3-D Cadastre in Greece – Legal, Physical and Practical Issues Application on Santorini Island

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Key words: 3-D Cadastre, registered rights, etc.

SUMMARY

A contemporary Cadastral system is used for the registration and management of information related to private or public properties. The usefulness of such a system varies, according to its structure, objective and automation level, but it is usually used to ensure and to protect property registered rights (based on certain secure procedures) and to constitute a tool for the development of many land or property related issues.

Concerning the protection of rights, a Cadastral system involves registration and guarantee exclusively of any property standing on the surface of the earth. Every piece of Real Estate registered in the Cadastral system, is calculated as the sum of land plus developments (constructions) upon it. In other words, cadastral maps and cadastral charts represent just the level surface of the ground. Therefore, 3D reality is presented in a 2D way, making the Cadastral system itself "bi-dimensional".

Current evolutions in the social, technological and economical aspects of modern life require Cadastral systems with 3D enabled geometrical and topological models for property registration and description. 3rd dimension should no longer constitute an element contained in a descriptive table, but an entity with a geometrical substance.

Under these circumstances, proceeding to a 3D Cadastral system, is gradually necessary in short-term and absolutely essential in long-term. Referring to a 3D Cadastral system, does not necessarily involve an entirely 3D structured registration system. A compatible, able to incorporate 3D object registration, bi-dimensional system, can often do the job, with equal success.

This project is aiming to prove, in which cases 3D visualization of reality is useful or even necessary to facilitate a mostly accurate and well-argued protection of (not-only surface) registered property rights.

In this paper we can also find all the current cases in Greece, where using the 3rd dimension is considered to be useful as well as necessary. Furthermore, an application of a 3D Cadastral registration process has been developed for a small village of Santorini island, called Castelli, located in Pyrgos community, from which typical examples are extracted.
Finally, conclusions and suggestions are presented, in order to make the development of 3D Cadastral systems feasible when needed.

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1. INTRODUCTION

Real Property is defined as either a real or an ideal part of space, which constitutes an autonomous or an undivided multi-owned property right. According to the Civil Code's Article 948 "Real Property is the land and its components". This legal definition matches the financial definition according to which: "Real Property = Land + Labor + Capital + Coordination". Thus, we can see that existing legislation does not take into account a Real Property not connected to Land.

2. EXISTING LEGISLATION

2.1 Superficies Solo Cedit

Current legislation about the registration of rights in the Hellenic Cadastre consists of:
- two basic Laws: L.2308/1995 and L.2664/1998, the backbone of Cadastral registration
- three recent supplementary Laws: L.3127/2003, L.3212/2003 and L.3208/2003 and
- the Cadastral Law of the Dodecanese islands (Italian Governor Decree 132/01-09-1929)

Since the Roman Law "superficies solo cedit" (whatever is attached to the Land forms part of it), whatever lies above or beneath the surface of the earth, belongs to the owner of the corresponding land-parcel. This concept of ownership was introduced in the Hellenic legislation by the Byzantine-Roman Law (Decree 23.02.1835) and recognized by the Civil Code of 1946 (articles 948, 953, 955, 1001, 1057, 1058, 1282).

Specifically, article 1001 defines: "Property ownership is extended, since no other law applies, above the surface and below the ground. Nevertheless, the owner cannot forbid an action taking place high or low enough to be of interest to him".

2.2 Horizontal Ownership

Exceptions to the "superficies solo cedit" rule, are Law 3741/1929 "about ownership per floors" as well as Law about "Mines ownership".

Confusion is caused when Law 3741/1929 (article 1) permits divided ownership per floor or part of it for the same building without the constitution of horizontal co-ownership, while the Civil Code (article 54) defines strict co-owned horizontal ownership. So, even if the latter is the usual form of divided ownership, the former remains an alternative for cases previous to the Civil Code. Additionally, in opposition to Law 3741/1929, the Civil Code's article 1002 states that: "Separate ownership on a building's floor or a floor apartment can only be

constituted by a legal act of the owner of the whole property". Any problems resulting from the differences of the two laws can be solved by public courts of law. (Supreme Court 55/92). The articles 1001, 1002, 1117 of the Civil Code specify the exclusive ownership of an apartment with simultaneous co-ownership of all the public areas of the parcel (horizontal ownership). According to article 1117: "When it comes to a building, the owner of a floor or an apartment is by the law itself (ipso jure) co-owner proportionally on the communal parts of the property. These articles apply on cases that took place after the Civil Code begun to be in effect and guarantee exclusive ownership (article 1002) and necessary co-ownership on Land, communal and co-possessed areas (article 1117) by the constitution of horizontal co-ownership.

