CONCEPTUAL MODEL OF GEOTECHNICAL INFORMATION SYSTEM

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ABSTRACT

Geological, geodynamical and hydrological research in Zagreb area resulted in several spatial data of different lineage, coordinate systems and resolution. The goal of this paper is the gathering of data in a unique geotechnical information system, which will be the basis for further analysis.We are using ArcGIS modules for spatial and geostatistical analysis. Geotechnical information systems can be used to prevent, mitigate and alleviate damage caused by the natural disasters such as earthquakes and landslides. However, the geotechnical data bases have not been utilized extensively. Examples of using the data bases this chapter for seismic hazards assessment, planning for new structures, ground water hydrology, disaster mitigation systems of gas pipelines, and infrastructure management systems are presented.

1. INTRODUCTION

Urban planners have a difficult job, having to map out the future needs of business and the community and provide the best possible environment in which to live and work. They must take into account political, economical, environmental, legislative and social requirements for both urban and rural environments. Geotechnical issues appear well down on the list of planning considerations and are often poorly understood, yet they can have huge impact on development feasibility and costs. Unfortunately, it is often only after mistakes have been made that attention is turned towards geotechnics.

Geographic Information Systems (GIS) have become a prevalent method of analysis in civil engineering. Flexible GIS models that manipulates, compile and process spatial data above or below the earth's surface have provided a powerful tool in civil engineering applications. Realizing this, City of Zagreb decided to address this niche area by providing a geotechnical Geographic Information Systems solution cum services which are desktop geological applications, bore hole study, ground engineering, geotechnical engineering, environmental engineering, rural, urban and regional planning.

2. GEOTECHNICAL INFORMATION SYSTEM

The conventional approach to these site investigations can be an arduous task. Existing data sources are found in a variety of hard copy and paper formats such as maps, reports, books, aerial photos, etc. Integrating these data together with photos, notes, borings, and other site specific data can require a significant portion of the effort expended during the preliminary investigation. Less time may be spent on data analysis and acquisition than on data integration. Also, reproducing the work may take as much time as the initial production. Using a GIS to aid preliminary geotechnical site investigations can greatly improve the efficiency and effectiveness of these investigations (Styler et al. 2007).

GIS has been defined as "a fundamental and universally applicable set of value-added tools for capturing, transforming, managing, analyzing, and presenting information that are geographically referenced". Most data utilized in geotechnical site investigations have spatial attributes, that is, they can be located at a point in space. The power of GIS is that it can link maps and photos directly to data describing their features and allows data to be searched and analyzed spatially. Layers of data, known as "coverages", can be readily combined to provide a wealth of information about a site and can be added or removed from a base map by turning layers on or off (AGS 2005)

Each company has a complex data according to their needs. This is one of the main problems, because it must be systemized and standardized for further usability (Figure 1).

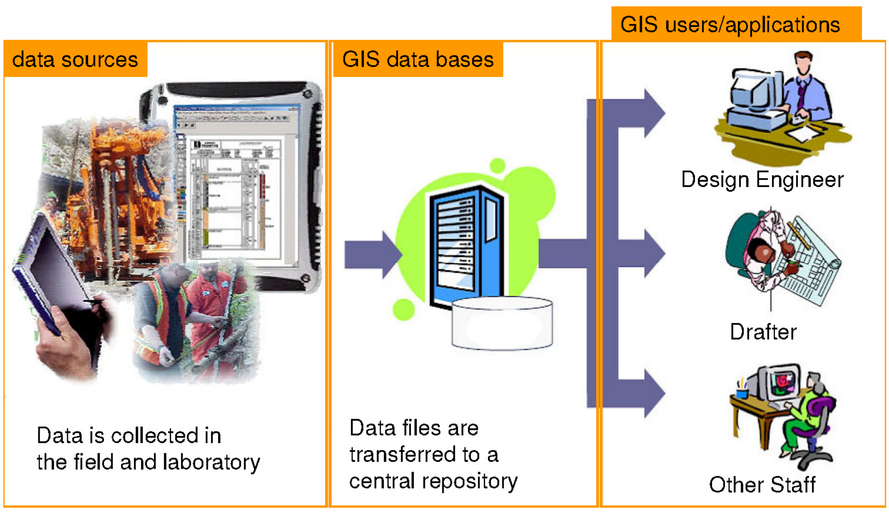

Figure 1. Geotechnical database in a company.

