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Space Applications Institute

Proceedings

Stresa, Italy, 28-30 June 1999

5th EC-GIS Workshop

Edited by **K. Fullerton**

EUROPEAN COMMISSION
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Printed in Italy

FOREWORD

Since 1995, the European Commission has recognised the importance of Geographic Information (GI) and Geographic Information Systems (GIS), both to the continued development of the European Union and as a potential market of billions of euros of software, data and services. To foster the growth of this market the Commission has sponsored a number of strategic activities, notably GI2000 - European GI Policy Framework and the EC-GIS Strategic Development for Europe initiative.

The 5th EC-GIS Workshop was organised as part of the JRC's GI&GIS project and provided a forum for presentation of GI and GIS projects sponsored by the European Commission, and enabled consultation and cross fertilisation of ideas between the developers and other participants.

The 5th EC-GIS Workshop, "GIS of Tomorrow" saw an increased participation both in the number of speakers and attendees. This reflects the growing recognition of the important role of GI and GIS in the Information Society. In addition to presenting GI and GIS projects, there were also more general presentations on European issues relating to the current evolution of GI technologies, standards and markets. A special session was also held to prepare a background document for a European Geographic Information Infrastructure EGII cross action line in the 5th Framework Programme.

The 5th EC-GIS Workshop was sponsored by the GI&GIS Project of the Space Applications Institute, Oracle Corporation and ESRI Germany.

Many thanks are due to Ulrich Boes, DG Information Society, initiator of the workshops, and to Robert Peckham, ISIS, JRC, organiser of the previous three workshops, for setting such a high standard.

Special thanks are due to the Public Relations Unit of the JRC, in particular Mrs. Dorit Schlittenhart, who helped in the organisation of the Workshop and to my AMS colleagues, Ioannis Kanellopoulos and Alison Munro.

Karen Fullerton
SAI, JRC - Ispra

http://www.ec-gis.org/

Contents

PLENARIES

Application of the HISTOCITY Method to mobility analysis and scenario definition in the city of Florence, Italy

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Abstract

The presentation refers to a study developed for T.A.V. (Treno Alta Velocità) high-speed trains and the Regional government of Tuscany on the mobility in the historical centre of Firenze. In the study, a specific analysis has been designed to show the variables involved in the solution of the historical centre mobility problem. The current scenario has been integrated with future projections to predict the impact on Florence after construction of the new high speed train station. Data regarding all transportation modes as well as demographic and urban data have been considered in an integrated analysis, based on the HISTOCITY method.

The study is based on data acquisition by ARC/INFO from various sources and particularly from the transport simulation software, this work package has been supported by Christiane Bohener of EC-JRC-ISIS of Ispra. The final results have been managed and reported using Arc-view 3.0a layouts.

Introduction

This study is based on the integrated analysis method that is being defined in the HISTOCITY Network research community. The research is part of the Project on the Historical Cities Sustainable Development funded by the European Community in the Programme Training and Mobility of Researchers – Euro-conferences (1998-2000). The aim of the Project is to link young researchers with senior scientists operating in multi-disciplinary topics concerning the study of sustainable development in European historical cities. The goal of the application is to integrate two different means of analysis, that of transport engineers and the urban designers by following the basic steps of the Histocity method.

Project Partners

The Project Partners are: the local Regional Government, the T.A.V. , the train engineering services division with experts in the transport simulation, consultants like the HISTOCITY Scientist in charge, a private company with experience in urban planning and the GIS_L.A.B (Land Application Builders) laboratory.

Aims of the Project

The goals of the project were to assess the current mobility systems of Florence compared to future scenarios after the building of the new high-speed train station in the historical centre of town. Projections were forcasted beyond the year 2005, taking into account the mobility system as well as urban planning.

To reach this aim, we have approached the problem using an integrated analysis to compare available transport networks with the current urban planning situation and future projects. To maximise results the project group also referred to analysis methods in both fields, urban planning and transportation, and integrated these two different analyses, generally conducted separately, in accordance with the HISTOCITY method.

Project Steps

The Project has been developed in six main steps, following the HISTOCITY integrated method:

1. The definition of variables, resources and targets;
2. The individuation of transport and urban models, in terms of entities and relationships, based on the zoning of the area of study;
3. The selection of data among a broad series of datasets already available from different organisations and conducting data quality assessment (sampling, meta-data catalogue, testing);
4. The implementation of a GIS database with Arc-Info (definition, structuring, acquisition, implementation);
5. Arc-Info Import/Export procedures to acquire simulation outputs;
6. Transportation simulation using EMME2 software;
7. The analysis of urban systems currently involved;
8. The definition of alternative scenarios, both less and more probable to occur after the construction of the new high-speed train station beyond the year 2005.

The first step was particularly difficult due to conflicts found in the documents defining urban policy, despite a thorough resources inventory. In the study, a weight has been assigned to each variables set in relation to the selected targets.

