

# Managing Geo-Data to Support Urban Planning Development Process in Turkey

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**Key words:** Geoinformation/GI, GIM, Spatial planning

## SUMMARY

Turkey meets with territorial planning issues as a result of rapid urbanization, unbalanced distribution of economic activities and population, immigration to cities, the lack of urban services and employment opportunities including uncontrolled destruction of natural resources. These result in disrupting the integrity of planning and implementation at country, region, and city level. In this study, production progress of plans in Turkey is examined for Master Plan a scale of 1:25000, Land Use Plan a scale of 1:5000, and Zoning Plans 1:1000. Inconsistency and incompatibility of planning data are pointed out with policy deficiencies at macro level. The Zoning Law (Article No. 3194) is examined with current legend and the deficiencies of planning data for the using on various applications areas. A conceptual approach is determined to manage geo-data in the preparation stage of planning context. A harmonized classification of planning legends is determined in view of users' recommendations all over the country. A novel plan data model is developed that is object-relational data model and compliant with ISO/TC 211, INSPIRE data specifications, and the expectations of Turkey National GIS actions.

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## 1. INTRODUCTION

Due to the availability of high living standards and profitable economic developments in urban areas, there have been huge migrations from rural to urban areas. Therefore, the land-use problems confronting urban areas are usually traced to rapid urbanization and massive urban growth in the recent decades. As a result of these, rapid urbanization has dramatically and continuously occurred in most major cities in the developing world. Thereby, these cities are faced with a lack of readily available land and this causes public services to fall further and further behind the demands of urbanization. In order to provide new services as rapidly as they are needed to support rapid urbanization, local government authorities must design and apply some efficient land-use planning strategies for new settlements and built-up areas.

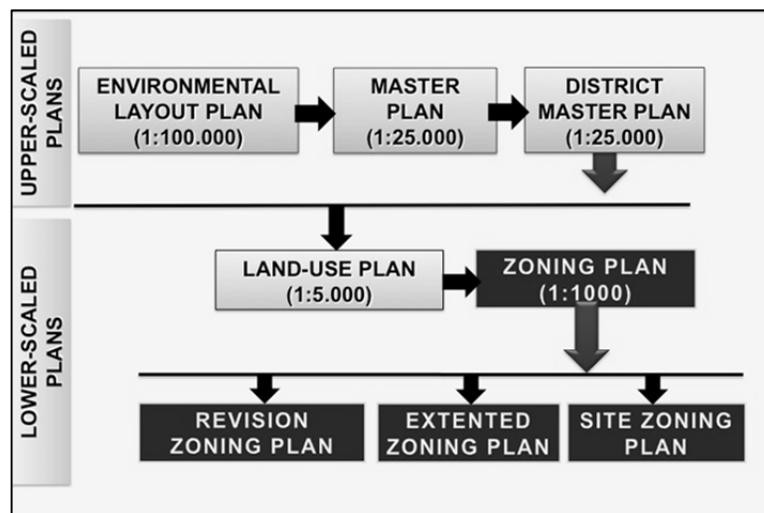
As in other developed countries, Turkey which is a country between Asian and European continents is affected by a process of rapid urbanization. The orientation of the population from agriculture to industry in Turkey has made urban life more attractive. In 2008, Turkish population is 71.5 million but 75% of these populations live in the cities. Because of speed urbanization and quick decision-making, it is faced with implementation problems during the planning process as a result. While the strategic decisions are taken primarily in upper-scale preparation of regional plans in order to manage this rapid progress on a regular basis first, zoning plans have been prepared in the lower scale in the form of application for detailed town plans. Local authorities in accordance with zoning regulations monitor all of these actions.

Today, the preparation of development plans and transfers to implement much faster than before with conventional ways because of new information management technological tools have emerged. The need for a multi-spatial data, especially in the process of plan preparation, GIS systems have become mandatory such as the use of spatial analysis. GIS technology has a great importance for assembling spatial data from many different sources and integrating them to transformation plan. However, the planning process to ensure the integrity of plans across the country is primarily needed for standardized plan legend symbols. According to the newly planning developments in present-day, legends that proposed by current laws in Turkey are insufficient now. Therefore, the processes of plan preparation and sustainable use of plan in GIS aspects require a new geo-data modeling structure for planning. For this purpose, the preparation of GIS-based studies has been initiated by the Ministry of Public Works and Settlement in Turkey.

