

# **GIS Update Problems of Cadastral 2014 Studies in Turkey**

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**Key Words:** Cadastre, Cadastral Problems, Cadastre 2014, GIS, Updating.

## **SUMMARY**

Rapid changes of information technologies affect all professional disciplines, facilitate the labor production fast and accurate, and force the managers and users for new searches about producing information and following technology.

In the 21<sup>st</sup> century, now we are living in, the life of a person changing rapidly every day, the continuing cadastral automation parallel with the changes in planning land-person relationship and the improving expansion of Field Information Systems put forward the increasing importance of the cadastre; in other words, the integration to “Cadastre 2014” vision which is a design for the future cadastral system became obligatory. The objective of Cadastre 2014 gains importance to facility-cadastre and following the changes developed further and updating studies.

The cadastral maps produced with various laws, methods and bases since the foundation of Republic are still being used today. There are encountered so serious problems during the usage of these maps in National Spatial Database, because most of them are nonnumeric and 60 % of them need to be renewed. For this reason, the basic objectives of the study occurred as the transfer of deed registers into digital medium and updating, following the deed and cadastre relationships spatially and solution proposals to the problems.

Therefore, the formation of databases appropriate to National Spatial Database is considered as the basic objective that the database in cadastral services, judicial position, standardization and coordination analyses will be held and solutions aimed at determining updating problems in cadastral services will be searched.

## **Türkiye'de Kadastro 2014 Çalışmaları İçin Güncelleme Problemleri ve CBS Yardımıyla Çözüm Arayışları**

### **ÖZET**

Bilgi teknolojilerdeki hızlı değişimler, tüm mesleki disiplinleri etkisi altına alırken, iş üretimini hızlı ve doğru olarak kolaylaştırdı; yöneticileri ve kullanıcıları bilgi üretimi ve teknolojiyi izleme konusunda yeni arayışlara zorlamaktadır.

21. yüzyılı yaşadığımız çağımızda, bilim ve teknolojinin ışığında insanın her geçen gün hızla değişen yaşamı, arazi-insan ilişkisi planlamasındaki değişimler çerçevesinde kadastronun devam eden otomasyonu, Arazi Bilgi Sistemlerinin gelişerek genişlemesi kadastronun artan önemini ortaya koymuş; diğer bir deyişle gelecekteki kadastral sistem için bir tasarım olan '**Kadastro 2014**' vizyonuna entegrasyonu zorunlu hale getirmiştir. Kadastro 2014 hedefiyle, tesis kadastrosu ve devamında gelişen değişikliklerin izlenmesi ve güncelleme çalışmaları önem kazanmaktadır.

Cumhuriyetin kuruluşundan bu yana farklı yasalar, yöntemler ve altlıklar üzerinde üretilen kadastral haritalar günümüzde halen kullanılmaktadır.Çoğu sayısal olmayan ve bu gün için %60'ı yenilenme ihtiyacı gösteren bu haritaların, Ulusal Konumsal Veri Altyapısının kullanımında çok ciddi sıkıntılar yaşanmaktadır. Bu amaçla, tapu sivil kayıtlarının sayısal ortama aktarılması ve güncellenmesi, tapu ve kadastro ilişkilerinin mekansal olarak izlenmesi ve sorunlara çözüm arayışları çalışmanın temel hedeflerini oluşturmaktadır.

Bu amaçla, Ulusal Konumsal Veri Altyapısına uygun veri altlıklarının oluşturulması temel hedef olarak görülp; kadastral hizmetlerde veri allığı, hukuki durum, standardizasyon ve koordinasyon gibi analizlerin yapılarak kadastro hizmetlerine ilişkin güncelleme sorunlarının tespit edilmesine yönelik çözümler aranacaktır.

**Anahtar Kelimeler:** Kadastro, kadastro problemleri, Kadastro 2014, GIS, Güncelleme,

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## **1. INTRODUCTION**

Expectations from cadastral surveys were acquired a shape according to the report which was published by International Federation of Surveyors (FIG) in 1994 "Cadastral Survey 2014".

- a-All legal conditions including public rights and restrictions must be shown.,
- b- Differences between maps and records must be eliminated,
- c-Digital cadastral survey model must be effective instead of cadastral survey maps,
- d.-Cadastral surveys that uses geometric technology instead of linear cadastral survey.
- e-Together public and private sector transformation to cadastral survey which are less flexi but has user tendency must be provided.
- f- Cadastral survey must be which provides cost recycling, and creates value added tax.

