

# Spatial Data Infrastructure in Turkey and Projects

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**Key words:** cadastre, GSDI, CORS-TR, metadata, orthophoto.

## SUMMARY

General Directorate of Land Registry and Cadastre (GDLRC) is a leader institution about map-land registry-cadastre and has executed many spatial projects during Pre-Accession to European Union.

Turkish National Geographic Information System (TNGIS) Project is one of the projects of GDLRC. In this project INPIRE (The Infrastructure for Spatial Information in Europe) Directive which is executed by European Union (EU) member countries is accepted as a basic document. This is a national-wide, long-term project. The first application step is to create the list of the institutions which ones will be added to the geographic information portal, to determine metadata standards and to publish metadata using these standards. In this concept Geoportal Projects is created under Land Registry and Cadastre Information System Project on [www.hbb.tkgm.gov.tr/metadata](http://www.hbb.tkgm.gov.tr/metadata) web site that serves actively now. This web site is responsible to register and publish information about maps. Its legal power based on Regulation on Production of Large Scale Maps and Map Information dated 2005. The aim is to provide coordination among map related institutions and to avoid duplicate production because there are many institutions that produce map or map information. While creating metadata on this web site ISO TC211/19115 Metadata Standard is used. The second project is CORS\_TR (Continuously Operating Reference System in Turkey) that is the other Project will serve for TNGIS Project). The first article in Annex I in INSPIRE Directive (coordinate reference system) is realized by CORS\_TR Project and studies. The coordinate reference system is one of the required spatial themes. Another required spatial theme is “orthophoto/orthoimagery” in Annex II in INSPIRE Directive. For the beginning to produce orthophoto 1/5000 Large Scale Digital Colored Orthophoto Production Adjudication that involves the cities of Adana, Izmir, Mersin and Manisa is realized on 29th June, 2009. Ongoing projects in 2010, Corum, Amasya, Gaziantep, Hatay. Planning projects in 2011 Sinop, Samsun, Elbistan. In addition to this the orthophotos will be the base documents for Land Registry and Cadastre Modernization Project to renew the cadastre.

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## 1. INTRODUCTION

National Spatial Data Infrastructure defined as the “technologies, policies, and people necessary to promote sharing of geospatial data throughout all levels of government, the private and non-profit sectors, and the academic community.” A NSDI has six basic blocks: Partnerships, Standards, Framework, Geodata, Metadata and Clearinghouse/Portal. Each of these components serves as a cornerstone in establishing consistency and structure when it comes to documenting spatial data for everyday applications, as well as in building a distributed network of producers and users that facilitate data.

The need of spatial data has also been increasing in Turkey as in the world. The spatial data is the basic of Geographic Information Systems (GIS). GIS is a kind of data processing in every field in societies and a component for national data processing policies (Yomralıoğlu, 2003).

Spatial Data Infrastructure (SDI) is the infrastructure for GIS and also its aim is to facilitate the exchange and the share of spatial data and to provide coordination among users. At administration level it is to reach the best results on economical, social and environmental decisions. Its role is to supply active and effective environment on organizational goals for producers and users. SDI accepts the technological support (Paudyal ve McDougall, 2008).

Spatial data has an important role on sustainable development and is a required component of e-government. Daily more people want to reach spatial data via Internet (Li, Wu ve Xiao, 2008).

The studies on e-government projects have been going on since 2000's (GDLRC, 2005-GDLRC, 2006 - Yalçın et al, 2009). To benefit from information technologies at national and sustainable development it is needed to create SDI. Cadastre Law (2005) says to create the infrastructure of spatial data. On 16.12.2009 Agreement for Service on Feasibility Research to Establish Turkish National Spatial Data Infrastructure (TNSDI) is signed by TURKSAT A.Ş. First phase finished December 2010.

## 2. TURKISH NATIONAL SPATIAL DATA INFRASTRUCTURE (TNSDI) AND INSPIRE

TNSDI Project aims to reach true and actual geographic information in national standards online in case geographic information users need to make decisions (GDLRC, 2006). In this project INSPIRE (The Infrastructure for Spatial Information in Europe) that will be executed by member countries of European Union is the basic document spatial datasets and services and to access and to use these. The second phase is to harmonize the spatial data sets and

services. The third phase is to develop common geographic data models and to integrate these data sets. The fourth, the last phase is to service seamless geographic datasets which have the different scales and sources in different national and local levels (GDLRC, 2005).

