

# A GIS FOR KNOWING, MANAGING, PRESERVING CATANIA'S HISTORICAL ARCHITECTURAL HERITAGE

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**Abstract:** *The historical centres of our cities represent the physical supports of the collective and contemporary memory, the attestation of the several civilizations which have left a trace of their own history. The identity elements of places make up a territory's cultural link, a man's psychological sense of belonging and respect to his own territory, as well as an interurban competition relating to globalization.*

*In the perspective of creating a fundamental cognitive framework of Catania's urban environment, the research team's attention aimed at designing a GIS for Urban Architecture, elaborating a structure that is able to collect data inside a defined and interrelated logic archival system conceived like an open and flexible database, which can immediately be consulted and constantly implemented.*

*Indeed, the aim of the GIS we created is to organize, manage, interrogate, visualize the peculiar aspects which characterize Catania's architectures, as well as to create thematic charts in order to make the system able to be consultable, updatable and implementable according to each user's cognitive path. It is a multi-scale system which can be navigated through its contents (texts, drawings, 3D rendering, pictures, historical documents) thanks to multi-directional "access-windows". A system which allows the integration of several documents in a common geo-database up to visualize the most meaningful details.*

*Its use could assure efficacious proposals of urban transformations and congruent plans in using and/or managing heritage assets, preserving and restyling urban and environmental images, exploiting the existent heritage and territory potentialities for a sustainable city development.*

## 1. INTRODUCTION

Knowledge and information are the main steps for the preservation and the valorization of the whole cultural heritage. This means that a more and more active historical-scientific document research is necessary to provide the respect for identity and singularity during years.

The historical centres of our cities are a remarkable example of this concept. Thus they represent the collective memory of the several civilizations which have left a trace of their passing. As a matter of fact, the sense of belonging and respect to our own territory springs from the identity elements of places, which make up a territory's cultural link.

The present study deals with results of a research, still in progress, aimed at the knowledge of the significant features of Catania's urban environment. The complexity of the different features of the city, the several scales of representation, the multi-dimensional objects and the historical, anthropic, formal relations have produced different kinds of information requiring a flexible instrument that is able to transcribe images, charts, texts and symbols in a single model of representation.

For this purpose geomatics has been used. A discipline which explains phenomena observed from a territorial scale point of view, starting from knowledge and instruments that are able to acquire, integrate, archive, handle, analyse, manage and distribute geo-referenced spatial data.

By means of the creation of a GIS for urban cultural heritage, urban environment becomes like a "hypertext" organized by on-line archival that memorizes structured information concerning different objects, placed in

their spatial position and defined by their reciprocal topological relations. An elastic structure, organized according to logical criteria that go from the general to particular without conditioned sequential paths.

Thanks to the conceived structure it is possible to manage, organize, investigate, visualize the most interesting features of Catania's historical architectures. The GIS is open to further integrations and updates. It is accessible so that each user can carry on his own knowledge process by reviewing and printing data.

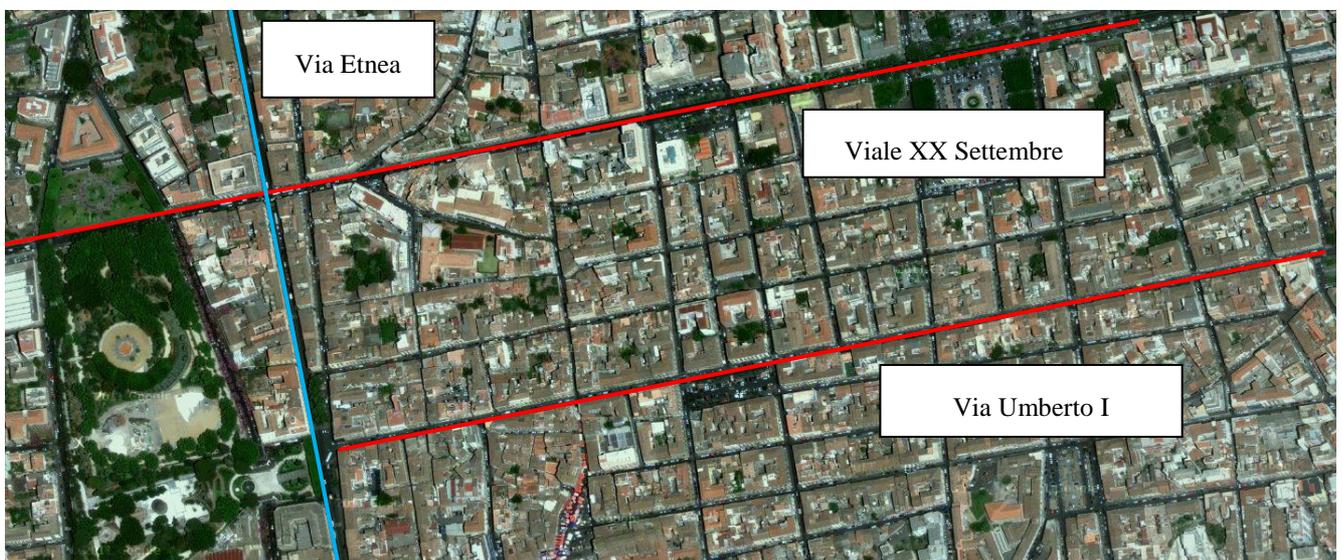
It is a multi-scale system that, surfing through 'access windows' towards contents (texts, drawings, 3D views and renderings, historical documents, etc.), allows integrating many kinds of documents on a common geographical database, starting from a cartographic overview up to visualize the most meaningful details (constructive, formal, morphological, figurative, stylistic ones, etc.).

