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## Topographic maps production on Croatian soil – project presentation

*Keywords:* old topographic maps; monograph.

### *Summary*

Production of topographic maps at various scales in the area of today's Croatia has a long tradition. The first modern topographic maps have been produced in the seventies and eighties of the 18th century, during the year of Josephine survey and since then the topographic map production has been ongoing until today. This production can be divided into four periods. The first period is the period between 1764–1918 when the Republic of Croatia belonged to the community of the Austro-Hungarian Monarchy. The second period was during the “first Yugoslavia” from 1918 until 1945. The third period was during the “second Yugoslavia” period, between 1945 - 1990. The fourth (and current) period is since the Republic of Croatia has gained independence (from 1990 until today).

Based on this rich history of topographical maps on the ground of Croatia and the fact that this year the development of new topographic maps in scale 1: 25 000 (that has started before 14 years in 1996) will be completed, State Geodetic Administration has launched a project to create a monograph. This monograph named “Topographical maps on Croatian soil”, should describe the four above-mentioned periods of topographic maps production in the Republic of Croatia. This project was launched in the year 2008. The article will describe the project contents of the monograph being prepared, with a detailed description of the topographic maps' production period.

### Introduction

Topographic maps are an important source of data on various aspects of political, demographic, cultural, economic and linguistic history. Through the development of topographic map production we can track the improvements in topographic knowledge, changes of political borders, organization of administrative/territorial and institutional structure, changes of geographical terminology as well as the development of old and appearance of new settlements, buildings and roads. The production of topographic maps in various scales on the territory of today's Republic of Croatia has a long tradition. The first modern topographic maps were developed during the 18th century seventies and eighties, at the times of the so-called “Josephine survey” and continued until today. The topographic map development can be divided into four periods. The first period is the period between 1764 until 1918 when the Republic of Croatia belonged to the community of the Austro-Hungarian Monarchy. The second period was during the “first Yugoslavia” from 1918 until 1945. The third period was during the “second Yugoslavia” period, between 1945 until 1990. The last period is in the independent Republic of Croatia between 1990 and 2010. Based on this rich history of topographic map development on the ground of the Republic of Croatia and the fact that in the mid-2010 the development of new topographic maps will be completed in the scale 1: 25 000 (the development started in 1996), State Geo-

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getic Administration has launched a project to create a monograph. This monograph named "Topographic maps on Croatian soil", should describe the four above-mentioned periods of topographic map production in the Republic of Croatia. This project was launched in the year 2008, and the completion and presentation of the monograph is expected in 2010. The monograph development is very important for the Republic of Croatia since the topographic maps were being developed for a long period of time in various countries that the Republic of Croatia then belonged. This is going to be an inventory of all topographic maps produced on the territory of the Republic of Croatia.

### **Development of topographic map production in the period 1764 – 1918**

The development of modern topographic maps on the territory of the Republic of Croatia started in the last quarter of the 18th century, during the "Josephine survey". This survey covered the detailed survey of topographic buildings in most parts of the Croatia. This was a great scientific step towards the topographic map production, since the work was at that time conducted using precise geodetic instruments. The topographic maps had been developed before that, but the survey methods were not so precise. The topographic map development served military purposes and it was also used to impose taxes on land use.

The political preconditions for the topographic map development matured at the end of 17th century and the beginning of the 18th century, after the liberation of big parts of Croatia from the Ottomans. After the Ottomans were defeated by the Emperor's Army, the borders were determined according to the principle of accepting the situation in the field. From the Habsburg side, the Delineation Commission was headed by the Count Fernando Luigi Marsigli, while the mapping was entrusted to a young topographer, Johann Christoph Müller who was assisted by the Croatian Parliament representative Pavao Ritter Vitezović. The border was marked by firm markers in the field. After the work conducted in the field during several months, Müller developed the delineation maps on 24 sheets in scale 1: 37 500.