Cadastral survey studies in Turkey even if there were some interruptions began in 1912 and has been continued up to now. It is known that all around the country with today's content cadastral survey was started with cadastral survey law with 1925 date and 658 numbers. In our country currently cadastral survey is applied as "legal cadastral survey" Land measuring and recording operations has become fairly different because of technologic facilities. Maps which are drawn with different laws and methods are still using in our period. It is known that correct, healthy data basis etc. needs in data systems, which use land as topic currently, can not meet needs sufficiently.

In this study targets that determined in Cadastral Survey 2014 can be performed. By doing some analysis like cadastral data base-base is formed which is suitable for National Situational Data Substructure-legal position, standardization; coordination solutions to update problems related to cadastral survey services are searched.

## **2. PRESENT POSITION of CADASTRAL SURVEY STUDIES in TURKEY**

In our country from the beginning up to now cadastral survey studies has been made with different methods and different standards. However in accordance with 13 laws, 4 regulations and 15 instructions about cadastral survey map sections the product of cadastral survey studies (from 1925 to 1948 number 658 cadastral survey law and number 243 cadastral survey and deed appropriation law is valid, never an instruction come into force.) with 11 different

scale maps between 1/2000 and 1/10000 are got by using different geodesic and photogrammetric methods and systems, using map section basis that are produced from different materials is understood. It is guessed that there are approximately 250000 map sections which are produced with this method. In table 1 according to their scale systems and in table 2 according to their section basis of maps which have been produced after cadastral survey studies since 1934 are shown.

In Turkey it is known that cadastral survey of 97 % of urban areas and 77 % of rural areas is finished as of 2005, although binding to land surveying triangulation network is fundamental principle, beside some technical problems like usage of local coordinates at some places , 14 % of area whose cadastral survey was finished, were done in graphic systems and all of the map sections needs to restore at many places, 1/5000 scale photogrammetric maps are not used as base anymore, some reasons from insufficient know-how and ability of staff 60% of country lands where cadastral survey was done must be updated again.

Table1: Position of Cadastral Survey Map According to Scale Systems

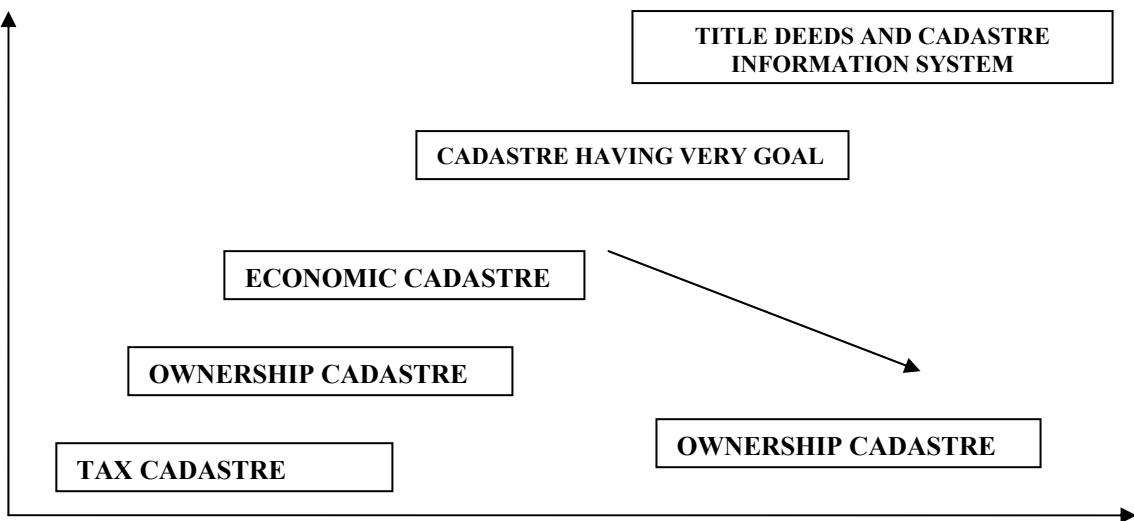
<b>Method</b>	<b>Percent</b>
Photogrammetric Method	16 %
Prismatic Method	17 %
Polar Method	20 %
Digital Method	5 %
Graphic Method	42 %

Table 2: Position of Cadastral Survey Map According to Map Section Basis

<b>Pad</b>	<b>Percent</b>
Transparent	25 %
Aluminum	31 %
Paper-Cardboard	44 %

Graphic of basic targets that are considered at cadastral survey studies from the beginning to now in Turkey are given in Figure 1. When Figure 1 is examined it is seen that cadastral survey of Turkey was suited to those days targets of the first quarter of 1900's, but in the second quarter of 1900's target was diminishing and went towards only one target.

