cables

This system enables owners and operators of utilities in Denmark to document the location and attributes of their infrastructure assets.

The utility cadastre was first established in 1980 as the LER registry. It has since been updated to the LER2 system, with additional requirements for data formats, delivery times, and access. LER2 stipulates that infrastructure data must be provided in a specified XML format, including both geometric and attribute information. Responses to inquiries must be delivered within 2 to 24 hours to enable efficient planning of construction and maintenance works.

While LER2 aims for nationwide coverage and consistent data standards, the accuracy and completeness of records can vary. Infrastructure data obtained from digitizing older analog maps may have inaccuracies of up to 20 meters, whereas recently surveyed data can achieve 25 centimeters of accuracy or better. Overall, the utility cadastre is estimated to contain data on nearly 100% of utility networks in Denmark.

Access to the LER2 system is available for a fee. Basic infrastructure data, such as roads, railways, and rivers, are openly available through the national geodata portal. More detailed utility records can be obtained by submitting an inquiry to LER2, which then contacts relevant infrastructure owners and compiles a comprehensive response.

Property surveyors play a partial role in developing and maintaining the utility cadastre. While large utility companies often have their surveying staff or contracts, the surveying process for documenting linear infrastructure can frequently be accomplished with more basic tools like GPS receivers. As AI and 3D modeling technologies advance, their integration into the utility cadastre system may enable more sophisticated applications, though most records currently lack height information.

Overall, the Danish utility cadastre provides a wealth of infrastructure data to support activities like construction planning, asset management, and emergency response. Continuous improvements to data standards, delivery mechanisms, and emerging technologies will help maximize the value and applications of this system in the future.

The Future of Utility Cadastre - 3D, AI and More

Utility data management in Denmark is evolving to leverage emerging technologies like 3D modeling and AI analytics. These innovations could provide significant benefits to utility cadastre systems.

Denmark has started adopting 3D modeling for utility data. Although 3D data is not yet distributed through the LER2 system, utility owners can store infrastructure data in 3D. In the future, 3D models may allow for more efficient infrastructure planning and maintenance. AI and machine learning also show promise for utility cadastre. Some companies are developing AI systems to generate realistic 3D views of infrastructure fields. While still in the early stages, AI could eventually help identify infrastructure issues, optimize asset management, and improve data accuracy.

To take full advantage of these technologies, Denmark may need to make 3D and AI-ready data more openly available. Although LER2 provides some infrastructure data to subscribers, most 3D and AI data must be obtained directly from utility owners. Wider access could spur innovation in the utility sector. Denmark may also benefit from developing data standards for 3D and AI to facilitate data sharing between utility owners and third-party developers.

Overall, 3D modeling and AI analytics are emerging frontiers for utility data management with the potential to significantly enhance infrastructure planning, maintenance, and safety. By making data more open and interoperable, Denmark can cultivate an ecosystem of public and private actors developing cutting-edge solutions for the utility sector. The future of the utility cadastre lies at the intersection of technology, data availability, and open innovation.

Conclusion

As you have seen, Denmark has developed an advanced utility cadaster system over many years. By developing close cooperation between utility companies and governmental agencies, Denmark now has a sophisticated model for recording and sharing data on underground infrastructure. The utility cadaster provides significant benefits to society in terms of cost savings, environmental protection, and public safety. With continued innovation and investment in new technologies like 3D modeling and machine learning, the Danish utility cadaster seems poised to become even more robust and useful in the coming decades. Overall, the Danish experience provides a model that other countries would do well to study and adapt to their own needs. Utility data is the foundation for building smarter, more sustainable, and resilient cities.

