

Policies and Standards for Building Turkey National GIS Infrastructure

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SUMMARY

Turkey started e-government actions to build Turkey's National Spatial Data Infrastructure titled as "Turkey National GIS" (TUCBS or TRGIS in English) in 2004. TRGIS actions aim to enable effective use and sharing of geographic data on electronic communication network by developing standards, policies, and technologies. Consecutive actions determined current situation and general vision. However, requirements could not be determined on production, management, and sharing of geographic data. The General Directorate of GIS in Turkey was established in 2011. Projects were triggered to define geo-data standards and to build legal and administrative structure of National GIS. Hereby, national GIS strategy and the legislation framework were determined to manage geographic information. General administrative structure was designed for the National GIS committee and working groups. National GIS portal with its metadata standard is being built to share geographic information. As a result of analyzing existing geo-data, data requirement works, and international standards; Data Specifications were designed for 10 reference geo-data themes in Turkey. These standards are being tested to use in GIS projects corporately.

ÖZET

Türkiye, Ulusal CBS (TUCBS) olarak isimlendirilen Ulusal Konumsal Veri Altyapısı kurulması için e-devlet eylemlerine 2004 yılında başladı. TUCBS eylemleri, geliştirilen standartlar, politikalar ve teknolojiler ile elektronik iletişim ağlarında coğrafi verinin etkin kullanımı ve paylaşımını amaçlamaktadır. Devam eden eylemlerde mevcut durum ve genel vizyon belirlenmiştir. Ancak coğrafi verinin üretimi, yönetimi ve paylaşımında gereksinimler belirlenemedi. Türkiye'de CBS Genel Müdürlüğü, 2011 yılında kurulmuştur. Coğrafi veri standartlarının belirlenmesi ve Ulusal CBS'nin yasal ve idari yapısını oluşturmak için projelere hız verildi. Böylelikle coğrafi bilginin yönetiminde ulusal CBS stratejisi ve yasal çerçeve belirlenmiştir. Ulusal CBS komitesi ve çalışma gruplarının genel idari yapısı tasarlandı. Ulusal CBS portalı, metaveri standardıyla coğrafi bilgiyi paylaşmak için kurulmaktadır. Mevcut verinin analizi, kurumlarda uygulanan veri gereksinim analizi ve uluslararası standartların analizi sonucu; Türkiye için 10 temel coğrafi veri temasını temsil eden veri standartları belirlenmiştir. Bu standartların CBS projelerinde uyumlu kullanımını test edilmektedir.

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1. INTRODUCTION

Uncoordinated geo-data management causes time and effort losses in Turkey. In this way, geo-data produced by different public institutions should be interoperable for effective use and sharing of geographical data. Turkey National GIS action triggered in 2004 aims to build Turkey's National Spatial Data Infrastructure. Standard, policy, and technology components are required to manage geo-data sets effectively on electronic communications networks.

Using standardized and interoperable geo-data sets on different applications will satisfy public institutions, private sector, research institutions, and citizens. However, technical, standard, and policy deficiencies cause problems on data production, management, and sharing. Geo-data sets were not produced to solve application driven requirements in various GIS projects and not designed to enable data interoperability.

In this paper, development process was examined to build geo-data infrastructure in Turkey. The standardization project of Turkey National GIS was explained with work packages. Standards and policies were discussed in detail.

2. DEVELOPMENT PROCESS FOR BUILDING NATIONAL SDI IN TURKEY

Public institutions in Turkey started investment for Information and Communication Technologies (ICTs) in the 1990s especially. They recognized the necessity of GIS in these years. Analog maps were commonly converted to digital format and used in some thematic projects. The General Command of Mapping (GCM or HGK in Turkish) pioneered digital map production process. Standard Topographic Maps, smaller than 1:5.000, are produced by HGK. Large Scaled Maps, 1:5.000 and larger, are produced by the Land Registry and Cadastre Directorate (LRCD or TKGM in Turkish) and local governments. Other public institutions and municipalities have produced maps for their working area.

In 1986, as a result of fast developments in technology, with TKGM's interest, "Mapping-Cadastre Reform Project's (HAKAR in Turkish)" first stage finished and main vision of the cadastre was determined. Land Registry and Cadastral Information System (TAKBİS in Turkish) project was started in 2000 and continues nowadays with the same vision of HAKAR project.

In 1999, Commission for Coordination and Planning Map Services Between Ministries (BHİKPK in Turkish) produced "Turkey National GIS politics and strategy draft" pioneered by HGK. Due to authority inefficacy, it could not be actualized.