Annual and periodic targets were selected in the subject of finishing ownership cadastral survey. Selected product targets were never reached at desired time and instead of eliminating reasons of unsuccessfulness, target deficiency at production was done. Especially behaviors in planned period can be given as an example (Erdi, Özkan ve Çay, 1999).



**Figure 1.** Target graphics that are considered at Cadastral Survey in Turkey

General Directorate of Cadastral Survey of Title Deeds (TKGM) is not a consumer organization and that has potential of producing resources to reconstruct itself, cadastral survey is a service that is vital and needs continuity, cadastral survey map sections which are done after cadastral surveys because of not only technical reasons but also parallel to dynamism in socio economical structure of society, when they are not suitable for temporary conditions and technologies, cadastral surveys cannot respond the expectations In short these can be told about present condition.;

- Diversity and quality of taken methods during cadastral survey production period, validity or usability of a lot of documents can be discussed.
- Observing alterations and updating operations on produced documents has not been done.
- Even in documents that are being produced currently there are not different information without ownership.
- The frame of number 2859 restoration law which was prepared to remove these problems is very narrow so it could be applied in restricted ratio and could not respond the expectations.
- In 2000's current days especially in technical dimension approximately none of organization has a document to be base for public works without buying a new map or completion.
- Country cadastral survey systems instead of being interactive or working coordinately with environmental systems, it is active in its world like the other public institutes,

- Generally register of title deeds in countryside lost validity of them. It causes big difficulties at setting situational information systems in application of nationalizing, consolidation etc. projects.

With 22<sup>nd</sup>,02.2005 date and 5304 numbered Law about making change at the law of Cadastral Survey To adding a sentence "***Forming substructure of situational data base***" was added to the first item. if technical works are done by auction there must be two cadastral survey technicians unless there must be one technician, during forestry cadastral survey there must be a forest engineer and agricultural engineers, at cadastral survey an additional item is put., related to expenditures, trading, restoration, leasing and training etc should be put in revolving fund and present outputs are made digital.

Innovation studies in Organization of Title Deeds and Cadastral Survey was begun firstly by Central Government Organization Research Project (MEHTAP) in 1962. Governmental Decision that has force of the law was changed and accepted as Currently valid 3045 numbered Foundation and Duties of General Directorate of Cadastral Survey of Title Deeds come into force in 1984. In 1985 (HAKAR) Map and Cadastral Survey reform Project was prepared by the cooperation of TÜBİTAK-TKGM-DPT and any changes has not been done (Tüdeş and Büyükkıran, 1994). Instead of Map and Cadastral Information system which was foresighted at the end of HAKAR project (Aksoy and his friends., 1987) currently Title Deeds And Cadastre Information System (TAKBİS) appeared. Started by Directorate of Title Deeds and Cadastral Survey and TAKBİS project (Fig.2) that aims to collect information, store, work up, and make useful to users by analysis by the help of Geographic Information System (GIS) has become one of the important process of Cadastral Survey 2014.

Ownership problems and technical, legal, social problems which comes after it are reality of our country. Solution of ownership problems appears as one of the necessary subjects .There are social problems because of ownership problems, in addition it becomes difficult day by day to solve the problem because of its insolubility. Insolubility of negativities about ownership topic damages the trustworthy of government. In addition there are problems in application of land regime policy.

Though cadastral survey of our country younger than cadastral surveys of European Countries reveals the idea of fewer problems, on the contrary there is a contrast condition. Making inadequacies of our laws a current issue and investigating precautions those are necessary to solve problems, the necessity of providing to transform current cadastral surveys to contemporary and multipurpose cadastral survey appears. On the other hand cadastral survey is a vital fact, so importance of the fourth dimension of cadastral survey "time" is obvious. Laws are stable enough, however they must be active in solving problems.



**Figure 2.** Title Deeds and Cadastre Information System (TAKBIS) Project

It is necessary to find the reasons in solution of ownership problems. Later present laws should be investigated and should be ensured that the ways of solving problems should be suited to laws.

Cadastral survey information which is constituted by The General Directorate of Title Deeds and Cadastral Survey (TKGM) form the base of investments and engineering services related to the land. Other information related to land have not integrated and situational information system has not formed, title deeds and cadastral survey information can not be benefited, and because of a lot of data review, it causes resource extravagant which reach millions of dollars (Durduran and Erdi, 2005).

Nowadays we need new systems to provide integration of all other information related to land with title deeds and cadastral survey knowledge quickly.