Targets	Variables			Relative weight	Weight
	Socio-economic factors	Co-ordinated actions of environmental protection	Territory infrastructures		
Urban functions accessibility	35	\	65	30	100
Transportation modes options	15	25	70	30	100
Surface occupation	\	60	40	20	100
Environmental impact	\	\	\	Constant	0
Economy	\	\	\	Constant	0
Safety	70	\	30	10	100
According to users needs	70	\	30	10	100

***Table 1** - Urban Mobility Objective/Variables strategic matrix in Firenze case study.*

In relation to step 2, the study modelling has been oriented to define the demand and supply for transport, to describe the socio-economic model (employed population refereed to the zones, resident population per zones etc.), to define the mobility catchment area (wider than the Florence administrative area and dependent upon the transportation type), the transport networks and facilities. The zoning of the area is based on a clustering of census zones.

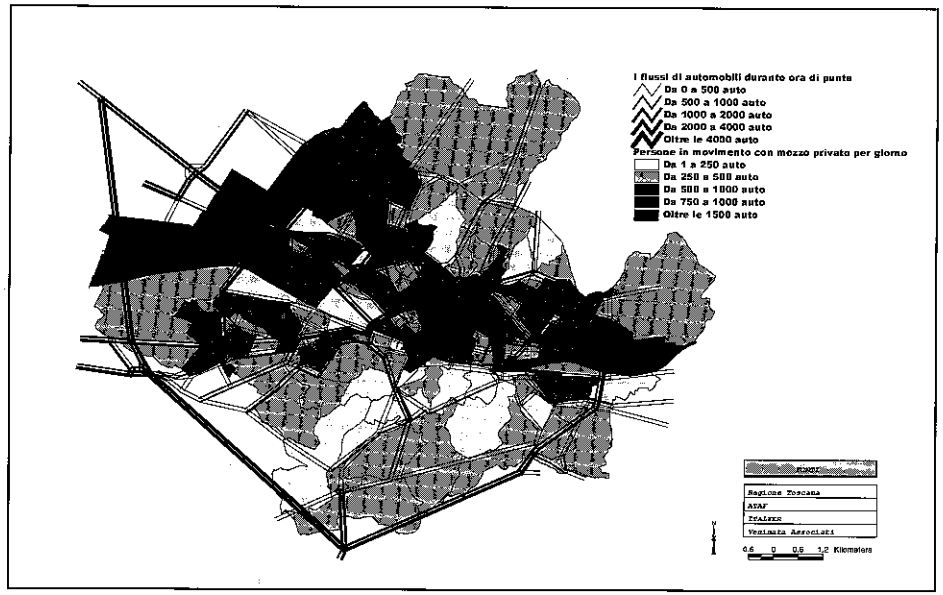

***Figure 1** - Scenario of Firenze beyond 2005: traffic flows and movement among city zones (based on MIT forecast).*

During step 3, the data selection has been made among a broad series of datasets already available from different organisations. The data types chosen for implementation are the following:

- Geographic data of the area of study, updated by Corinne remote sensed data and using detailed datasets of the Municipality;
- Population data;
- Road, railway networks data, updated by the transport experts of the project;
- Commuters flow data;
- Built asset data.

After gathering the data, a quality assessment (sampling, metadata catalogue, test) assured the effectiveness and usability of data. It should be mentioned that numerous problems have arisen in using ISTAT (Italian Statistical Institute) demographic data, both for the format of data as well as the contents which are often incomplete.

In step 4, the definition, structuring, acquisition and implementation of the Arc-Info Databases was developed. All datasets directories have maintained their original names to facilitate the origin of the data supplier.

The most critical work package of the study was step 5, the definition of the Import/ Export procedures to integrate the transportation simulation results, obtained using the EMME2 software, with the GIS application. Most of the problems originated from the original data format, based on a proprietary format that was necessary to modify using a software script to import records.

The main contribution of the study to the urban planning decision processes comes from steps 7, 8, 9: the creation of the visualisation of data related to the involved urban systems, including transportation networks, and the comparison of alternative scenarios. The scenario comparison showed that the catastrophic scenario predictions (based on MIT forecasts) looks less probable for Florence beyond 2005 because of already-planned improvements in public transportation and the popularity of bus use in the historical centre of the city. It also showed that the foreseen new transportation facilities may to be sufficient to meet the demand. In conclusion, the localisation of urban functions hugely affects traffic flows and the two aspects cannot be planned separately.

