

Inconsistencies amongst Urban Plans and Cadastral Data of Hellenic Cadastre

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Key words: Hellenic Cadastre data, Urban Plans, Data Inconsistencies

SUMMARY

Hellenic Cadastre elaboration began in 1995 and is expected to be in full operation by the end of 2023. Currently, less than 1/10 of Greece is in Operational Cadastre status. But as more of the 2/3 of the country are in publicity of temporary cadastral data status (Cadastral Survey elaboration) and thus data on how the Hellenic Cadastre incorporates Urban Plans provisions can be retrieved. The focus of this paper is to examine the elaboration of Urban Plans provisions, especially of those that determine public spaces and spaces of common interest and separates them from private spaces, subjected to ownership by fiscal or legal entities. Cadastral spatial data on urban areas, retrieved from the official Hellenic Cadastre web page, were compared to official Urban Plans, and retrieved from the Ministry of the Environment and Energy and Ministry of Interior geoportal. Results show significant inconsistencies amongst cadastral data and official urban plans provisions. Those inconsistencies affect private but also public properties legal and technical status, causing numerous problems in properties transfer processes, building permits issue but also to public works elaboration.

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1. Introduction

As cities and urban areas are continuously and rapidly evolving and expanding, not only over the ground but underground as well, their thorough and in detail spatiotemporal and legal documentation is of high importance. For urban planning, urban underground planning included, to succeed a fundamental issue is the acquisition of accurate and up-to-date geospatial data, and especially of data on land parcels and plots.

Cadastral data include in detail geospatial information on plots and urban land parcels as well up-to-date information on ownership status and ownership rights, use of the property and the plot, legal status and various legal restrictions deriving from relevant legislation, e.g. building regulations, land use restrictions, cultural heritage or natural environment protection. Cadastral systems are publicly accessed, under public authority supervision, as they have to enhance public faith during properties transactions.

Urban planning is a key element for cities development and in recent years, urban planning is focused on cities sustainable development and resilience. Integration of cadastral data on urban maps can enhance on the one hand, urban planning decision-making process and monitoring (Valls Dalmau *et al.*, 2014; Perperidou, 2020; Perperidou and Xydopoulos, 2021; Aydinoglu, Bovkir and Il, 2022; Koller *et al.*, 2022) and on the other hand cadastral systems' efficiency and interoperability with other systems (Martín-Consuegra *et al.*, 2018; Sánchez Ondoño, Cebrián Abellán and Garcia-Gonzalez, 2021) or even for creating urban cadastral maps (Hajiheidari, Delavar and Rajabifard, 2022, 2023).

Cadastral maps, geospatial data and descriptive data are usually based either upon simple description in legal binding documents (deeds or titles), or digitization of existing analog (in paper) maps, or large-scale surveys carried via photogrammetric processes, their precision and spatial/ geometrical credibility arises. Most common inconsistencies are detecting in land parcels or plots boundaries identification (Cienciała, Sobolewska-Mikulska and Sobura, 2021; Roić, Križanović and Pivac, 2021; Fetai *et al.*, 2022), thus resulting in uncertainties to real property geometrical/ geospatial description, affecting in parallel decision-making process and overall economic development.

In Greece the Hellenic Cadastre is under development, but in the areas that is in full operation inconsistencies of cadastral data are often detected in respect to urban plans provisions, especially in terms of geometrical or geospatial identification of plots and land parcels. In various cases, those inconsistencies lead to delays on properties exploitation both for private and public sector, resulting in economic development setbacks. Herein are presented the main legislative provisions on Hellenic Cadastre development, especially in respect to the 2D Spatial DB, the technical specifications of official urban plans administrative lines depiction and the inconsistencies between urban plans and Cadastral Data of the 2D Spatial DB.

2. Hellenic Cadastre

Even though Greece's first law on Cadastre dates back to the 1830s, the contemporary Cadastral System, Hellenic Cadastre or Greece's National Cadastre, was introduced in 1995. Hellenic Cadastre is a parcel-centric system, deriving from a detailed and legally defined Cadastral Survey and after its completion Greece's Land Registries are completely replaced by operational Cadastral Offices georeferenced in the official Hellenic Coordinates System, EPSG 2100 (Greek Grid). Hellenic Cadastre is under the strict supervision of Hellenic Cadastre legal entity under public law.