INSPIRE Directive is published on Official Journal dated 25.04.2007 and put into practice (Akıncı ve Cömert, 2009; European Parliament and of the Council of European Union, 2007). 2009-2013 is the Implementation Period of INSPIRE Directive. The first requirement in directive is metadata, the second one is geodata sets in Annex1, Annex2 and Annex3 and services (Aydınoglu vd, 2005). Member countries have to create and update metadata geodata sets and services. In Turkey Metadata Portal serves on <http://hbb.tkgm.gov.tr/metadata/> web site to publish and update metadata. Furthermore CORS-TR Project as the first theme “coordinate reference system” in Annex1, Orthophoto Production Project as the third theme “orthoimagery” in Annex2 and Cadastre Renovation Project as the sixty theme “cadastral parcels” in Annex1 have been executed.

## **2.1 Coordinate Reference Systems in Annex1**

Turkish National Continuously Operating Reference System (CORS-TR) is a project that aims to collect military and civilian data in third dimension (3D) actively and continuously. One of the basic objectives is to establish active, effective, economical in technologic platform and accurate position determination for infrastructure projects directed at defense and development by using correction information based on satellites. All institutions that are related to production of map and map information, especially General Directorate of Land Registry and Cadastre and General Command of Mapping, need fast and true surveying and calculations of Ground Control Points (GCP). (GCM, 2009).

Global Positioning System (GPS) has a very important role in position determination and the spatial information have been used in different fields like e\_government projects (Yıldırım et al, 2009). TNSDI is a e\_government Project that has been executed by GDLRC and it aims to serve the first requirement in Annex1.

## **2.2 Metadata in Implementation Rules in INSPIRE as The First Step**

European Union Member States will create metadata for spatial data sets and services corresponding to the themes listed in Annex1, Annex2 and Annex3 in INSPIRE Directive and keep up to date. Metadata must be created for Annex1 spatial data themes within 2 years and for Annex3 spatial data themes within 5 years (GDLRC, 2005).

In Turkey GeoMetadata Portal sited on <http://hbb.tkgm.gov.tr/metadata/> web address is put into practice to publish and update metadata and to form the first support for TNSDI. Geometadata Portal studies began after Regulation of Large Scale Map and Map Information Production came into force in 2005. In project ISO 19115/TC211 standards are used.

First web site was presented with “Under Test” warning to the users and critiques and interpretations at every stage had taken. The studies continued in this direction. Currently the portal serves with Publishing Metadata, Searching Metadata, Searching Ground Control Points, and Integration to Google Earth functions (Yalçın ve Bakıcı, 2008; Yalçın et al, 2007; Bakıcı et al, 2007).

### 2.3 Orthophoto (Orthoimagery) in Annex2

One of the methods to produce spatial data and spatial data set is Photogrammetry. It is a method to collect true and reliable data fastly. Furthermore it provides visual information wealth after integration of real maps and image of earth surface (Çelik et al, 2005).

Because of the huge importance of Digital Orthophotos, studies of National Orthophoto Information System began. *Commission of Scientific Research and Coordination under Council of Coordination and Planning of Inter-ministerial Map Works* aims to determine production and usage capacities of the institutions and to determine requirements and cost analysis for Orthophoto Information System (OIS) through existing possibilities (Ayhan vd, 2009). In the view of the commission report the ratio of usage of aerial photos is %17 and the ratio of usage of both aerial photo and satellite image is %52. The ratio of wish to set up OIS is %96 (BARKOK Report, 2009).

Digital Camera is purchased by GDLRC for OIS. Furthermore two adjudications, named 1/ 5000 Scale Digital Colour Orthophoto Production Work that contain Adana and Izmir but include Adana, Izmir, Mersin and Manisa were realized on 29.06.2009. These two work area are search and find on metadata portal web site.