## 2. BACKGROUND: PLANNING PHASES IN TURKEY

The basic planning process in Turkey begins at the national scale with five-year development

plans in regional bases. For this purpose, on a regional basis the country's socio-economic development trends, the growth potential of the settlement, and sector objectives and to determine the distribution of sub-structures has been taken account by the State Planning Organization. These plans also called as the Regional Development Plans including strategic development decisions. Then, on the basis of these plans, a scale of 1:100000 Environmental Layout Plans (ELP), a scale of 1:25000 District Master Plans (DMP) a scale of 1:5000 scaled Land-use Plans (LUP), and then a scale of 1:1000 Zoning Plans (ZOP) have been arranged (Figure 1)



**Figure 1: Plan Types and Hierarchy in Turkey**

Environmental Layout Plan (ELP) is regional based plan that balance and sustains development of economic and ecological decisions in accordance with the purpose of allowing consideration of a combination of upper-scale physical plans. On the basis of ELP to ensure the rational use of natural resources in agriculture, tourism, housing, industry, transport and so on. ELP provides the general land-use decisions, policies and strategies for a provincial base. Regional or basin on the basis of 1 to 100.000 scaled of the ELP also supported the plan disclosure report. ELP basic form other sub-scale plans (Official Gazette, 2003)

In Turkey, the Ministry of Environment and Forestry has been authorized to prepare and approve ELP on the basin basis of 1 to 100000 scaled by law (Article No.4856) in 2003. However, on the provincial basis, approval authority of 1 to 25000 scaled District Master Plan (DMP) belongs to provincial administrations by law (Article No.5538/5302) in 2005 (Official Gazette, 2005). Within the boundaries of metropolitan cities, planning authority belongs to the metropolitan municipalities.

A sub-scale of the DMP is called as Land Use Plan (LUP) with the scale of 1 to 5000. LUP are drawn on large-scaled topographical maps with outline of cadastral patterns on it. On the LUP, the general usage outlines of town, the main regional types, and the future population

densities, the intensity of buildings with a variety of sizes of the settlements, the direction and principles of development, transportation systems and indications such urban design solutions are arranged with 1 to 5000 scale. LUP can be bases for preparation a sub-scale zoning application plans and detailed report with a description of a whole. The approval authority of land-use plans is municipalities.

In order to implement zoning activities in urban level, a scale of 1:1000 detailed Zoning Plans (ZOP) are derived from LUP. The current status of cadastral maps have been processed and approved on ZOP, prepared in accordance with the various regions and islands of building site, their density and layout of the roads which required for applying zoning programs. Municipalities have the authority to prepare, approve and implement ZOP in Turkey. They are responsible for all kinds of urban development and zoning activities take place in a city according to ZOP.

## **2.1 Preparation of zoning plans in Turkey**

Zoning plan is a device of land use planning used by local governments in most developed countries. The word is derived from the practice of designating permitted uses of land based on mapped zones which separate one set of land uses from another. Zoning may be use-based (regulating the uses to which land may be put), or it may regulate building height, lot coverage, and similar characteristics, or some combination of these. Similar urban planning methods have dictated the use of various areas for particular purposes in many cities from ancient times. Theoretically, the primary purpose of zoning is to segregate uses that are thought to be incompatible. In practice, zoning is used to prevent new development from interfering with existing residents or businesses and to preserve the "character" of a community. Local governments such as municipalities commonly control it, though the nature of the zoning regime may be determined or limited by state or national planning authorities or through enabling legislation.

The last census, if 10,000 inhabitants of the settlements in excess then large scale urban development plans like zoning plans are required. The last population census, the population than 10,000 settlements, not exceeding, the city council decides whether or not necessary in the development plan.

In Turkey, an important legal basis of urban development procedures is the Zoning Law (article No. 3194) announced 1985. The aim of this law is to ensure place of settlement with the constructions in locations with health and environmental conditions based on plans. Where all structures to be built within or outside of a city area the municipalities takes place according to the provisions of this Act. During this process the most important technical resource is 1 to 1000 scaled Zoning Plan (Official Gazette, 1985).

