CO-295

# VIROVITICA ON CADASTRAL MAPS

*KICINBACI S.*
*State geodetic administration, VIROVITICA, CROATIA*

Virovitica is a town in northern Croatia with a population of 15,000. The town is situated in the valley of the Drava river, in the southern part of the Pannonian Basin. The year 1234, when Virovitica was made a free trade town, is regarded the town's founding year. The regular form of Virovitica indicates that the town was founded on a crossroads of two important traffic routes. The first route runs from the West to the East parallel with the Drava river, which is a tributary to the Danube; the second route runs from the North to the South. Being situated near the Hungarian border Virovitica also has a Hungarian name – Veröcé, which means "a small door", a name that reminds of that there is a passage there from the Drava river valley to the Sava river valley through the Bilogora mountainous range.

Some of the wealthy landowners had made the maps of their own estates even before any systematic survey was done, but these maps are not dealt with in this paper. The subject matter here is the systematic surveys and maps that are the result of the surveys. My wish was to analyse our cartographic heritage and link it with modern technologies.

## THE 19th CENTURY

The Virovitica Town Museum keeps some of the cadastral records from the time of Emperor Joseph II, when the survey of the 18th century locality of Virovitica was carried out. This preserved data does not contain any graphic supplements.

The first systematic cadastral survey that produced cadastral maps of the Virovitica Cadastral District was carried out during the time of Franz Joseph I, in the year 1862. The survey was done based on trigonometric network with a plane table, on the scales of 1:2880 and 1:5760. Forestry land was shown on a larger scale.

At that time the Virovitica Cadastral District was under Hungarian rule.

The length measuring unit was Vienna klafter (1 Vienna klafter = 1.896484 metres).

The origin of coordinates for this part of Croatia was the steeple of the Franciscan church in the town of Kloštar Ivanić. No projection was taken into account during the calculation, so the trigonometric network was calculated with the premise that the surface of the Earth was flat.

The basic trigonometric sheet is marked as I.K. X, 12. The Virovitica Cadastral District, with the area of 11,906 hectares, is displayed on 57 sheets. The table of contents is on the first sheet. Every map sheet is marked by inch graduation on sheet margins. Sheet dimensions are 52,4 x 65,4 centimetres.

Since cadastral survey in Austria-Hungary had extended over a long period of time, when the process was finally finished the cadastral plans needed to be systematically revised. So, after forty years Virovitica underwent a revision. New contents and division into lots were added to cadastral maps and parcels were renumbered as well.

Several copies of the original were made. One copy remained at cadastral offices, which are responsible for plotting alterations in the copy so that the existing registers could be kept up-to-date.

