

From CAD to GIS: Editing and Distributing Geographic Information from CAD Software

Tzvika EL-AZ, Israel

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SUMMARY

One of the challenges related to management of Geographic Information Systems (GIS) is the two way data conversion from CAD drawing to the GIS environment and back – from the GIS environment to CAD drawing within an integrated working environment.

The offered Solution: Working with a GIS-CAD integrated system

A system which integrates working with GIS and CAD data includes two main mechanisms:

1. Handling CAD files – the system includes full CAD abilities, including opening and processing CAD Files – as an every ordinary CAD system.
2. Logging into a Geo-Spatial Database – through a structured mechanism. The system enables to access the Geo-Spatial Database to receive and process data.

The integrated system abilities include instant data conversion between CAD objects in the drawing and GIS features in the data base and vice versa.

Study case demonstration – Land registration in Nigeria

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1. THE CHALLENGE

One of the challenges related to management of Geographic Information Systems (GIS) is the two way data conversion from CAD drawing to the GIS environment and back – from the GIS environment to CAD drawing within an integrated working environment.

This challenge becomes greater when it comes to GIS projects related to Infrastructure system management. These projects are implemented mainly by local and national government authorities where information from designers needs to be placed in a geographic context.

Five prominent examples for Infrastructure system management GIS projects:

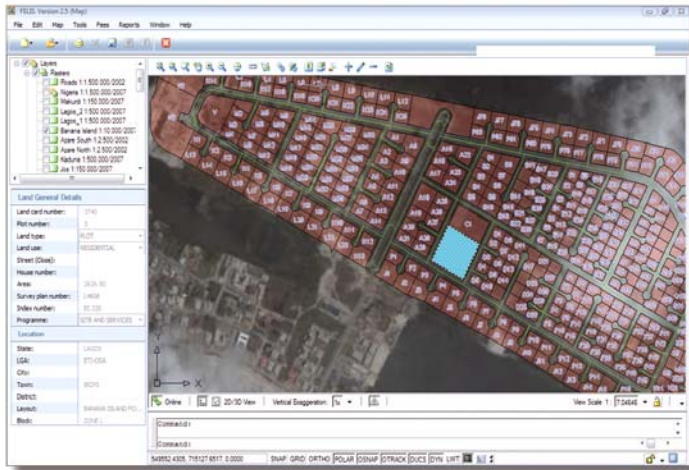
- Land and property administration GIS
- Urban systems GIS
- Road and Rail systems management GIS
- Pipeline systems management GIS
- Cable systems GIS

The design of large infrastructures (urban, roads, railways, bridges, tunnels, etc.) needs both CAD and GIS information: CAD software is applied for the engineering and construction while GIS data is essential for the planning and layout. In the design phase the geographic description of a region is often transferred from a GIS to a CAD system. Once the design has been completed in CAD, it is re-imported into GIS.

These projects are location-based services which need to activate a combination of CAD and GIS techniques for positioning and supplying the user with relevant information. It takes a lot of GIS and CAD integration before a sentence such as: "you can find the pipeline you've been looking for at 5 meters to your right and 2 meters underground " is generated automatically by the computer.

The CAD drawings are supplied by two main sources – the surveyor and the designer. In a changing reality, there is a need for a dynamic feed to the system of survey and design CAD drawing. The feeds come from different offices and from different locations.

The situation creates the need of an on-line web-based GIS system which is able to be updated by CAD files from different locations.



Picture 1. Federal Land and Property System of Nigeria.

CAD drawings are presented in form of Layout plans and also in form of long sections, cross sections and elevations. These forms challenge the GIS software developers to **leverage** GIS to the next level –and this is the 3rd dimension.



Picture 2. Development of 3D GIS

2. GIS-CAD INTEGRATED SYSTEM

2.1 CAD data and GIS data

Historically, there has been a cultural divide between the two disciplines. CAD and GIS are frequently referred to as ‘oil and water’. CAD developers consider their work as engineering-based with powerful precision entry and editing tools for design. GIS staff, on the other hand,

often view their work as larger-scale and cartographic in nature rather than being focused purely on engineering.