Apart from the delineation maps which covered the area along the border, several maps of Military Frontier (Vojna Krajina) were also developed. On the basis of several-year's work on the topographic map development, in 1709 Müller presented in Vienna the great map of Hungary with Croatia and Slavonia. Apart from the military purposes, the maps also began to be used for economic purposes. The supervision of forest and land exploitation and the need to impose a permanent tax that would be determined on the basis of cadastral revenue encouraged the Court to establish the permanent military headquarters for the production of maps. The first systematic survey of the Monarchy, named "the Josephine survey" by the emperor Joseph II, began in 1763 and lasted until 1787. The Croatian lands were surveyed between 1774 and 1785. Within the topographic surveys, the cadastral survey was also conducted.

After that, the topographic map of Slavonia was developed in scale 1:28 800 consisting of 66 sheets. This map was developed very precisely and displayed settlements, paths, relief, waters and other geographical elements. In 1817 the new survey began, the so-called "Francis survey". The survey was conducted in different stages for different Croatian regions and lasted until 1869. With the new geodetic methods and technical possibilities at that time, a new generation of topographic maps was created. The territories of Croatia, Slavonia and Vojna Krajina were mapped between 1865 and 1869. A total of 224 map sheets were produced. Between 1869 and 1887 a completely new survey was con-

ducted – the third survey of the entire Austro-Hungarian Monarchy in compliance with the modern technical and mapping achievements, in scale 1: 75 000.

All of the maps of Josephine and Francis surveys were developed in only two clear copies which were, due to military purposes, kept as a top secret until 1864.

### **Development of topographic map production in the period 1918 – 1945**

After the south Slavic countries merged in 1918 in one state, the basic mapping task was the development of a uniform basic topographic map for the entire state territory. At that time an Austrian special map of the Austro-Hungarian Monarchy existed for Croatia and Slovenia, in scale 1: 75 000, from the 1878 – 1889 period. Apart from that, there was (for the entire area) a recent map of Yugoslav countries, developed during the First World War (1915 – 1917) in scale 1: 200 000. These maps, in relation to the time of their development, the geodetic data set and sources, were not able to satisfy the state needs at that time, so activities on the development of new editions of topographic maps began. The only mapping institution that existed then and had the expertise to conduct comprehensive mapping tasks was the Topographic Department in Belgrade. This department was in 1920 transformed into the Military Geographical Institute which hired the geodetic officers of Yugoslav origin from the Viennese Military Geographical Institute, as well as the emigrants – officers of the Russian Corpus of military topographers.

The Military Geographical institute from Belgrade regulated the necessary geodetic data set between 1929 and 1933 (triangulation and levelling). It also conducted the topographic survey on a part of the territory in scale 1: 50 000 (between 1920 and 1928), and on the remaining part of the state the Institute conducted the re-ambulation of the basic Austrian map in scale 1: 50 000 (between 1929 and 1933)<sup>1</sup>.

Between 1920 and the beginning of the Second World War, the Military Geographical Institute mostly developed the maps for the Croatian territory which was part of Yugoslavia. Shortly before the beginning of the Second World War as well as throughout the war, a large number of topographic map publishers were active. All of them mostly used the existing maps of the Institute as the basis, and then they altered and adjusted them to their needs. The maps were mostly developed for certain state territories, depending on the political, economic and military interests. Judging by the issued map sheets, the important border areas were most frequently covered, as well as the coastal part of the Adriatic with the islands.

For the entire time period between 1918 and 1945, there are various sources on the publishers and the number of published maps, and all this data differs from one source to another, particularly for the war editions. It is visible that the war editions mostly have the same data source, and the issued sheets have different sizes, not only in different editions but also within the same edition and in a specific scale the sheets are of different sizes.

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<sup>1</sup> Peterca M., Čolović G: Yugoslav army surveyors, edition “Yugoslav army forces development” (Geodetska služba JNA, edicija “Razvoj oružanih snaga SFRJ” 1945th-1985th, Book no 21, Belgrade, 1987.

*Topographic maps in scale 1: 100 000*

The Military Geographical Institute of Yugoslavia (MGI) developed in 1920 the first topographic maps in scale 1: 100 000 for the Croatian territory. For the territories of Croatia, Slovenia, Bosnia and Herzegovina and Vojvodina, which constituted until the First World War an integral part of the Monarchy, the re-ambulation of topographic maps (1: 75 000) was conducted by the Vienna Military Geographical Institute (between 1929 and 1934) and topographic originals in scale 1:50 000 were produced. These originals were photographically reduced in scale 1: 100 000 for future maps.

