UDK 528.93:528.914:528.711.1:004.92
Original scientific paper / Izvorni znanstveni članak

INSPIRE Specifications in the Service of Making a Topographic Map

Slobodanka KLJUČANIN – Bihać[1]

ABSTRACT. Creating and displaying topographic map of any size on a computer screen is a difficult process. However, computer graphics are used to simplify this process. Thus, for example, the visualization of topographic data can be in vector format, raster format, or printed on paper. The Strategy for the Development of Official Cartography in the Federation of Bosnia and Herzegovina offered three functional models for the development of official topographic maps, of which the Model with a basic topographic database at a scale of 1:10 000 (BTDB10) was selected as official. This model relies on a data model based on INSPIRE specifications and is linked to various data sources. INSPIRE (Infrastructure for Spatial Information in the European Community) Directive establishes an infrastructure for spatial information in Europe to support environmental policies and policies or activities that may have an impact on the environment. It entered into force in May 2007. INSPIRE specifications allow the creation of harmonized spatial data sets that can be used seamlessly in a variety of applications. The Regulation on Spatial Data Infrastructure of the Federation of B&H relies on the principles of the INSPIRE Directive and its technical specifications. Visualization of BTDB10 data enables the unambiguous display of data of the topographic map at different scales 1:10 000, 1:50 000, and 1:250 000, following domestic and international standards. This article will analyze the existing legal acts that are the basis for the establishment of a basic topographic database at a scale of 1:10 000 (BTDB10), as well as the processes for visualization of BTDB10 data in the Federation of Bosnia and Herzegovina.

Keywords: topographic maps, basic topographic database, spatial data infrastructure (SDI), computer graphic, visualization of spatial data.

[1] Slobodanka Ključanin, PhD of Technical Science, Department of Civil Engineering, Technical Faculty, University of Bihać, Irfana Ljubijankića b.b., BA-77000 Bihać, Bosnia and Herzegovina,
e-mail: slobodanka63@yahoo.com.

1. Introduction

In the Federation of Bosnia and Herzegovina[2] (Federation B&H), there is an appropriate legal framework that regulates official cartography issues, such as copyright law, freedom of access to information, storage and use of survey data and real estate cadastre, Regulation on spatial data infrastructure, and many other laws and regulations about methods and accuracy of cadastral and topographic data collection and visualization. The state of the legal framework is also reflected in the fact that currently there are legal regulations that were taken over from the previous state – Socialist Federal Republic of Yugoslavia (SFRY) with certain adjustments (due to the development of data collection and visualization technology), and without harmonization with European trends.

Given that the official topographic maps for the territory of Bosnia and Herzegovina were made at the Military Geographical Institute in Belgrade (SFRY) until 1992, the Federal Administration for Geodetic and Property Affairs (FGA) was tasked to start making official topographic maps for the territory of the Federation B&H.

The Archives of Bosnia and Herzegovina contain photo material created by aerial photography of photogrammetry in the period from 1951–1992. The first site (1951) was the area of Semberija, and in the period from 1951 to 1960, there were 27 active sites in B&H. The first sites were considered experiments in which flat areas were taken, and later works were carried out on river canyons, power lines and larger cities. In the period of 1961–1970 there were 27 other active sites – mostly in the cities of Bosnia and Herzegovina. In the next decade, work was done on 42 locations, some of which were reviews of larger cities. In the period from 1981 to 1992, work was done again on 27 worksites (cities). The first institution to perform aerial photogrammetric surveying was the Federal Institute for Photogrammetry – Belgrade, and then they continued the combined survey with three institutions: Military Geographical Institute – Belgrade, Geopremer – Belgrade, and Geodetic Authority – Ljubljana (Ključanin 2013, Ključanin et al. 2014). From 1995 to 2017, an aerial survey was not done systematically, in terms of making topographic maps, although the survey was done to create a digital orthophoto and update the cadastral database.

Stored in FGA are: Topographic-cadastral maps (1:500 – 1:5000) in analog and digital format (raster and vector), analog and digital data of topographic maps (TM) at scales of 1:25 000, 1:10 000, 1:5000 (TM25, TM10, TM5), as well as topographic maps of smaller scales (TM50, TM100, and TM300). Also, new digital TM25s are available. They were created through the implementation of a project called "Digital Topographic Maps for Bosnia and Herzegovina" funded by the Japan International Cooperation Agency. On that occasion, 47 map sheets were updated (of which 25 cover the territory of the Federation of B&H) out of a total of 432 map sheets TM25 of Bosnia and Herzegovina (Ključanin 2013). Aerial photogrammetric data urban zones of Bosnia and Herzegovina were used as a basis for making the maps.

[2] The Federation of Bosnia and Herzegovina is one of the two entities that compose the State of Bosnia and Herzegovina.

