

MILESTONES TO BUILD SPATIAL DATA INFRASTRUCTURE SUPPORTING SUSTAINABLE LAND MANAGEMENT

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ABSTRACT

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. General Directorate of GIS 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 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 applications, data requirement works, and international standards; data specifications were designed for base geo-data themes. These standards are being tested to use in GIS projects of Turkey. By taking problems and processes into account, this study examines activities for building National GIS and gives milestones supporting National GIS initiatives as an integral part of land management.

Keywords TUCBS

**Full paper is not submitted.*

UTILIZATION OF CLOUD COMPUTING FOR PRESENTATION OF CADASTRE DATA

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ABSTRACT

Recent developments in Cloud Computing (CC) technology affect Computer Aided Design (CAD) and Geographical Information Systems (GIS). Due to harmonization of these technologies a new area called Spatial Cloud Computing (SCC) has been emerged. CAD and GIS are essential tools for a cadastre application. SCC will bring efficiency and velocity to process of cadastre applications done by government or private sector. Internet's accessibility will make spatial/non-spatial file shares easier and faster. As an example a surveyor in land may easily access to maps, satellite views or any data relevant without any obligation of going to office. This access also can be possible with smart phone, tablet or laptop thus just necessity is internet connection. With SCC user will be able to view, edit or share cadastre data or land title independent of installing any CAD or GIS software. On the other hand, at cadastre applications SCC brings functionality, high capacity and scalability besides accessibility. In this paper the innovations SCC brings to cadastre and related geospatial studies were researched and some of these were tested, verified with case studies.

Key words: Cloud Computing, Cadastre, GIS, Spatial Cloud Computing, 3D GIS

INTRODUCTION

Geographical Information System (GIS) is one of the most efficient tool for directing and sharing cadastre datasets like other spatial datasets. During the last 20 years we have witnessed concerted efforts worldwide to develop internet-based infrastructures to make data and information products more widely accessible and shareable to support science, public policy in different thematic areas, and provide improved services to public sector, citizens and business (Borzacchiello and Craglia, 2013).

Due to the incredible development in information technology, the information management function has been substantially improved over the last few decades, with many attempts to establish effective information systems to deal with land information (Demir and Coruhlu, 2008; Steudler, 2004). Usage of internet technologies for share of spatial data in terms of e-government applications is a necessity (Aydinoglu, 2002). In our day, there is a new concept for sharing spatial data and making it accessible to different user cluster. This technology is called Spatial Cloud Computing (SCC).

SCC capability can be as simple as running a GIS on a cloud platform and using Cloud Computing (CC) for GIS services (Yang and Deng, 2010) or as complex as building a well optimized CC environment based on sophisticated spatiotemporal principles (Yang et al., 2011; Srinivas et al., 2011). SCC is built on the benefits of CC and the advantages of leveraging the geographic component in data (Xue et al., 2010).). SCC presents new important research eras in terms of development of GIS technology (Kouyoumjian, 2010). In this paper we have investigated and tested usage of SCC technology for share any presentation of cadastre data. Advantageous and disadvantageous criterias were researched using SCC technology instead of classical server system for cadastral applications.

CADASTRE IN TURKEY

Two core cadastral projects in Turkey are; Land Title and Cadastre Information System (TAKBIS) and Real Estate Inf. System (MEGSIS). TAKBIS is one of the most important e-Government projects of Turkey. TAKBIS aims spatial data share and collaboration between associated organizations. It is an integrated objective oriented information system containing multi-functional aspects in terms of geospatial applications. 21 million land title and 5,5 million cadastre file were incorporated into system. After three TAKBIS project steps, hardware and software infrastructure of TAKBIS is evolved up to now but it is clear that this is a developing process and maybe TAKBIS 4 of TAKBIS 5 step will be under cloud technology.

MEGSIS is a project aiming gathering CAD based local based in same share pool and matching these CAD files with related tabular files as Land Title information. MEGSIS has three components;

- 1-Web based application software
- 2-Internationally standardized web map services
- 3-E-government web map service

Current situation at MEGSIS is shown at Table 1 displaying local manager office studies of General Administrative of Land Title and Cadastre for Turkey.

ABILITIES OF SPATIAL CLOUD COMPUTING

We argue that the latest advancements of cloud computing provide a potential solution to address these grand challenges in a SCC fashion (Yang et al., 2011). There is a strong contender for meeting the high level demands of GIS applications and a well-engineered cloud architectures for such applications can potentially improve the scalability, accessibility and usability of GIS resources (Bhat et al., 2011)

Lower Cost

Because the geo-technology infrastructure, the services and the data are provided; there is no large initial investment in time and cost, or ongoing maintenance. This is important because the cost of an enterprise GIS can be quite significant from a variety of factors including software licensing, applications development, data management, and (Information Technology) IT infrastructure (Williams, 2010).

Table 1: Current situation of MEGSIS

Local Office	Land Title Parsel	Cadastre Parcel	Integrated Parcel	Integration Rate	Multiplicing Geometry
Kastamonu	2.368.603	2.374.003	2.370.730	99,98	3.49
Yozgat	2.228.153	2.240.699	2.230.396	99,82	942
Samsun	3.339.994	3.341.519	3.309.511	98,79	2.687
Erzurum	3.052.933	3.065.595	3.014.279	98,35	2.377
Trabzon	3.161.355	3.142.549	3.117.597	98,35	1.568
Sivas	2.573.946	2.569.027	2.542.690	98,13	2.944
Antalya	2.789.089	2.833.109	2.787.862	98,05	1.255
Bursa	3.989.663	4.004.826	3.916.018	97,98	3.391
İstanbul	2.679.216	2.658.470	2.625.659	97,92	1.278
Konya	3.457.728	3.426.931	3.382.426	97,58	3.364
Eskişehir	3.879.682	3.850.565	3.781.660	97,31	3.699
Ankara	3.577.535	3.727.770	3.493.654	96,36	18.855
Diyarbakır	1.094.032	1.069.839	1.051.804	95,94	474
Hatay	2.536.803	2.516.072	2.442.251	95,87	4.972
Edirne	1.735.914	1.754.336	1.666.313	95,82	3.393
İzmir	3.455.326	3.386.711	3.311.584	95,56	3.069
Kayseri	2.701.734	2.687.943	2.603.316	95,52	3.629
Denizli	2.683.806	2.632.995	2.570.485	95,52	2.024
Van	1.063.084	1.048.515	1.011.438	94,62	4.487
Şanlıurfa	1.304.027	1.242.401	1.207.859	92,29	1.335
Gaziantep	1.386.196	1.312.476	1.257.472	90,52	2.002
Elazığ	1.899.488	1.817.875	1.718.391	90,11	8.417
TOTAL	56.958.307	56.704.226	55.413.395	97,29	

Solving Data and Computing Intensity Problems

SCC optimize CC infrastructure by helping arrange, select and utilize high end computing for computing intensive problems. (Yang et al., 2011). Huge and various spatial datasets can be stored and processed with SCC technology. ESRI systems showed that 4.5 billions of spatial data records can be analysed in 10 seconds with cloud computing and big data paradigms. In future studies this will open an inspiring door in front of geospatial sciences.

Scalability

This scalability on demand, when viewed against the backdrop of the typical software and hardware procurement process in many organizations, is a very real benefit. Furthermore, the flexibility this provides to organizations, through the capability to deploy this additional capacity on demand (Kouyoumjian, 2010).

Interoperability

Cloud infrastructure supports working with other geospatial or non-spatial systems. Various spatial datasets applications can be easily linked to existing systems with API's or web services. Also basemap function enables taking huge satellite view, Streetmap, or NASA geodatabase to existing system easily.

CASE STUDY

Study Area, Geodatabase Design and Load to Cloud

Case study area is Pelitli neighborhood, across Trabzon airport Turkey. Cadastre data was taken in CAD format and converted to GIS geodatabase with special software. After conversation some attributes were linked automatically to these files. Then all the cadastre data was loaded to cloud as it can be clearly seen at Figure 1. We used Esri's cloud services as a preference of cloud DAAS, also Used Arcgis Online (Esri) for SAAS. Geodatabase is comprised of polygon and line vector GIS files.