Nevertheless, there is a strong correlation between CAD and GIS data organization:

- GIS data are mostly kept in a theme layer (Roads, Infrastructure, Lots etc.) as geographic features such as a point, a line and a polygon.
- CAD data saved in theme layers as well (CAD software save the data in a layers model in order to create data groups of the same distinction – such as color, line thickness, etc.) as Vector Objects such as a line, an arc, hatch etc.
- One of the most common methods of saving GIS data is in a "Geo-Spatial Database". The method of data saving has the important advantage of being accessible by multiple users, including editing actions, updating and displaying all in the same time.
- CAD data saved mostly in files (such as DWG files)



Picture 3. CAD Data moved to GIS, Jordan River Water association water management system

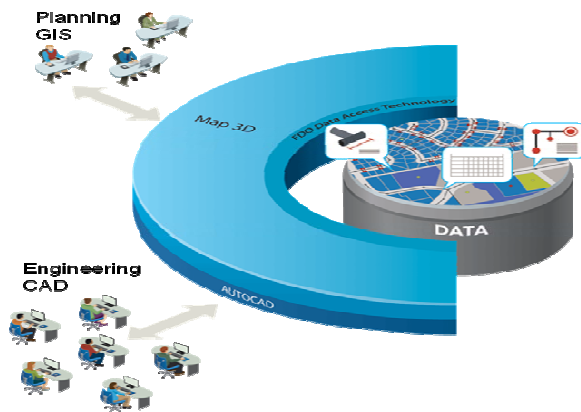
2.2 Working with a GIS-CAD integrated system

Software developers are now creating tools which are crossing the border between CAD and GIS but enable both disciplines to continue working in a familiar way. providing direct access to data, regardless of how it is stored, and enabling the use of CAD tools for maintaining a variety of geospatial information.

A system that integrates GIS and CAD data includes two main mechanisms:

1. Handling CAD files – the system includes full CAD abilities, including opening and processing CAD Drawing Files – as done with an ordinary CAD system.

2. Logging into a Geo-Spatial Database – through a structured process, for receiving and processing data.



Picture 4. Autodesk Geospatial Solution, transforming CAD to GIS.

AutoCAD Map 3D uses FDO technology to access various industry standard data stores directly without a need to translate data. It also allows direct read and write access and as a result reduces redundant data and data loss from translation processes.

The integrated system enables **instant data conversion** between CAD objects in the drawing and GIS features in the data base and vice versa, with a procedure which is easy and simple, a procedure that does not require special expertise.

This will allow the surveyor, engineer, architect or city planner to log in the system, load an updated CAD data and transform it into GIS data. This data will be available in real time over the Web based GIS system.

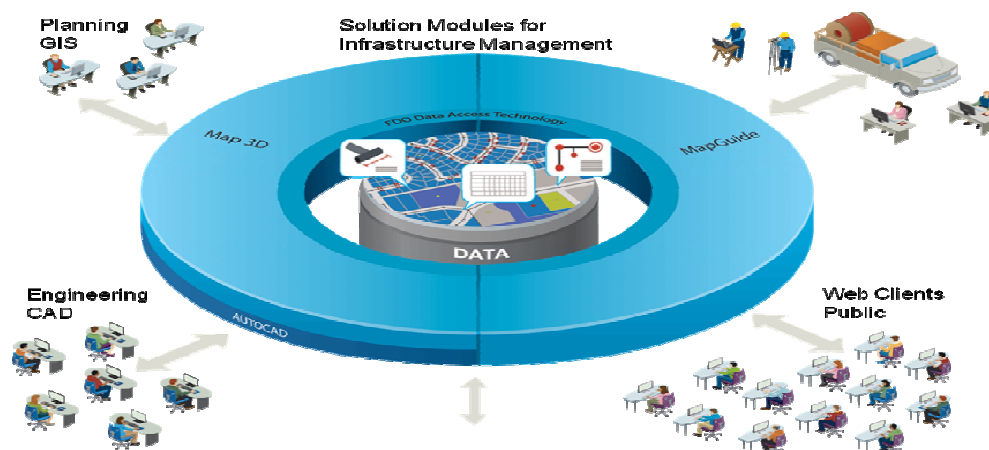
Sivan design chose to implement in its systems the following applications:

- Microsoft **SQL Server 2008** spatial as the database server
- **AutoCAD MAP 3D 2009** (Autodesk) as the GIS engine
- Web-GIS engine of **Autodesk MAPGUIDE** for web based users

AutoCAD MAP 3D is an extension to AutoCAD and complementing existing GIS implementations, it enables quickaccess, efficient editing, and easy management of a broad variety of large geospatial data sets, far beyond the standard AutoCAD could handle.

Because Map 3D is based on open data standards, users are able to work with virtually any spatial data available, an approach which offers far more flexibility than the minimal options inAutoCAD. Whether data is stored in DWG, DGN, Shp, or other standard geospatial formats,the software can directly access and edit the data, removing the need for continual translation of data between systems.

Also, as it works seamlessly with Oracle, MySQL, SQL Server and ESRI ArcSDE, users can manage and store geospatial data as easily as they can create and edit it. This approach ensures data is far more accessible – by CAD users wanting to access geospatial data or GIS users needing a view of design data from the engineers.



Picture 7.. Autodesk Geospatial Solution, transforming CAD to Web based GIS.