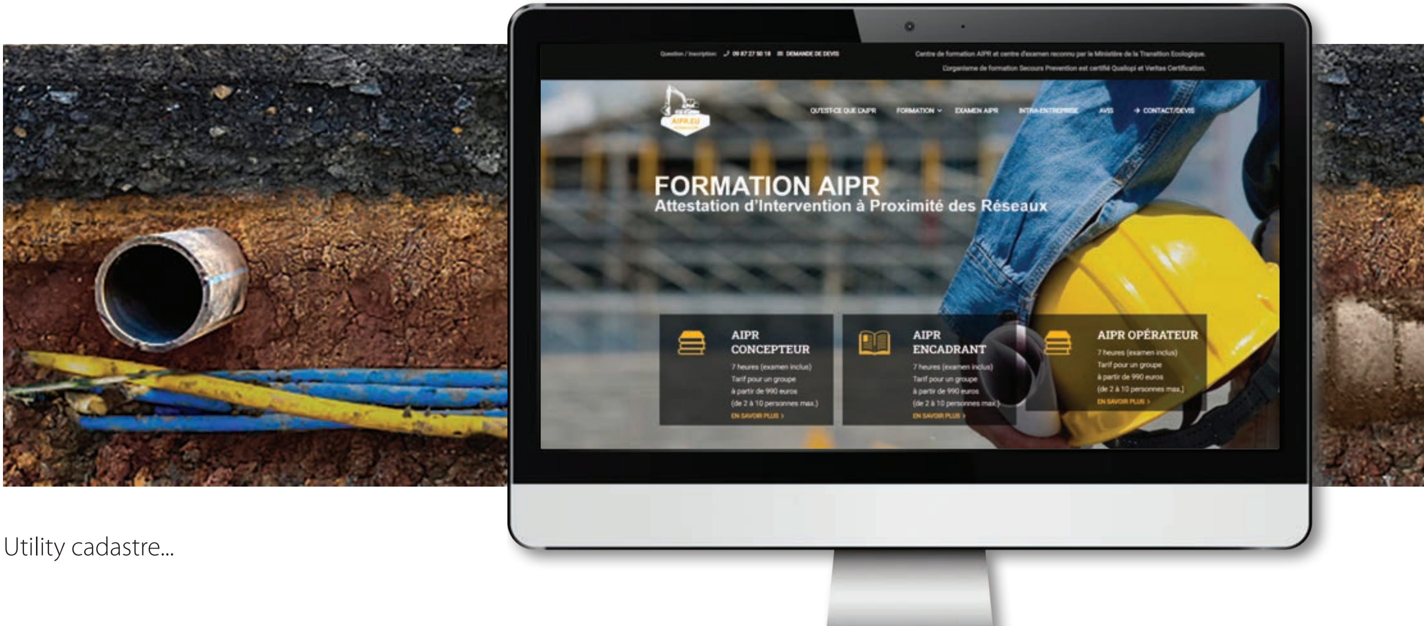
France (FR)

As a property owner or developer in France, understanding the Utility Cadastre system is essential to managing land effectively and avoiding costly mistakes. The Utilities Cadastre indirectly provides the data for a complete map of all public and private underground networks in a given area, from water and sewer pipes to electricity, gas, and telecommunications infrastructure. Access to the Utility Cadastre gives you a detailed view of what lies beneath the surface, allowing you to plan construction and excavation work with full awareness of any potential impact or interference with existing utility lines.

Although the Utilities Cadastre is primarily designed as a resource for public works projects and private construction planning, it also serves the interests of network operators by documenting the location and characteristics of their underground facilities. Managed by local authorities in France, the Utility Cadastre aims to provide a single source of truth about what lies beneath properties to meet the needs of both public and private stakeholders. Understanding how to access and use the wealth of information in the Utility Cadastre will help ensure that your projects proceed safely, efficiently, and with minimum disruption.

Legal Requirements for Utility Mapping in France

In France, utility mapping is governed by several laws and regulations to ensure standardization, accuracy, and safety. The 2011 decree made it compulsory to geo-reference and detect networks to specified levels of accuracy. There are two types of data: the first, which is easily accessible, concerns conventional networks. The second, more sensitive for various reasons such as safety, sustainability, or continuity of public services, is accessible with restrictions.



There are three levels of accuracy for utility mapping: Class A, B, and C. Class A requires the greatest accuracy, with a location uncertainty of 40 cm or less. Class B has an uncertainty of 1.5 m or less, while Class C is the least accurate, with an uncertainty of more than 1.5 m. Utility companies and surveyors carrying out measurements must achieve at least Class A accuracy for the networks concerned.

All utility mapping work must be covered by a works declaration (DT) or a declaration of intent to start work (DICT) sent to the network owners. They then have 7 days to respond. In the case of a class C network, the owner must carry out his investigations, at no cost to the applicant, to obtain a more accurate map of his network in the area covered by the declaration he has received. Measurements must be carried out by certified technicians, either by direct observation of the exposed utilities or using indirect detection technologies where it is not possible to excavate.

The results of utility mapping must be provided to network owners in a standardized format, with details such as the names of surveyors and technicians, the instruments and technologies used, the accuracy achieved, and georeferencing metadata. Random audits of mapping work can be carried out by digging down to visually inspect utilities.

Certification and training in utility detection and mapping are compulsory in France. AIPR authorization is required for any technician carrying out measurements on public utility networks. Network prospecting or detection companies must be certified and follow technical guidelines for utility mapping to ensure safety, accuracy, and compliance with regulations.

France has a strong legal and regulatory framework governing the utility cadastre to facilitate safe and sustainable land use and development. Mandatory requirements for accuracy, certification, and standardized processes aim to produce high-quality mapping of underground infrastructure.

The Georeferencing Process and Responsibilities

To establish an accurate utility cadastre, precise georeferencing and measurement processes must be followed. The project authority and contracted surveying companies have important responsibilities to fulfill.

