

# MapInfo Based Infrastructure -presentation and updating-

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**Abstract** – MapInfo represents software designed to support the management, manipulation, analysis, modeling and display of spatially-referenced data for solving complex planning and management problems. In this paper we present it as a powerful tool for updating and producing thematic maps ( layers) with high graphical and geometrical quality. By implementing the updating layers over the old maps, we have produced new updated maps.

**Keywords** – MapInfo, thematic layer, updating.

## I INTRODUCTION

The development of the computer technology and the high quality digital data disposal leads to new forms and ways of graphical data processing thus allowing a new effective kind of public/private institutions/enterprises management.

The Geographical Information System or GIS is an integral computer system capable of capturing, controlling, storing, analysing and displaying geographically referenced information [1].

The MapInfo is the GIS software used to create maps, design and develop digital spatial databases as well as to perform complex spatial analyses and reports [2]. It also provides combining many layers of different thematic information into one level in order to find their correlations. It is possible to link, or integrate, information that are difficult to associate through any other means. Thus, a GIS can use combinations of mapped variables to build and analyze new variables. Simply, the MapInfo is able to produce images –

not just maps but drawings, animations and other cartographic products which allow researchers to view their subjects in a way that they never could before. The power of MapInfo comes from its ability to relate different information in a spatial context and to reach a conclusion about their relationship.

As a fundament for the spatial and thematic processing, the digital topographic maps are used most often. However, besides archived data ( whether in analogue or digital form), the real world data can also come from other sources like satellite images and field measurements ( Global Positioning System – GPS ) for example. Nevertheless, the maps are generally easy to use with MapInfo and they are often the most effective in identifying the objects, their absolute location on the Earth's surface and their spatial relationships.

To more realistically analyze the effect of the Earth's terrain, three-dimensional models are available to display the Earth in realistic, three-dimensional perspective views and animations that convey information more effectively to wider audiences than traditional, two-dimensional, static maps.[3]

In few words, this technology can be used for scientific investigations, resource and situation management, and development planning. As a precondition, there is a need of accurate, precise and quickly produced data as well as of high quality maps to be use for various applications such as spatial planning, urbanism, waterworks, electrification, environment studies and many other fields.

To convey the results of analyses to the people who make decisions about resources, there are possibilities to produce graphics on the screen or on paper. Thus, wall maps, Internet-ready maps, interactive maps, and other graphics can be generated, allowing the decision makers to visualize and thereby understand the results of analyses or simulations of potential events.

Many countries have already established appropriate systematic registration of their socio-economical infrastructure inconstancy. Organizations around the world are using MapInfo products and solutions to view and analyse location based data overlaid on digital maps. The result is a better business intelligence, improved customer relations and much better bottom line performance. From this point of view our public and private sectors are just queuing up.

In section II in this paper we represent the concept of the project, section III includes description of the documentation used and the process of digitising, furthermore section IV illustrates the up-dating of the thematic layers as well as the database, while section V concludes the project.

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## II THE PROJECT

The Project represented in this paper is initiated by and realized in cooperation with the Public Corporation for Spatial and Urban Planning.

The project's concept consists of producing several basic thematic layers for a city area (specific regions of the city area - industrial zones, settlements, lakes, parks ; lines - rail and road networks, rivers ; characteristic points - churches, mosques, trigonometric points ) as well as of connecting the objects of these thematic layers with the database to be made.

So, the Project represents a summary of graphical and alpha numerical database connected in a functional wholeness. The database of the geographical information system includes data organized as themes, database tables and links to relevant existing documentation.

The expected results should provide a variety of possibilities starting from thorough analyses needed for spatial urban planning, through monitoring and predicting the pollution, socio-economical and demographic analyses, up to the construction and maintenance of the infrastructure.

In this paper we've chosen to present a part of the work done for the town of Bitola which includes updating of the existing documentation.

## III THE FUNDAMENT AND DIGITIZING

As a fundament for the layers in this case, as an existing documentation, we use a military topographical map produced in 1983, scaled as 1:25000 with the Gauss-Kruger projection as shown on Fig.1.