The principle of co-ownership was a result to the housing needs of the increasing population and acted as a reaction to the diminution of civil property units.

2.3 Complex Properties

"Complex properties" exist according to articles 58, 59 of the Civil Code, where there is a "legal implantation right on foreign land" or a "surface or separate ownership legal right on a plantation, trees or constructions on foreign land", In such cases, the owner of part of a building or of the exploitation of land, may as well not be the owner of the property itself. In fact, in a separate ownership case, the owner of the legal right might even have a 0% percentage on the ownership of the land-parcel.

Cases of separate ownership of a floor or part of it were (and occasionally still are) custom in the Cycladic islands, the Dodecanese islands and parts of continental Greece, based on local customs, Italian legislation and ottoman law. In the Ionian islands, in Crete and in Samos, horizontal co-ownership was mostly applied, based on local codes. Guidelines on Horizontal ownership forms based on customary laws, are provided in an explanatory circular of Law 2308/95.

According to the customary law of Cyclades, the horizontal ownership status is mainly characterized by the following:

- The possessor of a floor or of a part of a floor, is the sole owner of the floor, meaning of its own external walls, flooring, roof and communal spaces of the floor, but has a 0% percentage of ownership on the land-parcel.
- The possessor of the ground-floor is the sole owner of the land-parcel and the subsoil with a percentage of 100%
- The possessor of the upper floor is the sole owner of the "air", unless the "air" has already been transferred to another person

We can see that legislation relevant to registration of complex property rights, is rather confusing and contradicting, since the contemporary Civil Code specifically defines that each property is necessarily bonded to the corresponding land-parcel, while the Introductory Code 3741/1929 that was developed in order to regulate pre-existing registered rights, refers to properties without connecting them to the land-parcel underneath them.

3. 3D CADASTRE

3D Cadastral systems provide information beyond the typical planar data and can be used to ensure registered rights below, on & above the surface of a property. Land use of underground and above the surface of a plot, can be thus described, analyzed and become optimally developed and exploitable.

3.1 The Hellenic Cadastre

In Greece, the project of the "Hellenic Cadastre" is in progress, being the major developmental project in Greece for the last decade. It was designed as a parcel-based LIS, it comprises the registration of the parcels geometric description, as well as the ownership status and is expected to cover 16% of urban, 10% of agriculture and 7% of forestland areas, in 447 municipalities within the ongoing program. The project is carried out through collaboration between numerous public-sector & private surveying engineering companies, having the financial support of the EU.

3.2 Is the "3rd Dimension" Necessary?

The registration of the 3rd dimension is not part of the strategic planning of the project, although the particularities of the Greek territory might suggest or even force such an evolution in the future, considering:

- the complexity and difficulty to apply Greek legislation about the registration of cadastral information. Entire settlements with complex ownership status pre-existed to the relative legislation, or were under foreign armies occupation for hundreds of years and evolved independently
- the intense relief of the land, resulting to complex constructions, multi-level buildings and the entanglement of property areas for different (independent) properties
- that due to the extended history of the Hellenic Nation, most of the excavations for new constructions reveal older or even ancient constructions (with probable archaeological interest) since most of the contemporary settlements were built on the ruins of older cities
- the addition of the 3rd dimension (the level from the property's surface - not the level from the sea) would probably cure the above, perfectly describing every property.

On the other hand, there are factors making such an ambitious re-planning hard to implement:

- The cost for the development of the "Hellenic Cadastre" has already significantly exceeded the total forecasted cost causing the shrinkage of the specifications for the collection of the data, re-focusing on legal and not geometrical elements and a general concern about the normal continuation of the project.
- Consequently, appending data for the 3rd dimension would burden even more the budget of the program, preventing it to complete.
- The already large number of applications of disagreement to the Cadastral System output from property owners would increase dramatically, significantly delaying the progress of the procedure.
- There in no international experience, to provide the essential know-how

4. 3D REGISTRATION

There are certain kinds of properties requiring 3d registration, which apply to many areas of the Greek territory. Examples of these cases are presented below:

4.1 Case 1 - Constructions over a pPublic Road

Every public road belongs to the state, is constructed for the public benefit and is considered a communal area. It is thus an independent property, assigned with a unique cadastral id number. The first two numbers indicate the prefecture/province where the road is located, the next two indicate the municipality/community, the next two numbers “99” indicate a special property category and finally the numbers “01” characterize a public road.