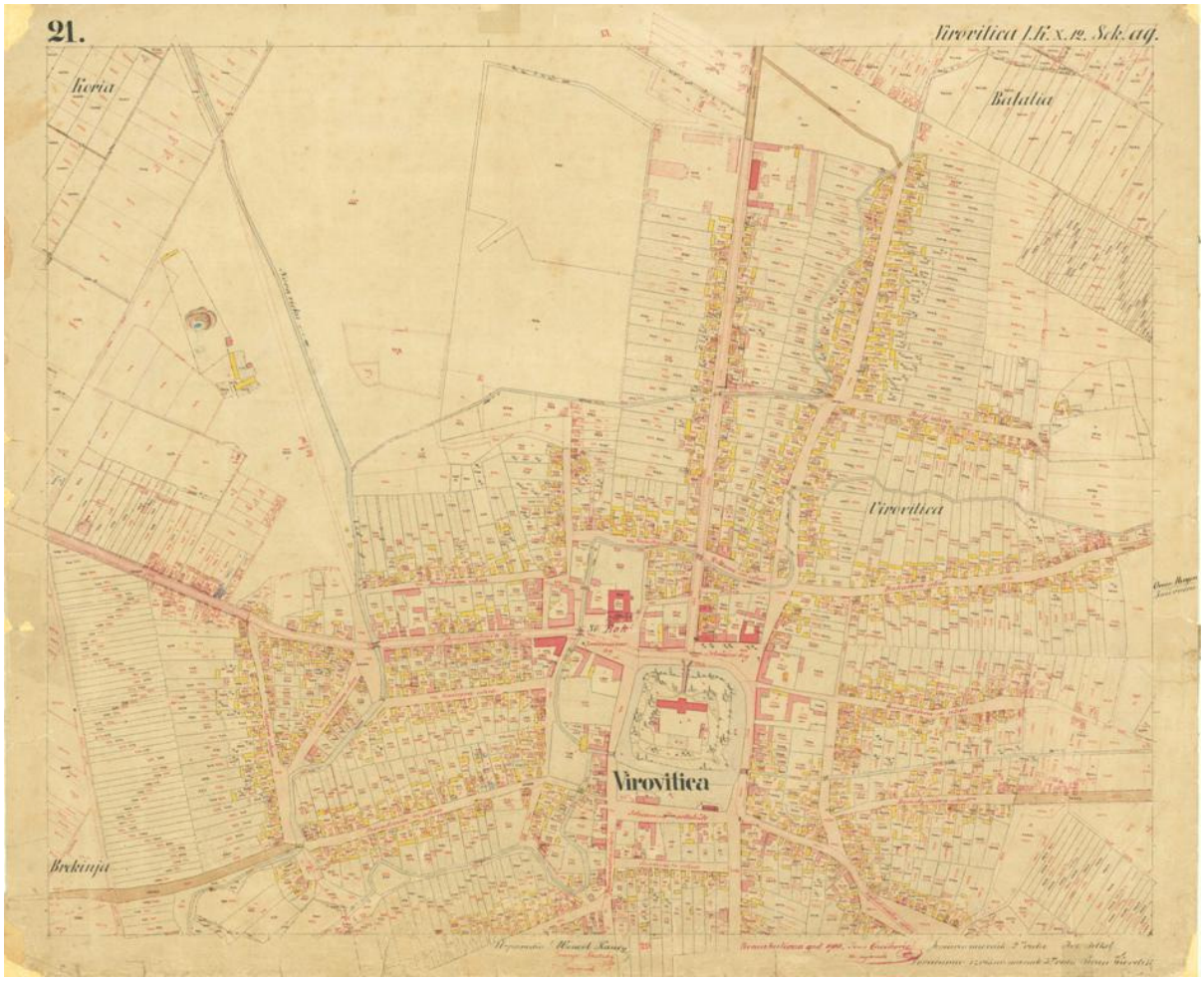


*Figure 1. Cadastral map in the period 1862 – 1900.*

**THE 20th CENTURY**

In the period between the two world wars there were no systematic surveys of the Virovitica Cadastral District.

In 1973 a numeric survey was carried out for a part of the Virovitica Cadastral District with the area of 1800 hectares. This survey had to be carried out because the maps made in 1900 were made on a scale too small for the building site that underwent numerous alterations since, so the maps became completely illegible. The survey included a part of building site in the localities of Virovitica and Milanovac and some of the agricultural land which was expected to be turned into building site in the near future. The new survey was carried out on two occasions; from 1959 to 1960 and from 1969 to 1973. This resulted in the founding of the Town of Virovitica Cadastral District.

The survey was carried out from a trigonometric network which was supplemented with a traverse network.

The positional coordinate system was Bassel 1841, the coordinate system was ellipsoid (φ, λ), the projection was a plane, a Gauss-Krüger projection with Cartesian coordinate system in 2D (y,x) in the 6th zone.

The height system (H) surface was measured with geodetic datum "TRST". The survey in this area was conducted through detailed levelling so the map displays the land relief in contour lines with 0.5 metre of equidistance. Sheet dimensions are 50 x 75 centimetres.