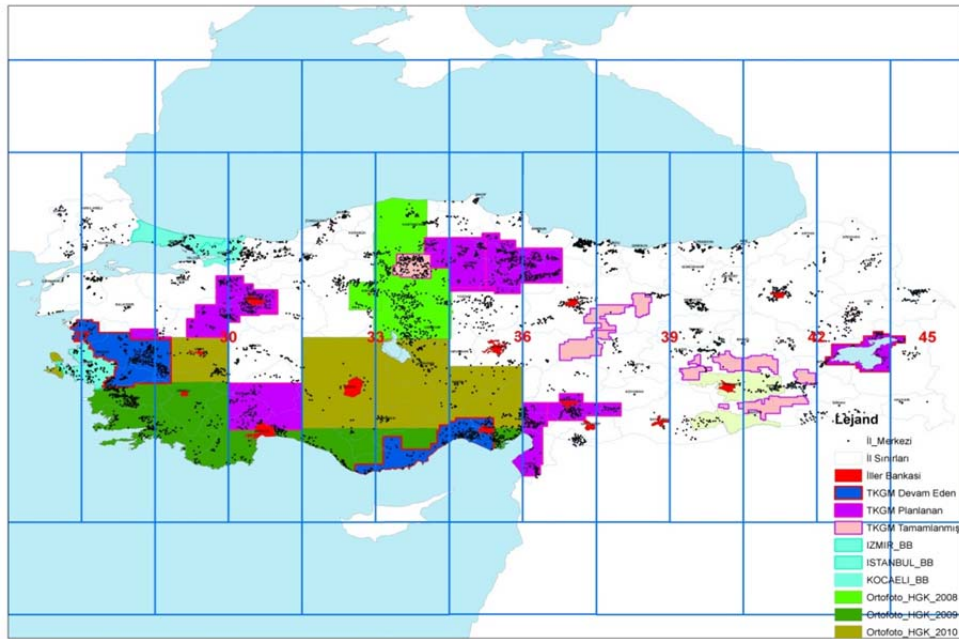


Figure 1: Orthophoto Production Project Area.

Ongoing projects in 2010, Corum, Amasya, Gaziantep, Hatay and planning projects in 2011 Sinop, Samsun, Elbistan. Per year is product orthophotos approximately 70.000 km2 area with digital aerial camera (Figure 1). The users are presented with the use of web services orthophoto displays after the production (Figure 2 and Figure 3).

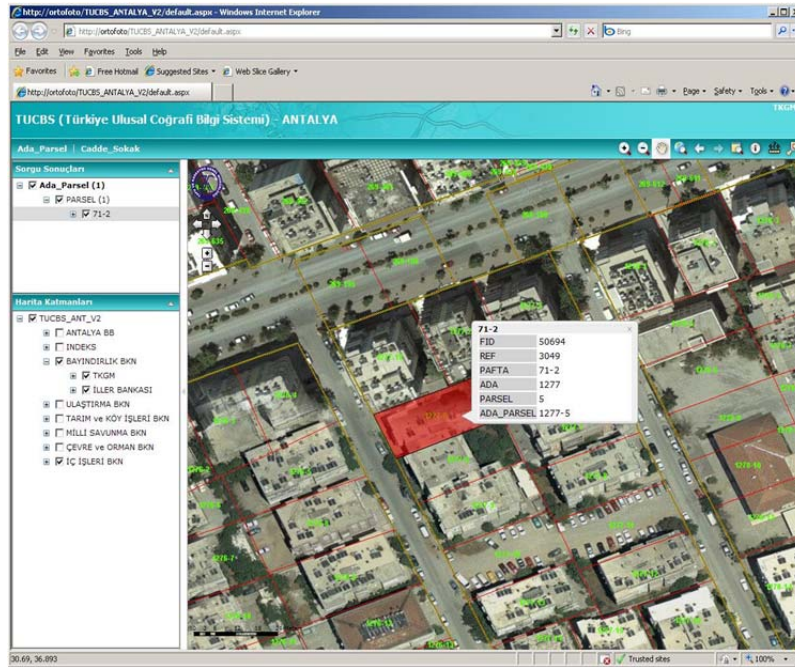


Figure 2: The use of web services orthophoto displays.