According to current legislation (Law 2664/1998) in the Hellenic Cadastre *are recorded all necessary information, technical and legal, aimed at achieving the precise and in detail land parcels boundaries and the publicity of properties transactions, listed in cadastral books, to ensure public faith, protecting also every goodwill party transacting with properties based on those cadastral records, it is based upon 6 principles:*

1. Parcel-based structure for recording and modifying cadastral information, having as prerequisite the continuous elaboration, modification, or update of cadastral maps and diagrams
2. Legality review prior to the approval of any new transaction registered in cadastral books
3. First-come first-served basis of any new transaction registration in cadastral books
4. Publicity of cadastral books and all relevant cadastral information/ data
5. Public faith safeguard on property transactions
6. Suitability of Cadastre as a receptive system for registration of any other relevant information (technical or legal) on properties, property rights etc., (Open Cadastre).

The status of Hellenic Cadastre is either under Cadastral Survey elaboration, undertaken by private contractors supervised by the legal entity under public law or Operational, Figure 1.



Figure 1: Greece's National Cadastre Status: Operational Cadastre: dark blue, Cadastral Survey: i. early stage: orange, ii. Mid-stage: green, iii. completion stage: red, Dodecanese Cadastre: yellow (Source: Hellenic Cadastre web map, accessed 10/03/2023)

Hellenic Cadastre consists of 2D Spatial and Descriptive Cadastral Data Base following specific technical specifications foreseen in the Hellenic Cadastre legal framework. The 2D Spatial Data Base of Hellenic Cadastre is designed so as to include the exact geometrical/ spatial location of each land parcel or plot that is defined in legal bidding documents or in administrative that are either transcribed to land registries or published in the Governmental Gazette. Furthermore, it contains all the necessary geometrical or spatial features or objects or the spatial relations that form specific relations or restriction to property rights exercise, such as administrative acts boundaries, administrative acts parcels, boundaries of administrative and cadastral entities, e.g., prefecture/ municipality/ commune, cadastral sectors and cadastral units, easements, plots vertical separation etc.

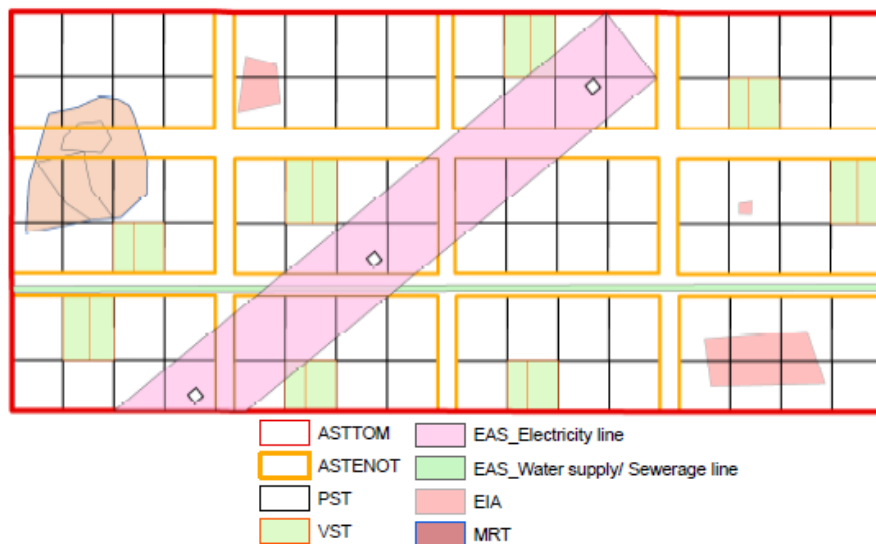


Figure 2: Hellenic Cadastral 2D Spatial DB (Source: (Perperidou, Sigizis and Chotza, 2021))

According to Hellenic Cadastre technical specifications for the 2D Cadastral Spatial DB, all administrative acts maps/ plans/ topographic diagrams/ cadastral diagrams, ought to be incorporated to the Spatial DB georeferenced in the official Hellenic Coordinates System, EPSG 2100 (Greek Grid). In the case that the act's map or diagram is in another reference system (official) or has no reference system, then the maps or diagrams have to be incorporated in the official 2D Spatial Cadastral DB by performing affine transformations and in detailed field surveys. In the case of urban areas for building blocks edges, detailed field survey is carried out and the survey's results are then correlated to official urban plans, maps or diagrams.