When a private property is constructed above the road (Fig.1), the Cadastral system should recognize two different owners at the same location and provide separate cadastral id numbers for each.

Fig. 1: “Seirios” is an Auto-route service providing station for motorists. An aerial construction can be seen above the National Road on the 35th km, covering the whole width of the road.

A 3D representation would also reveal the need for separate confrontation of two or more public areas, one over another (Fig.2).

Fig. 2: Athletic premises plus auxiliary and recreational facilities and open spaces over “Attica Road” (Attiki Odos)

4.2 Case 2 - Constructions Over a Communal Arcade

Constructions situated over a communal arcade are usually called “anogeia” (upper properties) and are considered to be extensions of another property next to the arcade, since their entrance is always located on the ground through that other nearby property. “Anogeia” are common in small villages (Fig.3) especially on islands and they are given two cadastral id numbers (one for the arcade, one for the other property) joined in a special notes field.

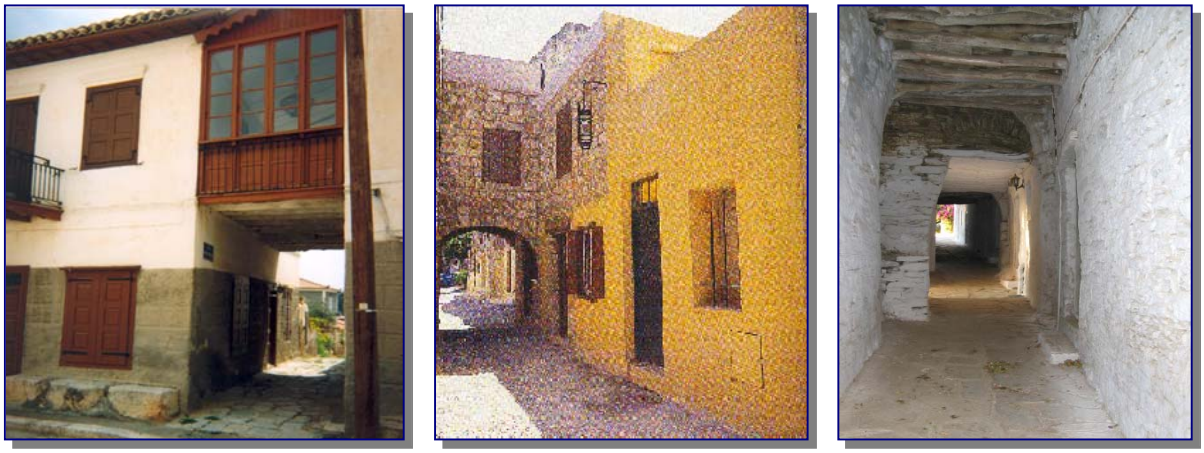


Fig. 3: Constructions over communal arcades

4.3 Case 3 - Constructions Under or Over Bridges

In this case, properties are confronted approximately the same way as in case 2. The cadastral id number of the bridge (of the road, in fact) is assigned to them, modified to indicate that it describes a private property (Fig.4).

Fig. 4: Many independent properties under the bridge of Arachova (town centre)

4.4 Case 4 - Underground Constructions

Underground constructions are usually carried out for commercial stores, garages, or storage facilities, in a need to exploit more and cheaper underground areas. Each of these constructions might extend under more than one land-parcel, directly connected to them or not. So, since the owner of the land might not be the owner of a construction underneath it, more than one cadastral id numbers should be applied. The key value to this case is the depth under the surface of the earth.

4.5 Case 5 - Underground Constructions With a Surface Entrance

It is a similar category to the above, only it mainly refers to residential properties on traditional villages (mostly on the islands) which are called “yposkafa” (Fig.5). The main property is on a different level than the corresponding entrance as a result of large hypsometric differences.