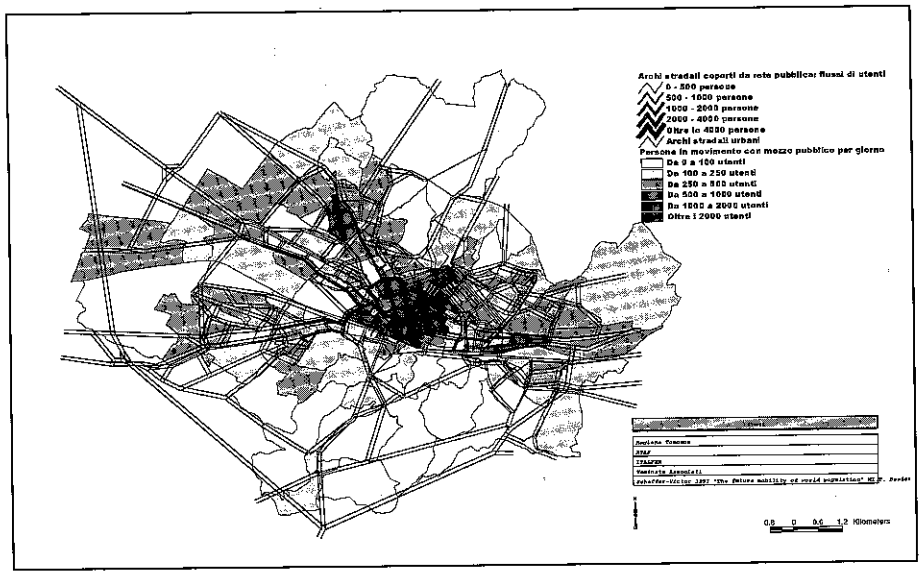

Figure 2 *- Scenario of Firenze beyond 2005 Public transportation users among city zones total input-output (based on MIT forecast).*

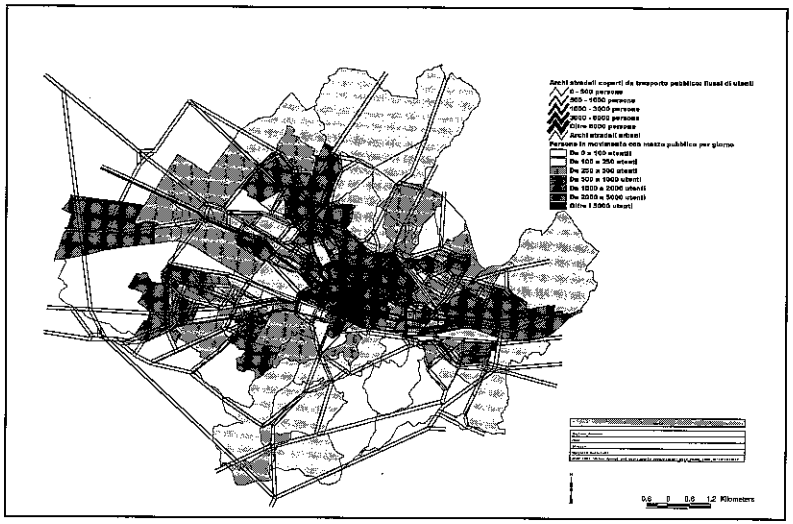

Figure 3 *- Scenario of Firenze beyond 2005 Public transportation users among city zones total input-output (based on ECMT forecast).*

The following planning design hypothesis has been chosen based on the results of comparison between the future and present scenarios and in accordance with the predicted increase in transportation systems.

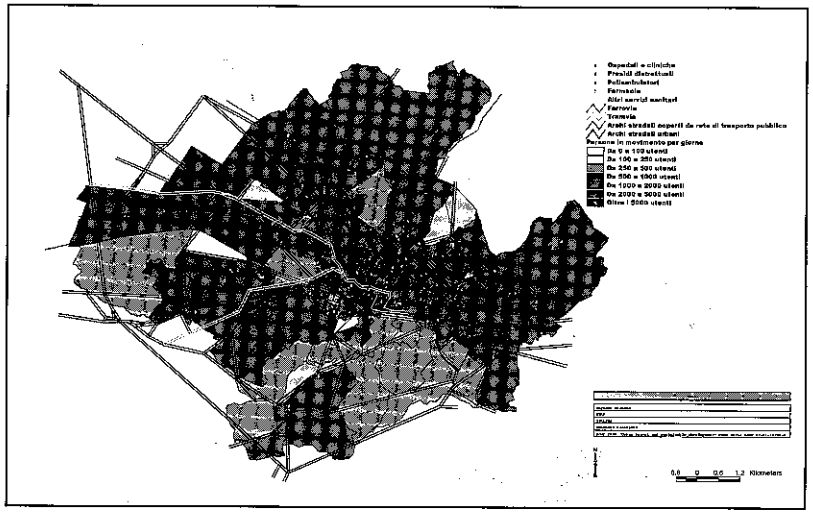

Figure 4 *- Total movement foreseen in Firenze beyond year 2005 compared to new poles location, commerce facilities, new road network, public transportation and new railway facilities (ECMT forecast).*