3. Urban Planning in Greece

Urban, and spatial, planning in Greece dates back to the formation of the modern Greek State in 1831 (Perperidou, 2021). The first urban plan was launched in 1933, the Athens plan, while the first legislation on urban planning, urban plans and their implementation was launched in 1836 concerning the implementation of Athens 1933 (amended in 1834) urban plan (Perperidou, 2021). Urban plans are approved by decree signed by the head of the State, from

1975 is the President of Greece, urban plans and detailed diagrams are integral part of the decree, that is officially published in the Governmental Gazette. Urban plans and their detailed diagrams are official administrative acts, affecting not only the urban landscape and the city formation, but also create property rights such spatially in when it comes to public spaces such as streets, parks, squares, etc.

Thus, from the very beginning, the fundamental principle of urban planning legislation and urban plans implementation was the determination, both in terms of definition and depiction, of the various administrative lines that are defined by urban plans diagrams or maps that are published with the urban plan's approval decree. The street line or urban line (for short urban line) is the official administrative boundary between public spaces and private. When urban line is separating public spaces is depicted in green color. With green color, it is also depicted when it is different from the building line, which is the line within the property parallel to the urban line that the building is allowed to be placed, that is depicted in red color, Figure 3. When urban line and building line coincide, then the single line of double purpose is depicted in red color.

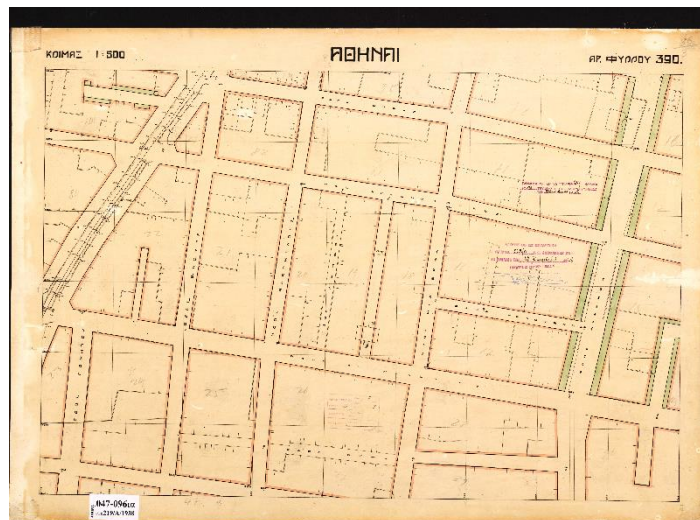


Figure 3: Urban lines and buildings lines, Athens official urban plan 1938 (Source: epoleodomia, official Web Portal of Urban Plans, Hellenic Ministry of Environment and Energy, accessed 10/03/2023)

A special category of urban spaces, foreseen in urban plans, is “stoa” (gallery). Stoa is located at the street level, within the private property, but is of common use. Above the stoa the private property is extended and stoa is covered by the building, forming a protected area, against weather events like rain, extreme heat and sunlight etc., for pedestrians. Stoa is formed by two administrative lines, its inner side and its outer line, which is the urban line. Stoa's inner line is depicted with continuous red color, as it is the line where the building can be placed in street level, while its outer line is depicted in red dashed line, corresponding to the urban line coinciding to building line one level above street level. The space between stoa's inner and outer line is colored in orange color, indicating the possibility of having a built-up space one level above the street, while at the edges of the building block where stoa's outer line is streets conjunction no built-up space can exist, and that space is not colored in the official urban plan diagram Figure 4. In the case of stoa's determination by amendment of urban plan, existing

buildings are not demolished, can be maintained but not expanded vertically, and the depiction of stoa's inner and outer lines follows the above described provisions.



Figure 4: Stoa lines, Athens official urban plan 1956 at Athens City Center, Omonia Sqr (Source: *epoleodemia*, official Web Portal of Urban Plans, Hellenic Ministry of Environment and Energy, accessed 10/03/2023)

When there is an amendment of the urban plan that usually is located in a specific and limited area, in the plan's amendment diagram the non-changing administrative lines are depicted in black color while the changing new ones are depicted following the above described technical specifications.