Once the CAD user gets the geospatial data into Map 3D they can view and query the attributes within the connected data, as well as style and theme the data based on the properties found within the DWG, connected mapping file or the database.

AutoCAD Map 3D brings users major benefits when it comes to working with Ordnance Survey background mapping.

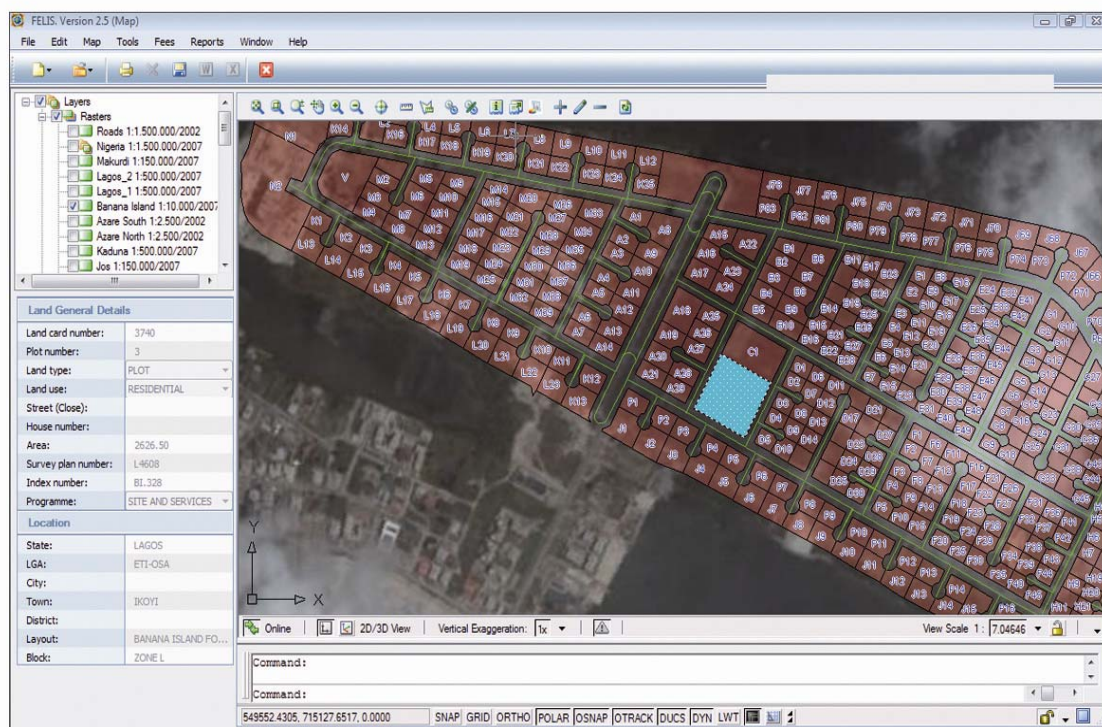
AutoCAD Map 3D enables users to access the data directly regardless of whether it is held in an Oracle database, a Shp file or ESRI ArcSDE. When Map 3D is connected to a central store of MasterMap data, accurate mapping is available across an entire enterprise, whether its users are CAD or GIS-based or a mixture of the two.

3. SYSTEM EXAMPLE FOR REALIZATION – LAND REGISTRATION IN NIGERIA

The federal office of land registration in Nigeria decided to found a new information system for registering ownership of land property.

In phase 2 the project expanded to link the cadastral unit (the unit in charge of drawing the plan for registration purpose) in the mapping center, as a supplier of many GIS layers.

Sivan Design is a leading provider of software solutions in GIS (Geographical information systems) surveying, mapping and civil engineering CAD (Computer Aided Design)..



Picture 1. Federal Land and Property System of Nigeria.

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BIOGRAPHICAL NOTES

Architect **Tzvika El-Az** is An International Regional Manager in Sivan Design, overseeing East Africa, India and Eastern Europe. He is a graduate of Tel Aviv University Faculty of Architecture and Town design.

CONTACTS

Architect **Tzvika El-Az**
Sivan Design
Email: tzvika@sivandesign.com
Web site: www.sivandesign.com

17 Ha'tidhar st.
Raanana
Tel. + 972-9-742-7991
Fax + 972-9-746 9295
Mobile +972-52-4446883
ISRAEL

Muthithi Road, Westlands
Nairobi
Tel. + 972-9-742-7991
Fax + 972-9-746 9295
Mobile +972-52-4446883
KENYA

HS-4, 3rd floor, shopping complex, Kailash colony
New-Delhi 110048
Phone: +91-11-41632371/2/3
INDIA

Str.Prof.Ion Maiorescu 67, Sect.2
Bucuresti
Phone/Fax: +40+21+2530530
ROMANIA