### 3. UPDATING PROBLEMS IN TAKBIS STUDIES and APPLICATION

In formation of TAKBIS target of TKGM; digital cadastral survey maps, making maps digital which have original scale and transfer information of title deeds records related to these maps to computer environment in the logic of information, providing to develop immovable inventory by benefiting from informatics technologies these outputs, forming decision mechanism, determining deficiencies in data, transforming data to knowledge and keeping these data at the base of operation as daily knowledge to database. Consequently to make TAKBIS database reachable and usable in definite standards (Mataracı, 2005).

Problems that we face while using and transferring to systems of Cadastral Maps are given in the following items (Durduran et. all, 2006).

- Cadastral Map sections which are in Cadastral Survey Directorate are opened in very different systems ,
- Situational data which are on cadastral map sections lost its validity or they have scale mistakes which force the limits of current scale limits according to current measuring techniques,
- Problems that come from the obligation of renewing problems in a lot of places
- Cadastral map sections are not in computer environment
- Map section deformation on cadastral basis,
- There are insufficient correct location because former cadastral maps were done out of current measuring technologies
- Cadastral maps are in country coordinate systems and there are local coordinate systems on municipality applications, because of this there is a coordinate union problem.
- Untidiness, insufficiency and complexity of archive,
- Bases which were formed during the first cadastral survey at the point of usability inadequacy of basic network and updating have not been provided.
- Which of map section, original scale value or ground is technically and legally will be used to form digital cadastral bases
- Problems that affect the result of making digital and faced during operation of making digital of the maps which were produced during the first cadastral survey are given in these following items.
  - Paper deformation ,
  - Edging problems with adjacent map sections,
  - Problems that come from adjacent map scales in different scale,
  - Problems that come from digital maker,
  - Problems that come from the person who makes digital etc. .including

It is under consideration to insert cadastral maps that were made in different methods and techniques from past to nowadays. For using these maps they should be transformed into digital map. Map sections bases are also different and ground and map section do not suited to each other so we should solve these problems.

Up to date produced, used and has been kept its legal validity the results which obtained during control of correctness are given in Table 3 (Inam, 1999).

Table 3. Point location correctness on Cadastral map sections

Kind of Map Section	$m_x$ (m)	$m_y$ (m)	$m_p$ (m)
Old Cadastral Map Section	0.263	0.265	0.373
Graphic Cadastral Map Section	2.043	1.894	2.786
PhotoPlan Map Section	4.174	3.423	5.398
Photogrammetric Map Section	1.126	1.020	1.519
Digital Cadastral Map Section	0.096	0.306	0.321

As we see in Table 3 Output quality of outputs, which are collected for the same purpose, are different. Investigating and developing studies must be continued to increase the usability of GIS which is suited to Cadastral survey 2014 vision.

All applications in GIS depended on cadastral map sections and Cadastral maps are the base of GIS, increases the importance of cadastral survey.

The most important element of GIS updating is done on cadastral maps this shows how important to keep cadastral map sections (Yerci 2003).

Studies are made at urban and rural areas in Konya region to observe the mistakes which were formed after transferring cadastral outputs to GIS environment. Parcel shapes are shown on obtained map.