Within the municipal boundaries, city council approves and signs urban development plans and put into force. If a plan proposal is not find in appropriate way then Municipal assemblies notify planner for revision of the proposed in writing within 15 days concerned. Outside the boundaries of the municipality and contiguous areas, the provincial government decides for

zoning plans to approve and put into force. All approved plans are announced to the public for a period of 30 days by the Administration, just in case of hearing any objections about plans.

## **2.2 Lack of standardization in planning process**

International spatial data standards for plan productions in Turkey have not yet become common. Especially during the planning process, particularly institutions that produce the plan, including municipalities, planning studies, the symbol does not use a common plan qualified. In earlier, Act No. 3194 Zoning Law was insufficient for today's needs with the spatial information defined in the plan legend. Today, legend symbols are reflecting the new developments and local planners have begun to produce more in their own new symbols of legend. As a result, plans stay far from the structure of the legend standard and the common language of the planning process begin to failure.

Differences between municipalities in the procedures of development plans have been occurred even using the same legend. Appropriated approaches were not developed for the production plans, manage and use in a GIS environment. Thus, the formation of a structure require for the future to ensure the interoperability of GIS data in the production of common standards.

The Ministry of Public Work and Settlement that is responsible for the production and control of the local plans has launched a series of studies to dispose negations in planning sector in 2010. The aim of the study that is initiated by the ministry is to determine the legends and preparing plans with GIS. For this purpose, the legend terminology for 1/1000, 1/5000 and 1/25000 scale plans is tackled again and new regulation preparation is initiated to provide uniform using of legends by planners all over the country.

## **2.3 GIS need in planning**

In recent years, plans are prepared with GIS technology in Turkey. It is aimed to merge and manage digital spatial data that belong to all kinds of scaled plans with GIS. In this way, while preserving, following and providing control of plans with spatial database; it would be a system which provides decision makers to access rapidly to plan information by serving plan information on the web via internet. With this spatial information system, it is also aimed to produce essential reports and statistical data with accurate queries on up-to-date data to serve the results by institutions at multiuser environment via different media. In order to accomplish all these processes, plan production standards must be arranged as compatible with GIS and interoperable. For this reason, the first aim should be improving the standards are for plan production.

## **3. A GEO-DATA MODEL FOR PLAN**

Geo-data model for planning purpose is constituted for the arrangement of data of master, land use, and zoning plan projects. Planning works need other datasets such as transportation, administrative unit, and land cover. The interoperability of these geo-datasets and GIS can be

possible with defined rules and conceptual model components. These rules enable to design a harmonized geo-data model for planning and to manage geo-data corporately in planning applications.

These conceptual model components include application schema rules with base application schema, general feature model, geometry, topology, object identification, attributes, relationships, and functions. As these conceptual models can be used independent of each other, they can also be used as a combination of various models to support different applications. This approach can support various applications for interoperable solutions and can be flexible and developable in order to adapt to different conditions.

Geo-data exchange format should be defined primarily to make plan data harmonized with other datasets. This format should be used by other systems and enable open data exchange on the web. Different geo-data formats should not be used. That is, stakeholders of plan data should send and receive the plan data in accordance with this data exchange format.

In this context, so called “TRplan” concept is developed to manage geo-data interoperable related to planning activities in Turkey. General specifications of TRplan and its conceptual model components are;

- The model includes the rules supporting the interoperability and data-exchange of Master Plan, Land-use Plan, and Zoning Plan in GIS Works, from national to local level.
- The model follows the Plan4all specifications that provide the means to search for geo-data sets and geo-data services with regard to spatial planning. The Plan4all also harmonizes spatial planning data and related metadata according to the INSPIRE principles that European countries follow to utilize in their country towards building European SDI.
- The model defines specifications, independent from any platform including particular software or hardware.
- The model is compliant with ISO/TC211 standards for designing geo-database and OGC standards for platform independent geo-data management.
- The model is an object-relational model. This approach benefits from opportunities of relational and object-oriented data model, enables the users to store geo-data and their associated attribute data in a single database system.
- An application-driven model based on an analysis of the intended geo-information use is designed to serve a set of useful planning applications.
- The model is designed with Unified Modeling Language (UML) class diagrams including well-defined semantics in a model driven approach (Figure 2). A Geography Markup Language (GML) application schema as an exchange format can be automatically derived from the UML model for harmonizing the geo-data model.
- The model is a semantic model including common domain of interaction and the related information. This interchangeable information results in standardization.
- A common framework is determined for the unique identification of objects to ensure interoperability among databases under national systems and to manage the lifecycle of the object.