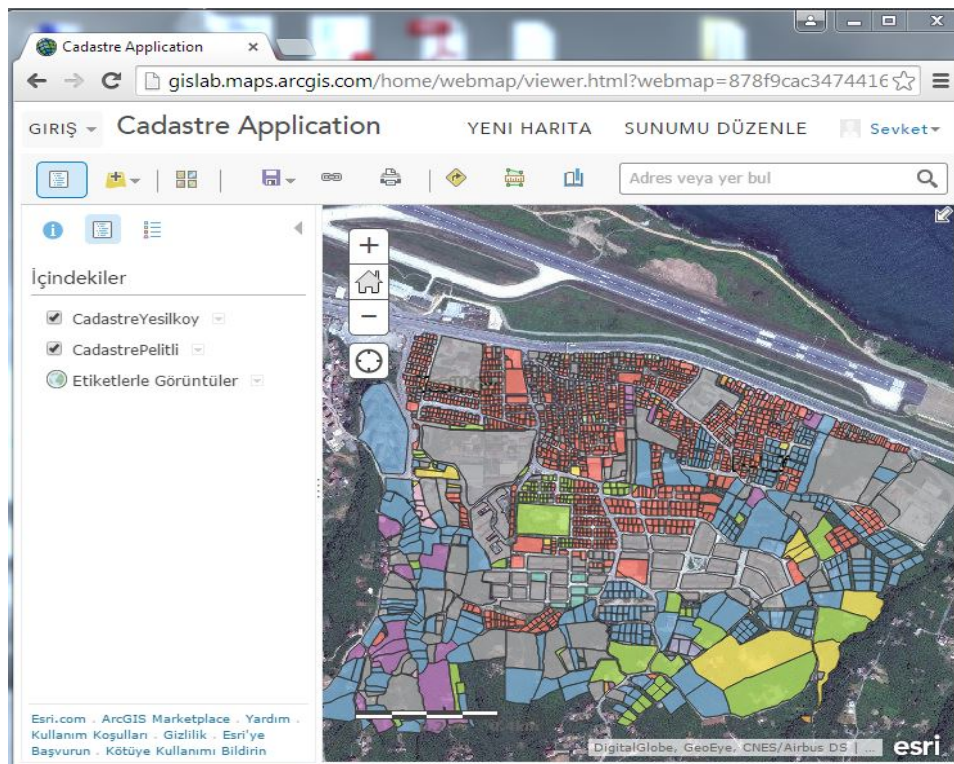


Fig. 3 View of cadastre data at cloud

GIS Queries and Analyses on Cloud

Some GIS analyses and queries were applied with the purpose of showing SCC capabilities and what can be done with cadastre data on cloud. As a small example attribute query and labeling due to request is shown at Figure 2. Some well known GIS analyses were done with SCC like; Buffer, Intersect, Overlay etc. Also optimum route analyse from one cadastre parcel to another parcel was done on cloud.

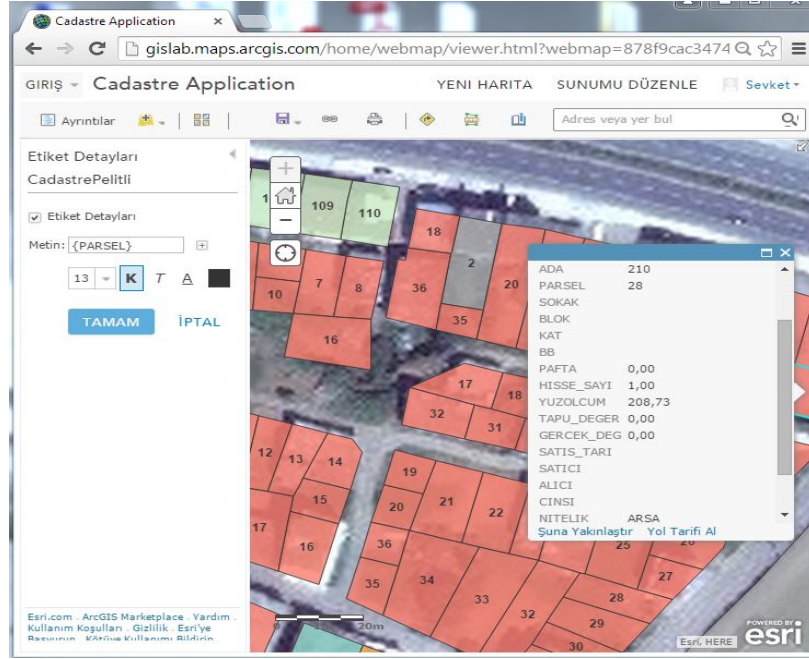


Fig. 2 Attribute query and labeling

Building Fast Web Applications

On the other hand dynamic web applications can be done with SCC quickly. In Figure 3 a useful web application can be seen. This application shows instant changes in cadastre attribute changes corresponding to instant data shown at screen. As an example at screenshot (Figure 3) there is 103 cadastre parcels and average area of these 103 parcel is 30.705 m². At other information pane average selling value or a special defined attribute average such as owner type (person, government or foundation).



Fig. 3 Building Web application with SCC

GIS Based 3D Model Integration on Cloud

After all GIS based 3D model of buildings at study area was rendered by City Engine and then sent to cloud. 3D model contains all the attribute information about the cadastre parcel which the building is settled on. If anyone clicked 3D model, all the information can be quickly seen in information panel.

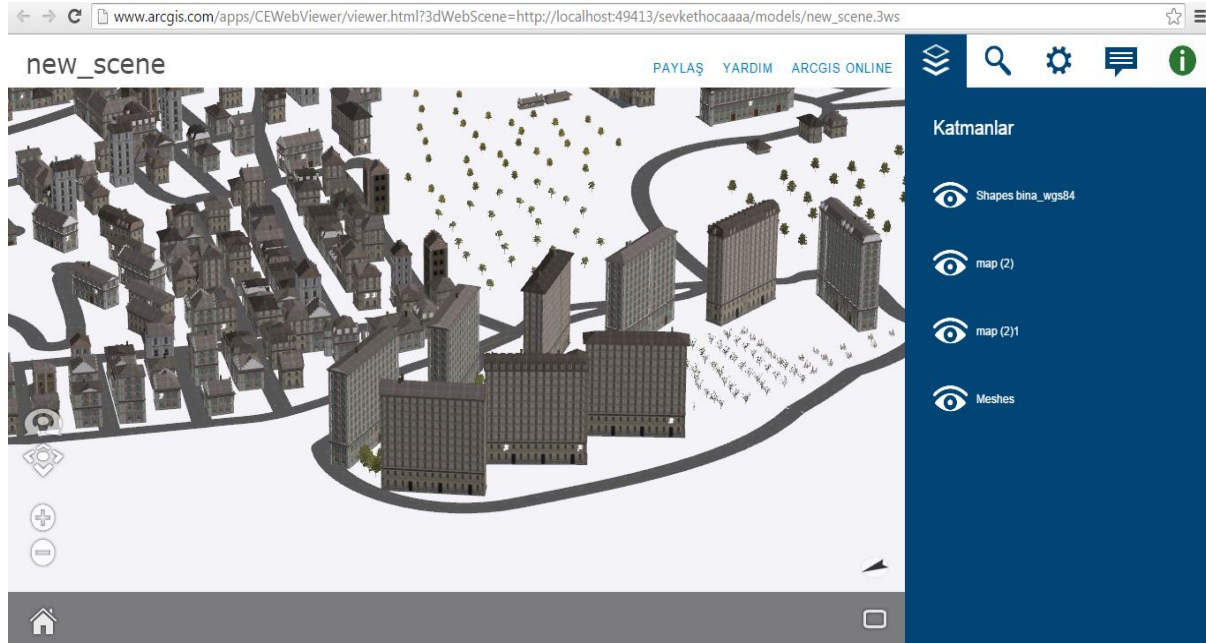


Fig. 3 3D model of builds at study area

CONCLUSIONS

This paper focuses on advantageous and disadvantageous results of storing, analyzing and sharing cadastre data with CC. SCC principles have been applied at this paper. Case studies stated that many benefits of SCC are scalability, economic efficiency and opportunity to work in an interoperable environment. SCC has also practical system building and sustaining structure for GIS and non-GIS users. At the other hand researches outside of case study showed that, SCC supports working with huge spatial datasets in terms of Big Data processing. Because power of parallel computer includes into system at this point. Basemap function brings access opportunity to necessary supporting spatial datasets.

As it has been declared at past projects, SCC has some problems in terms of security and privacy. But there is promising future plans for overwhelming these issues. Last improvements with MEGSIS and TAKBIS are promising about Turkey's cadastral web applications. Acceleration line of online services is good when to compare with past but exactly existing systems are not enough to support today or future demands. In conclusion, power and efficiency of SCC may be included to Turkey's cadastral applications and vision.