In 2000, National Information System was triggered by prime ministry. It is aimed that the data within authority and responsibility of public institutions and organizations should be reachable and usable by distributed systems. This project could not be also implemented. In 2003, a five-years Development Plan was prepared by State Planning Organization (DPT in Turkish). In this report, “Map, Land Registry and Cadastre, Geographic Information and Remote Sensing Systems Specialization Commission” determined some aims and visions about Turkish National GIS process.

Turkey has a vision to develop public administration, support environmental sustainability, and reach accession level of European Union (EU). In 2003, eTurkey initiative, identical to eEurope+, increased efforts to transform the country into an information society. The e-Transformation Turkey Project aims to foster the evolution and coordination of information society actions. As an action plan of this initiative, building Turkish National GIS was initiated under the responsibility of TKGM.

In 2004 with the National Action Plan No. 47 the current situation in relation to building Turkey National GIS (TRGIS or TUCBS in Turkish) was examined. However, it has yet to be determined which institutions produce which data and to which standard or scale.

With the National Action Plan No. 36, TUCBS concept and implementation models were determined in 2005. It was emphasized that it is necessary to build TUCBS to efficiently share the geo-data produced by participating public institutions, organizations, companies, and universities. According to Modernization in Public Administration Action Plan No.75 (KYM-75), under responsibility of TKGM, TRGIS geo-portal for public institutions serve their geo-data and related data content. Current status, responsible establishments of geo-portal, examples of international projects, and standards were analyzed with feasibility study.

Within the scope of E-Turkey Project actions, Action 53- Land Registry and Cadastre Information System (TAKBİS in Turkish) aims to extend nationwide databases for land registry and cadastre information. Action 55- Agriculture Information System aims to manage an integrated agricultural system. Action 59- National Transportation Portal aims to build nationwide transportation information system.

In addition to this, Guide for Interoperability Principles was published in 2009 and updated in 2012 by DPT within the scope of E-Turkey Project. This aims the interoperability between all institutions to serve geo-data sets in electronic environment to the community. This guide suggests international accepted OGC standards about web services, metadata, access to data and publishing. However, it is emphasized that metadata profile, common standards for feature-attribute catalog, and data exchange format are required.

However, there is a lack of coordination between the public institutions that produce and use geo-data. In addition, there are technical difficulties, a lack of data standards and specific policies governing GIS projects. These factors contribute to the inefficient collection of data, impact on the quality of the data, and impede the sharing of data and the management of the GIS projects (Yomralioglu and Aydinoglu, 2010; GD-GIS, 2012a).

3. TRGIS PROJECT

In Turkey, the General Directorate of GIS was established within Ministry of Environment and Urbanization in 2011. With its power, the general directorate aims to coordinate GIS activities, to produce standards, and to determine main policies and strategies in Turkey. General Directorate of GIS started the projects about “Developing Turkey National GIS (TUCBS or TRGIS in English) standards” and “Developing Turkey Urban GIS standards” (TRKBISS in Turkish) in 2011. These projects carried out by the Istanbul Technical University as a sub-contractor of the Turksat Inc.

TRGIS project’s aim is to determine TUCBS framework law and related legislation and to determine geo-data standards for TUCBS geo-portal. The TRGIS project includes eight working packages. These packages with outputs are explained as below (GD-GIS, 2012b).

- **WP.1 TRGIS Portal Analysis:** According to the criteria identified by looking at the relevant standards, site selection analysis was done. Centralized, distributed architecture, and cloud computing architectures are analyzed by examining the structures of the institutions that can be used as data center and portal center.

- **WP.2 TRGIS Management Model:** National and international SDI initiatives were examined. After examining legal and administrative structure in Turkey; vision, mission and expectations were determined in the context of TRGIS. The steps were defined for implementation strategy. The TRGIS framework legislation was prepared after examining INSPIRE directives and SDI legislation in European countries.

- **WP.3 TRGIS Data Requirements Analysis:** TRGIS data forms were prepared for data requirement analysis. These were conducted to determine the contents of the specifications of TRGIS geo-data themes. By visiting stakeholder institutions and workshops, information forms were completed and evaluations were made about the results of this analysis.

- **WP.4 TRGIS Conceptual Data Model Components:** The general structure of the conceptual data model was examined on the level use of ISO and OGC standards. TRGIS principles, terminology, reference model, the application scheme rules, cataloguing rules, coordinate reference system, metadata, data maintenance, and quality components were determined as conceptual model components of TRGIS. These components define base rules to develop interoperable geo-data specifications of geo-data themes.

- **WP.5 TRGIS Data Standards:** According to rules defined based on the components of TRGIS Conceptual Model, TRGIS application schemas and data catalogues of geo-data themes were developed. Feature classes for each data theme were defined with class name, geometry, attributes, coded values, sub-feature types, attributes, attribute relationship (code in detail the relationship type, cardinality), topological rules, and functions. UML/GML application schemas with catalogues and documentations were prepared for 10 base geo-data themes including Administrative Unit, Address, Land Registry & Cadastre, Building, Transportation, Topography, Hydrography, Land Cover, Orthophoto, and Geodesy.

