Technical Infrastructure and GIS in Czech Municipality

Technical infrastructure in urban areas using a data model in a GIS environment

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Abstract-The project deals with the administration and data management of the technical infrastructure in urbanized areas of the Czech Republic (CR). It focuses on data management in the private sector and in state administration. The research compares the data models in a GIS environment available in the CR. It proposes an intelligent solution for the storage of networks using trenchless technologies and associated technical infrastructure management. It recommends a high-quality data model in a geodatabase for data recording by state administration.

Keyword- technical infrastructure, spatial planning, data Model, GIS, no-dig technology, trenchless technology, INSPIRE

I. INTRODUCTION

The 2006 Building Act, among many other fundamental changes, introduced a new tool as a spatial planning substrate in the CR, called Spatial Analytical Data1 . The basic idea of this tool is to put all data on areas, including technical infrastructure, in one place and continuously update this data as well as provide it to the designers and processors of spatial plans as a relevant basis with information about the area, especially its limits, intentions and problems in the area.

With this tool, the Building Act got ahead of time and set up a good foundation at the level of municipalities with extended powers for the implementation of the INSPIRE2 European Directive, which came into force on 15 May 2007, five months after the effective date of the new Building Act. [1]

These are primarily technical infrastructure (TI) data, which essentially fulfill this directive through the form in which they are managed, maintained and updated.

An idea of the specific form is given by implementing Decree No. 501/2006 Coll. on spatial analytical data, spatial planning documentation and method of recording the spatial planning activities. However, it does not give exact instructions on what form the SAD should have, yet we can say that all municipalities with extended powers (MEP)3 stood with the registration, evaluation, processing and publishing method in the spirit of the INSPIRE European Directive.

The basis for this article was a research project regarding a specific research of the student grant competition SP2015/15. The research was based on the conclusions of the inquiry proceedings within the MEP and regions across the CR. The conclusions are also based on the practical experience of the authors.

II. MODEL LOCALITIES

The project was applied to two model localities. The first area was MEP Jihlava which is located in the

Vysocina Region. The second was MEP Kravare located in the Moravian-Silesian Region. MEP Jihlava consists of 79 municipalites. The city Jihlava has 50,000 inhabitants and functions as a county and statutory seat.

1 Spatial Analytical Data (SAD) is a set of continuously updated cartographic and descriptive data about the territory that characterizes the current state of the territory, its values, limits and opportunities for further development. This tool is usually conducted in a structured geodatabase, records and updates performed by spatial planning authorities for the individual MEP (204) in the CR

2 INSPIRE - INfrastructure for SPatial InfoRmation in Europe is an initiative of the European Commission. The eponymous European Commission and Council directive aims to create a European legislative framework required to build a European spatial data infrastructure. It sets out general rules for the establishment of a European spatial data infrastructure, in particular to support environmental policies and policies that affect the environment. The main objective of INSPIRE is to provide higher quality and standardized spatial information for the formulation and implementation of Community policies at all levels of the Member States.

3 MEP – term defined in Act No. 128/2000 Coll., on Municipalities in the Czech Republic

The second model location selected by the researchers was MEP Kravare with only 9 municipalites. The town itself has 7000 inhabitants and functions only as a municipality with extended authority. .

Selecting the above mentioned localities provided us with the possibility of comparing two different approaches to TI data administration and publishing, as well as contrasting the extent and complexity of TI management at areas with different degrees of urbanization.

III. TECHNICAL INFRASTRUCTURE DATA MANAGEMENT BY THEIR ADMINISTRATORS

Technical infrastructure data are mostly managed by their owners or administrators and operators. Currently, the TI administrators usually use several information systems. These are mainly the Operational Technical Information Systems (OTIS) of distribution companies in the areas of water, gas, energy management and telecommunications, which cannot do without the use of geographic information system (GIS)4 , based on high quality input data. [2] [3]

Data conducted by their administrators are passed onto spatial planning authorities under the Building Act, where they are kept in their database and used for evaluating the analysis of the territory's sustainable development, the creation of drawings regarding the limits, intentions. The quality and format of transmitted data varies based on how the data providers differ, such as the type of recorded infrastructure, size, history and other.

When looking at the technical infrastructure data and management, it is evident that in many cases this is done by an uncoordinated improvisation and the technical infrastructure's management in the area is in a poor state. The solution offers several infrastructures, from technical channels to sidewalks or roadway edges, the utilization of a trenchless technology using the combined management of the technical infrastructure in the technical channels or collectors. Municipalities with extended powers, which have a say in land-use management and can begin to enforce new trends in the restoration and management of the new TI, should take on this task. This power will be strengthened by the amendment to the Building Act, after which the zoning authorities will become the concerned body in the land management process and will write

binding opinions that will be enforceable at the time of implementation. [4]

A. *MEP Data Models*

The smallest regional self-governing unit of the Czech Republic, which has the statutory duty to manage technical infrastructure data as part of the spatial analytical data, is a 3rd degree community, a municipality with extended powers. Currently, the most widely used data models in terms of general use in the CR are the following models:

DMG of Hydrosoft Veleslavín, Ltd.