The cadastral map was made on a scale of 1:1000. The dividing of 13 sheets from the "old survey" produced 55 new sheets. Sheet frame and content are divided into decimetres.

The topography on the map was done as described in Topographic Key for Cadastral Maps on the Scales of 1:500, 1:1000, 1:2000 and 1:25,000, Federal Geodetic Administration, 1956. Topografski ključ za planove u razmerima 1:500, 1:1000, 1:2000 i 1:25000, Savezna geodetska uprava, 1956.

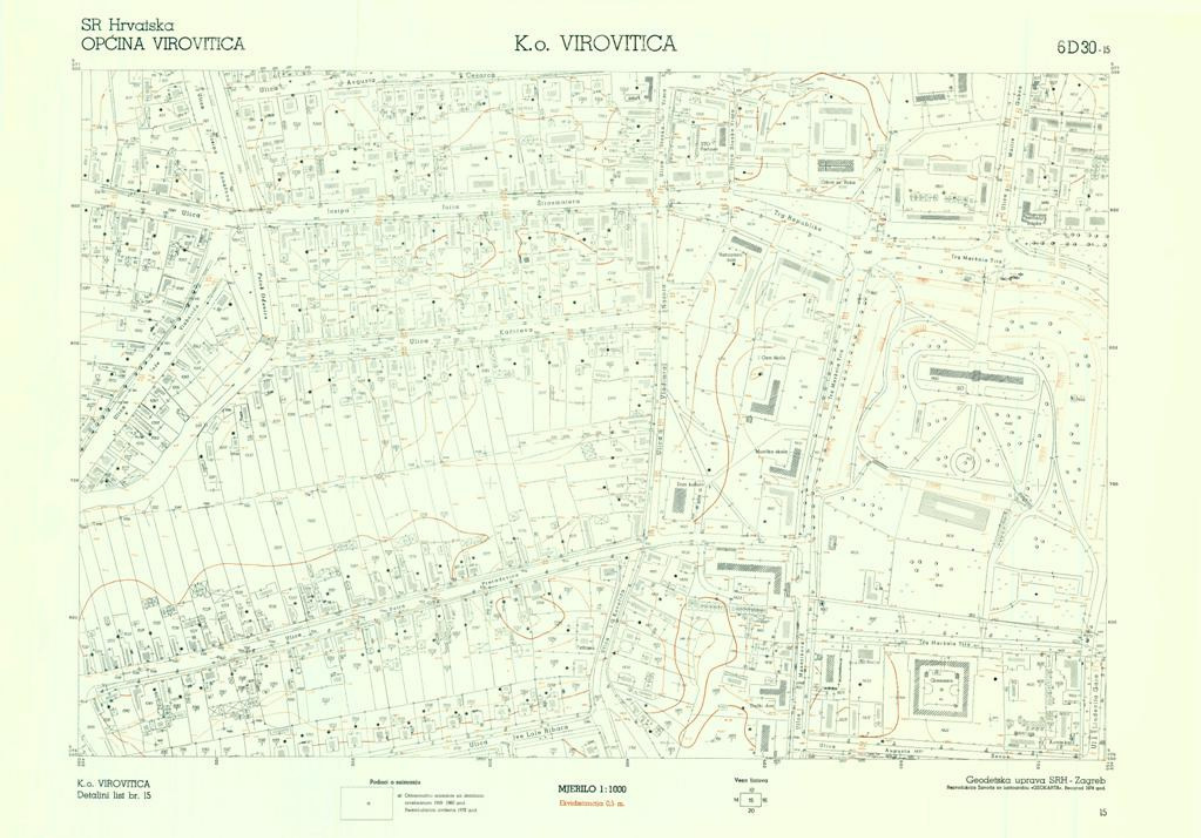


*Figure 2. Cadastral map from 1973.*

**THE 21st CENTURY**

The State Geodetic Administration which is responsible for the official conduct of real estate cadastre began the process of translating cadastral maps from analogue form to digital as well as establishment of Digital cadastral maps database.