Also, Digital Orthophoto (DOF) maps at a scale of 1:5000 for outside urban areas, and for urban areas at a scale of 1:2500 are available. Digital orthophotos were created within the aerial photogrammetric survey of the territory of Bosnia and Herzegovina, within the project "Spatial Information Services for B&H phase two – Digital orthophoto map" funded by the European Union (EU), for the needs of the 2013 census. An additional product of this aerial photogrammetric imaging is the digital terrain model (DTM).

The Strategy for the Development of Official Cartography of the Federation B&H has been written in 2014, which defined the model for the development of official cartography. A model with a basic topographic-cartographic database at a scale of 1:10 000 (BTDB10) was selected. This strategy defined the division of official maps into two categories: 1) topographic maps of basic purpose (scales 1:10 000, 1:50 000 and 1:250 000) and 2) topographic maps of special-purpose (scales 1:25 000, 1:100 000 and other scales) (Ključanin et al. 2014).

The Regulation on Spatial Data Infrastructure of the Federation of B&H regulates, among other things, issues related to the metadata of existing spatial data sets and services, creation of new spatial datasets, databases, the formation of services, and development of networking technology of various institutions are responsible for the collection and processing of spatial data (e.g. Roads Directorate, River Basin Agencies, etc.). Article 3 Paragraph (5) of this Regulation states: "Spatial Data Infrastructure of the Federation of B&H is established and maintained following the European Union Directive – Infrastructure for Spatial Information in the European Community – INSPIRE and other standards" (Federation of the Bosnia and Herzegovina 2014).

Based on INSPIRE and other international standards, the Topographic Information System of the Federation of B&H (topographic model) was created, and based on the current topographic model, BTDB10 is currently being established for the Bosnian-Podrinje Canton, Sarajevo Canton, and Herzegovina-Neretva Canton, while in the formation of BTDB10 for Zenica-Doboj Canton and Central Bosnia Canton is underway). The establishment of BTDB10 provides a uniform manner of data visualization, based on the control of topological conditions of BTDB data, cartographic generalization, the topographic symbolization of data together with an internal and external description of cartographic products, output product format, and cartographic paper, resulting in the final product – vector, raster and/or analog topographic maps. The purpose of visualizing BTDB10 data is to achieve consistency in the control and presentation of topographic data, i.e. topographic maps. Its goal is to enable the unambiguous display of topographic data for different map scales – 1:10 000, 1:50 000, and 1:250 000, following domestic and international standards (URL 1). For this purpose, computer graphics are used as a tool for generating, manipulating, and visualizing spatial data in the form of topographic maps.

2. Topographic Information model of the Federation of B&H

Topographic maps are models of geographical reality depicting selected objects or properties. Modeling is the process of representing real-world objects or phenomena in the form of mathematical formulas, in a narrower sense, the process of representing two-dimensional and three-dimensional objects in a computer (Panian 2005). Following the above, a topographic model is a model created by generalizing data about the Earth's surface and the objects built on it. The topographic database can be considered a subset of the spatial database whose goal is the visualization of data in the form of a topographic map (with different contents, types, and scales). Display models, using available technology, enable a larger amount of collected information and a more realistic display of objects and phenomena of the real world, as well as the possibility of different displays of the same spatial data. The data in the database is logically structured by an appropriate data model (Ključanin 2006). The establishment of the BTDB10 implies compliance with the rules of the topographic information system of the Federation of B&H (the topographic model). Data structured according to the topographic model can be used for different needs e.g. for visualization of topographic maps of basic and special purposes, the performance of spatial analyzes, etc.

Table 1. *Excerpt from the working material of the Topographic Information System of the Federation of B&H.*

Package	**Feature Type**	**Feature Type definition**
Geographical Names	NamedPlace	Any real-world entity that bears one or more names.
BuildingsBase	AbstractConstruction	An abstract type of spatial object is grouped based on common semantic features of the building, parts of the building, and some optional spatial object types that can be added to offer more information on the feature type of Buildings.
	AbstractBuilding	Abstract spatial object type grouped based on common semantic properties of spatial object types Building and BuildingPart
	Building	A building is a closed structure above and/or below ground, which is used or intended to shelter people, animals, or things or to produce economic goods. Buildings refer to any structure of permanent construction or erected on that site.
	BuildingPart	BuildingPart is a subgroup of the Building that can be considered as a separate unit, i.e. a building.

The topographic information system of the Federation B&H (available at URL 2) is made according to international standards and INSPIRE data specifications for spatial data theme. It consists of 11 spatial data themes (Table 1):

1. Administrative units,
2. Geographical names,
3. Buildings,
4. Hydrography,
5. Elevation,

6. Transport networks,
7. Land cover,
8. Land use,
9. Utilities,
10. Sea regions and
11. Geodetic points.

Each of these spatial data themes is divided into packages, and they are further divided into feature types and value lists. Feature types are interconnected by clearly defined relations and constraints. Fig. 1 shows the conceptual scheme of the Topographic Information System of the Federation of B&H.