REFERENCES

- Aydinoglu A. C. (2002). İnternet Tabanlı CBS Uygulaması: Trabzon İli Örneği, TMMOB Harita ve Kadastro Mühendisleri Odası 9. Türkiye Harita Bilimsel Kurultayı, Ankara, 31.03.2003 - 04.04.2003
- Bhat, M. A., Shah, R. M., & Ahmad, B. (2011). Cloud Computing: A solution to Geographical Information Systems (GIS). *International Journal on Computer Science and Engineering*, 3(2), 594-600.
- Borzacchiello, M. T., & Craglia, M. (2013). Estimating benefits of Spatial Data Infrastructures: A case study on e-Cadastral. *Computers, Environment and Urban Systems*, 41(0), 276-288. doi: <http://dx.doi.org/10.1016/j.compenvurbsys.2012.05.004>
- Demir, O., & Çoruhlu, Y. E. (2009). Determining the property ownership on cadastral works in Turkey. *Land Use Policy*, 26(1), 112-120. doi:
- Steudler, D., Rajabifard, A., Williamson, I.P., 2004. Evaluation of land administration systems. *Land Use Policy* 21, 371–380
- Srinivas, J., Kumar, K. K., Babu, B. S., Chandra, N. S., & Babu, G. C. (2011). Geoportal - A Spatial Cloud Information Service. *International Journal of Engineering Science & Technology*, 3(11).
- Kouyoumjian, V. (2010). GIS in the Cloud: The New Age of Cloud Computing and Geographic Information Systems. *ArcNewsmagazine*, Fall 2010, 1-31.
- Williams, H. (2010). A New Paradigm for Geographic Information Services. *Spatial Cloud Computing (SC2) White Paper*, 1-9.
- Xue, Q., Zhou, X., & Ma, J. (2010). A preliminary study of spatial cloud computing. *Computer Application and System Modeling (ICCA SM)*, 8, 576-581.
- Yang, C. W., Goodchild, M., Huang, Q. Y., Nebert, D., Raskin, R., Xu, Y., . Fay, D. (2011). Spatial cloud computing: how can the geospatial sciences use and help shape cloud computing? *International Journal of Digital Earth*, 4(4), 305-329. doi: Pii 938806602
- Yang, X., & Deng, Y. (2010). Exploration of Cloud Computing Technologies for Geographic Information Services. *Proceedings of the 18th International Conference on Geoinformatics*, 1-5.

İDEAL KADASTRAL VERİ MODELİ VE MEKÂNSAL GAYRİMENKUL SİSTEMİ (MEGSİS)

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GİRİŞ

Mekânsal gayrimenkul sistemi (MEGSİS) ile kadastro verilerinin toplanarak tapu ile entegrasyonunun sağlanması ve toplanılan verilerin uluslararası standartlarda sunulması hedeflenmiştir. Bu hedef 07.04.2014 tarihi itibarı ile % 97.50 oranında tamamlanmıştır. Toplanan veriler 200 den fazla kurumla WMS, WFS servisleri üzerinden, e-devlet üzerinden ve Parsel Sorgu üzerinden paylaşılmaktadır. Bu sayede toplanılan veriler birçok ulusal projeye altlık olmuş, kurumların ihtiyaçları olan veriye coğrafi koordinatlı olarak hızlı bir biçimde ulaşmaları sağlanmış ve vatandaşlarımızın bilgilendirmesi açısından oldukça faydalı olmuştur.

Kadastro verisi yaklaşık yüzyıllık bir süreçte, değişen teknolojik gelişmelere bağlı olarak, farklı standartlarda ve kalitede üretilen bir veridir. Bu nedenle mekansal verilerin tek bir koordinat sisteminde toplanması, sunulması ve tüm verilerde aynı kalite ve standartların yakalanması oldukça zor bir çalışma süreci ile mümkün olabilecektir.

Megsis ile Kurumsal anlamda kadastro verilerimizi tek bir altlıkta görme ve üzerinde kaba eksik ve noksanlıkların giderilmesi için gerekli analizlerin yapılmasına olanak sağlanmıştır. MEGSİS veri toplama çalışmalarımızda öncelik, paydaş kurum-kuruluşların ve vatandaş taleplerinin en hızlı şekilde karşılanması olarak belirlenmiştir. Bu nedenle ideal kadastro veri modeli değil veri toplama modeli baz alınmış olup, yaklaşık 57 milyon parsel ile ilişkin veri toplama çalışması 3 yıl gibi kısa bir sürede tamamlanmıştır.

Gelinen noktada toplanılan verilerin birçok alanda kullanıldığı ancak veri kalitesinin istenilen standartlarda olmadığı tespit edilmiştir. Bu sebeple veri iyileştirme çalışmalarına biran önce başlamak ve tamamlamak kaçınılmaz hedef olarak karşımıza çıkmaktadır.

MEGSİS'in var olan veya ortaya çıkabilecek diğer ihtiyaçlar göz önünde bulundurularak geliştirilebilmesi için öncelikle veri modelinin değiştirilmesi-güncellenmesi gerekmektedir. Yapılan çalışma sonucunda tüm kadastro verilerinin ITRF96 koordinat sisteminde kesin koordinatlı veri kalitesine ulaştırılması için, MEGSİS içerisindeki mevcut veri durumunun tam anlamıyla tespit edilmesi gerekmektedir. Böylelikle, veri kalitesinin artırılması konusunda gerçekleştirilecek çalışmaların planlaması yapılabilecek, veri paylaşımında paylaşılan verinin kalitesi ve tüm öznitelik bilgileri hem Kurumumuzca hem de paydaşlarca bilinebilecektir. Bunun sonucunda da, veri kalitesinin artırılması konusunda paydaşlarla birlikte projelerin üretilmesi dahi mümkün olabilecektir.

MEKANSAL GAYRİMENKUL SİSTEMİ (MEGSİS)

Sayısal veya raster olarak kadastro müdürlüklerinin yerel bilgisayarlarında bulunan verilerin merkezi bir sistem üzerinde toplanarak, parsel bazında tapu bilgileri ile eşleştirilmesi ve bu bilgilere ihtiyaç duyan paydaş kurum, kuruluş ve belediyeler ile uluslararası standartlarda harita servisleri ile paylaşılması, e-Devlet kapısı ve Parsel Sorgu üzerinden vatandaşlara sunulması amacıyla Tapu ve Kadastro Müdürlüğü tarafından projelendirilerek hazırlanmış açık kaynaklı bir uygulamadır.

Bu kapsamda;

- Tapu ve kadastro verilerinin karşılık olarak kontrol edilmesi,
- Öznitelik bilgilerinin toplanması,
- ITRF96 koordinat sisteminde bütünlenmesi ve sunulması,
- Hava görüntüleri (Ortofoto ve GoogleMaps) kullanılarak doğrulanması,
- Kontrol sorgulamaları ile veri kalitesinin artırılması,
- Verilerin güncel olarak tutulması amaçlanmıştır.

MEGSİS Projesi Kalkınma Bakanlığı tarafından hazırlanan, Türkiye Cumhuriyeti Hükümeti Dokuzuncu Kalkınma Planı'nın stratejik amaçları doğrultusunda geliştirilen bir Coğrafi Bilgi Sistemi projesidir. MEGSİS kapsamında toplanan kadastro verileri, tapu bilgileri ile birlikte Uluslar arası standartlarda (OGC) harita servisi olarak (WMS – WFS) sunulmaktadır. Ayrıca Üretimi yapılmış olan Ortofoto haritalarının açık kaynaklı GDAL kütüphanesi kullanılarak hazırlanan servisler aracılığı ile TileMapService (TMS) standardında sunulmaktadır.

MEGSİS Temel Modülleri

1. Harita Modülü: Harita modülü ile sistemde yer alan mekânsal veriler görsel olarak sunulmakta ve bu mekânsal veriler, kullanıcılar için kimliklendirme / yetkilendirme çatısı üzerinde belirlenen coğrafi yetki alanlarına göre görüntülenmektedir. Bu modül içerisinde, katmanlar bölümü, navigasyon ve çizim araçları yer almaktadır. Katmanlar bölümünde istenilen katman seçilmek suretiyle görünür kılma işlemi, saydamlık ayarlaması, Navigasyon araçları ile harita üzerinde gezinme, yaklaşma, uzaklaşma ve seçilen alan yaklaşma işlemleri, Çizim araçları ile nokta, çoklu nokta, çizgi, çoklu çizgi, alan ve çoklu alan çizme işlemleri yapılabilmekte, yapılan bu çizimlerin güncellenmesi, silinmesi ve temizlenmesi sağlanmaktadır. Ayrıca ölçüm araçları yardımı ile nokta koordinat bilgileri, uzunluk ve alan ölçme işlemleri yapılabilir.

2.Başvuru İşlemleri Modülü: Başvuru İşlemleri Modülü ile kadastro müdürlüklerine yapılan başvuruların sisteme kayıtlarının yapılması, personel görevlendirilmesi, randevu oluşturulması, anlaşmalı bankalar ile kurulan e-ödeme bağlantısı ile online ödeme işlemlerinin oluşturulması, fen kayıt işlemlerinin yapılması, personel görev durumunun takibi gibi işlemlerin yapılmasına imkan sağlanmıştır.

3.Tapu Sorgulamaları Modülü: Tapu menüsü altında tapu bilgileri, belirtme bilgileri, taşınmaz sorgulama ve kişi sorgulama modülleri yer almaktadır.

4. Veri İşlemleri Modülü: Veri işlemleri bölümünde veri yükleme, veri indirme, dosya bilgileri, dönüşüm dosyaları, entegrasyon işlemleri ve kontrol sorguları modülleri yer almaktadır.

5. İstatistik Bilgileri Modülü: İstatistik Bilgileri MEGSİS kapsamında toplanan verilere ait istatistik bilgileri kullanıcılara sunulmaktadır.

