

## UPDATING THE OFFICIAL SPATIAL DATA IN THE REPUBLIC OF CROATIA

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### 1. INTRODUCTION

After completing the production of official topographic maps in the scale of 1:25,000 (TK25) in the Republic of Croatia, a new task was put before the State Geodetic Administration to maintain and update the official topographic datasets. The production of topographic maps began in 1996 and ended in 2010. All 594 TK25 sheets were produced during that period for the entire State territory. In parallel with the TK25 production, the Base Topographic Database has been developed, containing the topologically processed planimetric data created before the above-mentioned maps were created. The Base Topographic Database represents the basic set of data serving as the basis for the production of all official scales.

Since the phase of the production of basic sets ended in 2010, the State Geodetic Administration has launched a project entitled "Production of the specifications for updating the Basic Topographic Database and the production of up-to-date TK25 sheets". The project was completed in 2010.

These updating specifications defined the guidelines for maintaining the BTM and producing the updated TK25 editions in a manner that can satisfy the user needs for up-to-date data.

The specifications described two methods of updating: a method according to the actually determined changes involving the updating of the created changes immediately after their occurrence and encompassing only certain objects of regional and/or state importance.

and the method of periodic updating involved the collection of all changes within a time interval according to the State Geodetic Administration program.

Given the specific situation, the production of topographic data meaning that the data is not produced within the SGA system has been outsourced by public tender and contract to private companies so we had to develop the system that accurately and precisely defines every step in the production i.e. renewal of data. The foundations of such a system are well defined in the product specifications for all data created during the production. Therefore, in parallel with the development of the Updating Specifications, we had to adjust also some other product specifications in order to harmonize primarily the data referring to the digital format of cartographic products.

The other imposing challenge which is one of the basics of an efficient updating system is the collection of information on changes. The collection of the information on changes presupposes the definition of updating process participants who, based on the field reports and their authority, submit the changes detected as compared to the official data set according to the determined methodology. Based on the information collected on a particular change, the information must be filtered and ranked by priority in order to be submitted in the end to the contractor who has to "map" it on the basis of originals and "integrate" it into the initial data set.

### 2. COLLECTION OF INFORMATION ON CHANGES IN SPACE

After gaining the independence, the Republic of Croatia regulated its national geodetic and spatial system in line with its own needs, possibilities and social and economic interests. With the adoption of the Law on State Survey and Real Estate Cadastre in 1999 followed by the implementation rules, primarily the Rules and Regulations on the Manner of Topographic Survey and the Production of State Maps, the State Geodetic Administration laid down the foundations for the development of the national topographic and cartographic system in line with the modern technological trends and achievements.

In order for such a system to be efficient and serve all commercial and other subjects, it is of crucial importance to define the basic sets updating system.

The system definition presupposes the determination of what, when and where needs to be updated in the official spatial data. In searching for the answer to this question, the SGA has used experiences of other, more developed mapping agencies in Europe. By comparing the updating systems in Belgium, Germany, Great Britain and the Netherlands, we have defined the system in which the SGA as the umbrella organization decides on every change to be performed on the official data set.

By answering the question of "what and when needs to be updated", we have divided all spatial data by priority. The priorities have been defined based on the experiences and polls conducted as part of the user

workshop for the Updating Specification Development Project. The updating priorities of every single object within the BTM and according to the cartographic key for the TK25 are as follows.

a) Priority no. 1

- "Transportation" package. "Roadways" (State and county roads) class, Railway class, Airstrip class
- "Constructions" package. "Energy facilities" class, "Industrial objects" (over 5,000 m<sup>2</sup>) class
- "Vegetation and type of land" class: "Special Purpose Areas" Class
- "Geographical names" class: Toponyms
- State border

b) Priority no. 2

- Mains
- Constructions: Class of objects not being the 1st priority.
- Waterways
- Vegetation and type of land: "Public commercial areas" Class
- Relief
- Geographical names:
- Trigonometric points and repairs

c) Priority no. 3

- from the "Vegetation and type of land" class: Class of objects not being the 1st and 2nd priority.

The objects classified as 1st priority are updated no later than 1 year from the date when the information on change was obtained. After updating the objects classified as 1st priority, the objects classified as 2nd and 3rd priority are being updated if directly linked to the updating of the object belonging to the 1st group. e.g. when creating a new road belonging to the 1st group of priority, all surrounding cover will also be updated as well as surrounding embankments and ravines.

Objects belonging to the 2nd group of priorities are updated immediately after the 1st group has been updated. By updating the objects belonging to the 2nd group of priorities, all objects from the 3rd group of priorities will be updated if directly linked to the updated object and all newly created objects from the first priority group if not, in the meantime, entirely derived.