Fig. 2 shows the elaboration of a conceptual model for the feature type Administrative Unit, while Fig. 3 shows a UML diagram with all the details describing the target feature type and connections to other feature taypes and value lists. It is clearly indicated which attributes are mandatory and which are not.

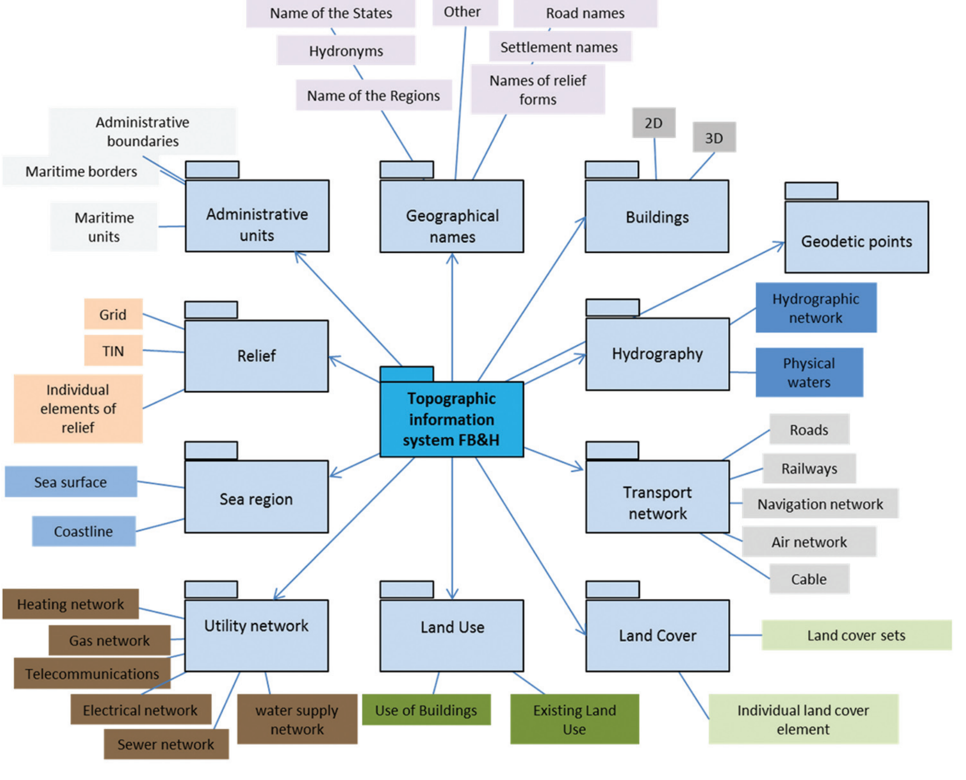

Fig. 1. *Conceptual scheme of the Topographic Information System of the Federation of B&H.*

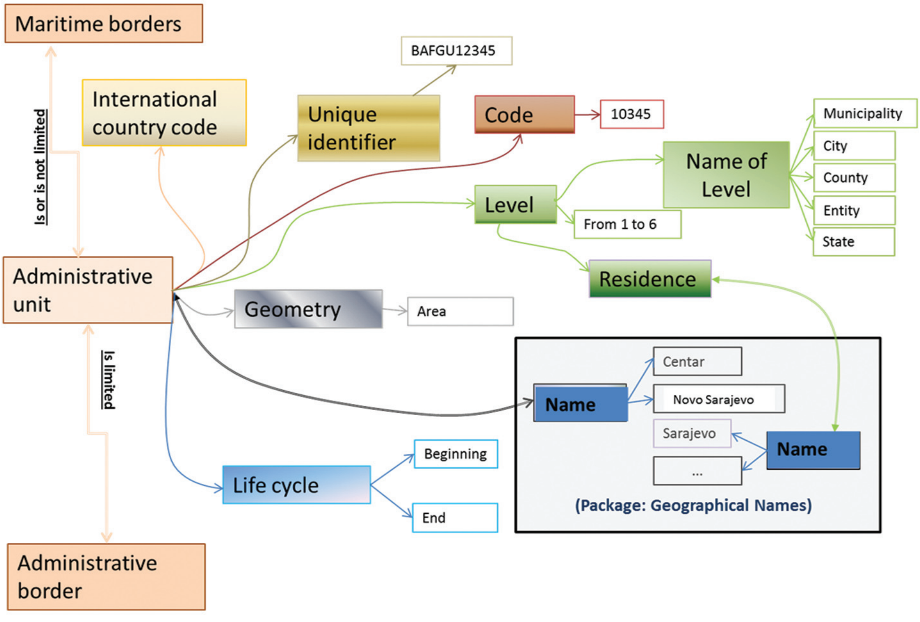

Fig. 2. *Development of a conceptual model for the feature type Administrative unit.*

