

# Gis for Land Management: An Overview on Italy

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**Key words:** Cartography, Land Management, Spatial Planning, Urban Renewal, Spatial Information, Environment

## SUMMARY

The introduction of the use of Geographic Information System (GIS), by many European cities of different dimensions and importance, became a necessity in the complex evolution of the urban and territorial phenomena.

The all sectors that deal with land analysis and management, consider GIS application a useful tool for integrating and analysing data from different formats, scale and coordinate systems, according to specific cognitive objectives. For each of these aspects, everything is based on land survey and its precise and accurate graphic and cartographic representation, where the main technical figure, also in Italy, is represented by Surveyors.

More advanced public administrations use these systems for spatial and not spatial data processing, to transform the data into information, for integration of different data type, for analysing and modelling phenomena that occur on the terrestrial surface, offering a qualified technical support for improving land management on decision making at political, administrative and strategic level.

Environmental protection, environmental impact studies, areas location, definition of use classifications, green areas management, definition of risk areas, gathering, control and analysis of environmental pollution data, garbage management, Cultural Heritage, these are some of the application fields where also the Italian Surveyors are involved, trying to adopt and let administration adopting GIS platform.

Public administrations turn constant attention towards GIS e Web-GIS, attracted from the various advantages offered by these technologies, but often the limited budget available to the public administrations does not allow them to adopt the use of these technologies.

In this presentation it will be broadly represented the Italian GIS situation, with some examples of these applications within land management field. Particularly noteworthy is the work performed by a team of young Sicilian professionals, coordinated by experts topographer surveyors, carried out the survey and the creation of an underground Cadastre of the historical centre of their city in order to promote their activities.

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## **1. THE PROJECT**

“Il Catasto del sottosuolo – subsoil cadastre” is a pilot project for underground services mapping of Mazara del Vallo (Sicily), where the technical figure of young Surveyors has played a fundamental role in the execution of the work.

The project, born from an idea of the Provincial College of the Surveyors of Trapani and from the synergy between the administration of Mazara del Vallo, with the Surveyors Professional Organizations such as the National Council, the Provincial College and the Social Security Fund Institute of Surveyors, has seen the participation of some young Surveyors registered to the Professional Register of Surveyors and the involvement of a team of young trainees Surveyors, coordinated by expert topographers Surveyors with proved experience.

The work, lasting one year, was characterized from the use of new technologies and tools for carrying out analyses necessary for the complete understanding of the territory, in compliance

with the regulation of the “Directive of the Ministry of Public Works” of 3<sup>rd</sup> March 1999” with subject “Rational underground system of technological installations”.

According to this Directive, Provincial Capital Municipalities and cities with a population over thirty thousand citizens or with a high seasonal tourist impact, have to draw up an organic plan for the rational use of the underground (Urban Plan of Subsoil Services) that is part of the General Town-Planning Scheme – “Piano Regolatore Generale” (PRG).

#### The survey

The survey has been carried out recording and mapping underground services, with the support of aero-photogrammetric maps, the PRG of Mazara del Vallo and the Cadastral Cartography. These documents have been digitised and graphically represented, with the creation of a data base available on Mazara del Vallo Municipality web site, allowing every professionals to know exactly and in real time which and how many services are placed in a particular area of the subsoil.

The digitization of the General Town-Planning Scheme and other procedures enabled to allow citizens-users get real-time news and certifications on urban planning are necessary innovations added to this tool.

This project enables, indeed, a Cadastre of the subsoil, which allows the correct monitoring of underground services, a better design of the paths of the new networks or the modifications of the existing ones, and is an important help for the municipal administration to define the priority of resources allocation.

Data acquired and catalogued has been geo-referenced and graphically represented within a web-oriented GIS, in order to allow the online usability and an optimal communication between council offices and consumers.