DM SP&SAD of T-MAPY, Ltd.

DM SAD JMK of AGERIS, Ltd.

Custom-made

Distribution of the data model usage in the Czech Republic is shown in the following cartogram.

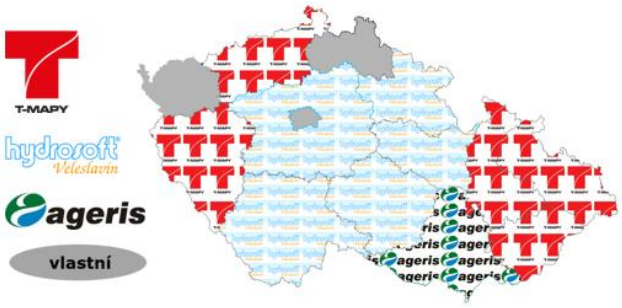

Figure 1. Data model used by regional municipality of Czech republic.

B. *The optimal data model*

A brief comparison of selected data models with their main characteristics is presented in the following summary table:

T-MAPS	DMG hydrosoft	Custom-made
Control attributes	Simplicity	Simplicity
Symbols in the attributes	DM expansion	Development under control
Data model management	Independent of SW	Customized
SAD <-> SP	DMG->MINIS	Basis from the existing DM
GIS/CAD	Free for MEP	Without division
STAV_ID		
Symbology - LYR		
T-MAPS <-> DMG		

Figure 2. Comparison of data models.

The selection of the correct data model could affect the formation of spatial analyses in the future. As a principle, the more distinctive the states and descriptive attributes of metadata, the better.

The researchers believe, based on experience, questionnaires and empirical comparison, that currently the most appropriate data model for recording the technical infrastructure in the Czech Republic is the T-map data model by the multinational Swedish consortium the T-Kartor Group. The main advantage is a detailed model design, its implementation and connection to the data provided by their owners – the interconnection of attributes (metadata). The data model is also accompanied by a pre-prepared logical symbology, which highlights the advantages of this solution.

The researchers selected the T-map data model as the most suitable and applied it to chosen model localities.

IV. TYPES OF DATA PUBLICATION

A methodology for data management was unfortunately not presented with the power of the new Building Act and its implementing regulations, and a unified data model for the entire country was not deployed in a way such data recording would deserve. The regions realized the need to deploy a unified data model, and so they mostly chose to introduce a unified model at least in their administrative territory. Because of the fact that it

4 Geographic Information System (GIS) is a computer based information system for the acquiring, storing, analyzing and visualization of data, which have a spatial relationship to the Earth's surface. Geodata the GIS works with are defined by their geometry, topology, attributes (metadata) and dynamics.

was an improvisation, each region faced the problem differently and thus there is a diversification of the solutions. However, with the upcoming amendment to the Building Act, a unification of the ambivalent status will occur, since the amendment paves the way for nationwide SAD in the CR. Therefore with regard to the unification and transfer of data in the MEP-> region> Ministry of Regional Development hierarchy, it offers to finally unite the data models into one common model across all levels.

Regional authorities proceeded to publish data outputs and regional SAD data in their regional geoportals, making use of the most common data models or using their own solutions.

Each level of the state apparatus approached the publication of SAD data, not just the technical infrastructure data, differently. The law only defines that the data are supposed to be published in a way enabling remote access. The law can be fulfilled in the following ways:

Raster publication – tiff - geoportals, flash publications, data are not fully interactive

Static presentation – PDF - simple publication in PDF file

Vector presentation – vector data display with reference to interactive questions – metadata of the displayed phenomenon, vector presentation of the technical infrastructure data, e.g. using ArcGIS online.

Optimal data publication according to project participants with respect to current trends in geoinformatics is available at URL: http://goo.gl/bejHZW, and it is an interactive display of geographic SAD data from the Kravare and Jihlava MEP, including metadata.

V. Conclusion and recommendations

Student project 2015/155 aimed to assess the state of information recording and management regarding the technical infrastructure not only in urban areas, comparing data models used at the administrative level, selecting the best data model and applying it to model areas of selected municipalities with extended powers.

One of the positive findings of the project was the fact that technical infrastructure data are becoming more enhanced and improving in the time projection of regular updates and there is a tendency to work on further refinement and improvement, not only by data owners and managers, but also by the state apparatus.

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