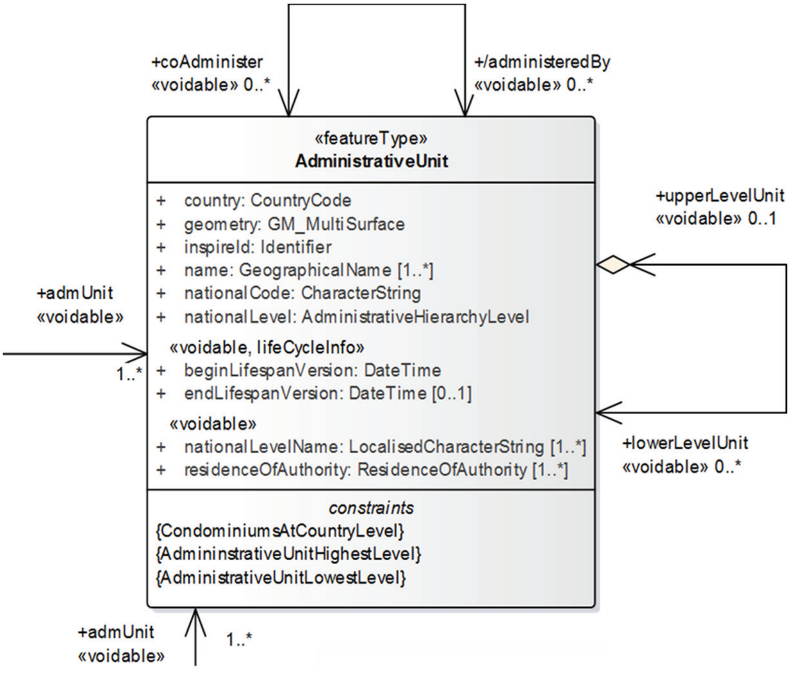

Fig. 3. *UML diagram of the Administrative Unit (URL 2, URL 3).*

The formation of BTDB10 implies the implementation of a topographic data model using appropriate hardware and software. Following the descriptions of spatial data themes and feature types, the user first forms the selected spatial data theme, its corresponding feature types, and value lists. Each feature type is assigned the required attributes. The feature type created in this way is not complete, because it lacks data on geometry. Computer graphics techniques are used to create the geometry of feature types. Data on the geometry of a feature type is entered by vectorization of the geometric object and placing the data in the database (Fig. 4).

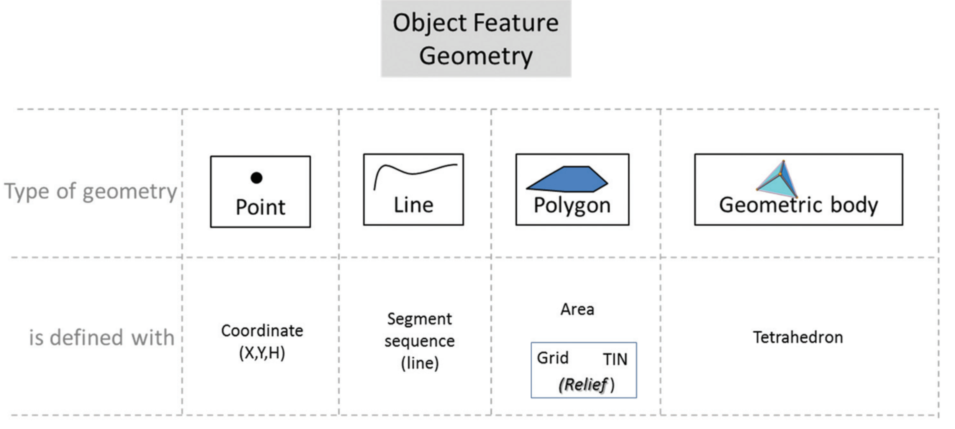

Fig. 4. *Examples of different Object Feature geometries. A point is defined by coordinates in a particular reference system, a line is defined by a series of segments bounded by points, a polygon defined by a series of segments that form a two-dimensional shape, a grid and TIN are relief modelling techniques, and a three-dimensional geometric object (the unit element is usually a tetrahedron).*

Features type geometry is entered into the database by applying various geometry creation techniques, such as the transformation of analog data into digital form (by scanning or vectorization data), downloading digital data collected from the field, or downloading data from existing sets or databases. For the needs of making a basic topographic map, as well as for any topographic map, it is necessary to collect data from the primary and secondary sources of appropriate accuracy. Primary data collection involves direct measurements related to the position and geometry of objects. Data collection from secondary sources is the process of creating raster and vector files as well as existing databases from analog maps and other available documents (Modrinić 2018).