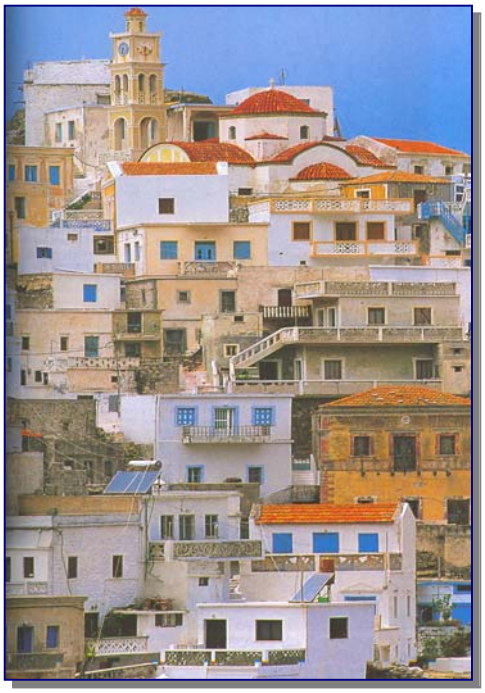
Fig. 5: The surface entrance of underground properties

4.6 Case 6 - Properties With Access From Neighboring Ones: “Floor Properties”

These properties function as lower and upper properties with different floor owners, and are usually called “floor properties”. Usually the owner of the ground-floor owns the land-parcel, while the owner of the floor has a percentage of 0% to the plot, and accesses his property by an external ladder or via a neighboring land-parcel.

4.7 Case 7 - Complex Ownership and Property-Use Situations

This is a case met in traditional settlements with intense relief, developed vertically on a mountain or a hill, as well as horizontally (Fig.6). For example a property's yard can at the same time be the roof of a neighboring one, providing two registered rights and consequently two different cadastral id numbers. In this case the only way to clarify the status of the ownerships and to visualize the position of the properties is 3D registration and representation.



Out of this example, emerges the need to "detach" certain properties from their corresponding land-parcel, during the registration to the Cadastral system, though simple ownerships as well as horizontal & vertical ownerships function fine. A useful appendix though would be the addition to the descriptive data of the floor number information for each property.

Fig. 6: A typical example of a settlement's vertical development is Santorini island

4.8 Mixed Land-Use

According to the Greek legislation, land-use in
areas where Urban Planning exists is strictly categorized. In general residential areas, up to 100 beds hotels, residential properties, commercial stores (not hyper-markets or malls), offices etc. are permitted. Despite of this, a mixed use in these areas (for example athletic premises with commercial stores) can be achieved through Administrative Acts, Presidential Decrees or Ministerial Decisions, resulting to construction permits contrary to basic Urban legislation. Such examples can be found in the constructions for the Olympic Games of 2004 (athletic premises, hotels, road network), in hospitals and in juridical buildings, under the planning of the Ministry for the Environment, Physical Planning & Public Works and approval of the local Urban Planning services. In this case, 3D cadastral registration is once more advisable due to many and contradicting building-uses in the same land-parcel.

And finally, there are cases where the person who uses a property, exploits it and makes an income from it, is not the owner of the property. The who is who is straightened out through the declaration of ownership, where the owner ("naked property") is differentiated from the user ("usufruct") of the property. No doubt that a 3D representation of the ownership status of the property would again facilitate the clarification of the role of the two persons.

5. PROPERTIES OF PUBLIC UTILITIES ORGANIZATIONS

Is the registration of the Public Utilities Organizations' (P.U.Os) networks necessary?
P.U.Os have developed complete, flexible, custom applications for the registration, management and operability of their own networks in order to ensure their unhindered operation, being responsible to keep them updated, upgraded and at the state of the art.

So even if these networks are located below the surface of the ground or in the air and could constitute 3D cadastral data, it is commonly agreed that the organizations themselves have better know-how and can surely manage more completely and efficiently their property, excluding it from the data registered in the Cadastral system.

As examples we can see:

- The registration of the Greek Telecommunications Authority network using SmallWorld software and an object-oriented database (Fig.7, 8)

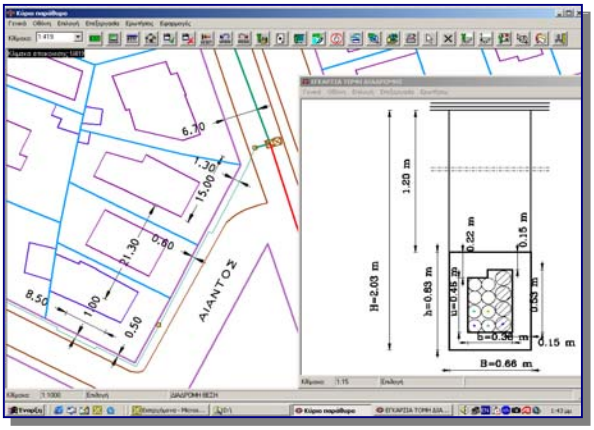


Fig. 7: Main window: The piping level is active
Secondary window: Cross-section dimensioned