The objects in the 3rd group of priorities are updated after the objects from the 2nd group have been updated, as necessary. By searching for the answer to the question of "where to update", a methodology has been developed to collect the information on changes in space based on the subject determination i.e. indicators to collect information on the changes in space and the manner of communicating with them.

### ***2.1 Subjects (indicators) for collecting the information on the changes in space***

A great number of institutions and organizations model and realize their own spatial IT systems to better manage the spatial data of interest to them.

The term „subjects/indicators“ denotes the organizations having certain experiences with the collection of spatial data and having the information on certain objects in the territory under their jurisdiction.

Since the data about the changes collected by certain process participants are not in line with the structure and accuracy of the data needed for the BTM or TK25 updating, we had to take only the information on the change into account.

The subjects to participate or already participating in the process of collecting the information (Figure 1) are:

- Regional cadastral offices in the State Geodetic Administration system through their branch offices
- County physical planning institutes and public companies (Croatian Waterways, Croatian Railroads, Croatian roads /motorways)
- Professional associations / organizations with which the SGA has already concluded the cooperation agreements in the field of official and thematic cartography such as the Croatian Mountain Rescue Service, State Protection and Safety Directorate, Scout Association of Croatia
- All users of the public web service (this option is been planned and has not yet been carried out)

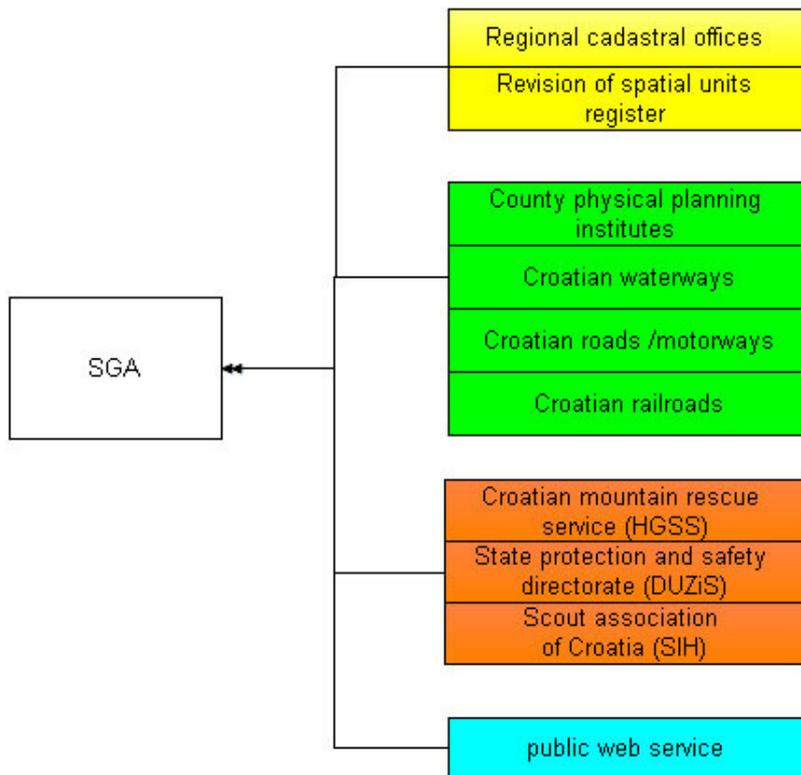


Figure 1: Subjects (indicators) for collecting the information on the changes in space

## 2.2 Process of communicating with the subjects/indicators

In order to use the collected information on changes, we had to develop a methodology for collecting the information in order to facilitate their manipulation. The developed methodology presupposes that all participants/indicators are forwarded the application along with the instructions for use and the raster data of the maps in the scale of 1:25,000 for their territory. (Figure 2).