The Federation B&H official cartography development strategy (Ključanin et al. 2014) and the Methodology and procedures for the establishment and maintenance of BTDB10 (Modrinić 2018) define data sources which are required for the establishment of BTDB10 (RECDB, register of geographical names, address register, and other registers and data sets which are not under the jurisdiction of the FGA). When entering geometry data in the BTDB10 the official geodetic datums and cartographic projections must be applied.

2.1. Geodetic datum

The geodetic datum of the Federation B&H is harmonized with the geodetic datums defined by the INSPIRE Directive only in 2019. However, ellipsoid Bessel 1841, and ETRS89 currently apply to the horizontal component of the geodetic datum, until the complete transition to the new geodetic datum. For official cartography applies Gauss-Krüger projection[3], and for the altitude component existing national rules are followed until the transition to the European Vertical Reference System (EVRS) (Federal Administration for Geodetic and Property Affairs – FGA 2019).

2.2. Cartographic projection

INSPIRE specifications to recommend the use of the following cartographic projections:

1. Lambert azimuthal equivalent projection (ETRS89-LAEA), for pan-European spatial analysis and reporting
2. Lambert conformal conical projection (ETRS89-LCC) for the conformal representation of Europe at scales smaller than or equal to 1:500 000, and
3. Transverse Mercator projection (ETRS89-TMzone) for the conformal representation of Europe at scales larger than 1:500 000 (URL 4).

For the Federation B&H area, according to the Rulebook on Basic Geodetic Works (Federal Administration for Geodetic and Property Affairs – FGA 2019), prescribed is the use of a Transverse Mercator projection with central meridian at 18° (6th zone). The Rulebook on the basic topographic database (Federal Administration for Geodetic and Property Affairs – FGA 2019) prescribes the mandatory content, technical norms, and the manner of making BTDB10, the manner of maintaining, distributing, and archiving the contents of BTDB10.

3. Data visualization

The term of data visualization first started to mention in the cartographic literature. With the development of computing, data visualization began to be treated as one of the techniques of computer graphics. By definition, visualization is the process of creating a visible image of space (URL 5). The strategy for the development of official cartography of Federation B&H (Ključanin et al. 2014) pointed out the need to develop a specification for the visualization of BTDB10 data and a digital collection of signs for basic and special scales of maps. In the Rulebook on the basic topographic database, Chapter VI entitled Presentation of the contents of the BTDB database, in Articles 13 and 14 (Fed-

[3] Gauss-Krüger projection belongs to the group of Transverse Mercator projections. It is similar to the Universal Transverse Mercator projection (UTM), but the central meridians of the Gauss-Krüger zones are only 3° apart, as opposed to 6° in UTM.

eral Administration for Geodetic and Property Affairs – FGA 2019) discusses visualization in different scales and for different needs, the formats, the use of topographic signs, object representation, and the rules to draw topographic signs. The BTDB10 Data Visualization Instruction to make official topographic maps at scales of 1:10 000, 1:50 000, and 1:250 000 (URL 1) prescribes a unique method of visualization data of BTDB10, based on control of topological conditions, the generalization of the model, the cartographic generalization, the topographic symbolization of data together with the instructions related to the final layout of the product (depending on whether it is a vector, raster, and/or analog topographic maps) and prescribes the content of the final report on the formation and visualization of data BTDB10.

3.1. Topological rules

After entering the data into the database, the accuracy of the entered data prescribed by the topographic model and their topological correctness are examined. The BTDB10 data visualization instruction to making official topographic maps (URL 1) provides detailed topological rules for each feature type (Tables 2 and 3).

Table 2. *Example of topological rules prescribed by INSPIRE specifications (URL 1).*

INSPIRE Specification	Package	Topological rules
INSPIRE Data Specification for the spatial data theme Land Cover	LandCoverVector	See the Geometric Representation section at (URL 6)
INSPIRE Data Specification for the spatial data theme Land Use	Existing Land Use	See the Geometric Representation section at (URL 7)

Table 3. *Land Cover Vector and Existing Land Use (URL 1).*

Object Feature	Topological rules	Connecting Object Features	Description of the topological rule
EXISTINGLAND USEOBJECT (ELUO)	It must not overlap with	EXISTINGLANDUSEOBJECT	ELUO must not overlap with itself
	Can be covered OR Can be inside	BUILDING, ADMINSITRATIVEUNIT, ADMINISTRATIVEBOUNDARY, TRANSPORTAREA (TNA), SEAAERA (SA), SURFACEWATER	The ELUO may be covered / within one polygon of the administrative area
LAND COVER UNIT (LCU)	It must not overlap with	SEAAREA, LAND COVER UNIT	LCU surfaces must not overlap with each other or with the sea surface
	It must have no holes	LANDCOVERUNIT	LCU surfaces must not have holes between them
	The border can be covered with	COASTLINE	The boundaries of the LCU area may be overlapped by the shoreline or coastal area as well as the sea boundary
	It can overlap	BUILDING, ADMINSITRATIVEUNIT, ADMINISTRATIVEBOUNDARY, TRANSPORTAREA, SEAAERA, SURFACEWATER	The LCU may overlap with the spatial objects shown as a surface

The result of the topological rule check is entered in Tables 2 and 3 by adding two new columns, which are named as follows: 1. the topology is correct or incorrect (enter yes or no) and 2. The contractor's recommendation to change the topological rule.