The analogue maps, which contained the alterations, were scanned and archiving was conducted at the SGA Main office. The data was then sent to the private geodetic-geoinformation companies that made the transfer of raster to vector format under the surveillance of and in cooperation with regional offices. Data check was carried out through comparing the area from cadastral maps with the parcels in the registers. Sheet division (and scale) are no longer important since now there is one single cadastral map for the whole cadastral district. Data base itself is Oracle Spatial 9i relational database. The data model was made according to the standards of object oriented data modelling.

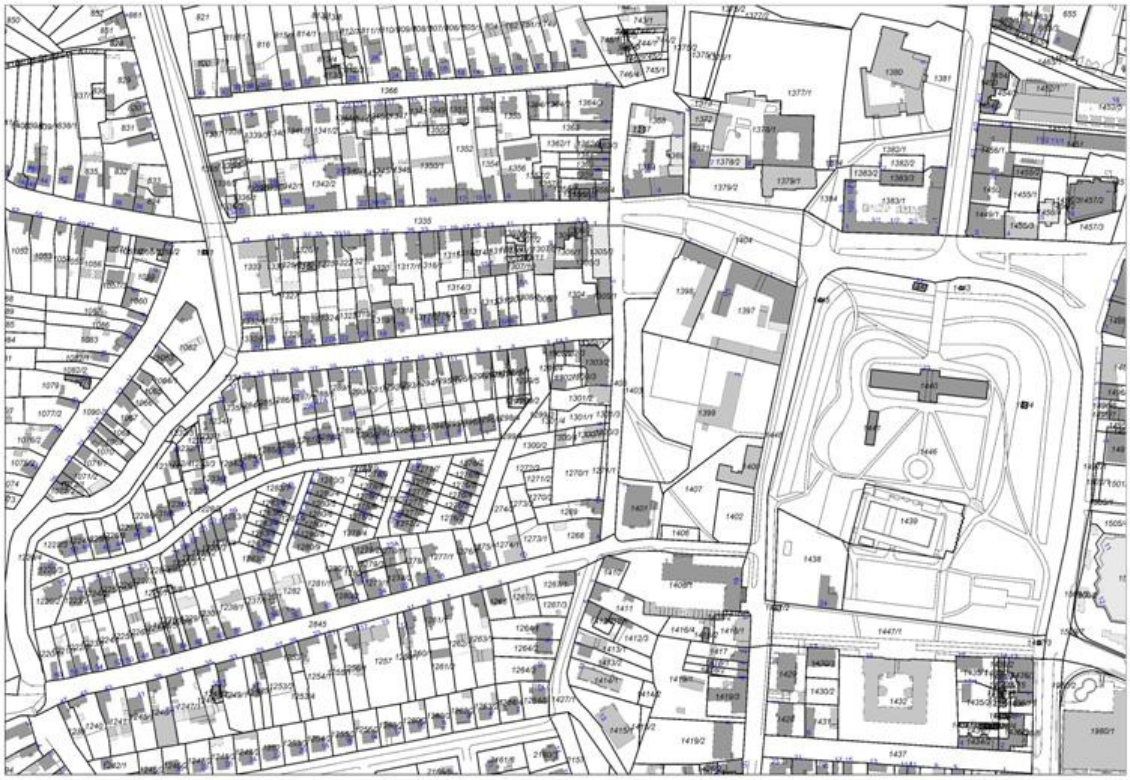

*Figure 3. A fragment of a digital cadastral map from 2007.*

In 2008 a survey and revision were started in parts of the Virovitica Cadastral District and the Town of Virovitica Cadastral District aiming at the total area of 2805 hectares. The survey is based on field points from the Croatian Terrestrial Reference System on the GNSS and the points of trigonometrical network to the level of reference network of 2nd order – the GNSS network is 10 x 10 kilometres. The survey produces an additional network of permanent points (average density is 1 point per 25 hectares).