The main goal is to reveal the transformative potentialities of historical urban areas by giving 'answers' to each question, arranging programmes on management, improving the utilization of cultural assets and carrying out interventions for the protection and development of the city and its existing heritage as well as for the environment and territory: without wasting resources and energies, increasing the value of potentialities and improving the quality of life.

## 2. A CASE OF STUDY: THE URBAN ENVIRONMENT OF CATANIA

Catania's historical centre is rich in events that have changed the city both from an architectonic point of view and from a chorographic one (earthquakes, volcanic eruptions). In order to manage and communicate the complexity and the heterogeneity of information concerning the city, a single "platform" has been structured and arranged.

We chose as field of investigation the urban area related to via Umberto I and viale XX settembre which are the main expansion axis of XIX century city [1,2,3,4]. As a matter of fact, these new roads mark the expansion of the city from the north-east towards the sea, just like the XVIII century junction between via del Corso (nowadays via Vittorio Emanuele) and Via Etnea, the main axis of the city from the seaside, from Platea Magna (piazza Duomo) up to Mount Etna's sides (figure 1).



**Figure 1:** Urban fabric of Catania interested by the development of via Umberto I and viale XX Settembre

Thus, in the city has born a new centre which is considered as a propeller for the new urban expansion through a system of orthogonal meshes that connects the eastern coast to the modern area where trading was supposed to take place. The new project, linked to a chessboard model system, was supposed to create homogeneous city blocks; in reality, since these new city blocks overlap the pre-existing urban fabric (extra-moenia) born without a criterion of salubrity and hygiene (Rinazzo, Carmine, Redentore), the final result was that in the same block there were different typologies of buildings..

These pre-existing areas used to be low-lying and underdeveloped compared to the road level of via Stesicorea (Etnea) with its elevated curtains that made up a sort of scenography for the noble residents walking along there, hiding poverty and unsatisfactory hygienic conditions. The heterogeneous condition of

blocks overlooking the new road network has led to the study of the morphologic-figurative features not only according to an architectural scale but rather at an urban scale in order to study the relations with the past concerning needs and contingencies [5,6].

From the noble architectures, that hide miserable blocks, we then pass on humble buildings, with one or at least two levels, memories of a still existing past along the narrow alleys and courtyards in which poverty and dilapidation are the only identity features of the society who lived there (figure 2,3).

The carried out structure is a “cognitive representation” which takes example from the direct experience and in situ survey, from drafts and models built, from researches and stories reported. The material has been integrated with historical-archival sources in order to understand if there are any relations between social-economic and physics history concerning territory. It is also a support for the creation of thematic maps, views, charts that tell the story about the urban environment, its natural inclinations and suffered amputations.

The use of these instruments applied to the urban and architecture scale allows the simultaneous development of the cognitive system to the project’s life cycle, by supporting the circulation of information and the involvement of actors together with a periodic updating of data which guarantees the model continuity.



**Figure 2,3:** The noble architecture which hides poor buildings (on the left) and the humble building from one to two elevations memories of the pre-existent Rinazzo quarter (on the right)

The redaction in the GIS environment of the informative database dealing with the urban area of Catania allows to have forecasts, Datum changes, transformations related to coordinate systems, or even to treat of survey data and spatial information as if they were common options of graphic systems settings.