3.2. Generalization

Generalization involves generalizing the contents of the BTDB10 to display its contents at the appropriate scale of the map. It consists of generalization of the model and cartographic generalization, in which, at the same time, different generalization strategies are applied. The goal of generalizing the model is to reduce the volume of data and remove data unnecessary for visualization at a certain scale of the map (Tables 4 and 5). A generalization of the model does not include cartographic generalization and is not limited by paper size (URL 8). Cartographic generalization is a generalization of the visualized content adapted to the scale and (or) purpose of the map (URL 9), (URL 10).

Table 4. *Example of model generalization rules for the needs of making the Basic Topographic Map 1:10 000 (URL 1).*

Object Feature	**Visualization BTM10**
Land Cover	
LandCoverUnit	Visualize: • artificially arranged land cover: areas > = 1600 m² • other land cover: areas > = 5000 m² • do not visualize the rest
LandCoverDataset	Visualize individual objects that are of interest for orientation in space (e.g. different types of vegetation, slopes, karst, etc., which are related to the display of relief)
Land Use	
ExistingLandUseObject	Visualize as follows: • merge into one polygon, if there are several areas whose land use is the same: areas <= 1600 m² • show a polygon if the land use is: areas > 1600 m²
ExistingLandUseDataset	Visualize individual objects that are of interest for spatial orientation (e.g., gas station, refinery, old town, railway station, stadium, playgrounds, swimming pools, electrical and other network poles, individual graves, TV tower, hydroelectric power map, thermal power map, etc.)

Table 5. *Example of model generalization rules for the needs of making a Topographic map 1:50 000 (URL 1).*

Object Feature	**Visualization TM50**
Land Cover	
LandCoverUnit	Visualize: • artificially arranged land cover: areas > = 8000 m² • other land cover: areas > = 25 000 m² • do not visualize the rest
LandCoverDataset	Visualize individual objects that are of interest for orientation in space
Land Use	
ExistingLandUseObject	Visualize as follows: • merge into one polygon, if there are several areas whose land use is the same: areas <= 25 000 m² • show a polygon if the land use is: areas > 25 000 m²

The process of cartographic generalization is performed in three steps: 1. examination of the conditions of the need for generalization (density, compactness, conflict, inconsistency, etc.); 2. measurements indicating the need for generalization (a measurement of object density, distribution, shape, distance, etc.); and 3. generalization techniques (selection, simplification, scrolling, aggregation, merging, emphasizing, etc.) (URL 1).

3.3. Internal and external content of the map

In the distribution of the final cartographic product, the rule is applied that the content of the map is divided into internal and external content of the map. The external contents of the map are in fact product metadata (Fig. 5).

The elements of the internal content a topographic map are the cartographic grid, the relief, the hydrography, the settlement, the different types of roads, the vegetation, the different types of borderlines, the corresponding geographical names, and other types of spatial objects. External elements of the topographic maps are the map frame, various labels, map descriptions, data, and examinations outside the map frame (URL 11). The elements of the external content of a topographic map are the interspace and the outer part of the map and imply a product description. The interspace is defined by an internal and external frame in which the coordinates of the coordinate grid are entered.