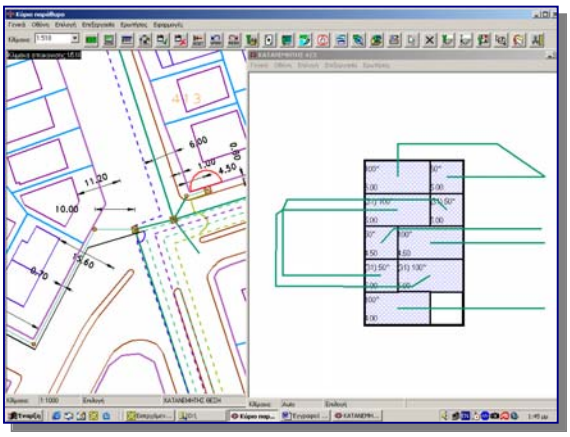


Fig. 8: Main window:
The cable level is active

- The registration of water-supply and sewerage networks (Fig.9)

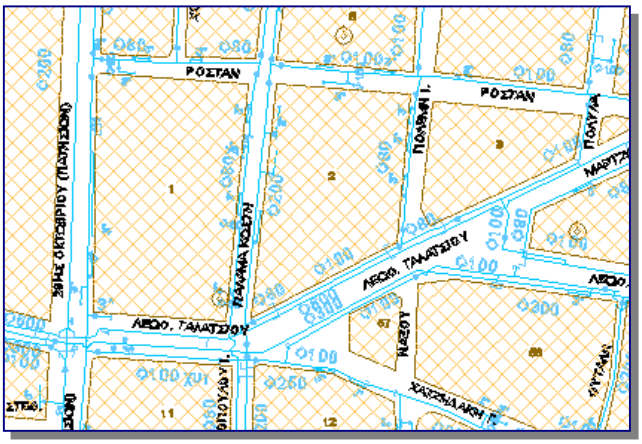


Fig. 9: The position of the pipes is presented approximately, since there is not any metric data available

6. APPLICATION ON SANTORINI ISLAND

6.1 The Study Area

Santorini island is located in the Aegean Sea, it is part of the Cycladic islands complex and is famous for its physical beauties, as well as for its intense relief. Castelli is a small settlement in Pyrgos community on the south of Santorini, where complex ownership rights are very common. It thus constitutes the ideal background for developing a 3D registration project on the complex rights and presenting them through a 3D-enabled GIS.

Castelli had the privilege to be in the first settlements having their Cadastral background assigned, so now – after the first presentation – pretty much most of the legal rights have been gathered. Many "yposkafa" (properties situated below public roads or other properties), floor-properties (properties extending, occupying other neighboring building's area) and upper or lower properties (where the owner of the ground-floor and the land-parcel is other than the owner of the upper-floor and the "air") can be located here, without being presented in the Cadastral maps.