The GIS allows to associate to the information collected at end of the survey the qualities of the objects (archival projects, technical reports and photos; metric data, typological, historical information, current photos, 2D and 3D survey elaborations) and of the relations which characterize a certain context. Thus it is possible to monitor the urban environment at different scales through simulation systems. As a matter of facts, the superposition (overlapping) of thematic layers also allows to understand the complexity of the key variables and the reciprocal interactions.

In a few words, the conceived structure is a data base which tells the story of Catania’s urban fabric history by means of different kinds of documents (texts, pictures, drawings); which preserves the sites’identity, its origin and changes through the memory of the past and the knowledge of present. Finally, it is a way to hand down to future generations the history of the city and its changes.

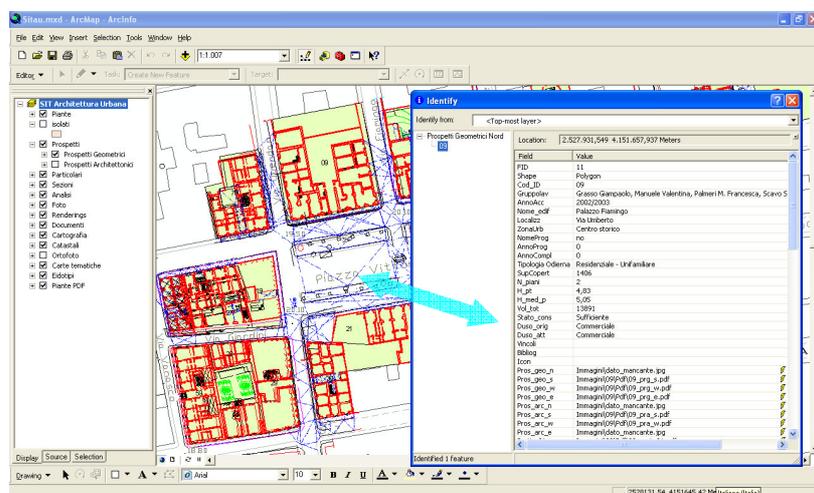
### **3. DATABASE STRUCTURE AND CONTENTS**

In the perspective to create a fundamental cognitive framework of the surveyed urban area, the research group’s attention aimed at the creation of a Geographic Informative System for Urban Architecture, elaborating a structure that is able to collect data inside a defined and interrelated logic archival system built like an open and flexible database, which can be immediately accessible and implemented.

In fact, today the logic of the informative system can be considered as the best system to represent the city's complexity since it can link lots of non-homogeneous information, manage and visualise it according to different parameters and different interpretative keys [7,8,9,10, 11, 12] . In this way, during the consultation each user can get directly information without following sequential predefined steps.

Starting from these methodological presuppositions, the goals pursued for the creation of a Geographic Informative System for Urban Architecture have been reached by using ArcGis Software by ENSRI which satisfied all the needs and requirements of the conceived structure [13].

There have been created two connected data banks: the “geographic data bank” and the “informative and descriptive data bank” (figure 4). The “geographic data bank”, which concerns the surveyed area and the buildings involved along via Umberto I and along viale XX Settembre, has been created by supplying georeference to the Gauss-Boaga national system both to the spatial material concerning surveyed buildings (trilaterations, ground floors, first floors, roofs), which is necessary in order to obtain a global vision, and to the cadastral historical maps of Catania, which are fundamental, through their overlapping, to understand the evolution of the urban fabric of the city.



**Figure 4:** The “informative and descriptive data bank” related to the “geographical” one

Moreover, it has been created a data bank, which can be systematically implemented, concerning a cataloguing chart of the buildings which links at the same time the informative content and the description of each catalogued building.

The correlation between the two data banks has been realized to organize the structure of the informative system according to flexible and interrelated ways by allowing different reading itineraries and to visualize in a simple way, even from a cartographic point of view, all the interested data (i.e. through the creation of adequate thematic maps).