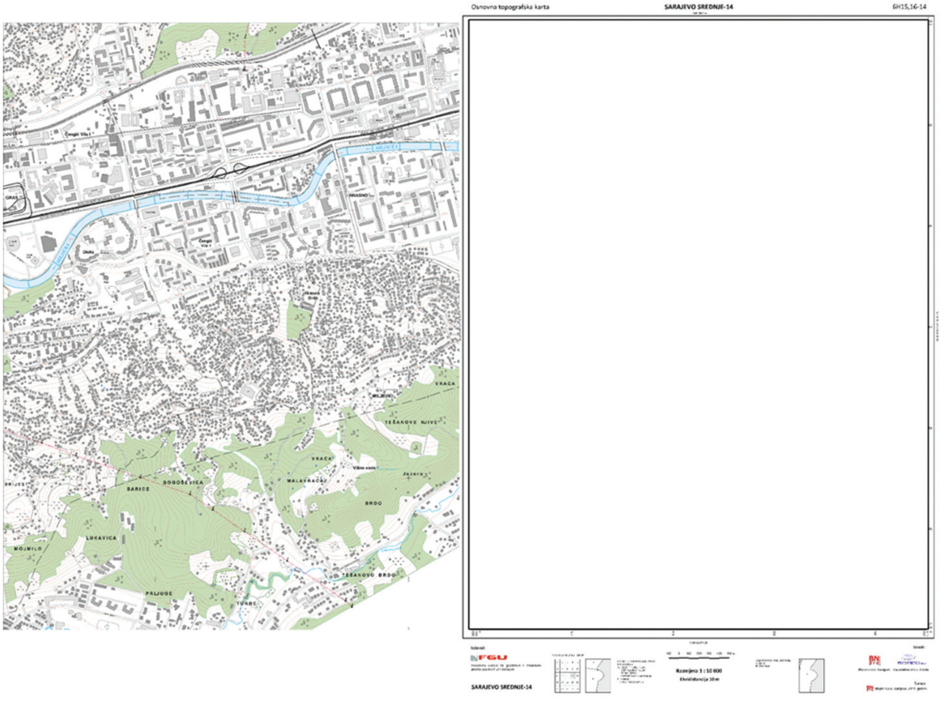

Fig. 5. *Internal and external description of the basic topographic map at a scale of 1:10000.*

For topographic maps of smaller scales, textual data on road and railway routes are entered, and if necessary extended internal content. The outer part of the map contains data about: the connection with the adjacent sheet, the full name of the product, name of the sheet, nomenclature of the sheet, name of the investor (and its logo), scheme of the position of the map sheet on the diagram of the total division of the sheets, scheme of origin of cartographic material, graphic and numerical scale, equidistance, scheme of administrative units, name of the contractor, name of the printing house and year of printing (URL 1). The sign system for displaying spatial objects on maps (internal content of the map) consists of cartographic-topographic signs and their mutual relation, the relation of signs to the displayed objects, and the relation of users to signs (URL 12).

4. Conclusion

In the Federation B&H, a legislative framework was applied for many years that did not follow the technological achievements in the collection, processing, and visualization of topographic data. In recent years, efforts have been made to bridge this gap by adapting existing national and applying new international standards. The Federal Administration for Geodetic and Property Affairs was issued a series of rulebooks and instructions that allow users to use technology for the production and use of traditional and modern topographic products.

Spatial data infrastructure (SDI) has the task of providing a legal and technical framework for searching, assessing the quality, and using spatial data. By establishing SDI a more significant sharing of spatial data sets from different data producers can be expected, as well as a greater number of new up-to-date topographic products. The establishment of Spatial data infrastructure in the Federation of B&H is at an early stage, but it should be emphasized that it represents a great potential for the future development of official cartography and cartographic products in general.

This article was an analysis performed of the application of existing laws, regulations, rulebooks, instructions, topographic information system in the B&H Federation for the needs of establishing a basic topographic database scale 1:10 000, data visualization processes, and distribution of the topographic product.

References

Federation of the Bosnia and Herzegovina (2014): The Regulation on Spatial Data Infrastructure of the Federation B&H, Official Gazette of the Federation B&H, No. 85/14.

Federal Administration for Geodetic and Property Affairs – FGA (2019): Rulebook on basic geodetic works, Official Gazette of the Federation B&H, No. 15/19.

Federal Administration for Geodetic and Property Affairs – FGA (2019): Rulebook on basic topographic database, Official Gazette of the Federation B&H, No. 17/19.

Ključanin, S. (2006): Interoperable cartographic databases, Master of science thesis, The University of Sarajevo, Faculty of Civil Engineering – Department of Geodesy, Sarajevo, Bosnia and Herzegovina.

Ključanin, S. (2013): Analysis of the official cartography in Federation B&H, Manuscript, Administration for Geodetic and Property-Legal Affairs, Sarajevo, Bosnia and Herzegovina.

Ključanin, S., Poslončec-Petrić, V., Landek, I., Ponjavić, M., Karabegović, A. (2014): Strategy for the development of the official cartography of the Federation B&H, Geometrika d.o.o., Grude, Bosnia and Herzegovina.

Panian, Ž. (2005): Informatics encyclopedic dictionary, Jutarnji list, Europapress holding d.o.o., Zagreb, Croatia.

URLs

URL 1: Federal Administration for Geodetic and Property Affairs – FGA (2020), Instructions on the visualization of data from the basic topographic database scale of 1:10 000, Sarajevo, Bosnia and Herzegovina, http://www.fgu.com.ba/hr/naputci.html?file=files/Novosti/2020/PDF/kt%20kljuc/h/Naputak%20O%20vizualizaciji%20podataka%20temeljne%20topografske%20baze%20mjerila%201%2010%20000%20za%20potrebe%20izrade%20sluzbenih%20TOPOGRAFSKIH%20KARATA.pdf, (accessed: September 25, 2020).