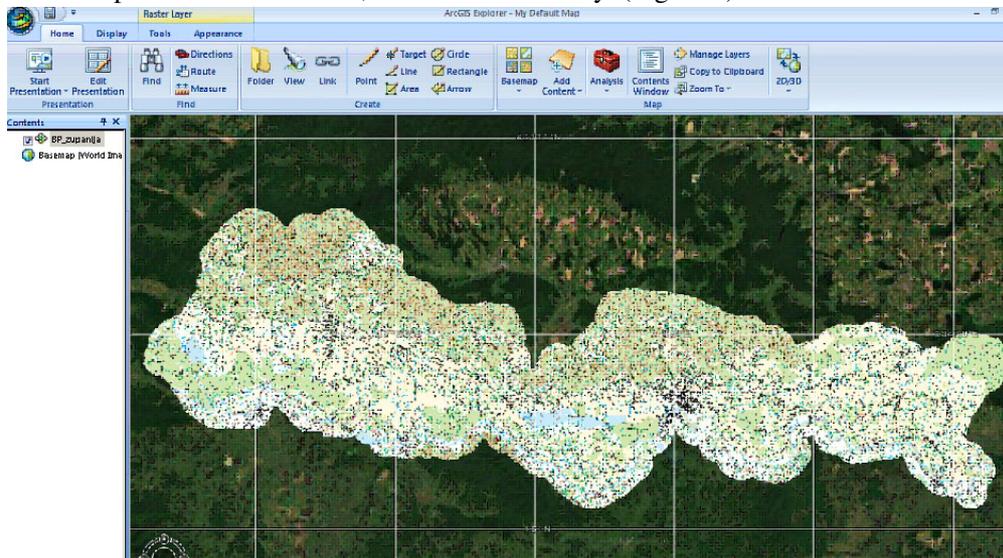


Figure 2: Application for collecting the geo-referenced data on changes

The participants follow the instructions developed by the SGA and mark the detected changes which they forward to the SGA.

The data created when marking certain detected changes as compared to the submitted TK25 is called Geo-Referenced Data on Change (GDC). GDC is submitted in .kml format and, due to their small size, is suitable for electronic forwarding by email.

The submitted data is used only as a piece of information on the change and cannot be used for illustration of certain objects in the BTD or on the map.

All submitted GDC's are subject to analysis by the SGA, consisting of:

- Data filtering which means that the duplicate information on changes submitted by various subjects/indicators is eliminated.
- Conversion to shp/mdb in order to facilitate the data manipulation
- Ranking by group of priority according to the criteria defined in the updating specifications
- Change verification

Based on the analysed GDC, the Report on Detected Changes (RDC) is produced. The RDC denotes a table overview of all collected GDC's produced by the SGA as part of the GDC conversion into shape/mdb file. Each line of the RDC has its graphical illustration in space and all data is kept digitally.

In the official BTM and TK25 dataset, only the data approved by the SGA can be updated (Figure 3).

A	B	C	D	E	F	G	H	I	J
Br.	Imena evaluaciona promjene	Opisna dijagnoza	Novi objekti (prema klasifikacijskim oznakama)	Tipovi promjena	Zone podataka u promjeni	Broj poligona	Obilježje cil. razine BGT	Ime i opisna vrste objekta u promjeni	Ime i vrste objekta u BTM
1									
2	1.								
3	2.								
4	3.								
5									
6									
7	datum u obliku dd.mm.gg	- stare geodetske božice	Navesti naziv prema Zbirni karteografskih	- Nastanak objekta (1)	- PUK-ovi	1	da		datum u obliku dd.mm.gg
8		- Zgrada		- Brisanje objekta (2)	- ZPPP	3	ne		
9		- Druga građevina i površine		- Promjena objekta (3)	- HESS	3			
10		- vodovod i odvodnja objekti		- Promjena geometrije objekta (4)	- SBI				
11		- Prave		- Promjena veličnosti objekta (5)	- Javna podzemlja				
12		- vožnja i vrsta zemljišta		- Promjena objekta vrste objekta (6)	- Javni servis (vob)				
13		- Ulice		- Objavljeni objekti (7)	- podatak iz revizije geotičkog objekta promjena jedinica				
14		- Reljef		- Spajanje objekata (8)					
15		- granice		- Izmjena objekata usljed ispravljanja poligonalne točnosti (9)					
16		- zemljišna imanja							
17									
18									

Figure 3: Report on detected changes (RDC)

### 3. UPDATING PROCESS

Based on the produced RDC containing, as previously said, all verified information on detected changes, the Updating plan (UP) is being created. The updating plan production is required in order to determine the timeline when respective objects in the BTM or TK25 will be updated and is based on the RDC and the priority of objects to be updated.

The UP and RDC are submitted to the contractor who, after the implemented public tender, has offered the most favourable production conditions.

During the period of validity of the contract for the current year, the contractor has to update only the objects that are in accordance with the updating plan. If the contractor notices the objects that could not be recorded in the RDC and defined in the UP, they have to be recorded using the same methodology as other participants/indicators and submitted to the SGA. After such data is submitted, the SGA analyses it and possibly verifies the submitted change and amends the RDC and the UP.

The definition of the change of certain objects and consequently the change verification denotes: object creation, object deletion, object revision, object geometry change, attribute value change, object type change, object splitting, object amalgamation, object change due to the correction of the position point. All of the above-mentioned instances of change must be recorded in the Report on Detected Changes.