The map also includes digital elevation model (DEM), digital height mode (DHM) and digital orthophoto plan (DOP).

In 2010 Croatia adopted a new geodetic datum and plane projection; the positional terrestrial system – ETRS89 on the ellipsoid GRS80 coordinate system (φ, λ, h), or 3D Cartesian system (X, Y, Z), the height terrestrial system is HVRS71, map projection is the transverse Mercator (Gauss-Krüger) projection with 2D Cartesian coordinate system (E, N), mark HTRS96/TM and ETRS/89TM.

Cadastral offices in cooperation with local authorised courts are obliged to permit public inspection of cadastral survey records for each parcel. When the public inspection is done, a new land register and cadastral register are made.

The data for the locality of Virovitica has been systematically collected four times, in two surveys, one revision and a combined survey and revision. There is only one printed town plan dating from 1993 whose original minute is a revised cadastral map.

**THE COMPARISON OF CONTENT**

The map contains parcels marked by number, position and form. Together with the parcels the map shows the facilities that belong to these parcels marked by affiliation symbol, since facilities are usually not separate parcels.

Topographic signs were made in accordance with the topographic key for the production of cadastral maps from 1820, titled “Instrukzion für Mesztischaufnahme.” The text was written in calligraphy. Topographic signs were used to define the sort of use of agricultural and forestry land. Linear objects; roads and watercourses, were highlighted in colour. Parcel numbers were horizontally oriented. Facilities were displayed as layouts and they were classified by colour into different categories. It is conspicuous that the facilities made of adobe and with thatched roofs were shown in yellow, whereas facilities made of brick and with tiled roofs were shown in red. Moreover, public facilities were shown in a different shade of red and religious objects were marked with a topographic sign. Parcel numbers were horizontally oriented.

Numbers on small parcels were written with shift to be more legible. Roads and major roads were highlighted in a specific colour, streets were shown in a different shade and paths also had a shade of their own. Building sites are still easily noticeable because gardens were screened according to the key and the colour of streets differs from the colour of paths.

After the revision a new series of maps was made. The lines that represent parcel boundaries became sharper; that is, there were no curved lines unlike following the first survey. Within some of the parcels interrupted lines were drawn to signal the differences in use; e.g. a pavement and a roadway in the street or an arable land and a ditch on an agricultural parcel. Most of the content was shown identically to the first survey. The position of parcel numbers depended on the form of the parcel.

The second generation of maps made in the 20th century was made in accordance with the Topographic Key from 1956. Facilities were classified with topologic signs according to the sort of use. Together with facilities, the maps showed balconies, stairways, marquees etc. Within the parcels details like cuttings and embankments were shown. Parcel numbers and other descriptions were written in technical lettering. The map was made on a larger scale for a more detailed display. The map was visually simpler because it was not made in colour.

Digital maps are even plainer than that. They show only parcels, their form and number. Facilities are shown plainly without topography. As databases, maps are made in layers that in the original contain multiple colours. As a formal deed drawn by a competent authority, maps are issued in black colour.

**A GEOMETRICAL COMPARISON**

Map is a display of a small fragment of the land. The first survey did not take into account the Earth's curvature. Numerical surveys contain the elements of projection regarding the network they were based on. We have the coefficients of transformation, which allows us to align the sheets from the Kloštar-Ivanić system with the system of the 20th century surveys, so we can make a geometrical comparison. I have made a comparison of all the facilities displayed on all of the maps.