In their content map scale 1: 100 000 is the topographic map, but until the Second World War was called a special map. These maps were for that time designed for tactical military needs, as well as for civilian purposes. The map was openly released and without limitations in use. Although the content of topographic maps matched conditions from 1920 until 1934, meaning that until 1945 elapsed 11 years, or 25 years from the original survey or the re-ambulation, the maps had still good utility value. During the Second World War and until the end of the newly produced system of topographic maps after the war, the map was suitable only for managing and monitoring military operations. During the war plagiarism of the map was made by Anglo-Americans and Germans for preparing the execution of war operations in the territory of Yugoslavia, while the Italians and the Russians used the map as a basic resource for making their maps of our territory.

*Topographic maps in scale 1: 50 000*

In the period from 1931 until 1940 the originals from which the map 1: 100 000 was made are reproduced without reduction, and used for substantially identical map in scale 1: 50 000. (see footnote 1). It is known that the MGI of Yugoslavia, created and published a map 1: 50 000 at the time between 1919 and 1941. During World War II German military forces needed maps in various scales, including 1:50 000. In the beginning they used the existing topographic maps, which were later reprinted with time codes added which was in fact a facsimile of MGI map edition from the 1932-1941 period.

<sup>2</sup> Between 1943 and 1944 the Germans printed their own topographic map in scale 1: 50 000. The base for making these maps were also topographic maps from MGI in Belgrade, scale 1: 100 000 from 1937. Names and numbers of map sheets are modified. <sup>3</sup> Washington Army Map Service, in the 1944-1945 period issued topographic maps in scale 1: 50 000. According to available data the Croatian territory was covered in 35 sheets. The Croatian Home Guard Geographical Institute published 1:50 000 maps for the territory of Independent State of Croatia (NDH) in 1944. It is in fact the German reprint of the 1: 50 000 maps taken from MGI from the 1934-1944 period.

*Topographic maps in scale 1: 25 000*

Between the two world wars, when Istria was under Italy, the Italians have changed the Croatian names and then produced again all the sheets resulting from the Austrian survey. Based on the sheets of the Austro-Hungarian precise survey, which began in Istria (scale 1: 25 000), and after the re-ambulation, the Italian Istituto Geografico Militare issued in 1927 all map sheets of Istria (80 sheets)

<sup>2</sup> Šever G., Modrić V., Okanović Ž.: Catalog of atlases, maps and archival collection plans of Military Geographical Institute, Part II, atlases, maps and plans between 1918 and 1945, Belgrade, 1997.

<sup>3</sup> Frangeš S.: Labels and names of individual sheets of state topographic maps and their sheets division (Oznake i imena pojedinih listova državnih topografskih karata i njihova podjela na listove), State Geodetic Administration, 2001.

in the “Carta d'Italia 1: 25 000” edition. So Istria was before all other Croatian parts the first to be covered with basic topographic maps in scale 1: 25 000 in the Austrian and Italian edition.

From 1934 until 1940 the MGI also worked on the topographic map in scale 1:25 000 (prime meridian through Paris). The map has been produced with classical topographical (graphic) measuring in the Gauss-Krüger projection.

The Berlin edition of topographic maps 1: 25 000 “Jugoslawien Deutsche heereskarte” from 1943 was made on the base of 1: 25 000 maps from the Military Geographical institute of Yugoslavia (MGI), produced in the 1934-1936 period and an old Austrian map 1:25 000. There were 69 sheets of which 27 for the Croatian territory. (see footnote 2)

The British released (from 1944 until 1945) 16 sheets of a 1: 25 000 scale map in two colours, size 61x71 cm of which 15 related to Croatia (the northern part of coastal area). They issued (in 1944) the 29 map sheets in scale 1: 25 000 in three colours and different sizes which covered the Dalmatian islands.

For the islands in the north part of the Adriatic sea, the English Survey Directorate published in 1944 the map 1: 25 000, in five colours, size 62x52 cm. Map sheets got the names of the islands: Skarda Ist, Molat, Long Island NW, Sestrunj

The Istituto Geografico Militare in Florence published in 1930 one topographic map sheet (ZARA E DINTORNI) in black, in size 82x76 cm. It is known that the map covers only the area of Zadar and is located in the MGI archives in Belgrade.