The georeferencing process involves determining the exact spatial location and characteristics of underground utility networks. This process requires adherence to strict accuracy levels - A, B, or C - as defined in legal texts.

Class A, with an uncertainty of 40 cm, is mandatory for all utility networks. There is one exception: where technically impossible, class B georeferencing can be carried out. To achieve this, surveyors employ high-precision instruments and methods, like GNSS receivers, total stations, and ground penetrating radar.

The project authority is responsible for declaring the intent to start civil works (D.I.C.T.) and ensuring that the measurements and georeferencing are made to the required standard. The surveying company must capture and provide essential data, including :

- The names of technicians responsible for direct measurements, indirect detections, and final georeferencing
- The date measurements were taken
- The D.I.C.T. number
- The nature of networks surveyed (e.g. electric, gas, sensitive or not)
- The equipment used (brand, model number)
- The achieved accuracy level

The Utility companies must review and approve the georeferencing documents to confirm all necessary information was provided before work can commence. Random audits of the results may also be performed.

To summarize, accurately georeferencing utility networks requires adherence to strict standards, the use of high-precision methods, and collaboration between multiple parties. A sustainable living environment where underground infrastructure is protected during civil engineering works can be guaranteed when done properly.

Utility Mapping Industry in France

Utility mapping in France is an important industry that ensures the safe development of infrastructure. There are about 1800 companies certified to conduct georeferencing and utility detection in France. Of these, 70 geomètres experts, or licensed land surveyors, make up a large portion and are inherently certified to georeference utility data.

Utility mapping is crucial for sustainable infrastructure development and helps avoid accidents that could harm workers or disrupt services. By locating and mapping utility lines, cables, and pipes, developers, and municipalities can plan construction that avoids damaging existing infrastructure. Certified companies use technology like electromagnetic detection, ground-penetrating radar, and radio detection to locate utilities before excavation begins.

Utility mapping in France follows strict technical and legal requirements to produce reliable data for sustainable infrastructure development. Ongoing certification and auditing of utility mapping companies, as well as clearly defined accuracy levels and operator approval processes, help minimize risks as cities continue to grow and develop.

Conclusion

In conclusion, the utility cadastre in France is an innovative system that provides significant benefits to stakeholders and society as a whole. Compiling and organizing data on underground networks into an accessible digital format increases transparency, reduces costs, improves infrastructure planning, and enhances public safety. Though implementing the cadastre requires investments of time and resources, the long-term rewards to both the public and private sectors make it a worthwhile endeavor. Overall, the utility cadastre is a forward-looking initiative that leverages technology to create a more sustainable and efficient framework for utility management in the 21st century.

Germany (DE)

As an industrialized nation, Germany is dependent on a functioning infrastructure for the supply of energy. The availability of water, district heating, sewage, and communication networks is also essential.

A utility cadastre maps the location and details of underground infrastructure like electrical powerlines, Natural gas networks, water pipes, sewers, telecommunications cables, and district heating networks. This article explores how the utility cadastre in Germany came to be, how it works, and how it serves both public infrastructure providers and private property owners.

What Is Utility Cadastre and Why Is It Important in Germany?

Utility cadastre refers to the systematic documentation and mapping of public utilities and infrastructure Networks of supply and disposal. In Germany, the utility cadastre has been digitally recorded for the past 35 years to provide comprehensive documentation across the country. Infrastructure documented in the utility cadastre includes underground networks like water supply systems, sewage systems, electronic communications, electricity, gas, and heating systems as well as above-ground infrastructure such as roads, railways, airports power plants, waterworks, and power lines.

In summary, the utility cadastre is essential for infrastructure management, development planning, and public security in Germany. By providing systematic and complete documentation of public utilities and infrastructure, the utility cadastre enables infrastructure operators, government agencies, and emergency responders to fulfill their responsibilities effectively. With increasing dependence on infrastructure networks, utility cadastre will only become more important in the future.

Key Players and Processes Involved in Utility Cadastre

In Germany, the utility cadastre involves several key participants to document and manage underground infrastructure. Various utility and disposal companies act as network operators, responsible for specific types of infrastructure like electrical, natural gas, and water supply, sewage systems, electronic communication, and heating systems. These companies gather, process, and store data on their utility assets and networks.

Construction companies have a legal obligation to inform utility companies before excavation or construction. Utility companies must provide the necessary data to companies and individuals with a legitimate interest. This data, stored by municipalities or operators, should have a high degree of accuracy, between 10 to 20 cm for measured points.

Authorities typically oversee data on above-ground infrastructure like roads and railways. They store this information at a central, state, or municipal level.

Third-party surveyors, including property surveyors, surveying engineers, and topographers, may also gather data on behalf of network owners or operators.

While Germany lacks legislation specifically governing utility cadastre, laws like the Energy Industry Act obligate utility companies to provide technical security in building and operating their networks. Court rulings and technical standards from various industries also help establish minimum requirements for the scope and format of network documentation.