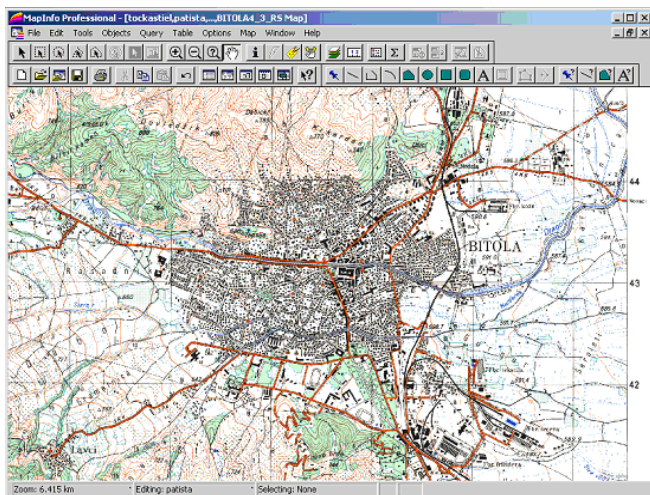


Fig.1. 1:25000 map of Bitola

There is a need to mention that the projection is a very basic element of map-making. It is a mathematical way of transferring information from the Earth's three-dimensional curved surface into a two-dimensional medium – a piece of paper or computer screen. There are many different types of projections according to the employed system of coordinates which are appropriate for a particular case. For example, a projection that accurately represents the shape of a continent will greatly distort its relative size [3].

The objects on the map and their spatial relationships in the city of Bitola are organized on several thematic layers:

1. Constructions: Settlements, Plants, Cemeteries, Archaeological zones, etc;
2. Traffic and transport : Railroads, Roads Bridges;
3. Hydro-geography : Rivers, Lakes, Dams, Channels.

For this presentation we've chosen two layers : Road layer (because we know there is a new, recently built up road) shown on Fig. 2, and Settlement layer presented on Fig.3. As we can see on Fig.2. the existing roads are digitised and separated from map. In the same time, a table with all the characteristic attributes, as a part of the database, is associated to this thematic level.

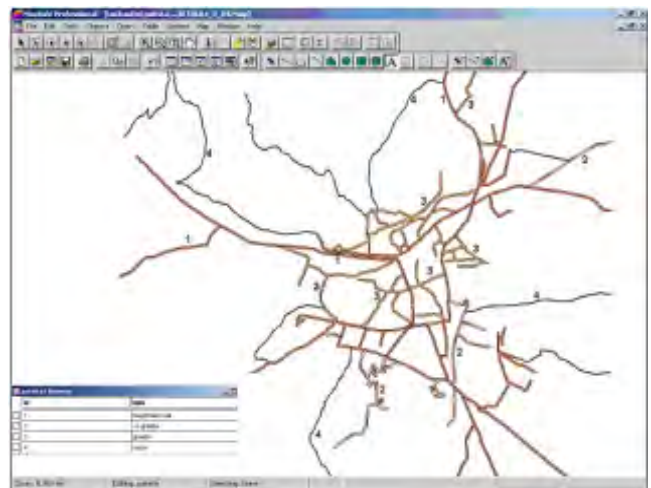


Fig.2. Road Layer

The same is done for the Settlement layer on Fig.3. The purpose of this one is to show the city's dynamic environment, to notice the rapid growth of the city as a result of increasing population and to stress the need for spatial urban planning. By this, the balance between the environment and the possibilities for surveys and services that maintain the city will be controlled thus allowing high-quality decisions for managing the space in the city area.

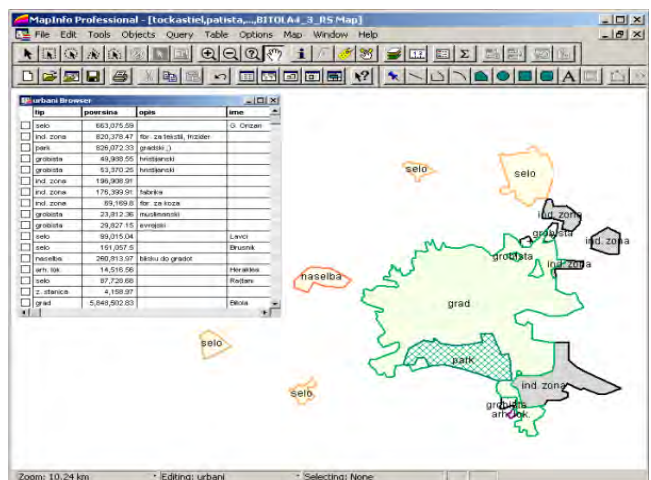


Fig.3. Settlements Layer

To digitise the map we can use various techniques that can capture information : hand-tracing with a computer mouse on the screen or on a digitising tablet to collect the coordinates of features (like in our case), electronic scanners can also convert maps to digits, coordinates from GPS receivers can be directly up-loaded into a GIS and so on.