Megsis Mevcut Durum

07.04.2015 tarihi itibarıyla Tapuda kayıtlı olan yaklaşık 56.982.670 adet parsel karşılık 55.566.872 adet geometri sisteme aktarılmıştır ve entegre edilmiştir. Sistemde yer alan mekânsal verilerin parsel bazında tapu kayıtları ile % 97.50 oranında entegrasyonu sağlanmıştır.

- MEGSİS kapsamında toplanan kadastral verilerinin protokoller kapsamında talep eden kurum, kuruluş ve belediyeler ile ücretsiz olarak paylaşımı sağlanmaktadır.
- Hazırlanan harita servislerinin standartlara ve kullanıma uygunluğu açık kaynak ve ticari ürünler ile test edilmiştir.
- MEGSİS kapsamında toplanan kadastral verileri aynı zamanda vatandaşların bilgilendirilmesi amacıyla tapu bilgileri ile birlikte harita servisi olarak e-Devlet kapısından sunulmaktadır.
- Bu servisler www.turkiye.gov.tr adresinden sunulan ilk ve tek coğrafi servis olma özelliği taşımaktadır.
- Aynı zamanda Bu servisler parselsorgu.tkgm.gov.tr adresinden tüm vatandaşlarımıza açılmış ve ada/parsel bilgisi üzerinden veya coğrafi koordinat ile MEGSİS kapsamında tapu verileri ile uyumlaştırılması tamamlanmış kadastral bilgilerine ait temel bilgiler sunulmaktadır.
- Sistem bir ulusal anlamda stratejik ve ekonomik öneme sahip bir çok projeye altlık teşkil etmektedir.

Veri iyileştirme çalışmaları

Gelinen noktada toplanılan verilerin birçok alanda kullanıldığı ancak veri kalitesinin istenilen kalitede olmadığı tespit edilmiştir. Bu sebeple veri iyileştirme çalışmalarına biran önce başlamak ve tamamlamak kaçınılmaz hedef olarak karşımıza çıkmaktadır.

MEGSİS'in var olan veya ortaya çıkabilecek diğer ihtiyaçlar göz önünde bulundurularak geliştirilebilmesi için öncelikle veri modelinin değiştirilmesi-güncellenmesi gerekmektedir.

Yapılan çalışma sonucunda tüm kadastral verilerinin ITRF96 koordinat sisteminde kesin koordinatlı veri kalitesine ulaştırılması için, MEGSİS içerisindeki mevcut veri durumunun tam anlamıyla tespit edilmesi gerekmektedir. Böylelikle, veri kalitesinin artırılması konusunda gerçekleştirilecek çalışmaların planlaması yapılabilecek, veri paylaşımında paylaşılan verinin kalitesi ve tüm öznitelik bilgileri hem Kurumumuzca hem de paydaşlarca bilinebilecektir.

Bunun sonucunda da, veri kalitesinin artırılması konusunda paydaşlarla birlikte projelerin üretilmesi dahi mümkün olabilecektir.

Veri Toplama Modeli: En kısa sürede, seçilebilecek en hızlı yöntemle verilerin toplandığı modeldir. Burada dosya bazlı çalışarak hazırlanan verilerin hızlı bir biçimde sisteme alınması dosya bazlı meta data girişi yapılarak iş yükünün en aza indirilmesi, acil ihtiyaç duyulan yardımcı verilerin sonuç verilerinin toplanması çalışmalarıdır. Günümüzde vatandaşa yönelik bilgi paylaşımı ve kaliteli hizmet sunumu, kamunun öncelikli çalışma hedefini oluşturmaktadır. Bu nedenle, diğer kurum ve kuruluşlarca yapılacak çalışmaların temel altlığı olan tapu ve kadastro verilerinin hazırlanması ve sunulması, bu çalışmalara da önemli bir ivme kazandırmaktadır.

İdeal Kadastral Veri Modeli: İdeal Kadastral Veri Modeli, kadastro verilerinin karakteristik özellikleri ile kurumsal ve ulusal ihtiyaçların tespit edilerek en doğru biçimde metadata verisinin geliştirilerek, kurumsal projeler (Sayısallaştırma, 3402 sayılı yasanın 22/a maddesine göre Yenileme, ...) ve müdürlüklerimizde yapılacak çalışmalarla kesin koordinatlı geometriler ve bu geometrilere ilişkin gerekli olan teknik evrakların toplandığı modeldir. Yapılan çalışma sonucunda tüm kadastro verilerinin ITRF96 koordinat sisteminde kesin koordinatlı veri kalitesine ulaşmak için, mevcut durumun tam anlamıyla tespit edilerek, gerekli olan tüm sorulara cevap verebilecek bir veri modeli oluşturulmuş olacaktır.

İdeal kadastral veri modeli çalışmaları,

1924 den bu güne her türlü teknik ve altlık da üretilen ve gelişen teknolojik süreçler ile değişen ihtiyaçları takip edebilmek için birçok kanun değişikliklerine tabi olan kadastro verilerinde aynı kalite ve standartların yakalanması oldukça zor ve kapsamlı bir çalışma sürecinin sonunda mümkün olabilecektir. Bu kapsamda Kadastral veri yönetimi ve entegrasyonu şube müdürlüğü olarak tüm sorunlar incelenerek pilot uygulamalar başlatılmıştır.

Ankara Kadastro Keçiören Bağlum mahallesinde yapılan çalışmalarda sorunlar detaylı olarak analiz edilmiş ve sonrasında Ankara Kadastro Müdürlüğü Çankaya İlçesinde yapılan pilot uygulama çalışmalarında ise veri modeline uygun veritabanı tasarımı tamamlanmıştır. Çankaya İlçesinde devam etmekte olan çalışmalarımızda ise veri tabanına uygun veri giriş pilot uygulamasının kodlamasına geçilmiştir. Bu çalışmalar kapsamında yapılan işlem adımları ve mevcut MEGSİS ile karşılaştırılması aşağıda gösterilmektedir.

<i>Veri İyileştirme Çalışmaları</i>	<i>Pilot Uygulama</i>	<i>Mevcut Durum</i>
<i>Veri Yönetimi</i>	<i>Geometry Bazlı Veri Yönetimi</i>	<i>Dosya Bazlı Veri Yönetimi</i>
<i>Kadastro kaydının oluşturulması,</i>	<i>Tescile tabi olan veya olmayan tüm parsellere karşılık bir kadastro kaydı oluşturulmuştur.</i>	<i>Yok</i>

<i>Detaylı öznitelik bilgilerinin toplanması,</i>	<i>Paftası, Kadaastro Alanı, Kadaastro Niteliği, Koordinat Sistemi, Ölçü Yöntemi, Koordinat Kalitesi, Epok, Sayısallaştırma Yöntemi ... gibi parseli tanımlayan tüm detaylar tasarlanmıştır.</i>	<i>Dosya Bazlı temel Tanımlamalar</i>
<i>Bağlı geometrilerin entegrasyonu,</i>	<i>Parsel ile ilgili olan Yapı, irtifak geometrileri gibi diğer geometrilerinde envanterinin tutulması ve entegrasyonun yapılması tasarlanmıştır.</i>	<i>Yok</i>
<i>Pafta kayıt defterlerinin standartlaştırılması,</i>	<i>Mevcut pafta kayıt defterlerinin güncellenerek Pafta kayıtlarının güncel olarak oluşturulması ve parsel pafta ilişkisinin kuruluşması.</i>	<i>Yok</i>
<i>Parsel temel işlemlerinin takibi,</i>	<i>Parselin tescil ve terkin edildiği temel işlemlerinin ve Parsel üzerindeki Yapılan Değişiklikler ile Aplikasyonların takip edilmesi.</i>	<i>Yok</i>
<i>Niteliklerin standartlaştırılması,</i>	<i>Yatırıma Uygun alanlar, Tarım Arazileri, İmarlı Alanlar, Sosyal Alanlar .. Vb. Tematik analizler ve Parsel Niteliklerinden kaynaklanan sorunların çözümü için Niteliklerin Standartlaştırılması işlemleri tasarlanmıştır.</i>	<i>Yok</i>
<i>Temel teknik arşiv belgelerinin entegrasyonu,</i>	<i>Veri Paylaşımında ve müdürlüklerimizde yapılan işlemlerde en çok kullanılan ve ihtiyaç duyulan parseli tanımlayan temel teknik evraklardır. Bu kapsamda Koordine Özet Çizelgeleri, Alan Hesapları ve Ölçü/Sınırlandırma/Röleve Krokilerinin Parsel ile ilişkisinin sağlanması tasarlanmıştır.</i>	<i>Yok</i>
<i>Veri İyileştirme Çalışmaları</i>	<i>Pilot Uygulama</i>	<i>Mevcut Durum</i>