#### *Topographic maps in scale 1: 200 000*

The topographic map in scale 1: 200 000, the division by Paris with the prime meridian passing through Paris), was produced between 1922 and 1940 in MGI in Belgrade. Basic cartographic source was a topographic map 1: 100 000 (Paris prime meridian).. Map was offset-printed in six colours. This map partially covered the territory of RoC and the region of towns Pula and Zadar.

During World War II the originals for 8 map sheets were made in the Independent State of Croatia, namely: Zagreb, Bjelovar, Senj, Kostajnica, Banja Luka, Brod, Split, and Mitrovica. These allegations about the produced topographic maps cannot be confirmed on the basis of existing documentation. In the historical Archive exist just examples of sheets Zagreb and Bjelovar (from 1940) published in the MGI in Belgrade, and not in the Croatian Home Guard Geographical Institute. Work on map production was continued after 1945. (see footnote 1).

The Croatian Home Guard Geographical Institute, in 1941 released 35 sheets of topographic maps in several colours, size 45x61cm. For these maps the “Generalkarte v. Mitteleuropa” Balkan in scale 1:200 000 was used. (see footnote 2).

#### *Topographic maps in scale 1: 500 000, 1: 750 000 and other scales*

In the period from 1938 until 1940 the Military Geographical Institute from Belgrade (MGI) created a reviewed topographic map in scale 1: 500 000. The map was created in conical projection and consists of 6 sheets with dimensions 90x62 cm, of which 4 covered the Croatian territory.

At the beginning of 1945, maps in scale 1: 750 000 for the Yugoslavian territory started being produced. The above-mentioned 1: 500 000 map was used as the cartographic source. The first edition of the map called “Map of the Democratic Federal Yugoslavia” was made and multiplied in the MGI in 1945. Because of the undefined Yugoslav-Italian border, the map is printed with a note “temporary release with the borders from 1941”. (See footnote 1).

### Development of topographic map production in the period 1945 – 1990

After World War II the activities of MGI from Belgrade, which was responsible for topographic maps production, were continued. However, the first map produced and published in the Democratic Federal Yugoslavia was a map at a scale 1: 750 000 issued in 1945.<sup>4</sup>

In the period from 1968 until 1990 MGI has released a new review and topographic maps of the former Yugoslavian territory, including the Croatian area.

In the Republic of Croatia, at the time of the Socialist Federal Republic of Yugoslavia, there was not established any state institution which would deal exclusively with topographic-cartographic activity, topographic and photogrammetric recording, and producing and issuing topographic maps, because of political reasons. Only the primary state map in scale 1: 5000 for the Croatian territory was made under the authority of the Republic Geodetic Administration of Croatia.

#### *Primary state map in scale 1: 5000*

The first individual sheets in scale 1: 5000 were made in 1951, but intensified production began between 1966 and 1967 until 1983, when about 48% map sheets of the Croatian territory was produced. For these maps photogrammetric surveying and field processing were used.<sup>4</sup>

#### *Topographic maps in scale 1: 25 000*

From 1947 until 1967 a topographic survey of the entire former Yugoslavia was conducted, which resulted in topographic maps in scale 1: 25 000, with the prime meridian, that of Greenwich. The period from 1947 to 1962 can be called a period of the first (I.) variant, and the period between 1962 and 1968 the second (II.) variant of the first release of published topographic maps in scale 1: 25 000. Works on the second release of topographic maps in scale 1: 25 000 started in 1968, immediately after the I. release was finished, and lasted until 1986.

#### *Topographic maps in scale 1: 50 000*

The first (I.) release of topographic maps in scale 1: 50 000 for the Croatian territory was issued from 1966 until 1973. Regarding the appropriateness colours and grids the difference between different release published topographic maps scale 1: 50 000 was only in view of trees and bushes, which is given with dark green colour and in relief recesses marked gray.

The experience gained in the cartographic processing, preparation and printing of various maps in MGI was adopted in the preparation of the II. release of topographic maps published in scale 1: 50 000, which were produced in the period from 1978 until 1990.