Anyway, software tools that automatically extract features from satellite images or aerial photographs are gradually replacing what has traditionally been a time-consuming capture process. In each case, the spatial objects from the real world are identified and approximated by points, lines or areas combined with their alpha numeric attributes.

So, after organizing the thematic levels, tables of attributes have been created and the captured objects are identified in a series of attribute tables - the "information" part. This significantly minimizes the number of attributes assigned to every spatial object and provide better and faster accessibility. Spatial relationships, such as whether features intersect or whether they are adjacent, are the key to all GIS-MapInfo based analysis.

This represents the first step of making a consistent database. After these relations are explicitly established, data browsing, updating, analysing and displaying can be done.

Before digitizing the map it is necessary to register some geographical control points. This provides that geographical objects on any thematic level will be registered on the same, mutual system of coordinates which later will provide correct overlaying of all thematic layers.

To ensure consistency and compatibility of the spatial information used in this project, a unique nomenclature is defined. Sometimes extra information(meta) are needed for the database. In order to reach additional data, there is a possibility of connecting to an already existing, standardized, external databases. (In this project access data base is used). This is possible if the nomenclature is standardized.

Standardization also helps to stretch data collection funds further by allowing data sharing, and, in many cases, gives users access to data that they could not otherwise collect for economic or technical reasons. Unifying in accordance with the European standards enables incorporation of the database on European level allowing its connection on International level with other thematic databases. Nowadays spatial data can be accessed and analysed over the Internet through Internet map server technology.

#### IV UP-DATING

Updating the thematic levels is done by marking (registering) the spatial units on the Earth's surface, which do not exist on the topographic map.

This is accomplished by overlaying the layers over a more recent satellite image (in this case the satellite image dates from 95/96 and is taken by the French satellite SPOT). The satellite image is shown on Fig.4.

As it can be seen on the satellite image (concerning the two mentioned layers) the difference between the map and the current situation ( the satellite image) is quite obvious.

To update the map we got to update the layer of concern. So, overlaying the layers one by one, the digitisation of the new detected elements is done for every thematic layer

separately, followed by updating the database. This provides registration of the infrastructure changes during the given time period.

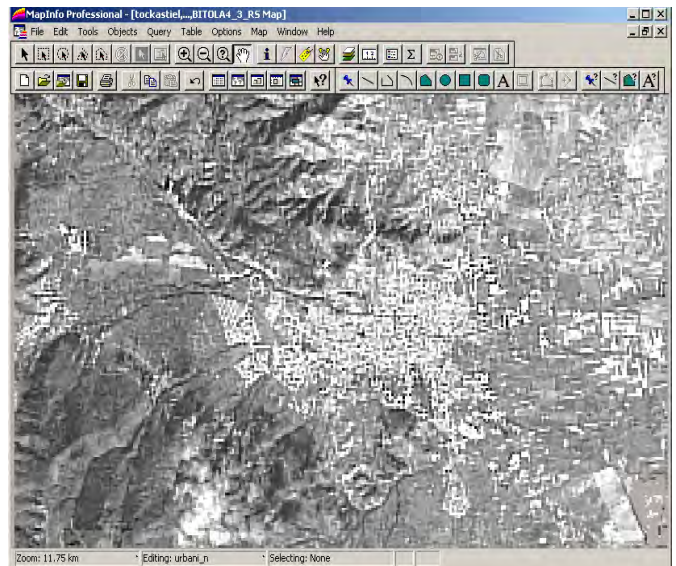


Fig.4. Satellite image of Bitola

On Fig.5. we can see the road layer overlaid on the satellite image and that the new magistral road is detected and drawn on the layer.