<i>Dönüşüm parametresi çalışmaları,</i>	<i>Dönüşüm Parametrelerinin Kapsadığı Alanların tespit edilerek çakışan veya dönüşüm parametresi olmayan alanların tespiti için, dönüşüme giren noktaların birinci sistem ve ikinci sistem koordinatları ile a, b, cx, cy parametrelerin tespitini yapılması tasarlanmıştır</i>	<i>Akratımı yapılan dosyanın dönüşümü için gerekli olan a, b, cx, cy parametreleri.</i>
<i>Onay mekanizmasının kurulması,</i>	<i>Sisteme aktarılan geometriler ve bu geometrilere ilişkin metadataları sisteme giren ve onaylayan olarak ikili onay mekanizması ile kullanılması ve paylaşılması tasarlanmıştır.</i>	<i>Yok</i>
<i>Geri bildirim mekanizmasının kurulmasıdır.</i>	<i>Veri ile ilgili karşılaşılabilecek tüm sorunlar tespit edilerek Geri bildirim formatlarının oluşturulması ve tüm kullanıcıların karşılaştıkları hataları bu formatlardan seçerek kayıt altına alınması tasarlanmıştır. Bu sayede hangi tür hatadan nerede ne kadar olduğu ve çözüm yollarının neler olabileceği belirlenebilecektir.</i>	<i>Yok</i>

ROLE AND IMPORTANCE TUSAGA-ACTIVE (CORS-TR) IN BASIS OF THE OPERATIONS CADASTRAL PLAN

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ABSTRACT

In Turkey and the TRNC 146 TUSAGA-Active(Turkey National Fixed GNSS Network-Active) Continuous GPS Station and Control Centers have been established. with TUSAGA-Active in the projects area, any place and time, at centimeter accuracy, map and geographical information can be obtained in seconds. TUSAGA-Active system is one of the world's largest CORS (Contionusly Observing Reference Stations) system in terms of number of stations and covers the area 4721 of the Civil Code; Article of 1003 It is written that; "A record of the index and a real plan is essentially based on an official measurement in determining"; and in Article 719 It is written that; "... .. If the marking on the ground and the Land Registry Plans does not match, the boundary on the plans is valid." As a result of these articles, Land Registry Plan and Cadastre Index which is one of the main records, is indispensable in terms of real estate law and cadastral technical applications. In this paper, the role and importance of the TUSAGA-Active system which is an effective tool for the first property cadastre, land restoration, nationalization, land consolidation and spatial data collection, is emphasized.

Key Words: Civil Law, Land Registry Plans, Cadastre Index, TUSAGA-Active, GNSS, Position Determine

TUSAGA-ACTIVE SYSTEM

Continuous Monitoring GNNS Stations Network and the National Datum Transformation Project (TUSAGA-Active / CORS-TR)" Istanbul Kultur University (IKU) executive, The General Directorate of Land Registry and Cadastre (TKGM) and General Command of Mapping (GCM), including joint customers has begun in, 08 May 2006, started its operations with the completion of December 2008. The sysem which is operated by TKGM and HGK colectively, is operated free of charge for test purposes untill 15 June 2011. After that date it has been operated for a fee that the prices is determined by Inter Ministries Mapping Coordination and Planning Committee (BHİKPK).

Structure of TUSAGA-Active System

TUSAGA-Active System is consist of 2 control centers in TKGM and HGK, 146 fixed GNSS reference stations, 4 of these stations are in TRNC. (Figure 1).

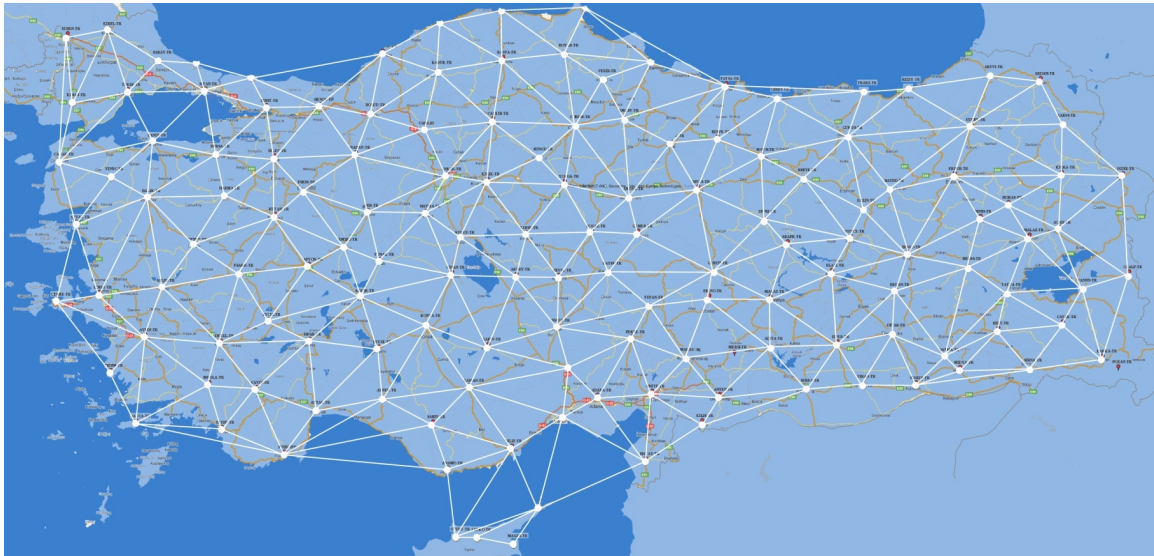


Figure 1. TUSAGA-Active Stations

Operating Principles of TUSAGA-Active System

In TUSAGA-Active system, observations of GNSS receivers which cover the entire country and coordinates known, transmitted to control centers through VPN or GPRS/EDGE. In the control center, RTK / DGPS corrections are calculated in real time by modelling the atmospheric and other errors and these corrections are sent in the RTCM (Radio Technical Commission for Aeronautics) format via GPRS / EDGE to mobile GNSS receiver, for positioning. (Gezer and Karan..., 2014)

Real Time Kinematic (RTK) correction data is in RTCM communication format and it is sent to TUSAGA-Active system users via GPRS / EDGE by NTRIP (Networked Transport of RTCM via Internet Protocol)

Servers located in the control center make atmospheric modelling by using of instant data from all stations and DGPS / RTK correction data is calculated. This correction data transferred to the mobile users in NTRIP format via GPRS / EDGE. In this way, the GNSS receivers determine the position below 1 meter accuracy by using the DGPS data and determine centimeter position accuracy using RTK data.

FIXED GNSS STATIONS OF TUSAGA-ACTIVE SYSTEM

Before Installation of TUSAGA-Active system fixed GNSS stations, necessity of testing issues such as atmospheric effects that can effect the whole system, country topography and communications devices is decided and Benchmark (BM) test work carried out between 2 September-31 November 2006. An area of 300 x 100 km in Thrace and Istanbul region are selected as test area and 13 fixed GNSS station location are identified (Figure 2), tests were conducted over three types of network that are 60-90-120 km. each of them are consist of 6 fixed GNSS stations. As the result of BM test results, it was found that the average distance between fixed stations efficient around 80 km and the number of fixed GNSS stations were

increased from 81 to 146. Locations of fixed GNSS stations are determined according to security, electricity and internet infrastructure. According to these criterias total of 146 TUSAGA- active stations built in Turkey and TRNC. Station locations are shown in Figure 3.

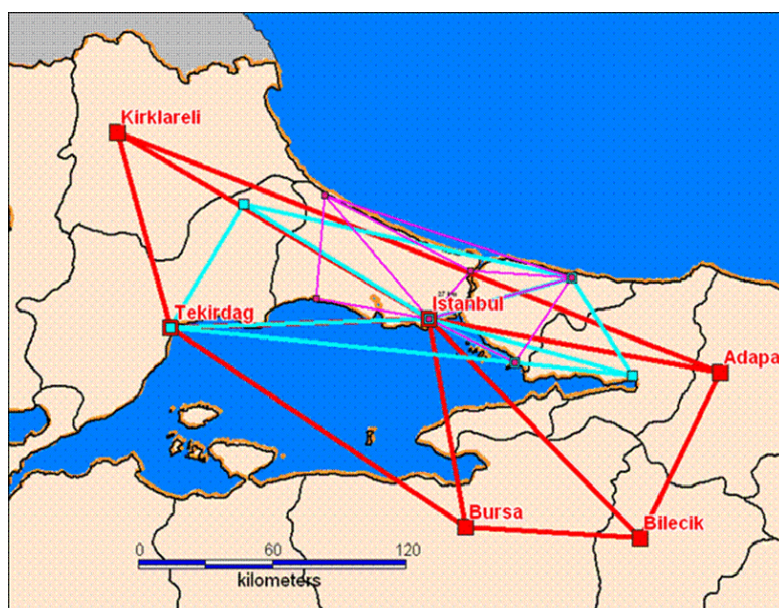


Figure 2. Benchmark test network (60-90-120 km)