Overall, the utility cadastre in Germany involves the coordinated efforts of various private companies, government entities, and third parties to systematically document critical infrastructure data in a standardized way. By digitizing and centralizing this information, all key players can more effectively exchange data and collaborate to ensure a well-maintained infrastructure system.

Standards and Regulations Guiding Utility Cadastre

In Germany, there are no centralized legal requirements regarding utility network documentation. However, companies that operate critical infrastructure networks, such as those for energy, water, and telecommunications,

are obligated to ensure the technical security of their systems. This obligation implies that these companies must gather, process, and store data on their utility networks.

While no laws dictate how companies should manage their utility network documentation, court rulings have established some minimum requirements for the scope of analog or digital documentation based on current technological standards and practices. These standards outline procedures for surveying, measuring, and documenting utility infrastructure as well as define responsibilities. For example, standards for electric supply systems specify the contents and symbols required for electrical network plans in both digital and print formats.

In the absence of strict legal regulations, technical standards guide utility network documentation in Germany. Standards for individual utility types, such as electricity, gas, water, heat, and wastewater systems, establish best practices for surveying and mapping. These standards aim to ensure utility companies have accurate data to guarantee the security of supply, enable construction planning, and facilitate maintenance.

To protect critical infrastructure, Germany enacted the Critical Infrastructure Protection Act. This law requires utility companies to implement risk management and security measures for certain infrastructure types like energy, telecommunications, and transportation networks. While the law does not specify how companies must document their utility networks, accurate and up-to-date mapping is essential to securing critical infrastructure.

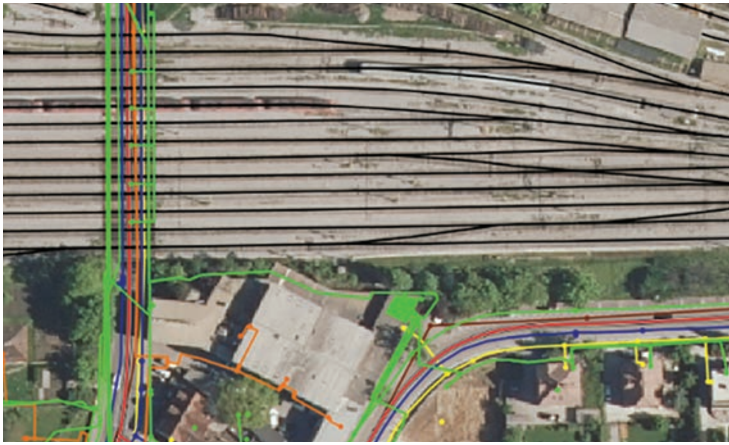
In summary, technical standards and regulations in Germany shape how utility companies approach asset and network documentation. By following best practices and risk management procedures, companies can gather the necessary information to safely operate, maintain, and protect their critical utility infrastructure.

Conclusion

So, in summary, a utility cadastre is an essential tool for coordinating and managing underground infrastructure in densely populated areas like Germany. By recording the location and attributes of utility assets and networks, it provides key information to planners, engineers, and emergency responders.

Although implementing a utility cadastre requires significant investment, the long-term benefits to public safety, environmental protection, and economic efficiency make it worthwhile. With careful planning and data management, a utility cadastre can become an invaluable resource for building smarter, more sustainable cities.

Overall, utility cadastres are a vital mechanism for navigating the complex challenges of the 21st century.



Slovenia (SI)

Slovenia's utility cadastre has been evolving for over a decade and today includes data on over 60 different utility networks. As it continues to expand and connect more systems, it's enhancing efficiency, safety, and quality of life for all Slovenians. An initiative that began as a matter of good governance has developed into a vital digital infrastructure in its own right.

Slovenia's Centralized Utility Cadastre System

Slovenia established its national Utility Cadastre system in 2005 to provide a centralized database of public infrastructure data. The system contains information on underground infrastructure, such as water, sewage, electronic communications, electricity, gas, and heating systems, as well as above-ground infrastructure like roads, railways, airports, and cable cars.

The Surveying and Mapping Authority of Slovenia (SMA) maintains the Utility Cadastre system and its data. Infrastructure owners and operators provide information to the SMA, which then adds it to the centralized database. The SMA follows European open data directives and provides all Utility Cadastre data freely through an online portal. Users can view and download reports for specific areas of interest that include both graphic and attribute data for all infrastructure. The SMA also offers a web service that provides infrastructure data for the entire country in an Esri shapefile format.

To ensure data quality, infrastructure changes, and new construction information must be submitted to the SMA through an official digital project report, complete with graphic elements, attribute data, and certification from an authorized surveyor. All data added to the system since 2017

is 3D-modeled and ready for use in artificial intelligence systems to provide a realistic view of infrastructure locations.