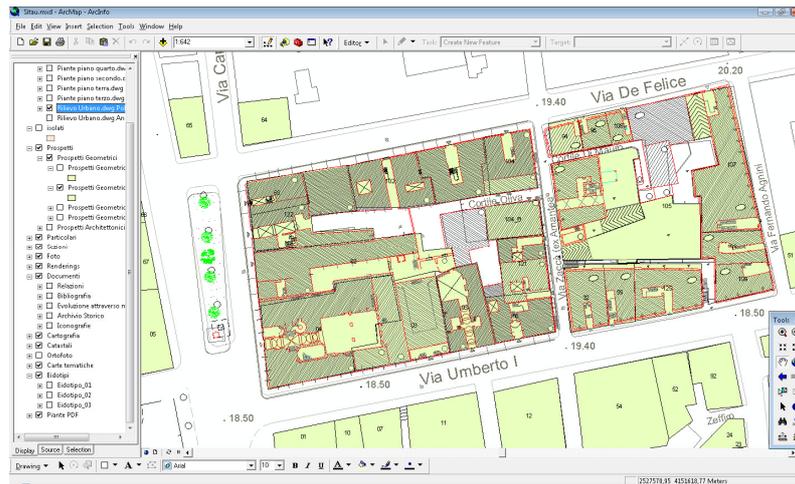
The final goal is to have interconnected information thanks to the creation of an informative system that from a scale point of view – going from the general to the particular – allows more and more a closer approach to the single building, using as starting point a little scale project where it is possible to take all the information. It is also possible to have a double reading key: an “horizontal” one for the different thematic characters of the surveyed area and a “vertical” one for single buildings. Therefore, starting from general information we are able to reach very specific information on each single building even its architectural quality.

### 3.1 Geographic data bank

The geographic data bank represents the core of this informative system since it represents not only a meaningful cartographic reference for all buildings in the urban area of Catania, but also the data structure in which all the necessary information representing the descriptive and informative data bank are linked to. Moreover, to geo-reference the buildings related to the two road trails, which allow the XIX century city to expand, simplifies future integrations for other areas of the city, the overlapping and/or the comparison with any other geo-referenced spatial reference into a single work area, and it arranges spatial evolved analysis (like geo-processing) typical of the GIS environment.

The Geographic data bank is constituted of the following components:

- vector numeric cartography of Catania in Dwg format at a 1:2000 scale, natively geo-referenced in the Gauss-Boaga system;
- Digital coloured orthophoto of the Region of Sicily in ECW format at a 1:10000 scale, natively geo-referenced in the Gauss-Boaga system;
- Historical cadastral maps (1876, 1884, 1897, 1925) in Bmp format, specially geo-referenced;
- Plan drawings regarding trilateration, ground floors, typical floors, roofs, cartographic codified representations according to the UNI (Italian Organization for Standardization) Normative 7310/74 in DWG format, specially geo-referenced and put in different layers in order to carry out typological investigations on the urban fabric (figure 5);



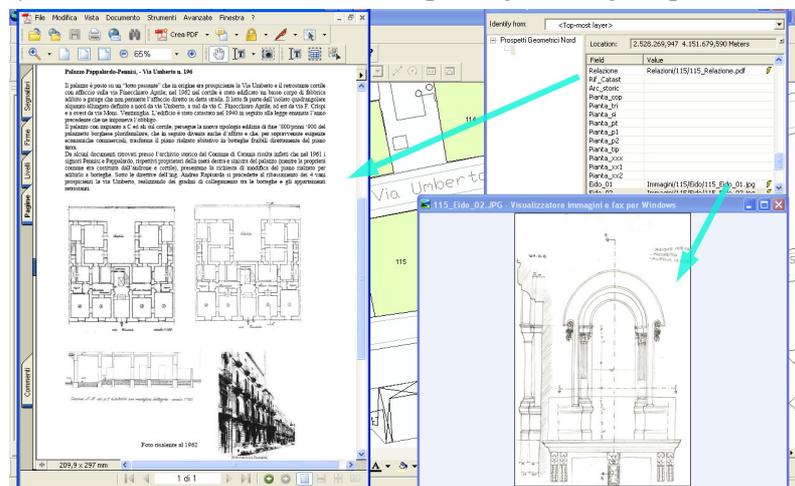
**Figure 5:** Codified representations according to the UNI Normative 7310/74.

- The different buildings have been identified through an ID code and recorded into a single layer in shapefile format, based on polygonal geometry, related to all buildings interested. This format has a database embedded thanks to which it is possible to have an easily access (just a mouse click) to one of the data linked to the polygons which represent the buildings.

Thus the shapefile corresponding to the building represents the heart of this GIS structure since the “descriptive and informative data bank” are linked to it thanks to ID codes.