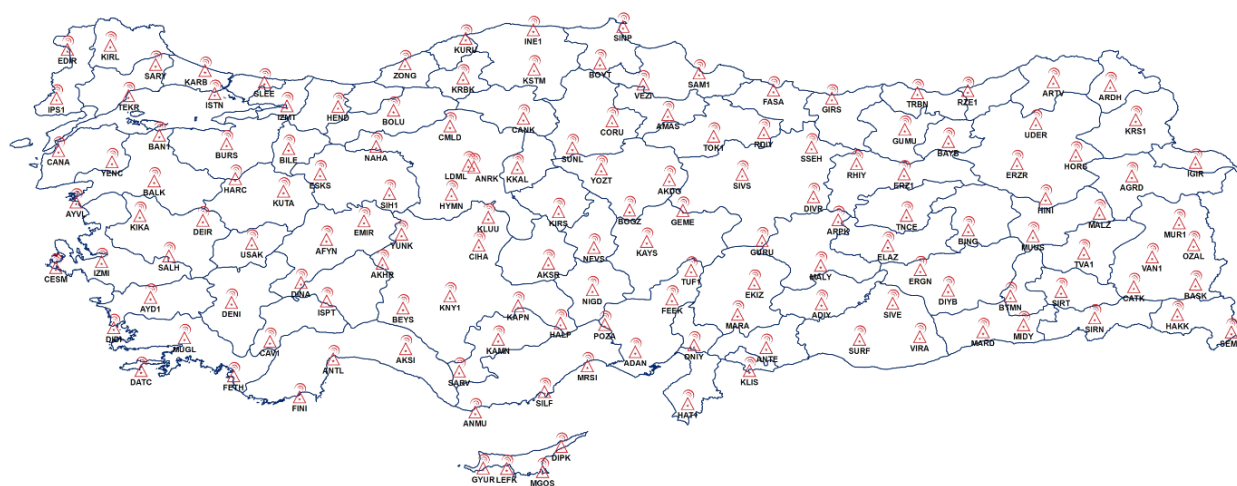


Figure 3. TUSAGA-Active Stations(146 Station, 80-100 km distance)

Ground facilities are planned according to the regional conditions. As a result, it was decided to manufacture two types of floor plants;

- Concrete pile in the ground floor
- Large diameter and galvanized steel pile on roofs and terraces

Distribution of the 146 pile across the country according to size is as follows

- 2-meters pile 85 pieces(including ground)

- 3-meters pile 58 pieces.
- 4-meter pile 3 pieces.

2 m in length concrete pile sample is given in of Figure 4. And 3 m. length galvanized coated steel pipe pile sample is given in Figure 5. The station cabinet contents are given in Figure 6.



Figure 4. IGIR Station



Figure 5. DIYB Station

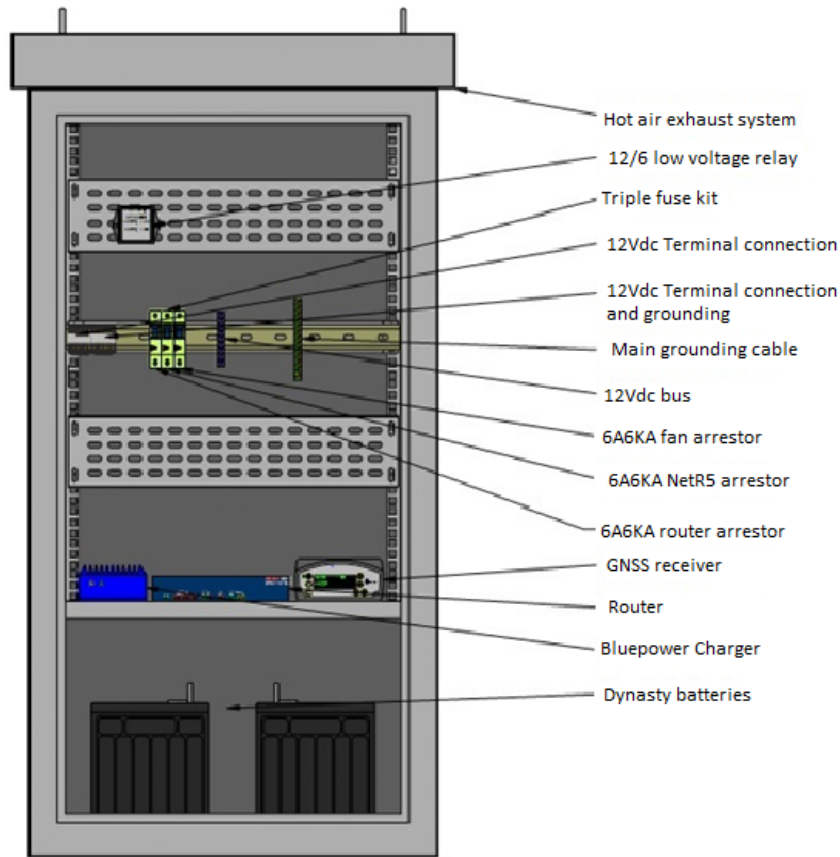


Figure 6. Station Cabinet

TUSAGA-ACTIVE CONTROL CENTER

Within the scope of TUSAGA-Active Project 2 control centers were established. The main Control center is in TKGM and the auxillary control center is in HGK. All TUSAGA-Active fixed station data is automatically transmitted to the control centers and calculated network-RTK correction data are delivered to the users (Figure 7).



Figure 7. TKGM TUSAGA-Active Control Center

Hardware of TUSAGA-Active System Control Center

TUSAGA-Active Control Centers founded in 2008 and established in accordance with the technology that day and served until today.

At the end of 2014, according to the technological development (32-64 Bit, increased RAM capacity, increased processor speeds of the cores, the increase in the capacity of the storage and speed, etc.). TUSAGA-Active system software and hardware have been updated (Figure 8).

In the control center that have updated software and hardware; The data from each of the second fixed GNSS stations is evaluated by the Control Center software and calculated network-RTK correction data are presented to users.

In addition to data collected by GNSS stations and sent to control center, 1 second RINEX data are saved hourly and 30 seconds data are saved daily. Data are stored in RAID5 Storage Control System that provides security. In the storage area the RINEX data in Hatanaka format, reports and log files are stored and presented to users.

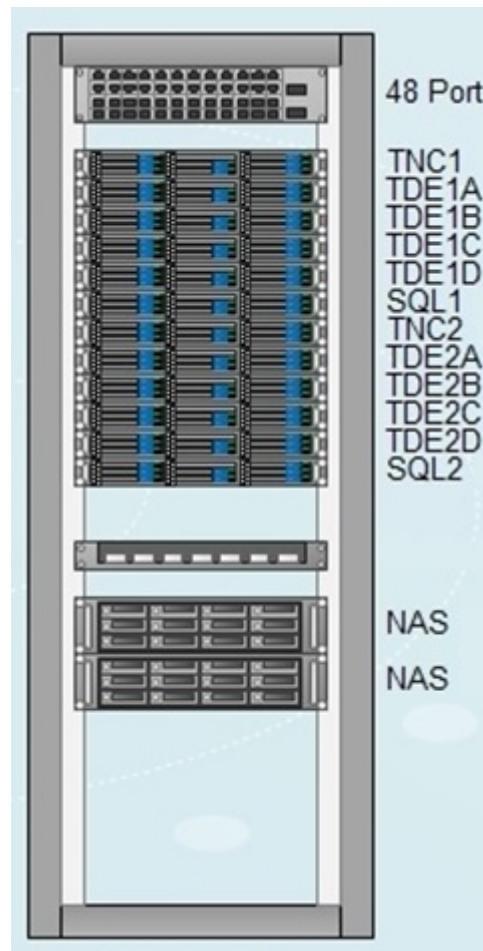


Figure 8. 2+2, 2+2 Server

Software of TUSAGA-Active System Control Center

Control Center has a powerful control center software. The main functions of this software;

- Transferring of links and observations of all netr5 reference station,
- Calculation of the coordinates of the point TUSAGA-Active fixed GNSS stations,
- Modeling of errors, calculation and broadcast of corrections to the rover,
- RTK services
- WEB services
- Monitoring of rovers
- Data storage and etc.

Correction Parameters of TUSAGA-Active System

Five different correction data are broadcasted by the control center, these broadcasts are VRS CMR+, VRS RTCM3.1, SAPOS FKP 2.3, RTCM3Net (MAC) and DGPS. Correction parameters used by TUSAGA-Active compatible GNSS receivers and real-time user can be tracked by the system (Figure 9).