#### *Topographic maps in scale 1: 100 000*

The topographic map in scale 1: 100 000 (prime meridian through Paris), produced in the post-war period between 1946 and 1967, and in the I. release from 1968 until 1974 was printed in 6 colours, while the map with karst land forms of the relief was printed in 7 colours. For the topographic maps in scale 1: 100 000 the second release was produced between 1979 and 1987 and the standards and colours of grid have been taken from release I.. Cartographic symbols are in accordance with the symbols of the “Manual of topographic signs” from 1981.

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<sup>4</sup> Lovrić P.: General Cartography (Opća kartografija), Textbooks of University of Zagreb, Zagreb, 1988.

*Topographic maps in scale 1: 200 000*

The already mentioned topographic map in scale 1: 200 000 issued from 1947 until 1951 (with the prime meridian through Paris), used the topographic symbols from 1939. Except from a different font, maps had a blue rectangular grid, while the display of individual trees, rows of trees and shrubs was in black (unlike the usual green). After that the MGI from Belgrade produced the I. release topographic maps, with the same name, between 1972 and 1975, and the II. release was made from 1979 to 1987.

*Topographic maps in scale 1: 300 000*

The reviewed topographic map in scale 1: 300 000 was first published in 1950, and then several times with minor or major amendments between 1953 and 1967. The latest edition of this map appeared between 1986 and 1990.

*Topographic maps in scale 1: 500 000*

The general geographical map in scale 1: 500 000 was produced in two time periods, from 1947 until 1954 and from 1969 until 1975. After that, a reviewed topographic map in scale 1: 500 000 was made between 1979 and 1982.

**Development of topographic map production in the period 1990 – 2010**

Production of topographic maps in scale 1: 25 000 and smaller, was in the former state entirely the competence of the federal military government or Military Geographical Institute (MGI) from Belgrade, as institution authorized for that activity. Republic Geodetic Administration of Croatia was responsible for making the primary state map in scale 1: 5000.

After the independence, the Republic of Croatia was left with no possibility of printing and updating topographic maps, because the reproduction originals, necessary for printing, remain in MGI. In the war situation it was not possible to launch the map production, but for the military operations needs in the Homeland war, some copies of the remaining maps were used.<sup>5</sup>

For all these reasons, the State Geodetic Administration (SGA) of the Republic of Croatia began an independent development of geographical cartography in technological sense, which resulted in the production of the new topographic maps in scale 1: 25 000. In the same period SGA continued with the production of Croatian base maps in scale 1: 5000 (previously named primary state map).

*Croatian base map (HOK) scale 1: 5000.*

By the end of 2009, SGA finished the production of almost all maps in scale 1: 5000 necessary for covering the Croatian territory. In the period between 1990 until 2010 all remaining map sheets were made, precisely 25% (Fig. 1).

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<sup>5</sup> Institute for Photogrammetry: Official Topographic-Cartographic Information System (Službeni topografski-kartografski informacijski sustav – idejni projekt), State Geodetic Administration, Zagreb, 1995.