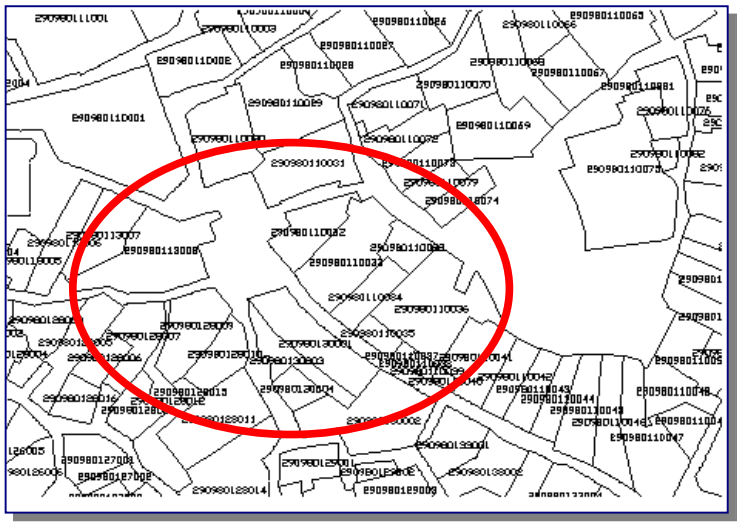


Fig. 10: Cadastral map of Castelli and the study area

6.2 Data Collection

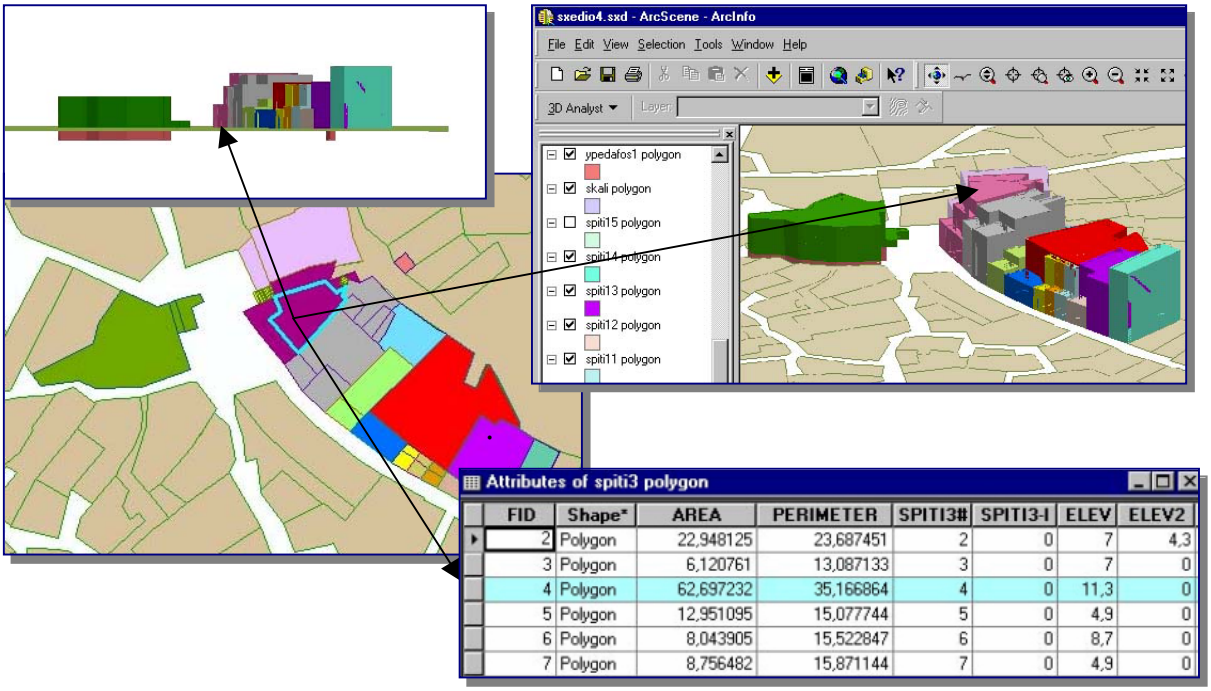
A digital drawing file (in dxf format – NGRS 87) of the cadastral map, presenting the land-parcels' boundaries and their cadastral id numbers (fig.10), was provided by the Cadastral office that is in charge of the survey in Castelli.

All the necessary updates to the diagram where collected at field with a total-station. The first objective was to get all the missing information of the ground plan (either because there were recent alterations, or because it could not be presented on a 2D map). After that, height information was collected from all the properties, in order to give them "volume" through the 3rd dimension. All the buildings could then be presented as 3D solids and no longer as 2D projections. During the field work horizontal levels were created, to facilitate the floor-property ownership emulation.

6.3 Software

- Data management was carried out using the ArcGIS 8.2, GIS software.
- 3D manipulation and visualization was achieved using the ArcView 3D-Analyst module

6.4 Screen-Shots of the Application



FID	Shape*	AREA	PERIMETER	SPITI3#	SPITI3-I	ELEV	ELEV2
2	Polygon	22,948125	23,687451	2	0	7	4,3
3	Polygon	6,120761	13,087133	3	0	7	0
4	Polygon	62,697232	35,166864	4	0	11,3	0
5	Polygon	12,951095	15,077744	5	0	4,9	0
6	Polygon	8,043905	15,522847	6	0	8,7	0
7	Polygon	8,756482	15,871144	7	0	4,9	0

Fig. 11: A thematic map of the study area, 3D visualizations of the buildings and the descriptive data table