## **2. THE TEAM OF SURVEYORS**

Four teams have been organised in order to proceed with the survey and the graphic restitution of data acquired. They were composed of four Surveyors and one workman. Two of the Surveyors were young trainees; the third was a young Surveyor registered to the College of Surveyors of Mazara del Vallo Municipality and the fourth was an expert that coordinated the work.

All professionals have been trained with a two weeks long course, to provide them with a wider knowledge about GPS and GIS tools, focusing on theory and practice of fundamental disciplines that let them face soon with the field survey.

### **2.1 Instruments**

The Surveyors were provided with a hand held computer (Leica Geosystems GS20) with a receiver and integrated antenna GPS in order to collect data for creating and updating GIS data, allowing measurements with sub-meter precision.

The GIS software chosen for the data acquisition platform was the one used by Mazara del Vallo Municipality for its land management: KARTO of Miduell Informatica of Belluno.

For data post-processing was used GISDatapro that allows import/export, visualisation and processing of data acquired with GS20.

## 2.2 Operative steps

Urban and extra-urban areas were divided into four sectors, covering an area of about 828 ha of the 27.000 ha of the total council area, each of them assigned to a team of Surveyors.

The detected underground services were:

- Hydraulic system
- Sewer system
- Methane gas system
- Public illumination system
- Electricity system

For each network was recorded the exact position in respect the road, the deepness and the diameter of the pipelines (both for water and sewer systems). All data was then reported on the digital cartography in different layers for each street of the four sectors.

## 3. SURVEY OPERATIONS

The Real Time Kinematics (RTK) method has been used for the positioning of the points, with intervals of 10-20 seconds and relating to a permanent station of the network ASI-*Agenzia Spaziale Italiana*, named NOTI, 230 km far away from Mazara del Vallo, because at the moment of the survey the interested city was not provided with permanent stations.

When the satellite signal was low, the points were positioned using the “*fuori centro*” method and insert manually after measurements were taken with a metric tape.

While the GPS points were gathered, the surveyors entered the related attributes in the database.

### 3.1 Data acquisition transfer

Every day data acquired on the field were downloaded into the central system at the SISTR office of Mazara del Vallo and then data registered from the permanent station were retrieved in order to download the RINEX files of the survey day.

Data from the field were processed using GISDatapro and then the coordinate were transformed from WGS84 into Gauss Boaga, the coordinate system used from the offices of Mazara del Vallo. This allowed a first verification of acquired data quality, compared with the digital cartography. Another control has been done on the results of the calculations, in order to verify whether the mean square deviation of the survey were acceptable and were within the accuracy limits required in relation to the scale of representation of the cartography used.

### 3.2 The base cartography

Data related to the networks recorded, were imported and edited on the raster base of the aero-photogrammetric cartography of Mazara del Vallo, previously geo-referenced and created for the digitization of the new PRG.

The cartography is composed by twenty-two aero-photogrammetric tables with scale 1: 2000 of 1987, then digitized and geo-referenced into Gauss-Boaga system, necessary not only to organize the vector data, but also as a base for updating and reading all the related attributes not present in the vector model (such as toponymy, technological systems and so on).

### **3.3 Network drawing**

Networks were drawn and maps were created for each of them, in order to make easier their management from the different council offices in charge of it. The different maps, with the same reference system, can be overlapped and consulted allowing a complete vision of the underground services and their interferences, necessary for a correct and efficient planning and maintenance operations.

The CAD available in the software Karto, allowed creating a graphic-numeric cadastre where enter, archive and update the geometric characteristics of the networks.

## **4. PUBLICATION OF THE WORK**

Data obtained with this survey has been recorded on a magnetic support and distributed to all professionals of Mazara del Vallo. Furthermore, data have been made available online on the city's web site, for consultation from the operators of the sector and from the company suppliers of the services, in order to give them a complete vision of the available underground services.

The result of this notable work will be the base of future works; it will be registered and updated with new installations of underground services. The system is a useful tool for professionals, technicians of the municipality offices, foreman and workers, for planning maintenance interventions, querying and updating GIS data.

## **CONTACTS**

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