After the completed updating process, the contractor hands over to the SGA entire datasets as follows:

- TK25 cartographic data in accordance with the TK25 product specification
  - TK25 v cartographic data
  - Reproduction originals for each TK25 sheet in pdf format
  - TK25 raster files (Geotif)
  - Final reproduction originals in digital format
- Digital Terrain Model (DTM) data in accordance with the DTM product specifications
  - 3D vector data in .dgn format with inserted changes
  - Digital elevation model (DEM) calculated from the DTM (ASCII record: X, Y, Z)
- BTM data in accordance with the topographic data product specifications
  - Newly collected topographic data – original data of the photogrammetric mapping (3D vector data) in .dgn format.
  - Data for uploading into the BTM in .shp format
- Technical reports on the works performed with clearly and professionally documented data on the processing flow.

All submitted data is subject to quality control by the SGA and after the final control, the products /data are sent for further being uploaded into the database and for the map printing.

### 4. BOOK OF CHANGES

The changes implemented in the newly created data are recorded in the Book of Changes. The Book of Changes is actually a digital database and records all changes implemented on the data. In parallel with the Book of Changes that is primarily linked to the cartographic data i.e. in this case to the TK25, a term „Object Life Cycle“ has been introduced into the BTM. The establishment of a life cycle is the introduction of attributive data linked to the change of a respective object in the Basic Topographic Database (Figure 4).

Attribute name	Attribute description	Type of field	condition
TOID	Unique identifier of the topographic object in the database.	Long integer	U
OBJECT_START	Date of creating the object in the database. Remark: When updating the object for the first time, the date is identical to the start of the first version i.e. the data contained in the QCID attribute value The QCID attribute has the YYYYMMDDC structure and has been generated by the CGI after the object has undergone quality control.	date	O
OBJECT_END	Date when the object was retired in the database because it no longer exists in the real world. TOID of the retired object must not be associated to the new objects.	date	U
VERSION_START	Date when the object change occurred while the object is still considered the same entity. Date when the change on the object was recorded in the database.	date	O
VERSION_END	Date when the version ceased to be valid. Identical to the data of the start of the new version in the BTM.	date	U
CREATION_DATE	Date of the data creation in the real world. E.g. year of the construction of a building such as church etc. OBJECT_START attribute is linked to the creation of the object in the BTM.	date	N
DISSAPEARANCE_DATE	Date when the object disappeared in the real world.	date	N
ORIGINAL_DATE	Date when the original used for the data revision was created. e.g. date when the aerial photo was taken that served as the basis for mapping the object or when the situation uploaded into the BTM was screened. <sup>1</sup>	date	O
REVISION_DATE	Date of the object revision is independent of whether the change occurred or not	date	O
REASON_FOR CHANGE	Reason why the object was given a new version. The reason for change is recorded in the new version of the object.	Integer (Reason_for change)	O
VERSION	Number of version (increases sequentially)	Integer	O
NAME_OF OPERATOR	Name of the SGA operator inserting the data into the BTM.	Character String	N
NAME_OF MANUFACTURER	The subject having collected the data – private company, SGA, CGI, organization with which the SGA has an agreement etc.	Character String	O

Figure 4: List of attributes of Object Life Cycle in BTM

## 5. CONCLUSION

By completing the production of the basic sets of spatial data in the Republic of Croatia, a great effort has been completed with regards to the production of official spatial data. The work to be completed in the upcoming period is based on the establishment of the most efficient updating system of the same information because its value and importance becomes less by the day. Today, spatial information is becoming the product that is used or demanded by a great number of users on a daily basis. In the past, this referred to the analogue maps in different scales while today this refers to the digital spatial data used in various ways with the help of new technological tools.

As the space around us is constantly changing, the SGA is tasked and legally bound to promote and maintain the spatial information and must inevitably do everything in its power to form the products demanded by prospective users by, naturally, adequately communicating with them.

## REFERENCES

- GEOFOTO, 1996, CROTIS- Topographic Information System of the Republic of Croatia, Zagreb, State Geodetic Administration
- Institute for Photogrammetry, 1992, Study on the Structure of the Official Topographic and Mapping Information System of the Republic of Croatia, Zagreb, State Geodetic Administration.

- Institute for Photogrammetry, 1995, Official Topographic and Mapping Information System – project design, Zagreb, State Geodetic Administration
- Bačić, Landek, Vilus, 2009, New Topographic Map of Croatia – Tool for Education and Networking, Vienna, ICA Symposium on Cartography for Central and Eastern Europe 15.-17. February 2009.
- Republic of Croatia, 2007, Law of State Survey and Real Estate Cadastre, Zagreb, Official Gazette 16
- State Geodetic Administration, 2008, Ordinance on Topographic Survey and State Map Production, Zagreb, Official Gazette 109
- State Geodetic Administration, 2009, BTD Updating Specification and the Production of Up-To-Date TK25 Sheets