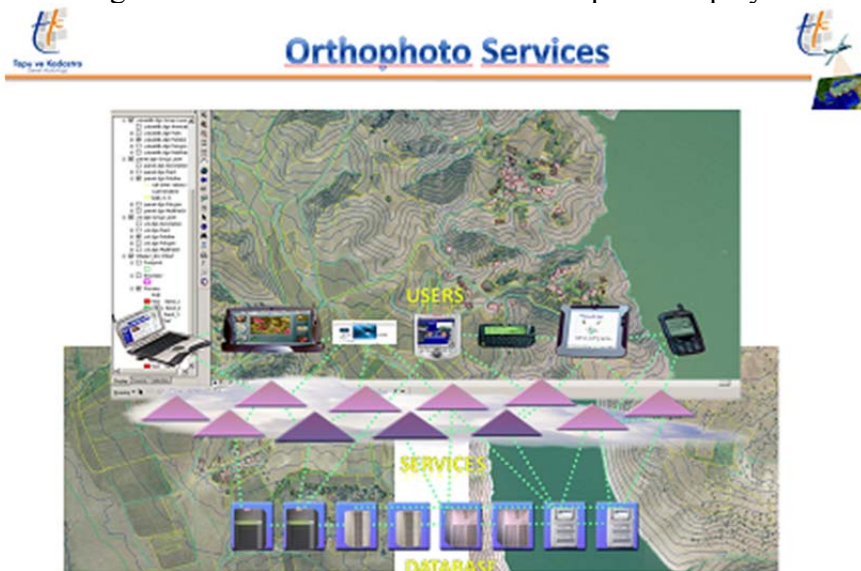


Figure 3: Orthophoto Services.

Orthophotos are one of the requirements in Annex2 in INSPIRE and the metadata of these should be created.

## 2.4 Cadastre Renovation and Modernization Project and “cadastral parcels” in Annex1

TKGM Cadastre Modernization Project in the country with the transfers of all parcels (Figure 4) to digital media. TAKBIS called the project the digitized parcels, with web services will be offered to all users. TAKBIS is one of the most basic “e-government project” aiming the GDLRC services in a more correct, rapid, reliable and effective way to other institutions and citizens in a unique database.

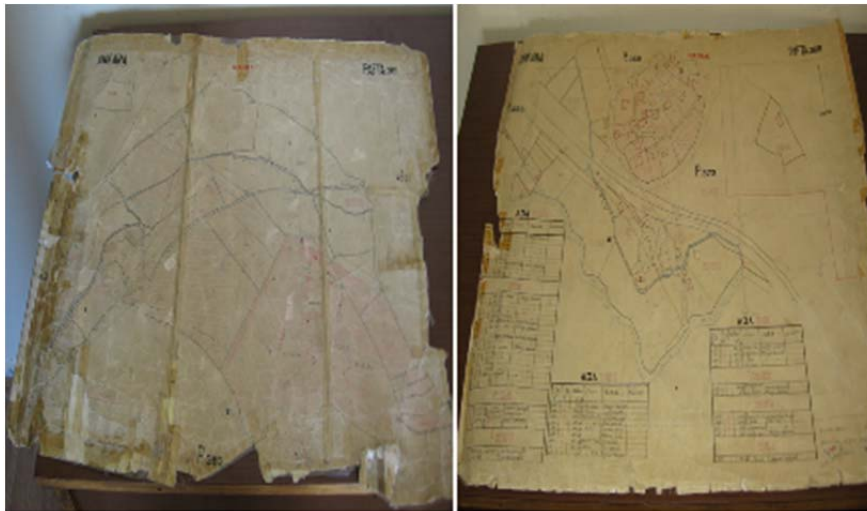


Figure 4: The cadastral sheets.

Cadastral Parcels are one of the requirements in Annex1 in INSPIRE and the metadata of these should be created.

## 3. CONCLUSION

In Turkey the studies to create spatial data infrastructure named TNSDI (Turkish National Spatial Data Infrastructure) have been executed by GDLRC (General Directorate of Land Registry and Cadastre). In this concept INSPIRE Directive is the basic document.

Geometadata Portal Project, CORS-TR Project, Orthophoto Production Project and Cadastre Modernization Project are the basic first projects and studies in GDLRC.

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