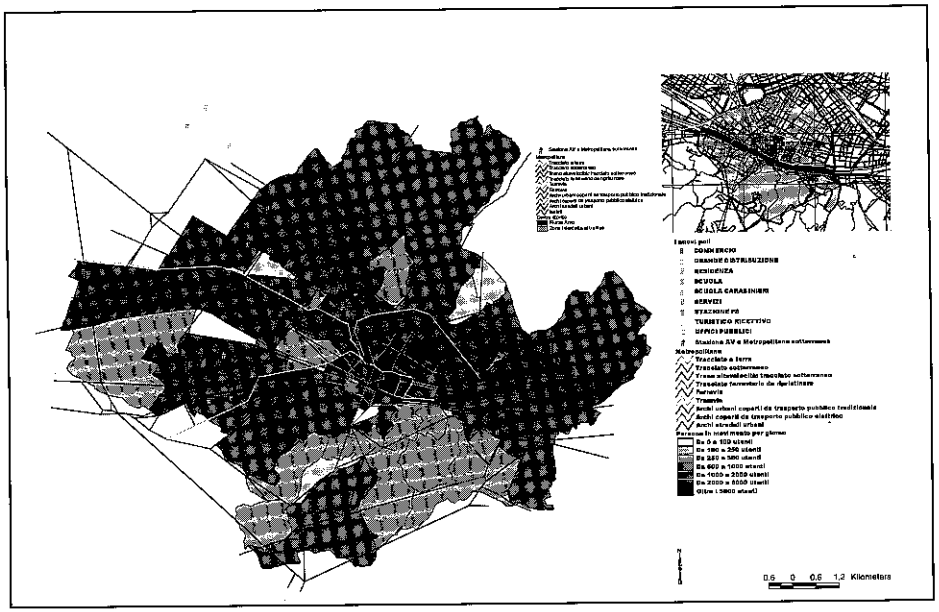

***Figure 5** - Case study of Florence: a possible design solution in agreement with the highest weight objectives (transportation modes options, surface occupation, safety, user needs).*

A further study extension could verify the sustainability of such solution making the variables/resources matrix more detailed and being supported by a multi-criterial analysis.

Conclusions

In addition to the results of the study, the project also proved a valid testing ground for the HISTOCITY method. The discussion of these results show that the presented decision process technical support cannot be started without the definition of strategic framework and also the current standard GIS cannot manage dynamic simulations (i.e. transport simulation, matrixes, multi-criterial approaches) in an integrated way. It should be a future expected advancement in GIS technology providers.

In fact, the study is an example of the kind of problems that arise from integrating just two points of view of different disciplines in the urban analysis. At this point it becomes necessary to create a multidimensional view for more complex analysis, capable of representing a reliable model of the historical city. Therefore, the hypothetical project presented in the case study (selected on the basis of weighted targets) could be assessed using a more detailed framework, including a more extensive division of objectives.

Furthermore, current results should be considered a starting point for refining the HISTOCITY method, particularly in the theoretical area but also in the assessment techniques area.

The_City
On-line navigational environmental city information

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15780 Zografos (GR), Greece
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Abstract

THE_CITY delivers a validated GIS software technology (a generic s/w "Tool-Kit", TK) This TK is utilised by city departments and other interested parties to develop city-relate environmental applications such as environmental maps on demand, and city environmenta navigation, on the Internet via any *commercial* Internet browser (e.g., installed on a cit *InfoKiosk* or any PC). The use of a standard commercial browser for city-GIS databas navigation, on the Internet, is a technological innovation of THE_CITY and is expected t be used by thousand of cities by year 2000+.

1. Project Rationale

Millions of citizens world-wide are keen to obtain free information on a specific city and it environment; Information such as: where is the closest park? what is the pollution today? where is the nearest bus stop for a bus to a specified area?, where is the nearest parking an the way to it?, where is the specific bank on the city map?, where is the museum on th map?, what cultural activities are offered this week in citizen-specified theatres close t their leaving?, how can I reach a location in the fasted way?, what is the population densit in a user-selected area?, how can I reach by taxi the airport in the fasted way at a specifi hour? what is the weather likely to be tomorrow?, what are the working hours of a publi authority?, what are the schedules of selected transport systems as train?, what are the rate of selected tourist sites, hotels, attractions?, what is the telephone number and the locatio on a map of a citizen's residency?

World-citizens have a demand for «*gratis, on-line, and navigational*» information t be obtained with *standard* Internet browsers (e.g., Explorer, Netscape). Citizens (and in broader sense, any type of city-server *client*) are not interested in the acquisition o specialised s/w. Citizens use systems only when they can "*access-and-get at no cost*". Thi purpose is accomplished by THE_CITY, as a deliverable for public benefit.

2. Project deliverables

THE_CITY delivers a validated GIS software technology (a generic s/w "Tool-Kit" TK). This TK is utilised by city departments and other interested parties to develo city related environmental applications, such as environmental maps on demand an city environmental navigation, via the Internet using any *commercial* Internet browse

School Planning confronted with demographics and transportation networks using GIS

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1 *Primary Keyword*

Public service management

2 *Secondary Keywords*

Demographics, transports and scholastic networks.

3 *Abstract*

The subject of this study is a GIS for the analysis of catchment areas in order to forecast enrolments and then plan the suited scholastic network. The problem of school management may be resolved only with a multidisciplinary approach: in fact it is necessary to integrate data regarding demographics, transport and schools' in order to evaluate the scholastic network.

This study is a collaboration between:

- Comuni of the Provincia di Lucca
- Provincia di Lucca.
- Provveditorato agli studi di Lucca.
- Faculty of Architecture, Florence;

4 *Description*

5 *Customer's Need*

In Italy there is a lack of basic information systems for school management. This situation increases the necessity to create a database and especially a GIS, since geographic location is a major factor in the choice of schools by students. The GIS is necessary in order to analyse the actual or planned school network asset.

School planning is the result of an agreement by a number of bodies:

- the *Provveditorati* for the management of teachers and other personnel;
- the *Comuni* and *Provincie* for the management of school buildings.
- public or private Transport firms

Besides there are other bodies that have to express their opinion regarding the planning proposals, so it is quite important the external communication of the actual and planned school network asset.