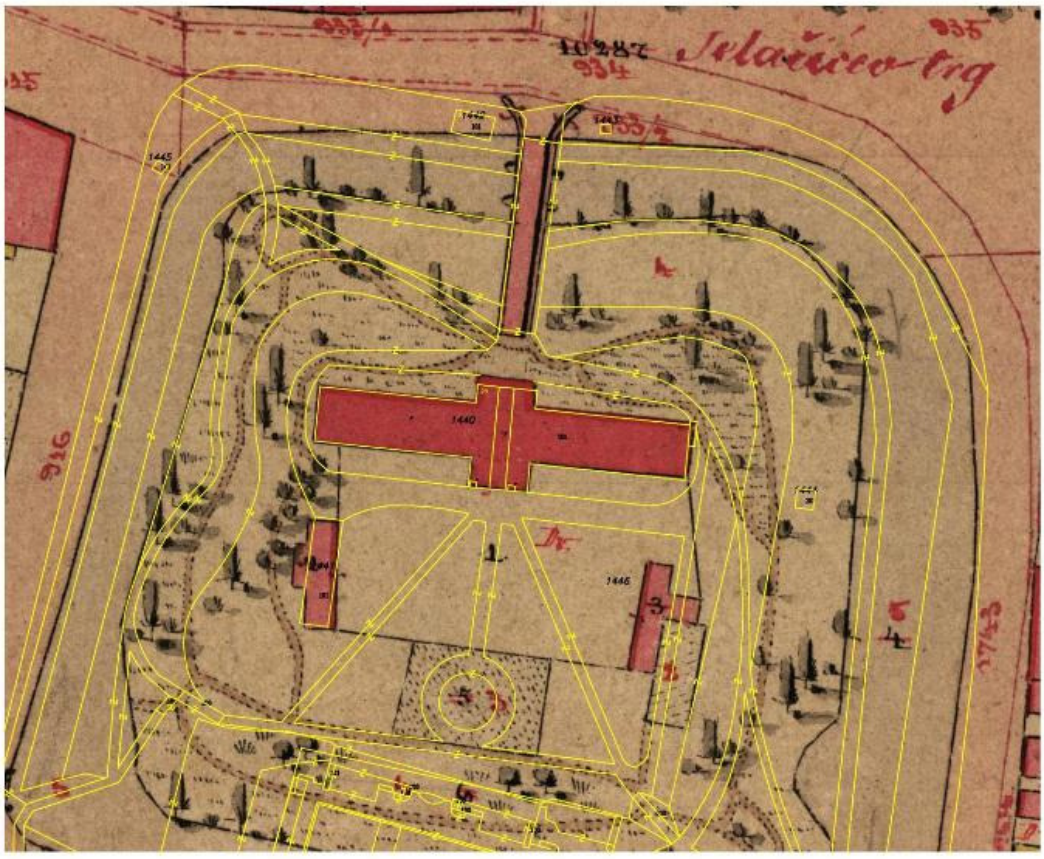


*Figure 4. A fragment raster cadastral map from 1900 and digital cadastral map from 2007.*

These are two different local coordinate systems. Numerical survey captured more details, the scale was larger, the projection was a plane, a Gauss-Krüger projection. The comparison could be made simply by aligning details.

## CONCLUSION

Digital maps are made according to the technical specifications for the production of digital maps as described in SGA Specifications for the Vectorization of Maps. A new topographic key is expected to be issued in the near future. New generation maps are highly technologically advanced; nevertheless, our cartographic heritage should not be forgotten.

Visual contents should be modelled according to the old maps, since they are better in conveying full spatial information. Cadastral map is a basic spatial information. Despite its simplicity it contains a large set of data. Today it is not necessary that the map contains a totality of data, because maps can be used with just some items of data. For instance, buildings, house numbers, streets, street toponyms and digital orthophotos are the items of map data which are going to be used as technical documentation for the purposes of conducting a census in Croatia in 2011.

The cadastral maps were created in a survey for tax collecting purposes. Their use has changed since then. Today in Croatia there are no taxes on real estate but spatial data is still there. The need for quality, accurate and easily accessible spatial data is becoming greater and greater. I believe that the information about spatial data should be visually easy comprehensible.

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