We will then be able to create Geotechnical Virtual Data Center (GVDC). First User requests records from GVDC then GVDC request records from Data Providers. Then Data Provider locates and transletes record into XML files On the end GVDC delivers XML files or SVG graphics to the user (Figure 2).

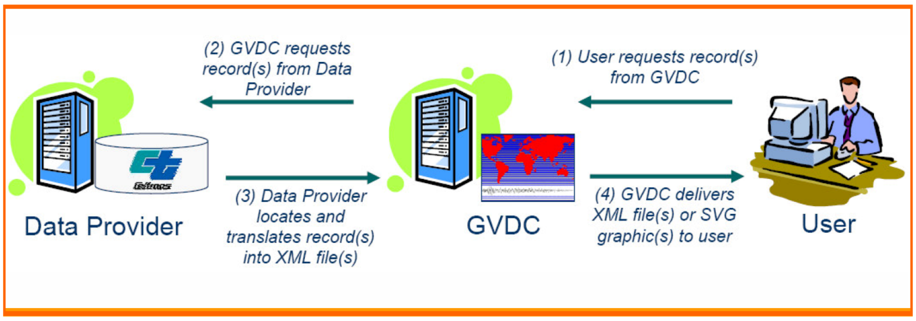

Figure 2. Geotechnical Virtual Data Center (GVDC).

Geotechnical data archive of the City of Zagreb was established in 1961 for collecting reports about geotechnical, seismic and hydrogeologic investigation. Paper based archive and reports for period from 1961. to 1993.

Essentially, the problem is that the databases and applications we are working with have been designed to store data for geological maps but we are not just map maker, we are also a data custodian and supplier. When you focus on maps you putting a tremendous amount of geological information into the text entries on a map legend, so effectively we have ended up with a lot of data locked away in free text database fields. In addition we have the same data duplicated across a number of systems. Ultimately it is difficult to:

Keep these data in synch; and
Use them for analytical purposes

Finally we have found ourselves dependent on proprietary data models and formats. GIS vendors often supply a complete solution from the application down to the data storage tying us strongly to a particular vendor This means we have to do a lot of conversion work when delivering data; and Changing software vendors can be a time consuming, non-trivial exercise (Jellema et al. 2004).

A modular design philosophy was adopted with the intent of minimising the dependence on proprietary information systems and models. We started with a data model that focuses on geological principles, not our software or products. We have built a data store based on this model using a pair of integrated spatial and non spatial databases. We're now building a layer of services that handles the management and integration of the data in meaningful chunks that could be used by client interfaces and systems. These interfaces may have been acquired or developed ourselves specifically for the project; or belong to external parties or organisations. Data are to be delivered to our clients using open standards compliant mechanisms. Predominantly Web Feature Services using GML, and community applications of GML like GeoSciML and XMML and so on (Toll 2001).

3. CONCLUSIONS

A better mutual appreciation of the roles of Urban Planners and Geotechnical Engineers is vital if we are to make the best use of the available expertise to improve the quality and reduce the cost and impact of future developments on society and the environment. Better collection, collation, presentation and dissemination of geotechnical information will reduce the risks of encountering unforeseen ground hazards. The interpretation and presentation of geotechnical information in a format that considers key urban planning issues would facilitate the work of planners and developers. Centralised, web-based Information System for geotechnical related issues to enhance accessibility and quality of data, information and clarify the organisation of the Zagreb Geo-Community.

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