6 *Method*

Making and implementing this GIS has needed:

- The definition of the data model.
- The definition of spatial queries in order to obtain decision support, especially
  - Models of public services spatial distribution analysis.
  - Mathematical models for enrolments analysis and forecasting.

This model is the most important point of the entire work: in fact as students can enrol where they wish, it is necessary to implement flow models (spatial interaction models) usually adopted for commercial services. These models give information about alternative assets based on:

- demographic variations;
- school network asset variations;
- accessibility variations.

7 *Results*

The system gives information about the spatial relation between schools and population, and permits to forecast enrolments in order to overlay this data with buildings' capacity.

The system gave to Provveditorato, Provincia and local public bodies the decision support information in order to dimension school institutions for applying the "Bassanini" law.

This Information System looks very useful nowadays especially in Italy, in which for the next years is planned the increase the period of compulsory permanence at school: it is necessary to have an evaluation of the actual school network in order to edit new utilisation plans.

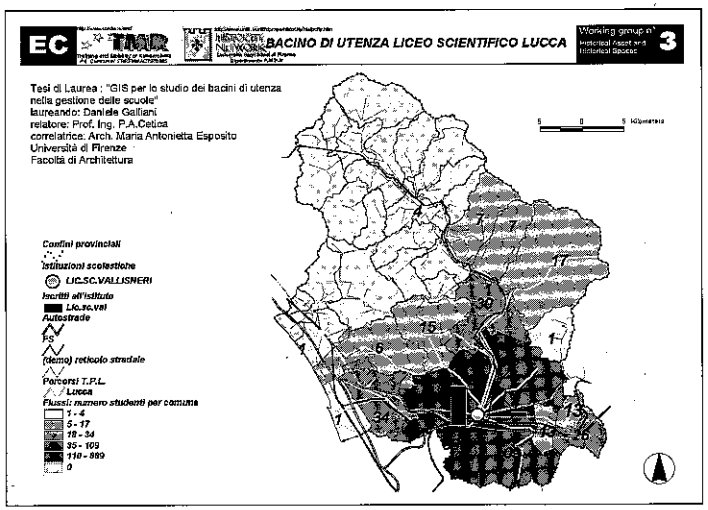

Figure 1: *catchment area of a school*

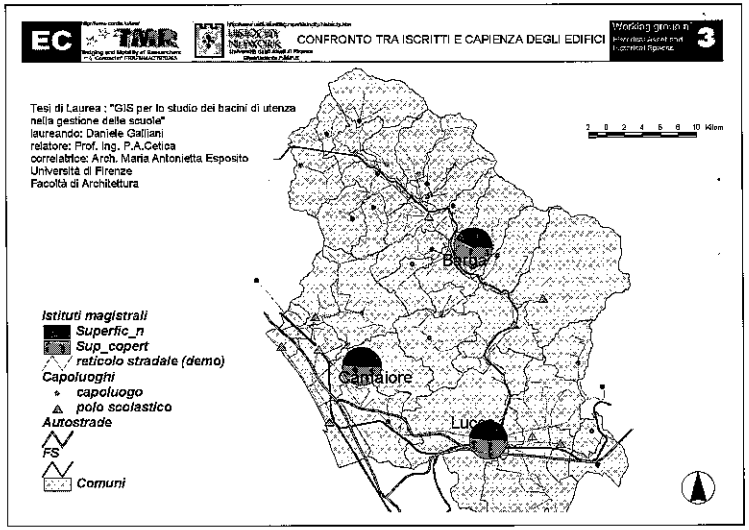

Figure 2: Relation between necessary and actual square of schools

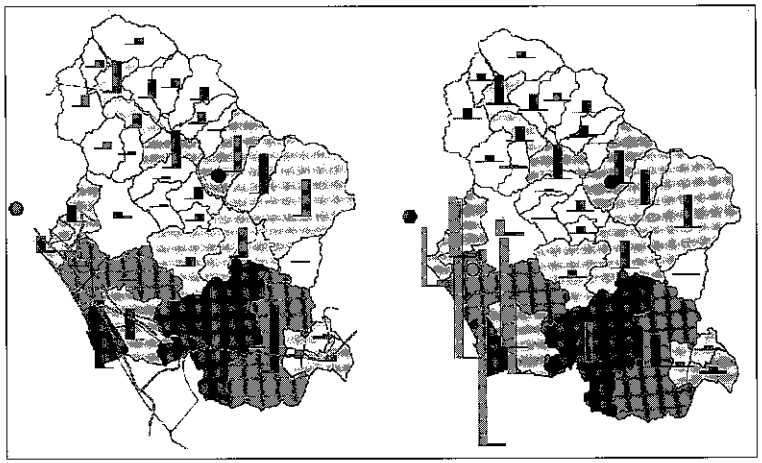

Figure 3: Impact in enrollments of the institution of a new school

Spatio-Temporal Visualisation in Naturdetective and Beyond

GIS for monitoring glacio-nival environment in mountain regions

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Mountains and high plateaux occupy approximately 20 percent of the global land surface, and are the source of significant water resources. Some 25 million people reside permanently at elevations of 3,000 m or above, and millions more visit high elevations for summer and winter tourism and sports. Hence, knowledge of the present climate regimes of mountain regions, and understanding of their variability and sensitivity to change, are of vital importance to scientists in many disciplines. In view of their enormous economic importance for winter tourism as well as for water supply, records of snow cover and glaciers in mountain areas have begun to receive considerable attention.