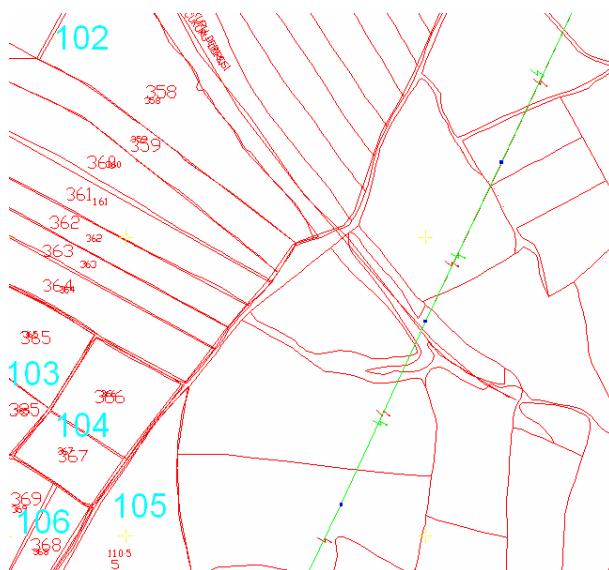


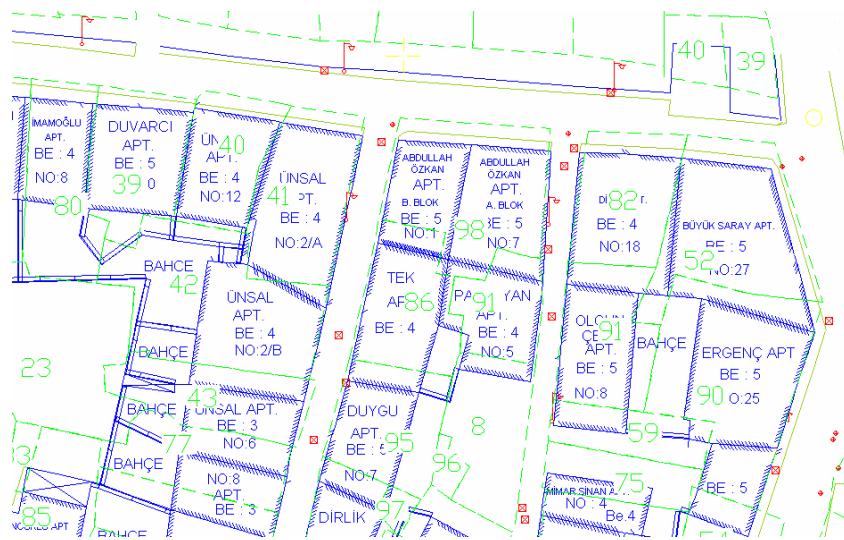
Figure 3. Cadastral updating at rural area

As we see in Fig. 3 there are parcel shapes at the borders of ownership at rural area where we make updating study. Cadastral map used at present was produced by using photogrammetric method and its scale is 1/5000. When we collide them to each other we see 3m mistakes in average at x and y coordinates. The area that forms from these parcel shapes are shown in Table 4.

Table 4 Differences in areas at updating studies which were made in rural area

BLOCK/PARCEL NUMBER	MAP SECTION PARCEL AREA	MEASURED AREA	DIFFERENCES	RESULT Dfmax>df
101/386	42165,61	44842,97	2677,36	reject
101/389	28231,03	29196,29	965,28	reject
101/390	34287,65	34633,98	346,33	accept
102/361	35369,64	32834,63	-2535,02	reject
102/395	16525,20	17060,83	535,63	accept
102/396	16345,87	15659,60	-686,27	reject
112/380	33469,52	23971,28	-9498,25	reject
112/383	71573,75	71996,96	423,20	accept

It is seen that there are also parcel shapes and differences in area in updating studies which were made at urban area (Fig. 4, Table 5).



**Figure 4.** Cadastral updating at urban area

Table 5 Differences in area in updating studies which were made at urban area

BLOCK NO	MAP SECTION PARCEL AREA	MEASURED AREA	DIFFERENCES	RESULT Dfmax>df
248	2292,451	2234,175	58,276	reject
254	1434,469	1446,66	-12,191	accept
255	2451,234	2339,36	111,874	reject
909	18958,926	19028,79	-69,864	accept
916	6152,517	6138,23	14,287	accept
950	2140,035	2185,335	-45,3	reject
951	3466,076	3418,71	47,366	accept
973	2340,689	2175,83	164,859	reject
974	2244,515	2205,753	38,762	accept

#### 4. CONCLUSION

By adding “**forming the substructure of situational knowledge system**” to target item of 5304 numbered law which foresighted some changes in 3402 numbered cadastral law determining borders of immovable properties on area and map that depended on cadastral or topographic cadastral map of the country and determining the legal conditions and setting title deeds records that is foresighted by 4721 numbered Turkish Civil Code and regulations are put forward as “**forming the substructure of situational knowledge system** is aimed”.

On these days that we qualified as knowledge systems period, TAKBIS project which started by General Directorate of Title Deeds and Cadastral Survey, bases of studies related to other organizations at the point of collecting cadastral and ownership information in a definite data standard, and controlling from a point, An obligation according to 5216 numbered municipality law it has a big importance in establishing urban information system (UIS). TAKBIS must become widespread immediately. Using same systems and same language among organizations operations resulted more quickly. Initiative of staff decrease to minimum in organizations. It will provide coordination, data sharing, work, workforce and time profit by using technology together among organizations (Durduran et.al., 2006).

Nowadays cadastral survey is an important organization which law, economy, social life statistics and science need and production, store, present, observing changes of some basic data Cadastral survey is knowledge that is produced by cadastral organization and presented as knowledge systems and bases of systems collecting situational or none situational data systems these knowledge dependent on official registration .Therefore in these

- Honesty
- Sensitivity
- Being valid

Qualities are demanded, to obtain these qualities, properly problems at present determined objectively, permanent solution must be found (Biyik 1999).

If the base problems that we meet during cadastral survey studies and some activities at present structure are not corrected legally updated cadastral survey map sections we can not provide usability of not only TAKBIS but also from the point of law .To put forward cadastral maps suitable bases to TAKBIS and it should plan to make the second cadastral survey.

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