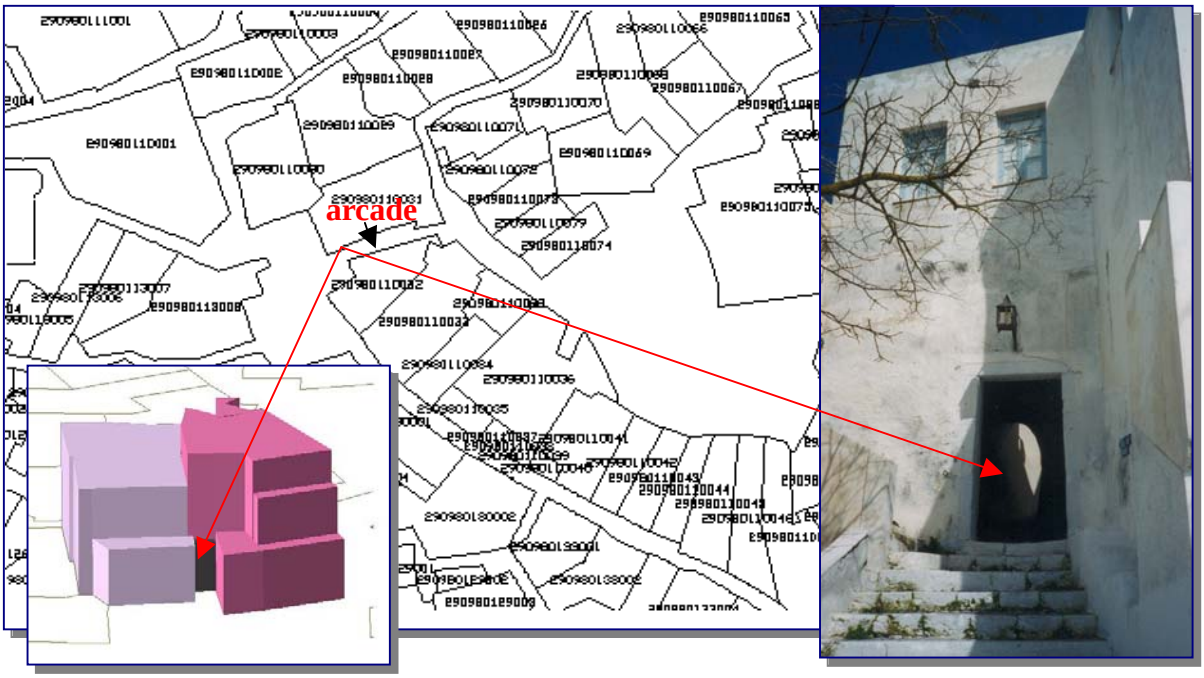


Fig. 12: The property with the Cadastral id number 290980110032 (purple) lies over a communal arcade

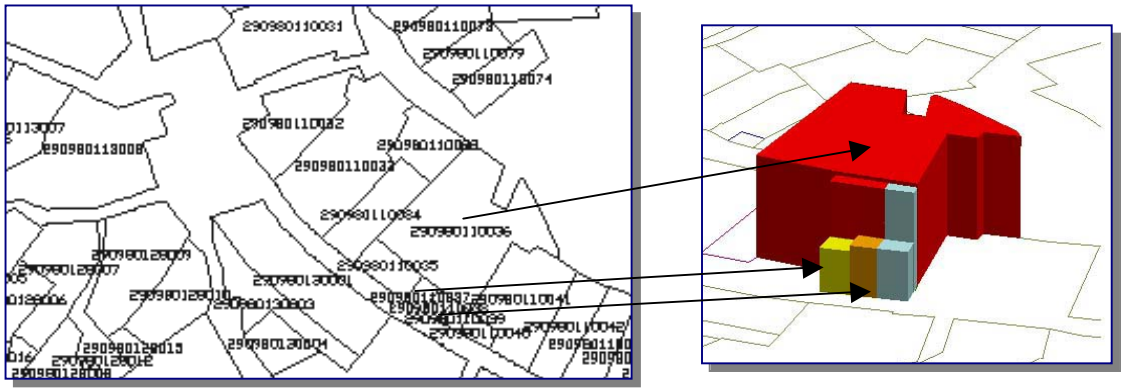


Fig. 13: The property with Cadastral id number 290980110036 (red) lies over properties with id 290980110037 (yellow) and id 290980110038 (orange)