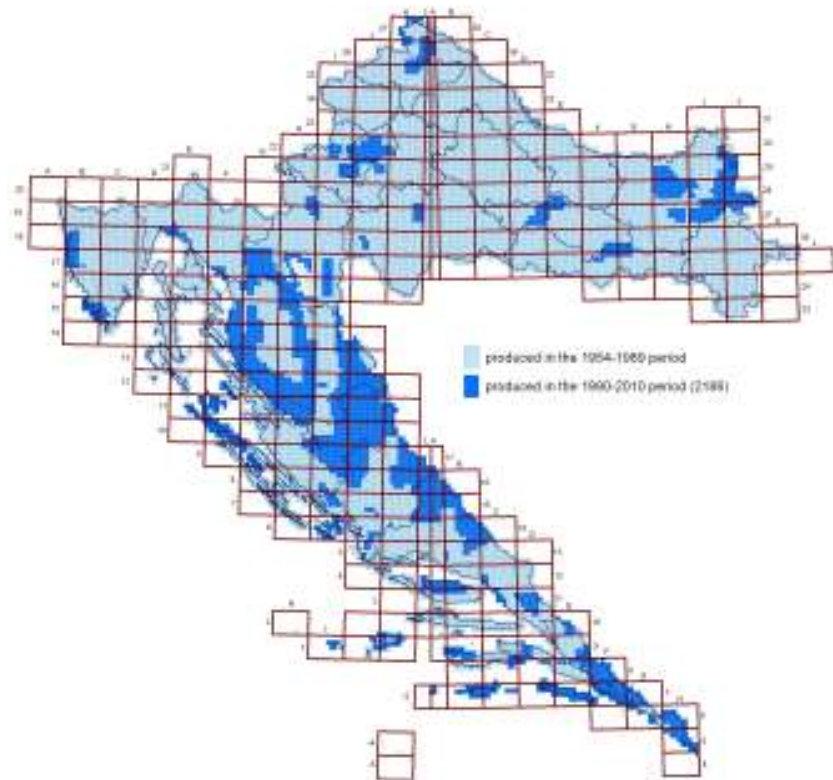


Figure 1. Index map of Croatian base map, current situation.

*Topographic maps in scale 1: 25 000*

In the period between 1996 until 2010, SGA made the new topographic maps in scale 1: 25 000 for the whole Croatian territory. The first produced map sheet was titled Rakov Potok, and covered the area located 20 km from the capital Zagreb (Fig. 2).



Figure 2. Clip of the first new topographic map in scale 1: 25 000, sheet Rakov Potok.

After that the production of topographic map scale 1: 25 000 began and until 2000 121 map sheets were contracted (Fig. 3).

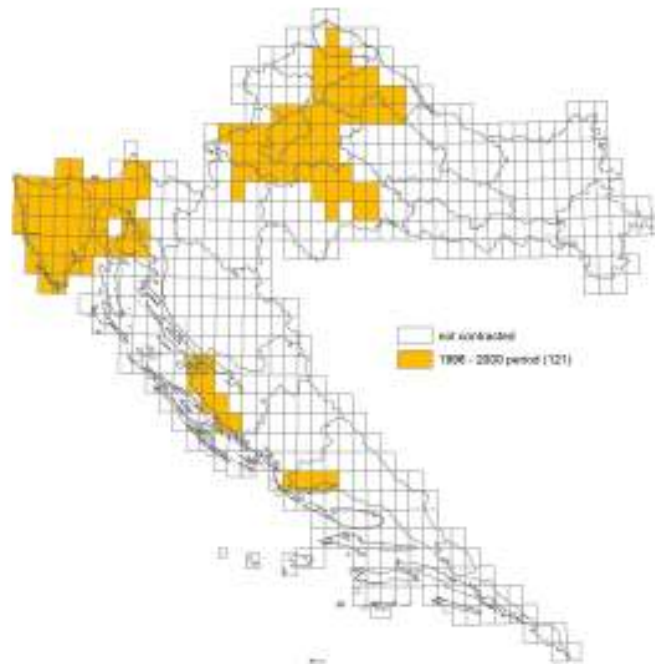


Figure 3. Index map of topographic maps 1: 25 000 contracted from 1996 until 2000.

From 2001 until the end of 2010 all maps of the Croatian territory were contracted. The year 2010 will also be a year of finishing all official topographic maps in scale 1: 25 000, or SGA I. release (Fig. 4).



Figure 4. Index map of topographic maps 1: 25 000 contracted from 2001 until 2010.

## Conclusion

The production of modern topographic maps in the Republic of Croatia has a big tradition, created through the years, since 1764 until today.

Topographic maps always were of great importance: in the beginning mostly for military purposes, later for commercial purposes (transport) and economic (tax collection). Geospatial data have today paramount economic importance for every country.

The State Geodetic Administration of the Republic of Croatia has established a fundamental topographic database, which was used for producing the new topographic maps in scale 1: 25 000. We are proud to say that representation with topographic maps has always been present on Croatian territory. Because of that, the State Geodetic Administration has launched a project "Topographic maps on Croatian soil". The project will show the development of topographic map production from its very beginning until the present day.

This report will serve all coming generations of cartographers for informing, in a quick and easy way about the development of cartography on Croatian territory.

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