The development of geo-computer science provides new opportunities for management of huge volumes of the information from all areas of geographical knowledge, including the science of snow and ice in plains and mountains. These opportunities have become a reality through the central role of the cartographic model, the basic tool of geographical researches, in the structure of geographic information systems (GIS). Twenty years ago, the creation of the World Atlas of snow and ice resources began, based on recent geographical information and current theories of glaciology. The main purpose of the Atlas is to provide global and regional estimates of snow, ice and melt water resources, and to characterise regime, variability and prospects of utilisation of natural ice.

Natural ice is of great importance for climate, fluctuations of the sea level, and the river run-off. It is critical for the power production, irrigation of arid areas, transportation of great amounts of water, construction and recreation in polar and alpine regions. For insufficiently studies areas, special methods and techniques were developed through comprehensive research, conducted specially for this purpose. It consequently became possible to compile, for the first time, maps of solid precipitation, temperature conditions, snow cover and runoff in alpine areas. The maps were compiled with due regards to the indicative role of glacio-nival phenomena.

Over the same period the wide adoption of the system mapping methods and statistical methods, and then electronic mapping, took place in geographical science. Now, automated mapping using GIS has a primary place in geographical studies. Geo-computer science is the synthesis of geography, computer science, theory of information systems and cartography. As a result we can see and apply the continuous process of map creation and map use in which cartographic models, their transformations, analysis and synthesis form continuous chains.

Glaciology, the part of geography, concerning the science about nature ice, was one of those best suited for the application of modern geo-information methods.

In the World Atlas of Snow and Ice Resources there are maps of all mountain

A GIS for historical asset management

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Keywords:
Primary Keyword: HISTORICAL ASSET
Secondary keyword: HISTORICAL CITIES, URBAN PLANNING

Summary:
The aim of this application is to provide a way to include the geographic data about historical asset into standard urban planning activities. The study has been developed for the Urban Planning Department of the province of Seville (Spain).

Description

Customer needs

In the Urban Planning Department (Departamento de Urbanismo) of the Province of Seville (Diputación de Sevilla) the planning activities are assisted by a GIS, used mainly to visualise information about the territory. This GIS lacks data about monuments, thus reducing the efficacy of the tool. The Diputación needed a Data Base Management System to collect, analyse and print data about monuments. All the data collected needed to be geo-referenced as well to allow spatial analysis and the production of thematic maps automatically.

Method

The DBMS proposed in this work has been developed starting from the official cataloguing methods used in Italy by the "Istituto Centrale per il Catalogo e la Documentazione", which are derived from the general methods for cataloguing the cultural patrimony proposed by UNESCO.

The first step was to identify the different basic types of monuments, which are: buildings, gardens, archaeological sites and, lastly, complexes. Complexes are the result of the aggregation of the first types of monuments and are used when the concept of cultural patrimony applies to the whole group other than to the single elements. All of these entities have their own particular attributes used to describe the monument in detail.

The structure of the database can be expanded to deal with more specific data, depending on the needs of the GI system. Tests have been conducted including data for urban/land planning activities as well as data about the financing of restoration works.

After the first design step, the structure of the database for the Diputación was made compatible with the existing database of the Instituto Andalúz del Patrimonio Histórico, whose competence is collecting data about monuments of Andalucia. This

allows easy exchange of data between the two catalogues, which can also be integrated into a single catalogue. The compatibility is achieved using the same logical names for the shared attributes and the same logical structure of the database.

The procedure to collect and store the data of the catalogue starts from the analysis of the territory to get basic knowledge of its history and to identify the most important sites and monuments. Then it is necessary to collect all the documentation about these monuments, including taking pictures and drawings illustrating the current state. Finally the territory and the monuments can be catalogued by filling out the forms of the DBMS. The geographic information is represented by UTM coordinates of the monuments and, alternatively, by the code of the cadastral parcel. It was necessary, in fact, to provide different ways to visualise data with the GIS, since part of the cartography available at the Departamento does not include cadastral information.

3 Result

The information about the actual state of the cultural assets can be accessed dynamically inside the GIS application to produce thematic maps about the degree of conservation of monuments, use of the monuments and more (see figures). These maps are used as support for urban planning.

Once the plan is completed, the prescriptions are inserted into the DBMS to complete the catalogue and the information is also displayed with the GIS to produce maps about protection level of monuments, designated land use etc.

The integration of data about monuments into a GIS environment clarifies the relationships existing between the territory and the historical asset, thus making urban plan more effective and, in some ways, easier to develop.