The Utility Cadastre system aims to provide a complete, accurate, and up-to-date overview of Slovenia's public infrastructure to facilitate planning, construction, and maintenance projects across the country. Continual improvements to data quality and the potential addition of legal status information could make the system an even more valuable resource in the coming years. Overall, Slovenia's centralized and freely available Utility Cadastre system leads the way for modern infrastructure mapping.

Accuracy and Completeness of Slovenia's Utility Data

To fully understand the utility infrastructure in Slovenia, one must consider the accuracy and completeness of the data in the utility cadastre system.

The utility cadastre contains information on nearly all utility networks in Slovenia, with data on approximately 98% of infrastructure captured. After almost 20 years of operation, the system has accumulated data on the vast majority of networks, though the quality varies.

The accuracy of the data depends greatly on when the infrastructure was constructed. Information on older systems transferred from analog maps may be less precise, while data on newer networks, captured through modern survey techniques before installation, can be extremely accurate, within 0.1 to 10 meters. All changes and new construction have been delivered to the Surveying and Mapping Authority (SMA) in a digital format since 2017 and are available in 3D models ready for use in artificial intelligence applications.

While the utility cadastre provides a wealth of data on the location and attributes of infrastructure networks across Slovenia, it lacks information on the legal ownership of these systems. The SMA is drafting legislation to upgrade the current technical system by recording the legal status of individual networks. Adding ownership data would provide a more complete picture of utility infrastructure and enable better management and protection of these critical assets.

With ongoing improvements to increase accuracy, provide 3D modeling and legal status, and capture any remaining utility networks not yet documented, Slovenia's utility cadastre system is a robust and valuable resource. Continued maintenance and upgrades will ensure it remains an effective tool for government agencies, utility companies, and other organizations well into the future.

The Role of Surveyors in Slovenia's Utility Cadastre

In Slovenia, authorized geodetic surveyors, known as property surveyors, play an essential role in the utility cadastre system. Property surveyors are responsible for forwarding all changes and information regarding newly constructed infrastructure networks to the Surveying and Mapping Authority (SMA) of Slovenia. This includes providing graphic elements as well as attribute data for the networks in a specified transfer format.

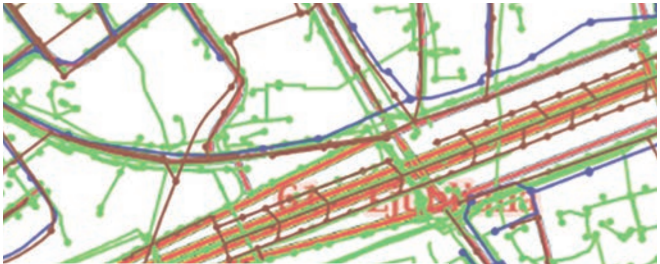
Property surveyors must attach a certificate with an authorized seal to verify the information. Only certified property surveyors are permitted to maintain Sloveniaâ€™s utility cadastre system by inputting data and ensuring its accuracy.

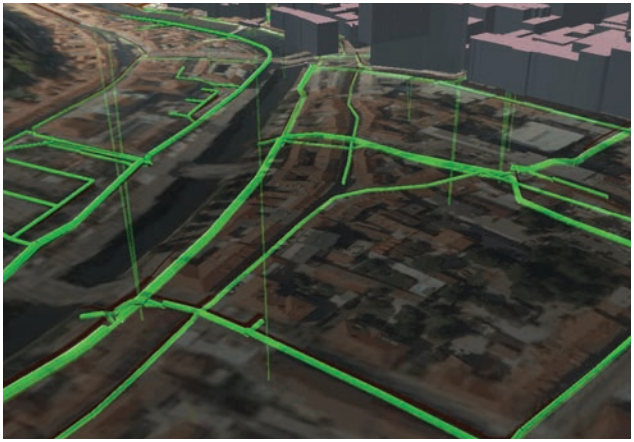
The utility cadastre's open data portal allows any user to obtain reports on infrastructure networks for a self-defined area of interest. This includes accessing graphic and attribute data on all infrastructure within the selected area. There are also web services enabling users to obtain data on individual infrastructure networks across the entire country in an Esri shapefile format.

Overall, property surveyors play an integral role in Slovenia's utility cadastre system by verifying and inputting data on infrastructure networks to ensure the information in the system is as comprehensive, up-to-date, and accurate as possible. Their work helps provide transparency regarding the country's utility infrastructure and enables effective management of these critical networks.