WP.6 TRGIS Legislation Requirement: Legislation and implementation rules were examined to manage TRGIS portal, data specification, responsibility of data providers. And, possible legal arrangements were investigated to develop TRGIS in the long term.

WP.7 Portal Implementation Rules: INSPIRE, ISO and OGC criteria, web services, personnel criteria, software / hardware details were examined to build TRGIS portal for the institutions. The portal implementation rules were defined by power and responsibilities in terms of network services and network access.

WP.8 TRGIS Training and Dissemination: Papers, slides, and case applications were prepared for training experts and developing educational strategies in public institutions.

3.1. Legislation phase

TRGIS draft legislation was prepared and is about to put into practice. This legislation includes contents like INSPIRE legislation accepted in European countries. Other legislation requirements were also examined. The sections of this legislation include (GD-GIS, 2012a);

- TRGIS vision, aim, scope, and definitions,
- TRGIS administrative structure with units, principles, and duties to coordinate TRGIS activities in Turkey,
- TRGIS base and thematic geo-data themes with definitions,
- Responsibilities of stakeholder institutions,
- TRGIS metadata,
- TRGIS network services with properties and pricing policy,
- TRGIS interoperability principle for sharing geo-data sets and services,
- TRGIS calendar.

3.2. Geo-data Themes

To develop geo-data standards, use case and requirement analysis were utilized to all stakeholders of National GIS including 15 ministries, 86 general directorates, 88 departments, and 118 branches. As a result of fieldwork and workshops, 254 information products as map, application, and product were analyzed.

Requirements and Feature Types were identified, depending on use cases specialized in Data / Function matrix. In As-is analysis, the existing specifications were determined and used as basis and potential data specification for the relevant data themes. In Gap analysis, deficiencies like missing features and attributes were obtained from fieldwork and best practices.

TRGIS base geo-data themes were determined as geodesy, topography, ortophoto, land cover, hydrography, transportation, administrative unit, land registry-cadastre, building, and address.

According to the conceptual model components, UML application schemas for these geo-data themes were designed independent from any particular software and hardware. UML class diagrams express the structure and content of the data to be exchanged. It is supposed that if the data providers and the data users agree on UML application schemas according to ISO/TC211 standards, these schemas can be used as base schema that enables the data for multiple uses.