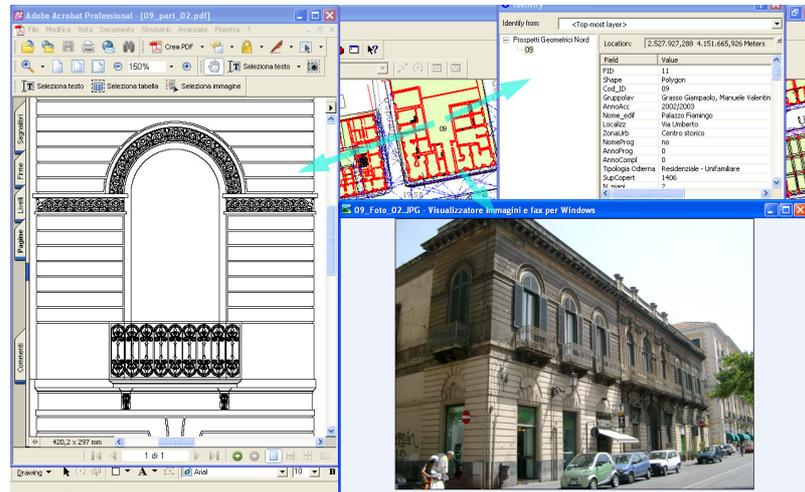
### 3.2 Informative and descriptive data bank

Informative and descriptive data concerning the single buildings has been uploaded into the database connected to shapefile by providing a cataloguing chart composed by many fields coherent to the complexity of the elements which constitute it. This chart has been conceived in order to guarantee an exhaustive data management, full of any detail, user friendly for consultation, visualisation and printing, with a good performance.



**Figure 6:** The historic report and the sketches concerning a building

The first part of the record – informative data bank – holds alphanumeric information on the surveyed building and it has been created according to the following fields: building identification code, work group, academic year, name of the building, location, urban area, designer, plan year, year of accomplishment, typology (civil, military, religious, social, funerary), cadastral references, covered surface estimate, number of floors, height of ground floor, average height of the other floors, total volumetric estimate, preservation state (awful, mediocre, sufficient, good, excellent), current and initial purpose of use regarding the ground floors, presence and typology of the constraints. Each one of this information can be quickly seek from the map by clicking on the shapefile of the building concerned.



**Figure 7:** Picture and architectural detail of an historic building.

The second part of the chart – “the descriptive data bank” - collects descriptive data on the involved building, describing the current state thanks to photographic images and surveys (drafts, trilateration, plans at different levels, geometrical elevations, architectural elevations, details, sections, renderings and animations), the graphical documentation that can be found in the historical archives, illustrative report, the iconographies, bibliography related to the building.

In order to guarantee full availability of the contents and at the same time to protect them from any possible manipulations, PDF format has been used where possible (figure 6,7,8).

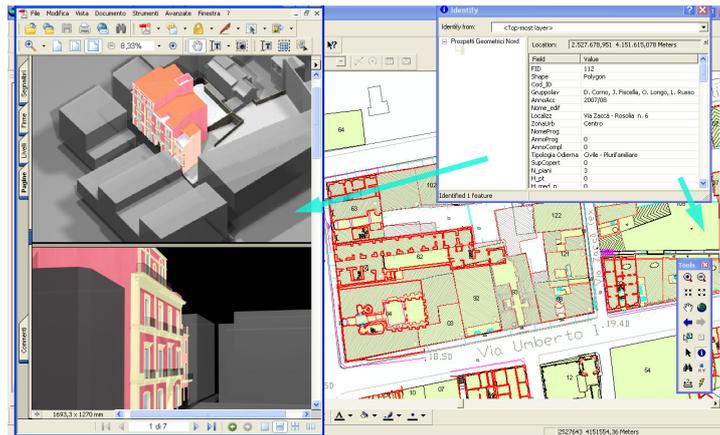
It is possible to access to these last data through the hyperlink function, by activating the object of interest of the “descriptive data bank” from the legend and clicking directly on the map, on the correspondent building.

### 3. CONCLUSIONS

It has been developed a multidisciplinary, adaptable and changeable reading model. A model which is reticular thanks to which it is possible to read the complexity of the natural and social evolution; a cognitive model based on the cultural structure of places, which describes transformative and modifying process of places.

The quantity of documentation, information obtained during the survey and the following graphical processing, have decisively influenced the total dimension of the informative system. The database which is presented as an open structure to any possible integration, is now composed by 130 charts and 4000 enclosed files.

The developed structure is a connective environment open to further integration, which is able to allow an active cooperation between subjects who can get in touch thanks to it, in order to exchange, compare and discuss about themes and experiences related to auto-sustainable local development and its forms of representation.



**Figure 8:** 3D views concerning a city block

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