Conclusion

As you have learned, the utility cadastre is a critical infrastructure for any modern society. In Slovenia, significant progress has been made to develop a comprehensive national utility cadastre over the past decade. However, more work remains to fully realize the benefits of an integrated, digital system. With continued government support and strategic private-public partnerships, Slovenia is poised to complete its utility cadastre and serve as a model for other countries working to modernize infrastructure data management. Though the road ahead is long, the rewards of improved efficiency, sustainability, and economic growth will make the journey worthwhile. The future is bright for Slovenia's utility cadastre.





Spain (ES)

As an essential infrastructure system within any modern society, utility networks require careful management and oversight. In Spain, a utility cadastre system helps ensure efficient operation and governance of utility networks across the country. The utility cadastre is a digital mapping system that provides detailed spatial information on the location and characteristics of utility networks.

The utility cadastre thus acts as an important planning and management tool for ensuring that utility networks across Spain can operate safely, sustainably, and reliably into the future. By providing a spatial record and overview of these vital systems, the cadastre supports the effective governance and development of utility infrastructure across all levels of government and industry. Overall, the utility cadastre plays an integral role in guaranteeing essential services for citizens and enabling the functioning of contemporary society.

What Is the Utility Cadastre System in Spain?

The utility cadastre system in Spain is a spatial data infrastructure that provides information on public utilities and infrastructure. Its main purposes are to facilitate the management of these assets and enable better decision-making.

The utility cadastre includes data on both surface and underground utilities. Surface utilities refer to visible infrastructure like roads, railways, and power lines. Underground utilities include pipelines and cables for services such as electricity, water, sewage, gas, and telecommunications.

Mainly, surface utility data is collected and maintained by Spain's national cadaster agency, the Dirección General de Catastro (DGC). All that data is nationwide continuous and freely available to the public through the DGC's electronic office, the Sede Electrónica de Catastro (SEC).

However, more detailed utility data provided by other sources (such as utility companies) may require payment of fees and demonstration of legitimate interest.

The utility cadastre provides economic benefits by improving the efficiency of infrastructure management. It allows utility companies and government agencies to locate and monitor their assets, plan maintenance and expansions, and avoid interference with other utilities. For citizens, the utility cadastre promotes transparency and accountability regarding public services.

While surveying engineers play an important role in collecting and managing spatial data in Spain, utility surveying and mapping don't require a regulated Surveying Engineer signature as in some other countries. However, professional organizations like the Regulatory College of Surveying Engineers in Spain, Ilustre Colegio Oficial de Ingeniería Geomática y Topográfica (COIGT), aim to strengthen the surveying profession and push for more regulated standards and requirements. The utility cadastre system reflects gradual progress toward a more robust spatial data infrastructure in Spain.

Key Players and Legal Framework Behind Spain's Utility Cadastre

Spain’s utility cadastre system involves several key organizations and laws. The Dirección General de Catastro (DGC) oversees the national cadastre, while the Dirección General de Seguridad Jurídica y Fe Pública (DGSJFP, DGRN before) oversees the national land registry. The Sede Electrónica de Catastro (SEC) is the cadastre's electronic office, providing online access to records. As well as DGSJFP’s cartography is also available in geoportal.

Relevant laws include the INSPIRE Directive 2007/2/EC, which establishes an infrastructure for spatial information in the EU, and Spain’s Ley 14/2010, which transposed INSPIRE. The utility cadastre is mandated under Annex III of INSPIRE and Annex II of Ley 14/2010.

Ley 13/2015 coordinates the cadastre and land registry. A joint resolution by the DGC and DGSJFP establishes technical requirements. The cadastre provides information on surface utilities like roads, railways, and power lines; whilst underground utilities like electricity, water, sewage, telecommunications, and gas networks might be provided by private companies (if available) under legitimate interest and at a cost. Records note the location, extent, and attributes of utility infrastructure.

While utility data is often available for free through the SEC, some information may be unavailable or approximate. Surveyors and engineers collect and manage the data, though certain property jobs require certification. The goal is to provide information to facilitate administration, policymaking, and commercial activity. Regular updates help ensure accuracy and usefulness.

Spain's utility cadastre has improved thanks to organizations like COIGT and ASOTEX, which aim to strengthen the profession and share knowledge. By following European directives and improving access, Spain’s cadastre helps enable an efficient infrastructure and utilities sector. Overall, the utility cadastre provides a vital service to Spain and its citizens.

How the Utility Cadastre Captures Critical Infrastructure Data

The utility cadastre in Spain maps both underground and surface utilities, providing data on critical infrastructure. Underground utilities like water, sewage, gas, and telecommunications lines are mapped, as well as surface features such as roads, railways, and power lines.

The utility cadastre aims to capture the location and attributes of utility networks to facilitate planning and development. Data on underground utilities prevents damage during construction and enables emergency response. Information on roads, railways, and power lines aids transportation and infrastructure management.

Surface utility data is available through Spain's electronic cadastre office for legitimate uses at no cost. While underground utility maps may lack precision, surface feature data is fairly accurate. Certain sensitive infrastructure like military bases or nuclear power plants may have restricted access.