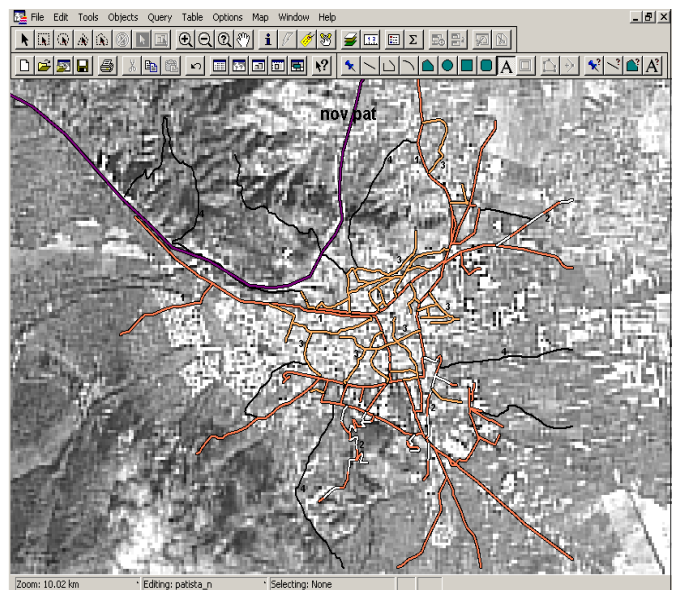


Fig.5. Overlaying the road layer

The consistence of the spatial relationship is obtained or provided by the MapInfo from the previously registered control geographical points. That is the reason why the layer will match any image taken from any distance and why the new inserted drawings will match the scale.



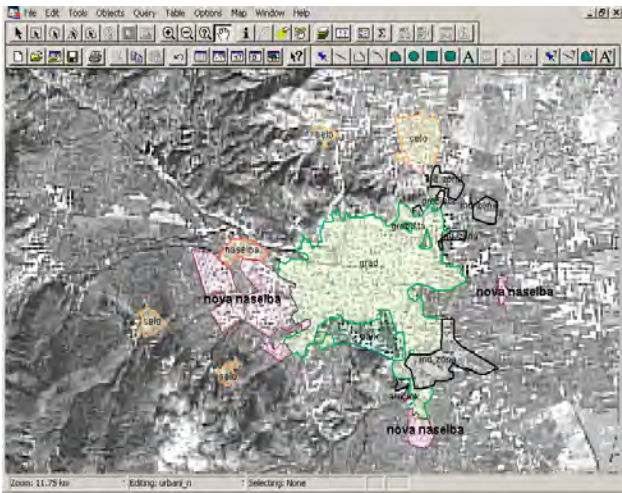


Fig.6. Overlaying the settlement layer

On Fig.6. the settlement layer is overlaid and the new areas of constructions are registered. As it can be notified, this satellite image offers a good registration of an area but it can not be said for the spot elements ( houses in that area). Mainly it is a consequence of the bad resolution of the image that we have on our disposal. Contemporary satellite images can offer quite better resolution which is much bellow one square meter. Unfortunately, the cost of such images are much more above the price of this one.

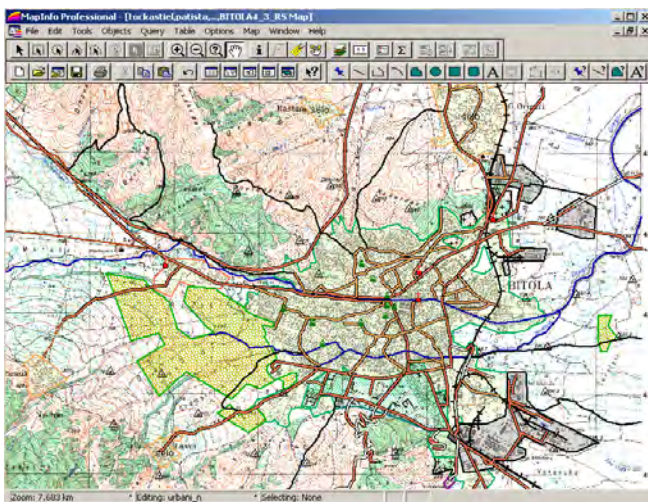


Fig.7. Final Map

So, the most appropriate solution is to obtain aero-photos taken above the areas of concern. Certainly it is possible to use the data from the urban planning office but usually they are not quite accurate.

The final map clearly shows the value of the MapInfo and updated database.

We can see that the new road and the settlements consisting of not registered constructions are placed on the final map in proper, corresponding spatial relationship with the other objects on the map which have already existed in the old map.

## V CONCLUSION

In this paper, satellite image data are used to update an old topographic map. By processing the image according to the described technique thematic maps are produced with high graphical and geometrical quality. They represent graphical base which entirely enables quality analysis of the target area. Finally, by implementing the updated layers over the old map we can print and produce a new updated map which is presented on Fig.7.

It is also noticed that updating of specific layers requires adequate quality of the input data according to the customer requirements.

The results can be used for production of standardized thematic maps in various scales, contents and levels of generalization provided for integration with other data on national and international level.

Although this system is usually associated with larger state or local administration, it makes the spatial information more available and makes the decision process more transparent, dynamic and easy to control.

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