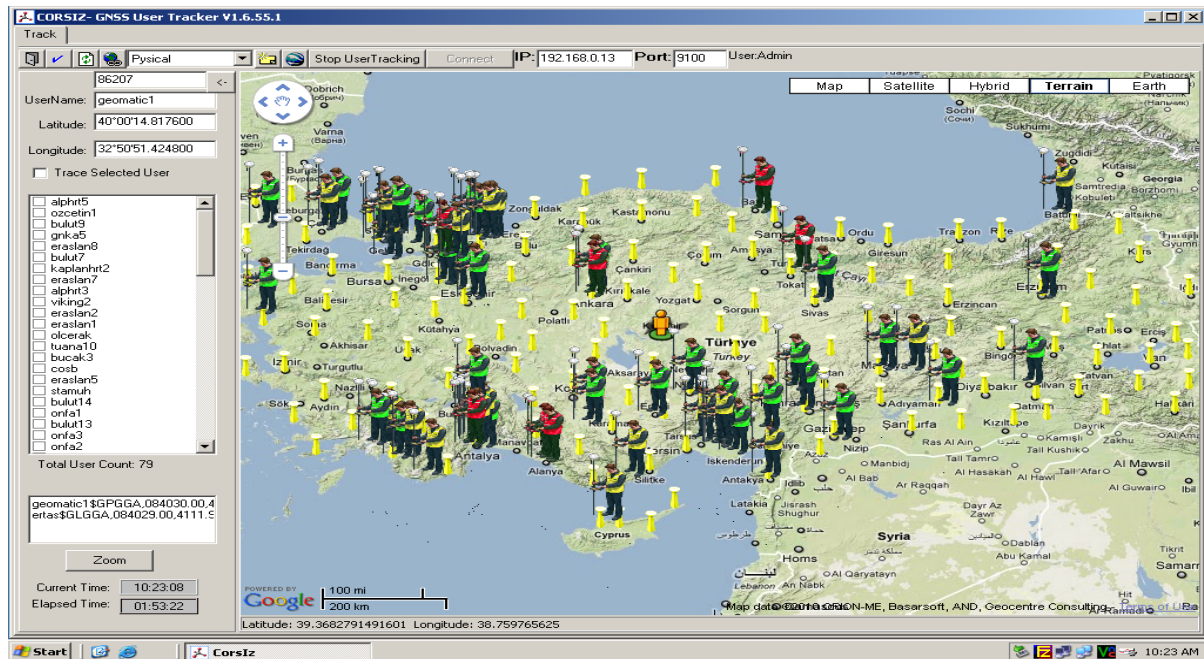


Figure 9. Monitoring Users in Real time

FKP Correction Technique

Area correction approach known as FKP(Flachen Korrektur Parameter) in the literature, using all TUSAGA-Active system network and/or carrier phase corrections are calculated in each fixed station,

- Corrections can be used by rover(with many different interpolation models)
- Double/single way communication is sufficient.
- There is no limitation on the number of users.

FKP approximate location allows the calculation of error term due to the distance between the known reference station and rover. Here position determination can be performed independently from all network related calculations. Rover takes the network corrections from one of the fixed stations. Rover determines this station as the center in two-way communication. In One-way communication, the user must select one of the station that is close to itself and because of this situation One-way communication is almost never used. Broadcast format is RTCM 2.3.(Eren and Uzel, 2008)

VRS Correction Technique

Pre-condition in the VRS (Virtual Reference Stations) virtual reference station applications is the two-way communication between the control center the TUSAGA-Active system network and rover. Rover sends its approximate coordinates to the control center and the center creates the VRS reference data for its mobile position by using whole network information. (Eren and Uzel, 2008)

VRS corrections created at the center, are usually sent to the mobile users with RTCM. Adjustments created in the VRS method from the entire network, is broadcasted through a virtual reference station formed just near the mobile user. This virtual station is created with

GPS(DGPS) technology. The corrections also can be calculated by taking double-differenced from this virtual station. Broadcast Formats are CMR +, RTCM 2.3, RTCM 3.0.

MAC Correction Technique

The Idea of MAC(Master Auxiliary Concept) RTCM 3.x which is the basis of network format, provides to send the subnet measurement data as compressed and provides the mobile user to make its own network calculation for different error sources. However, a disadvantage of this is, usually sending datas of only one part of the whole network . Another disadvantage of the RTCM 3.0 is sending ionospheric and geometric errors for only a certain time. (Eren and Uzel, 2008)

When mobile start to receive the data file directly, it can't have an information about systematic effects immediately. In Ionospheric and especially in tropospheric models, time is needed to determine the parameters.15 minutes or a longer time is needed to reach a good model sensitivity.Systematic errors can be modelled in a required safe level only in this time period.

RTCM 3.x network method, doesn't let to use the complete filter situation which is created in network server. It only use the ambiguities gained from the server and it removes them from the Carrier Phase measurements. In an other word, MAC design, is to be sent the codes and carrier phase data in the main station and carries phase data in auxiliary station by evaluating the ambiguities in advance. server. Mobile which is getting this data;

- Simple interpolation of the effects of geometric and ionospheric
- It performs to create a model complex model involves all the error sources which is before the network server changes the network data to RTCM 3.0 format.

USERS OF TUSAGA-ACTIVE SYSTEM

Correction parameters broadcasted by TUSAGA-Active Systems are broadcasted independently from the receiver. All brand and model GNSS receiver, supports NTRIP protocol and with GPRS/EDGE modem, can receive TUSAGA-Active broadcasts and can achieve location information real time. Users who want to take advantage of this purpose, are able to receive correction parameters with GSM modem from 212.156.70.42 IP number. There are 6088 users registration on system as of date 01 March 2015 and these users are using system actively (Figure 10). When the user information is analyzed, user distribution is according to population density in overall country (Figure 11).

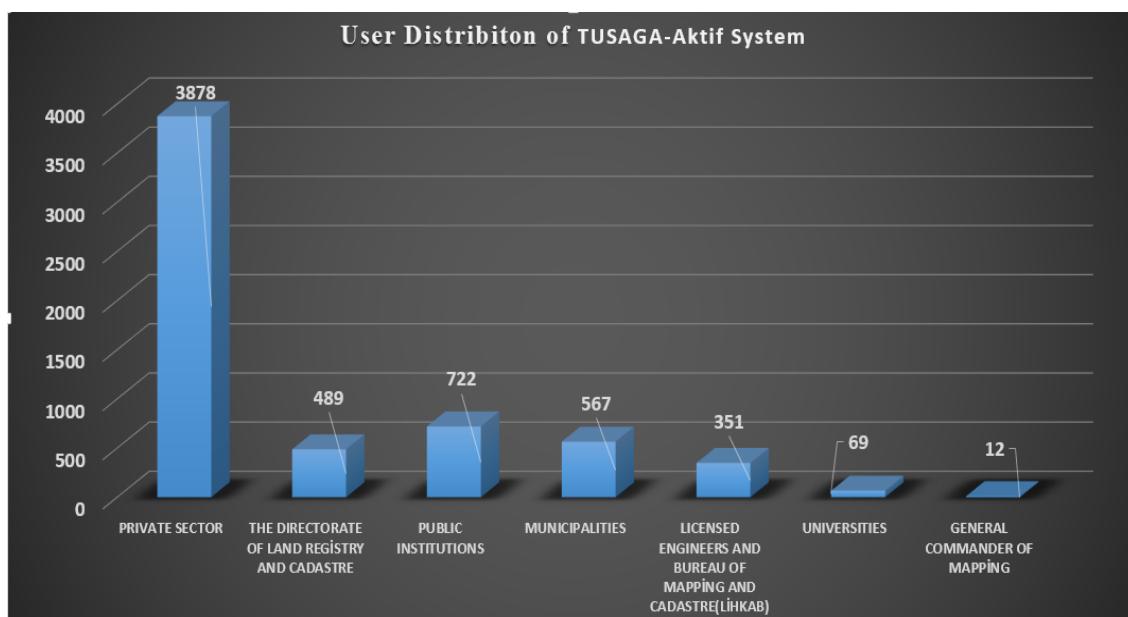


Figure 10. Users Distribution of TUSAGA-Active System



Figure 11. Using Map of TUSAGA-Active System in 2014

Institutions That Take Advantage of TUSAGA-Active System

THE GENEREAL DIRECTORATE OF LAND REGİSTRY AND CADASTRE

- Land Registry and Cadastre Modernization Project(TKMP) within 22-a Cadastre Restoration in the work,
- Forest cadastre and 2-B implementations,
- Converting the ITRFyy systems cadastral sheet
- RTK applications,
- Cadastre Offices applications,

GENERAL COMMAND OF MAPPING

- Different coordinate systems (ED50 / WGS84) the determination of transformation parameters between,
- Geodesy applications (coordinate purchases, point speed, determination of active tectonic movements etc.)
- Work in all GNSS reference coordinate system to eliminate uncertainty as a fixed point of service

MUNICIPALITIES

- Topographic maps
- Infrastructure and other geographical studies,
- E-municipality

MINISTRIES

- Ministry of National Defense,
- Ministry of Forestry and Water
- Ministry of Environment and Urbanization
- Ministry of the Interior and others ministries,
- E-State and National Geographic Information Systems.

OTHER ORGANIZATION

- All institutions and organizations that need instant location information, especially disciplines dealing with infrastructure, cartography, geographic information.

SCIENTIFIC ORGANIZATION-UNIVERSITIES

- Earth science and geographic information systems research,
- Earthquake engineering, geophysics and seismology fields
- Known in advance of earthquake early warning activities,
- Meteorological studies,
- Other studies in space and earth sciences.