Surveyors and surveying engineers play an important role in collecting and managing utility cadastre data, though professional certification is not always required. There have been calls for tighter regulations and an official certification program to ensure data quality. Professional organizations like the Association of Experts in Cadastre, Property and Valuation (ASOTEX) advocate for the surveying profession in Spain.

The utility cadastre provides an essential spatial information infrastructure for Spain. Continuous improvements in data capture, management, and access will help maximize the benefits of this critical resource. Overall, the utility cadastre in Spain captures vital data on infrastructure to support planning, economic activity, and public services.

Conclusion

In conclusion, the utility cadastre in Spain has established an efficient system for managing underground infrastructure and ensuring the safety and continuity of utility services. By implementing a comprehensive digital database of utility networks across the country, Spain has enabled more effective planning, reduced service interruptions, and minimized damage during construction and emergencies. The utility cadastre provides substantial benefits not only to utility companies and government agencies overseeing infrastructure but also to citizens and businesses relying on essential services. Overall, the utility cadastre demonstrates how innovative data management solutions can drive improvements in both public services and quality of life.

Switzerland (CH)

As a property owner in Switzerland, you are likely familiar with the cadastre system that records details about land ownership and boundaries. However, you may not be as well acquainted with the utility cadastre, an important complement to the land cadastre. The utility cadastre provides a comprehensive record of the location and characteristics of underground infrastructure like pipes, cables, and tunnels on private and public property across the country.

By documenting the precise position and technical specifications of utility networks, the utility cadastre facilitates coordinated planning between utility companies, property owners, and communities. It allows all parties to understand where infrastructure currently exists and where new installations can be accommodated to minimize disruption, cost, and environmental impact. With increasing urban density in Switzerland, the utility cadastre is an essential tool for the efficient and sustainable management of critical infrastructure.

The Origins and Purpose of Switzerland's Utility Cadastre System

Switzerland's utility cadastre system originated from various political initiatives recognizing the insufficient documentation of underground infrastructure. The Federal Council commissioned a study to determine if a national utility cadastre was needed and how it should be implemented.

The 2017 feasibility study found a utility cadastre would meet needs and be welcomed by cantons without existing systems. Recommendations were for federal coordination and cantonal operation. The goal is consolidating existing cantonal systems into a homogeneous national cadastre defining purpose, goals, and quality requirements to enable cost-benefit analysis for further decisions.

A working group was formed to analyze creating a utility cadastre in Switzerland (LKCH) providing clarity on feasibility and requirements. The LKCH aims to comprehensively and reliably document above-ground and underground infrastructure promptly to:

- Reduce risks of infrastructure damage during construction.
- Enable eGovernment and digitization of spatial planning and processes.
- Contribute to the secure provision of energy, water, communications, and waste management.

The LKCH contains infrastructure routing, location, and attributes as defined in SIA405, representing space used for different media and enabling coordination without replacing utility information for construction.

Public LKCH access varies. Permanent users register for full access and downloading. Small extracts are free with ID. A display service, PDF extracts, and map extracts have no geographic restrictions.

Surveyors play an important role, in managing transport pipelines and the LKCH as envisioned in the Swiss Cadastre 2014. They must engage in these processes to become key players. The LKCH is a major step forward in cadastre management and a challenge in comprehensively understanding land conditions and use.

Key Components and Services of the Utility Cadastre

The utility cadastre in Switzerland consists of key components and services to document underground infrastructure in a standardized manner. The primary elements are:

1. Data from utility network owners. Utility companies provide details on their utility networks, including geometry and attributes. This forms the basis of the cadastre.
2. Municipal registers of utility network owners. Municipalities maintain records of which utility companies operate in their area. These registers are provided to the national utility cadastre.
3. Data aggregation at the cantonal or regional level. Depending on the canton, regional geographic information system offices or data integrators collect and compile utility data before sending it to the canton or directly to the national utility cadastre.
4. Public access services. The utility cadastre offers various public access options, including data extracts with the complete data structure, geometric extracts (maps), a display service, and PDF extracts. Permanent users can access full datasets through registration. Smaller area extracts are freely available using an ID.
5. Defined data content. The content of the utility cadastre is defined based on the Swiss Standards Association's guidelines. It includes the geometry and selected attributes of utility networks to serve as an orientation and coordination tool, though it does not replace utility company's detailed records.

Image source: The brochure, "The Swiss Cadastral System: a basis for security and prosperity"

The utility cadastre plays an important role in efficiently and safely managing Switzerland's underground infrastructure. By providing comprehensive and up-to-date documentation of utility networks, it aims to reduce risks, enable digitalization, support infrastructure planning, and contribute to a secure supply of resources. Overall, the utility cadastre is a vital service for effectively governing subterranean spaces.