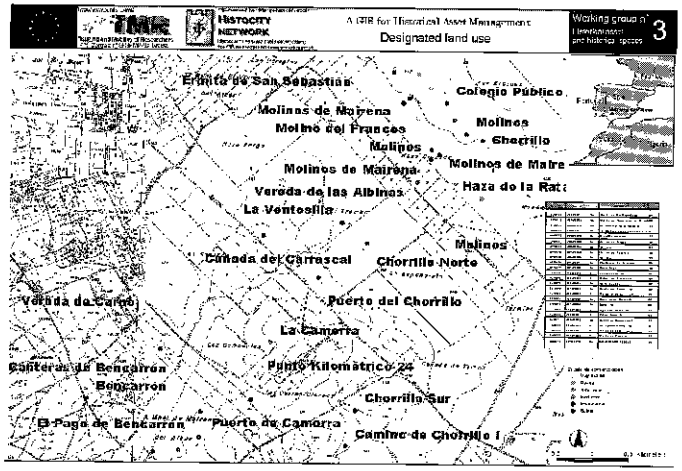


Figure 1 *Degree of conservation of monuments, represented on a digitised map as points. Extra-urban scale.*

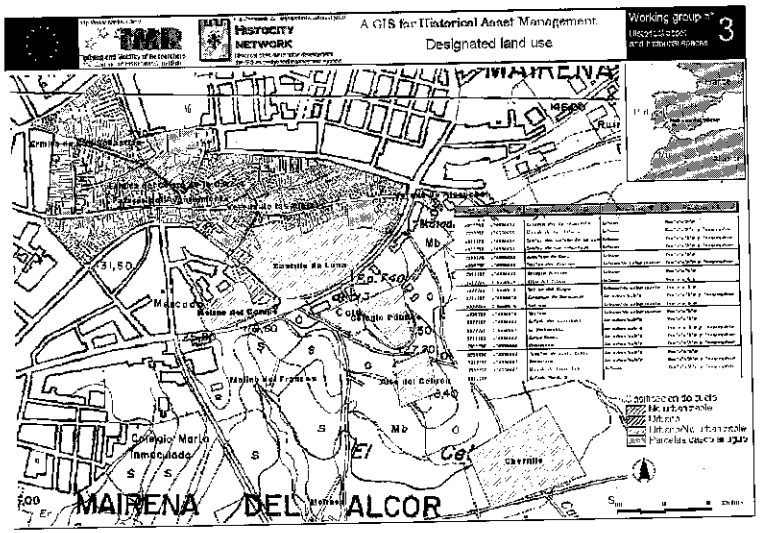


Figure 2 *Overlay of previous map with the designated use of monuments.Extra-urban scale.*

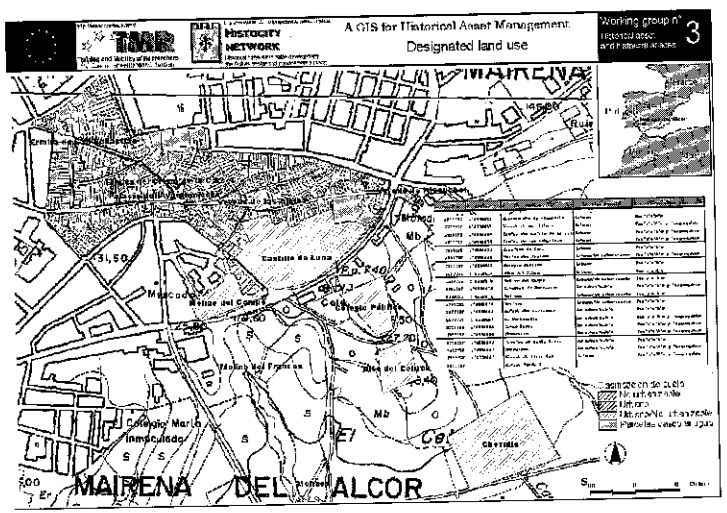


Figure 3 *Designated use of monuments at urban scale.*

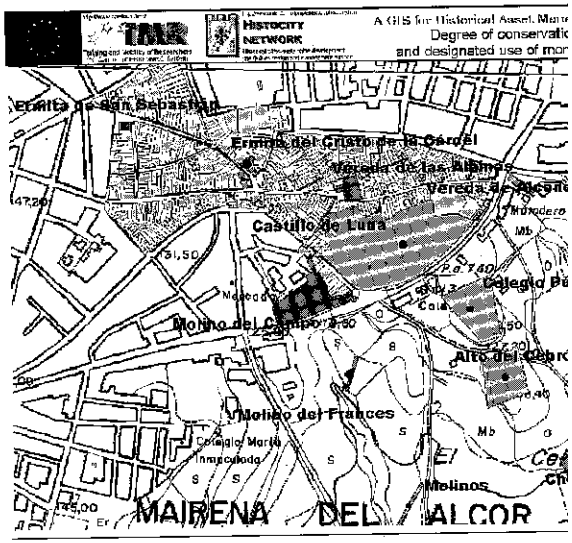
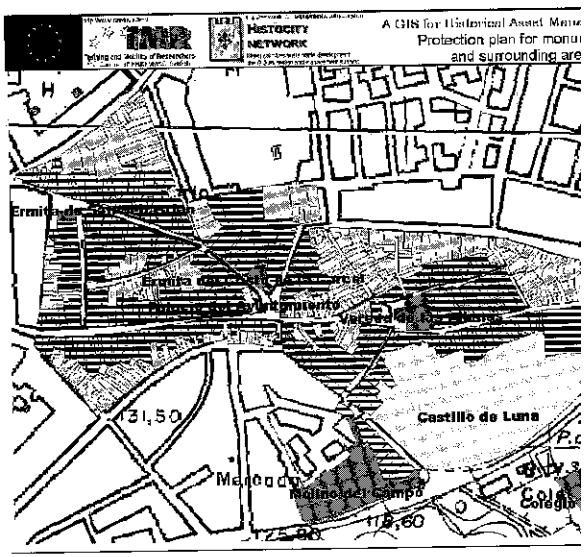