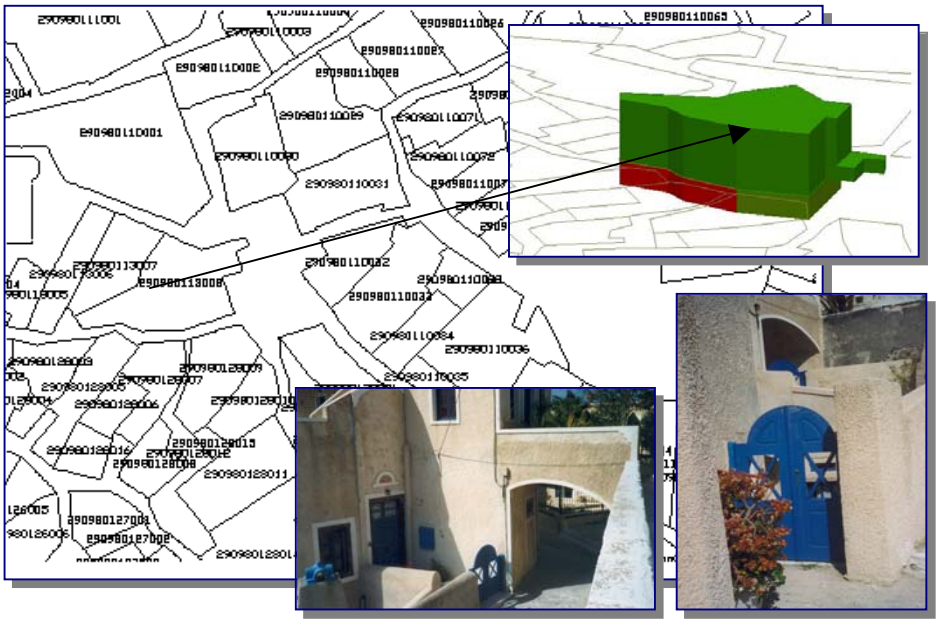


Fig. 14: Under part of the property with Cadastral id number 290980113008 (green) lies another property (red). Complex two-level properties with three-level exits

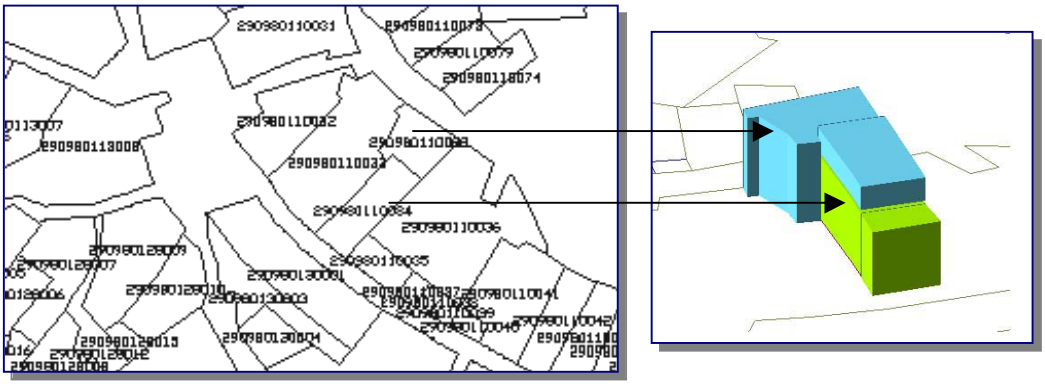


Fig. 15: The property with Cadastral id number 290980110080 (cyan) lies as an upper-level property over property with id 290980110084 (green)

7. CONCLUSIONS

At this point, we can define as a 3D Cadastral system, a system which provides information about land-use above and below the surface of the earth, aiming to its best and profitable exploitation. Critical to the system's success is the compatibility of the relative legislation to its specifications, or vise-versa the adaptability of the system. A successful 3D Cadastral system constitutes a unique tool, a lever for any effort for sustainable development in urban and land planning and in every aspect of technical, financial, social and legal issues of our everyday life. It can also be used as a means for political decisions and pressure.

A contemporary 3D Cadastral system should evolve through:

- the modernization of the relative legal frame, through Ktimatologio SA (which is in charge for the project) and its evolution to a Cadastral Code, defining every different type of ownership right and the way it should be registered and managed.
- the reformation of the specifications of the project in order to include the registration formula of complex legal rights. So, a categorization of the legal rights is necessary in order to achieve the smoothest, fastest and most economical transition from the bi-dimensional registration to the 3D Cadastre:
  - old complex properties could be declared parts of traditional settlements and preserved as they are, or they could be marked for monitoring – so if and when the parameter that makes them complex disappears, they would return to a simple property status
  - newer properties developed during the period that the Civil Code was in value, (no floor-ownership), could be treated respectively
  - a legal frame should be developed, for the properties to be formed in the future
  - the existing records of the Cadastral database should keep on being valid, progressively appending to them a field for the hypsometrical information of the properties and occasionally transforming them to 3D Cadastral records
  - properties with simple ownership status, should update their database information by providing a floor reference (floor number).
- the inevitable transition of the Real Estate legislation, to the state that any property can exist not necessarily connected to a land-parcel

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