URL 2: Federal Administration for Geodetic and Property Affairs – FGA (2015), Topographic information system of the Federation B&H, Sarajevo, Bosnia and Herzegovina, http://www.fgu.com.ba/bs/model-podataka.html?file=files/Stranice/PDF%20files/Model%20podataka/Topografski%20informacijski%20sustav%20FB&H.pdf, (accessed: September 14, 2020).

URL 3: INSPIRE Data Specification for the spatial data theme Administrative Units, https://inspire.ec.europa.eu/id/document/tg/au, (accessed: September 14, 2020).

URL 4: INSPIRE Knowledge Base, https://inspire.ec.europa.eu/id/document/tg/rs, (accessed: September 9, 2020).

URL 5: Hrvatsko strukovno nazivlje, http://struna.ihjj.hr/naziv/vizualizacija/2360/, (accessed: September 14, 2020).

URL 6: INSPIRE Data Specification for the spatial data theme Land Cover, http://inspire.ec.europa.eu/documents/Data_Specifications/INSPIRE_DataSpecification_LC_v3.0.pdf, (accessed: September 7, 2020).

URL 7: INSPIRE Data Specification for the spatial data theme Land Use, http://inspire.ec.europa.eu/documents/Data_Specifications/INSPIRE_DataSpecification_LU_v3.0.pdf, (accessed: September 7, 2020).

URL 8: Državna geodetska uprava Republike Hrvatske, https://dgu.gov.hr/UserDocsImages/dokumenti/Pristup%20informacijama/Zakoni%20i%20ostali%20propisi/Specifikacije/SP_TK50ver%201.0_skupna.pdf, (accessed: September 15, 2020).

URL 9: Frančula, N. (2003): Cartographic generalization, The script, The University of Zagreb, Faculty of Geodesy, Zagreb, Croatia, https://bib.irb.hr/datoteka/42516.Kartografska_generalizacija_pswd.pdf, (accessed: September 16, 2020).

URL 10: Franula, N., Kartografska generalizacija, https://bib.irb.hr/datoteka/42516.Kartografska_generalizacija_pswd.pdf, (accessed: September 15, 2020).

URL 11: Hrvatsko strukovno nazivlje, http://struna.ihjj.hr/naziv/elementi-karte/1831/, (accessed: September 17, 2020).

URL 12: Kartografsko-geoinformatički rječnik, 1. faza, http://www.kartografija.hr/nzz/images/Rjecnik.pdf, (accessed: September 17, 2020).

INSPIRE specifikacije u službi izrade topografske karte

SAŽETAK. Stvaranje i prikazivanje topografske karte bilo koje veličine na ekranu računala težak je postupak. Za pojednostavljenje tog procesa primjenjuje se računalna grafika. Tako, na primjer, vizualizacija topografskih podataka može biti u vektorskom ili rasterskom formatu ili tiskana na papiru. Strategija razvoja službene kartografije u Federaciji Bosne i Hercegovine nudi tri funkcionalna modela za izradu službenih topografskih karata, od kojih je odabran model s temeljnom topografskom bazom podataka u mjerilu 1:10 000 (TTB10). Taj se model oslanja na Topografski informacijski sustav Federacije BiH, koji je zasnovan na INSPIRE specifikacijama i povezan je s različitim izvorima podataka. INSPIRE (Infrastruktura za prostorne informacije u Europskoj zajednici) Direktiva uspostavlja infrastrukturu za prostorne informacije u Europi za podršku politikama i politikama okoliša ili aktivnostima, koje mogu imati utjecaj na okoliš. INSPIRE Direktiva stupila je na snagu u svibnju 2007. INSPIRE specifikacije omogućuju stvaranje usklađenih skupova prostornih podataka, koji se mogu neometano primijeniti u različitim aplikacijama. Uredba o infrastrukturi prostornih podataka Federacije BiH oslanja se na principe INSPIRE Direktive i njezine tehničke specifikacije. Vizualizacija podataka TTB10 omogućuje nedvosmislen prikaz podataka za različita mjerila topografske karte temeljne namjene 1:10 000, 1:50 000 i 1:250 000 primjenjujući domaće i međunarodne standarde. U ovom radu analizirani su postojeći zakonski akti, koji predstavljaju temelj za uspostavljanje temeljne topografske baze podataka mjerila 1:10 000, kao i procesi za vizualizaciju podataka TTB10 u Federaciji Bosne i Hercegovine.

Ključne riječi: *topografske karte, temeljna topografska baza podataka, infrastruktura prostornih podataka, računalna grafika, vizualizacija prostornih podataka.*

Received / Primljeno: 2020-11-10

Accepted / Prihvaćeno: 2020-12-18