- Plan data should be maintained at a level where the data is managed effectively. The only way to have consistent and current national datasets is to have transactional updates performed by local datasets. These data can be combined, transformed, and integrated into national datasets.

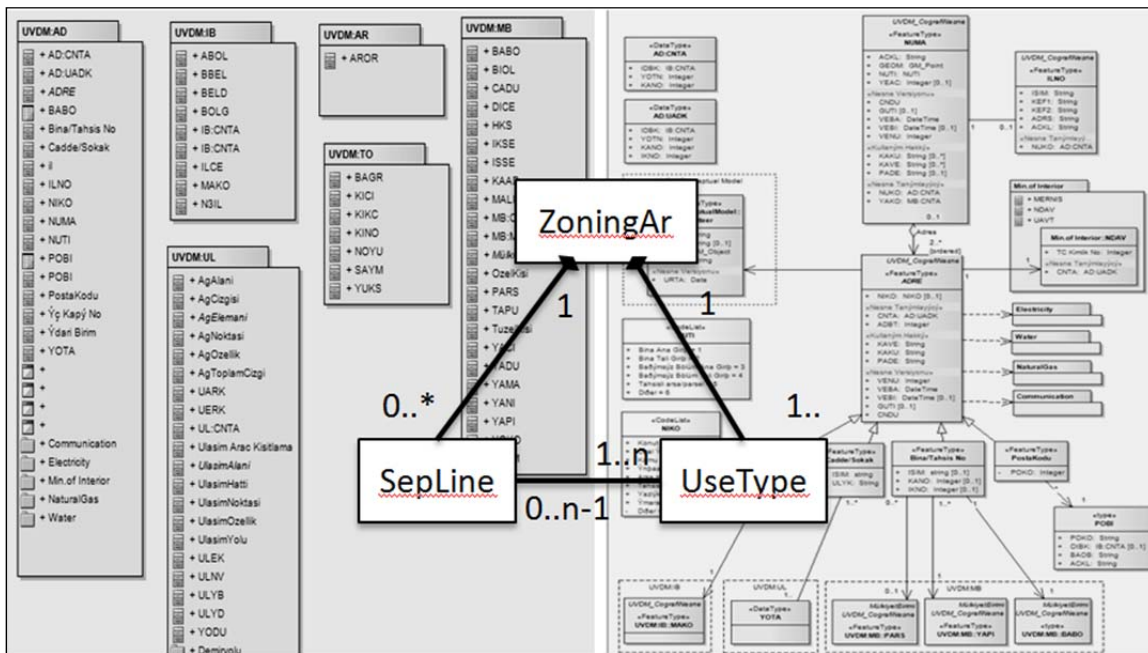


Figure 2: Geo-data themes and UML Application schema for plan data as a case

#### 4. CONCLUSION

While GIS-enabled databases store and organize planning data in relational structures, geo-data models are applied to organize and describe geo-data in ways useful for particular applications. Geo-data model for planning purpose is shaped for arrangement of data using with master, land use, and zoning plan projects. Because of the nature of planning process other datasets such as transportation, administrative unit, and land cover should be integrated. The interoperability of these geo-datasets and GIS can be possible with defined rules and conceptual model components. These rules enable to design a harmonized geo-data model for planning and to manage geo-data corporately in planning applications.

In this paper, development of a geo-data model for plans in Turkey is basically examined. Master Plan a scale of 1:25000, Land Use Plan a scale of 1:5000, and Zoning Plans 1:1000 have been taken into account. A conceptual approach has been provided to manage geo-data in the preparation stage of planning perspective. A harmonized classification of planning legends was firstly determined in view of users' recommendations all over the country. So, a novel plan data model was developed that is object-relational data model and compliant with ISO/TC 211, INSPIRE data specifications in Turkey.

## REFERENCES

- Official Gazette, 1985. The law for Zoning Plan, No. 3194, 09.05.1985, 18749, Republic of Turkey.
- Official Gazette, 2003. The law about Organization and Tasks of The Ministry of Environment and Forestry, No. 4856, 08.05.2003, 25102, Republic of Turkey.
- Official Gazette, 2005. The law for Provincial Public Administration, No. 5302, 04.03.2005, 25745, Republic of Turkey.

## BIOGRAPHICAL NOTES

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