APPLICATIONS OF TUSAGA-ACTIVE SYSTEM IN THE GENERAL DIRECTORATE OF LAND REGISTRY AND CADASTRE

Land Registry and Cadastre Modernization Project (TKMP)

In the scope of the projects in General Directorate of Land Registry and Cadastre, TUSAGA-Active system is being used effectively in geodetic studies and have found that large gains in both cost and time. TUSAGA-Active systems is being used extensively in Land Registry and Cadastre Modernization 22-a renovation project which is carried out intensively in recent years; Nationwide, 22-a renovation work started in 2009 and by the end of 2014; It is seen that 300 package tender was issued, in which services received for 6000 units (districts, villages) and 22-a renovation is completed. Renovation work carried out in 6000 units costed approximately 340 Milion TL. and during this renovation work's geodesy portion TUSAGA-Active system

used intensively and it provided %20 profit (70 Million TL.) .TUSAGA-Active Sysem is also used for renovation of cadastral map to support digital cadaster map and land register.

As a result of the conclusion of this projects with TUSAGA-Active in a shorter time, it's aimed to service the digital land registry and cadastre informations to public and private institutions and to increase effectivity and profitability of land registry and cadastre services by developing policies that maintains best international applications for real estate valuation in Turkey. As a result of the project; 4 million parcels renewal, basic map production of 40 thousand square kilometers, external users' accesibility to online data and to develop policy and capacity about real estate valuation, will be supplied. The requirement of Geodetic studies and position information in the scope of this project, are supplied based on TUSAGA-Active system. (TKGM, 2011)

TUSAGA-Active System in Manufacture Orthophoto Map

General Directorate of Land Registry and Cadastre orthophoto map production work is in progress, produced orthophoto maps are presented in a web environment and form the basis to decision-making in Cadastral Office applications with TKMP project. In Orthophoto map production, Image Central Point Coordinate values of each image are calculated by using GPS/IMU data. 1 second RINEX datas recieved from fixed GNSS stations of TUSAGA-Active system are used to evaluation of GPS/IMU datas and by this way there is no need to set fixed GNSS point on the land during image acquisition process from the air.(Mekik, Salgın..., 2011)

TUSAGA-Active System in Forest Cadastre

TUSAGA-Active systems are widely used in forest cadastre studies and in the project of lands removed from forest boundary (2 / B) in the scope of the protocol signed between The General Directorate of Land Registry and Cadastre and the General Directorate of Forestry.

TUSAGA-Active Sytem in Licensed Mapping and Cadastre Offices

With LIHKAB (Licensed Mapping and Cadastre Offices) coming into force, demand services which were carried out by General Directorate of Land Registry and Cadastre up to date, are carried out by those licenced offices now. 195 licensed offices; benefit from TUSAGA-Active system in their works.

In all studies carried out in General Directorate of Land Registry and Cadastre, 459 TUSAGA-Active compatible GNSS receivers have been delivered to Cadastral Office in order to maintain an effective and efficient cadastral office service. So that, TUSAGA-Active System has proven itself by serving more people in shorter time in all cadastre application, demands less man power and more integretd. TUSAGA-Active System can detail survey without the need for ground control points. Where appropriate, it is also possible to read the coordinates of polygon points with RTK method instantly. In Production of C1, C2 and C3 degree ground control points static observations can be made with a single GNSS receiver and coordinates of C1, C2 and C3 degree ground control points can be calculated by processing with static data of TUSAGA-Active fixed GNSS stations. (TKGM, 2014)

LEGISLATION WORKS SCOPE OF TUSAGA-ACTIVE

According to Article 43 of Large Scale Map and Map Information Production Ordinance (BÖHHBÜY) that Entered into force on 15 July 2005 the title "Fixed (permanent) GPS stations and the use of" describes the fixed GNSS stations. BÖHHBÜY includes informations such as Installation of fixed GNSS station, point degree, recording range of GNSS receivers, coordinates and accuracy and reliability of the velocity vectors etc. Therefore, in order to create legal basis to TUSAGA-Active system Network RTK use applications, legislation has been accelerated. In this context, studies about adding subjects related with TUSAGA-Active system to BÖHHBÜY, completed by Inter Ministries Mapping Coordination and Planning Committee (BHİKPK) and added to draft regulations.

TUSAGA-Active use has been added to 2010/11 No. Cadastral Map Production and Control Circular in order to not being a legal gap until the approval of BÖHHBÜY by Council of ministers.

TUSAGA-ACTIVE SYSTEM SUBSCRIPTION AND USERS SUPPORTS

How To Subscribe TUSAGA-Active System

Service demanders make application via CORS-TR web page. The service fee demanded is paid by either credit card or bank wire/EFT to the bank account. Applications coming to CORS-TR system manager screens, are approved online and users are provided with their passwords to use the system. After the application of service demander, end user agreement is signed as 2 copies and sent to Mapping Department of TKGM in 7 days at the latest. The agreement viewed by the Mapping Department of TKGM is signed and one copy sent back to the service demander.

TUSAGA-Active Call Center and Information

TUSAGA-Active system users and those who want to have information can call 444 46 77 (GNSS) call center or send email to tusagaaktif.bilgi@gmail.com and find the answer to any question on the subject. In addition to that users are informed by SMS for any information related to the TUSAGA-Active system.

CONCLUSIONS

TUSAGA-Active system, serves to increasing number of institutions and users from December 2008 until today. Approximately 6000 GNSS receivers that are used in all around the country increased their performance up to 50%. Cadastral and geodetic studies throughout Turkey without the need for local reference point and executing quick and economical way with the help of TUSAGA-Active system and works can be done in real time.

TUSAGA-Active System users are able to get coordinates of the location with accuracy of ± 4 cm by using Network-RTK method in seconds without the need of a second GNSS receiver or person.

220 million USD cadastral renovation work was initiated throughout Turkey. 20% of these works are geodetic studies and it is estimated that a saving of USD 35 million will be gained. In addition, the State Planning Organization, has allocated 158 million TL for Cadastral Records and 232 Million TL for GIS Infrastructure Installation under the program of Citizen-Focused Service for Transformation and Modernization of Public Administration. Approximately 20% saving is estimated by using TUSAGA-Active system in this study.

In the first article of the Cadastre Law 3402 The aim of the law is expressed as “ To establish land registry that provided by Turkish Civil Law 4721 and to create infrastructure of spatial information system by specifying property boundaries on the map and land based on cadastral and topographic maps of country according to Country coordinate system.

Some of the Tasks of TKGM that reached its present status with law 6083 number issued on November 25, 2010, are to make or to get, to check, to control and to identify basic principles of geodetic infrastructure, acquire image from the air, 1/5000 and larger scale terrestrial and photogrammetric maps, to produce Large-scale cadastral and topographic maps.

TUSAGA-Active system is used in many areas and its importance increases day by day. It is used in marking the boundries of the property on the ground accordingly informations and documents in land registry plan, in the control of maps and plans that will be registered, separation, leaving to the road, establishment from the road, boundary maps, zoning maps, nationalization maps and village settlement maps etc.

4721 of the Civil Code; Article of 1003 It is written that; "A record of the index and a real plan is essentially based on an official measurement in determining"; and in Article 719 It is written that; "... .. If the marking on the ground and the Land Registry Plans does not match, the boundary on the plans is valid.". In this context; These plans must be created based on reliable underlays. Country horizontal control network created firmly with TUSAGA-Active system and especially TKGM and other institutions establishing their plans with this infrastructure.

REFERENCES

3402 Number Cadastre Law

Ç. MEKİK, Ö.SALGIN, İ.CANKURT, S.ERGÜNER, H.B.ATEŞ and T.KARA, GPS/IMU Verilerinin TUSAGA-Aktif Sisteminin Sabit İstasyon Verileri İle Process Edilerek Resim Orta Noktası Koordinat Değerlerinin Belirlenmesi, TUFUAB VI. Teknik Sempozyumu, 2011

M. V. GEZER, Z. S. KARAN, E. KULAKSIZ, B. ERKEK and S. BAKICI (2014) TUSAGA-Aktif Sistemi ve Kullanıcı Profili Analizi, 7.Mühendislik Ölçmeleri Sempozyumu, 2014

K. EREN and T. UZEL, Ulusal Cors Sisteminin Kurulması ve Datum Dönüşümü Projesi, TUSAGA-Aktif (CORS-TR): 3. Çalıştay, 2008

The General Directorate of Land Registry and Cadastre- Department of Mapping Education Documents, <http://www.tkgm.gov.tr/tr/harita>

The General Directorate of Land Registry and Cadastre – TKGM Corporate Financial Situation and Prospects Report, 2014, <http://www.tkgm.gov.tr/tr/icerik/tkgm-2014-yili-kurumsal-mali-durum-ve-beklentiler-raporu>

The General Directorate of Land Registry and Cadastre - Cadastral Operations Directory 2011, <http://www.tkgm.gov.tr/tr/sayfa/yayinlarimiz-0>