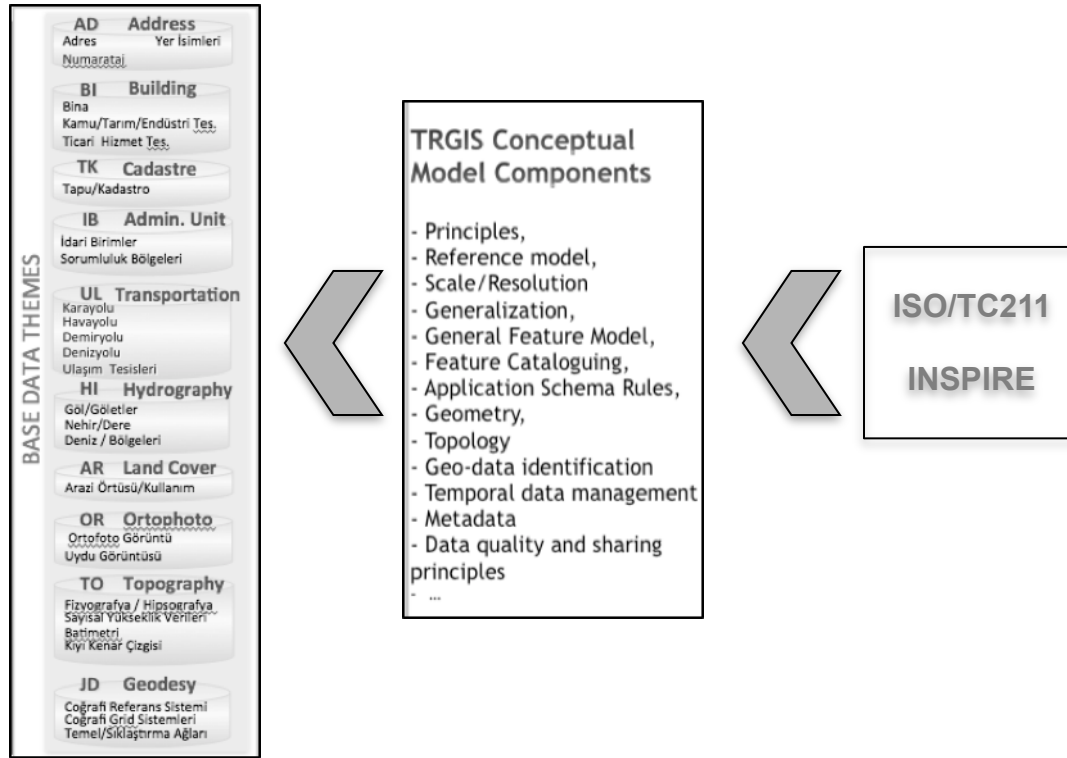


Figure 1. TRGIS Conceptual Model Components and Geo-data Themes (Yomralioglu and Aydinoglu, 2012)

TRGIS geo-data themes define base geo-data models that different users/sectors need to share.

- **TRGIS.AD Address:** This theme defines any land or building in terms of geo-location and function. It includes geographic place names. Address identification is expressed with address components and numeric information at local level.

- **TRGIS.BI Building:** This theme includes structures on land and water, permanent or temporary, official and private, underground and over ground with their construction. The building within the scope of this theme is the structures for living, housing, working, and other use. And, this theme includes contents required by the users.

- **TRGIS.TK Land Registry & Cadastre:** This theme includes land ownership parcels with cadastre and immovable property that is the smallest homogeneous unit refers as spatial. This real estate title deed, registered for goods contains the information for the property and other rights.
- **TRGIS.ID Administrative Unit:** Administrative Unit defines administrative boundary areas of management units including central and local administrative units and institutional units. The hierarchy of administrative units is defined compatible to Turkey's administrative structure and regional statistics definitions.
- **TRGIS.UL Transportation:** Transportation theme includes road, rail, sea, and air transport networks. This structure provides integrated solutions for the management of transportation data, other transport networks, intersections and network-related data.
- **TRGIS.HI Hydrography:** The lake, river, watershed, coastal regions, and features related to hydrography are defined in this theme. Hydrographical data is organized to facilitate interoperability and sharing.
- **TRGIS.AO Land Cover:** This theme includes built-up areas, agricultural areas, forests and semi-natural areas, wetlands and water bodies formed in the surface of the wet areas and cover the physical and biological surface.
- **TRGIS.OF Orthophoto:** Images taken from satellites and aircraft and other air tools are used as corrected map after eliminating defects.
- **TRGIS.TO Topography:** Land, coastal edge and water bodies are defined with heights in digital elevation model. Earth's three-dimensional express is represented with the topography.
- **TRGIS.JD Geodetic Infrastructure:** Reference coordinates and geographical grid systems are covered in geodetic infrastructure data theme (GD-GIS, 2012b).

3.3. Technical Infrastructure

TRGIS Portal was built and tested. TRGIS metadata and validation services are in the progress to service TRGIS geo-data sets. Beside this, Cloud TRGIS opportunities and minimum requirements were determined as next GIS vision in view of technological development.

TRGIS Metadata identifies information about geographical data sets and services. TRGIS Metadata includes 39 metadata components, 15 of which is compulsory, in 9 metadata classes such as Data Identity, Classification, Keyword, Geographical Position, Data Standard and Reference Information, Lineage, Geographic Data Quality and Validity, Data Right of Usage/ Distribution, and Metadata Reference Information.

4. CONCLUSION

In Turkey, geographical data produced by different institutional stakeholders and the geographic information system applications, decision-making process by contributing to the creation of a structure to avoid information loss in terms of time and effort required. Interoperability of geographic data, expressed as the effective use and sharing of geographical data, which provides various administrative levels, policies, standards and technologies, identification and effective management of electronic communications networks and geo-portal that provide Turkey's National Spatial Data Infrastructure (TRGIS - SDI) is aimed to build.

TRGIS actions like National SDI initiatives around the World were carried out in Turkey since 2004. TKGM had responsibilities to manage TRGIS actions until 2011. In almost all actions, current situation was analyzed and vision, mission, and working steps were determined to build TRGIS. Expectations were indicated about legal, standard, and technical infrastructure of TRGIS initiatives. But no concrete steps had been taken. Since 2011, General Directorate of GIS with its legal force gets a significant role to build and implement TRGIS.

According to the result of our fieldwork and meetings in Turkey, as understood, public institutions, academicians, and private sectors in GIS industry have deficiencies about Spatial Data Infrastructure vision and using geo-data specifications suitable to ISO/TC211 standards and TRGIS geo-data themes. Uncoordinated bureaucracy and authorization changes constantly hamper the sustainability of TRGIS progress. In this way, beside capacity building activities, TRGIS require process-based approach in the long term instead of product-based approach in short term.

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BIOGRAPHICAL NOTES

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