Figure 4 *Overlap of degree of conservation and d monument at urban scale.*



4 Future development

The same basic data structure can be used in other GIS applications where it is critical to have a very precise calculation of the value of a monument. Further development is being carried out to provide a tool to co-ordinating restoration activities of different public administrations with the aim of optimising financing. This Spatial Decision Support System integrates data about the cultural patrimony with economic data about financing of restoration works and strategic importance of the monuments.

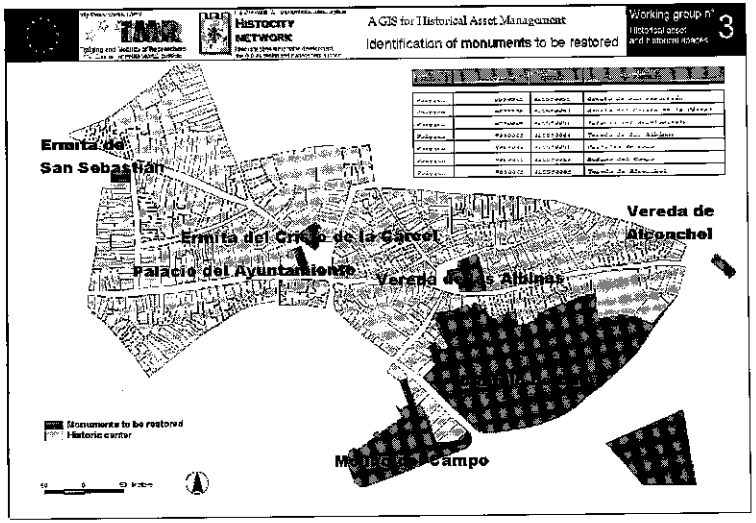


Figure 6 *The monuments needing restoration are displayed (risk assessment).*

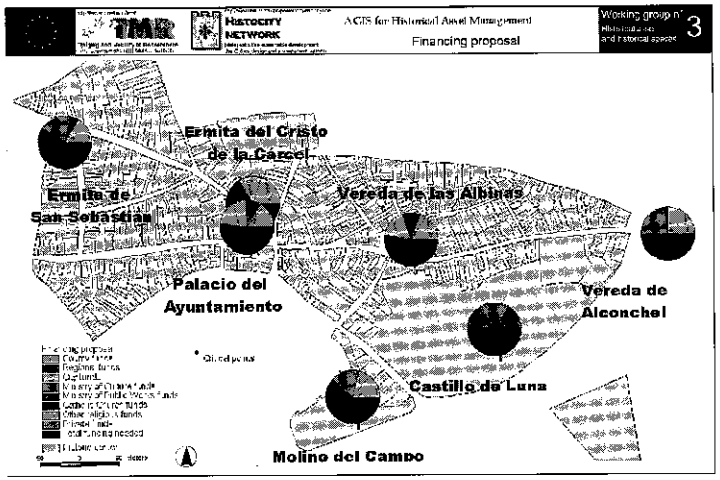


Figure 7 *The financing available are inserted and the system shows the difference between total need for the restoration work and the total amount available.*

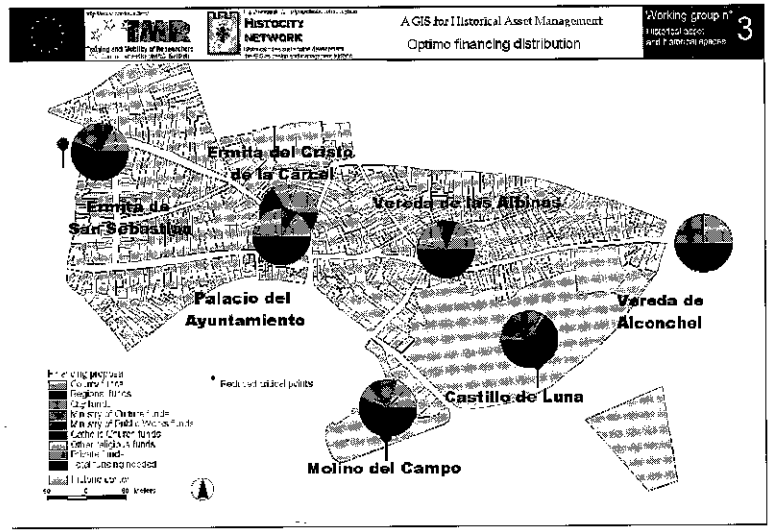


Figure 8 *The amount available can be distributed in a optimal way. In this case it was supposed that the funds of the Ministry of Culture where used on the critical points only.*