4. Detection of inconsistencies between urban plans and cadastral data of Hellenic Cadastre

As analyzed in section 3, urban plan provisions, as those are depicted in official plans' diagrams, part of the official decree that are published by the official Governmental Gazette, result in a series of ownership rights on the public spaces that are created (or amended) by the urban plans. Furthermore, plans provisions, such as stoa, affect the use of private space, restricting the exercise of private property rights in street level, limiting at the same time private building rights.

Diagrams of official urban plans are characterized as administrative lines, and their integration in the Hellenic Cadastre Data Base, and especially in the 2D Spatial Data Base, is of high importance and high significance. Legislation on Hellenic Cadastre foresees the accurate integration of urban plans administrative lines in its Data Base, georeferenced in the official Hellenic Coordinates System, EPSG 2100 (Greek Grid). But as the majority of urban plans official diagrams are in different coordinate system than EPSG 2100, or in non-referenced coordinates system, this integration faces many challenges and difficulties.

According to Hellenic Cadastre Cadastral Survey technical specifications (for the creation of operational Cadastre) in urban areas, as those are defined by the Hellenic Cadastre legal entity under public law, detailed field surveys, carried out in EPSG 2100, have to be undertaken so as: a) the actual status of urban fabric to be documented and b) the collection of sufficient measured in EPSG 2100 reference points for the integration of urban plans to Hellenic Cadastre

2D Spatial DB. Private contractors, responsible for the cadastral survey, are obliged to measure all the edges of the building blocks as well as the plots' façade in EPSG 2100 using the Hellenic Positioning System, HEPOS (developed and run by Hellenic Cadastre legal entity under public law). For this purpose all private contractors are given full access to HEPOS services, free of any charge.

However, in multiple cases Cadastral above described technical specifications are not implemented, resulting in inconsistencies between Urban Plans administrative lines and Cadastral Data of Hellenic Cadastre. Those inconsistencies cause serious problems, especially in the operational Cadastre phase, where the correction process is costly and time-consuming. Due to those inconsistencies plot owners cannot issue a building permit or are not able to sell their property, unless those inconsistencies are solved.

The most common inconsistencies are:

- a. Misrepresentation of plots boundaries
- b. Misrepresentation of urban lines
- c. Misrepresentation of other urban plans administrative lines such as stoa

4.1. Misrepresentation of plots boundaries

Over time, Greece's legislation on urban planning and urban plans imposes that urban plots have to have rectangular or regular shape, thus no-regular or no-rectangular plot shapes usually do not acquire building permit. Under this prism, urban plots cannot have irregularities such as broken (not straight line) boundaries, rectangular shape, or non-regular shape. As during cadastral survey only plots' façade and building blocks are measured, resulting in urban plots cadastral diagrams of no-normal or no-rectangular shape, causing serious problems during building permit acquisition or property sell.



Figure 5: Cadastral Diagram excerpt of no-normal urban plot shape, Ampelokipoi Municipality, Thessaloniki Prefecture (Source: Hellenic Cadastre web map, accessed 10/03/2023)

4.2. Misrepresentation of urban lines

As analyzed in section 3, urban lines must be integrated in the Hellenic Cadastre 2D Spatial DB georeferenced in EPSG 2100. Nonetheless, in many areas, especially those that are covered by old urban plans that are non-referenced in official coordinates system, urban lines have not been properly integrated, causing serious problems during building permit acquisition or property sell.



Figure 6: Cadastral Diagram excerpt of no-normal urban plot shape, Athens Municipality, Attica Prefecture (Source: Hellenic Cadastre web map, accessed 10/03/2023)

4.3. Misrepresentation of other urban plans administrative lines: the case of STOA

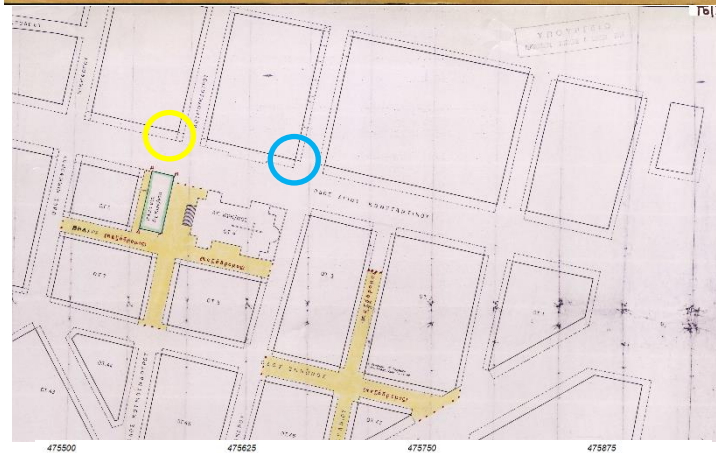
In the case of stoa the Cadastral Survey, for the creation of Hellenic Cadastre, has to deal with inherent problems on urban plans amendment record-keeping and diagrams modification. In numerous cases the original diagram provisions that are not amended, are misrepresented or wrongly presented in the amendment diagram. This usually occurs in the case of old diagrams that are amended, with the personnel responsible for the final diagram wrongly depicting the urban plan's provisions that were not amended.