The Role of Surveyors in Managing the Utility Cadastre

Surveyors play an essential role in developing and maintaining a utility cadastre. They are responsible for accurately mapping utility infrastructure to create a digital record of its location and attributes.

Surveyors collect data on utility networks through field surveys, using specialized equipment to detect the locations of underground pipes and cables. They record the horizontal and vertical positions of utility lines, as well as details such as material, age, and owner.

The surveyor's job does not end with data collection. They must integrate the collected data into the utility cadastre system. This requires ensuring the data meets the standards for accuracy and format established for the cadastre. Surveyors use GIS and CAD software to digitize maps, upload field data, and link records to the digital maps.

Utility infrastructure is continually expanding and improving, so the utility cadastre must be updated regularly to reflect changes. Surveyors conduct resurveys of utility networks to capture new installations and upgrades. They also verify existing data by comparing digital records to conditions observed in the field. Outdated or inaccurate information is corrected to provide the most up-to-date view of utility assets.

Beyond building and maintaining the cadastre, surveyors provide consultation on how the data can be used. They help determine appropriate levels of access for different user groups based on the sensitivity of utility data. Surveyors may also advise on analysis and planning uses of the cadastre, such as for construction projects that require knowledge of underground networks.

In summary, surveyors are instrumental in developing an accurate, reliable, and useful utility cadastre. Through their work collecting, integrating, updating, and consulting on utility data, surveyors enable effective management and coordination of critical infrastructure.

Conclusion

You now have a high-level overview of the Swiss Utility cadastre, an essential system for managing critical infrastructure networks across the country. By recording the location and attributes of utility lines, pipes, and cables in a standardized digital format, the cadastre provides a single source of truth for planning authorities, utility companies, and emergency responders. With comprehensive and up-to-date data on these vital networks, the cadastre enables the safe and sustainable development of communities and helps ensure the continuous and uninterrupted flow of resources on which we all depend. Though complex in scope, the Swiss Utility cadastre is a model of efficiency and transparency that benefits both government and citizens alike.

CONCLUSIONS AND RECOMMENDATIONS

IMPORTANCE AND HARMONISATION

All owners of utilities are aware of the importance of a good knowledge about the 3-dimensional position of their infrastructures (i.e. location and depth), especially in densely populated areas. This information is critical for security, planning and ownership reasons.

Most European governments have understood this importance and are regulating the matter but their approaches are very diverse. At the European level and often even at the national level, there is no harmony whatsoever. It's not our priority to obtain improvements in this field. However, on the long run it would be recommendable to develop more coordinated approaches.

STRESS TESTS AND SECURITY

More coordination would enable Europe to perform comparative stress tests. For other sectors such as the banking system, such stress tests are well established. Large scale failures of energy networks for instance can have similar adverse effects and should be monitored with the same caution.

Geodetic and property surveyors aren't typically in charge of national or regional security questions. However, observing the various approaches in the field of data security in a broad sense of the term, we do recommend a European security policy. Utilities are at risk due to natural disasters (earthquakes, landslides, floods, etc.) as well as during manmade disasters (cyber-attacks, conflicts, wars, etc.). We are not aware of the development of a unified security strategy although we are convinced that this would be an absolute must.

RECOMMENDATIONS FOR UTILITY CADASTRES

» Utility Cadastres, an absolute must

A utility cadastre is a good way of preventing damage, optimising interventions and securing property rights / easements. Even if it is difficult to quantify, a high return on investment generated by such cadastres is certain. It suffices to think about the avoided accidents and the resulting reduced volume of corporal and material damages.

Most of the countries in Europe have, or are in the process of developing, a solution for managing their utility cadastres.

» Comprehensiveness and accessibility

These utility cadastres must be comprehensive and their use must be straightforward, via a centralised access and a necessarily decentralised update and maintenance.

This requires user-oriented approach, not only for consultation purposes but also for quick and easy updates. A control system must also be put in place.

» Legal and financial sustainability

There are many different networks with different characteristics, which is why it is necessary to have a solid legal basis to be able to deal with them all.

The solution put in place must be financially sustainable, and its coordination must be ensured by the authorities.

As always, precise exchange standards are required to enable effective surveys to be carried out by professionals.

» The role of property surveyors

Typically, the intervention of property surveyors is mandatory when property rights and easements are concerned. However, their expertise is also welcome for all other cases. For cost management, a quality management and control by property surveyors might be sufficient in some cases.

That's why, it's important to involve Surveying organisations in the development of Utility Cadastres, a soon as from the conception phase, especially in emerging countries were nothing has been done so far.

» Required high level education

Keeping the importance of the matter in mind, the Universities and Technical High Schools educating geodetic and property surveyors must prepare them for these very specific tasks, not only for data collection purposes but also for data management and maintenance.

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