The private contractor of the Cadastral Survey is obliged to integrate to the Hellenic Cadastre 2D Spatial DB the latest valid diagram, and frequently does not cross-check with the older one. In the case of Stoa depicted in Figure 4 the latest valid diagram misrepresents valid administrative lines that have not been amended, resulting in wrong depiction of those administrative lines in the Hellenic Cadastre 2D Spatial DB, Figure 7. Furthermore, as the private contractor is obliged to survey the current status of the urban fabric and is unaware of the urban plans provision and Stoa depiction, in numerous cases wrongly depicts the property status in respect of administrative lines in Hellenic Cadastre 2D Spatial DB, Figure 7.

(a)



(b)



(c)

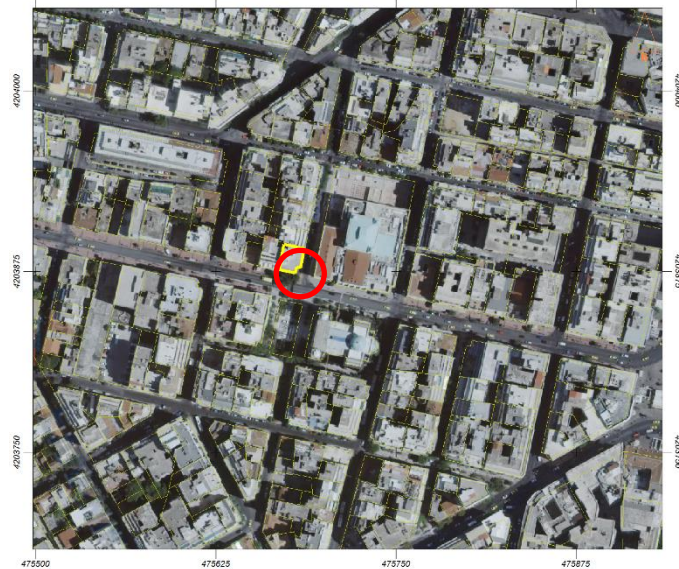


Figure 7: Stoa lines, Athens official urban plan 1956 at Athens City Center, Omonia Sqr (a), urban plan amendment 1991 (b), Cadastral Diagram excerpt (c) (Source: epoleodomia, official Web Portal of Urban Plans, Hellenic Ministry of Environment and Energy, accessed 10/03/2023 for (a) & (b), Hellenic Cadastre web map, accessed 10/03/2023 for (c)) - Yellow circle not amended in 1991 urban plan / right depicted in 1956 & 1991 urban plan diagrams

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– Blue circle not amended in 1991 urban plan/ wrong depicted in 1991 urban plan diagram
- Red circle not amended in 1991 urban plan / right depicted in 1956 & 1991 urban plan diagrams/ wrong depicted in Hellenic Cadastre 2D Spatial DB

In this case as well, this misrepresentation is causing serious problems during building permit acquisition or property sell.

5. Conclusions

In this paper, the main inconsistencies of the representation of official urban plans provisions and especially of the administrative lines, in Hellenic Cadastre 2D Spatial DB are presented. After presenting the basic legislative provisions for the Hellenic Cadastre Cadastral Survey, mainly of technical aspect, and the technical specifications on depicting the administrative lines of officially approved urban plans, three categories of misrepresentations of urban plans provisions in the Hellenic Cadastre 2D Spatial DB are presented. The misrepresentations presented result in inconsistencies of the Hellenic Cadastre spatial and geometrical data affecting properties' legal and physical status and boundaries, and imposing obstacles in obtaining building permits or in selling the property procedure.

Future research can be focused on assessing the actual economical and administrative cost of those inconsistencies and to define a methodology to address them.

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BIOGRAPHICAL NOTES

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