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TECHNOLOGY OF CREATION THE DIGITAL LOCATION MODEL ON THE EXAMPLE OF SYRETS REGION KIEV BY USING ARCHIVE DATA

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Key words: Babyn Yar, digital model of terrain, archival aerial image, archival topographic plan.

Formulation of the problem

In Ukraine, there are currently a number of organizations with a historical background and are engaged in the restoration of historically prominent land sites. With the development of digital technologies to reflect the previous situation on modern materials, it can be filed using GIS technologies, as well as restore historically significant terrain objects.

The urgency of cartographic research of historic sites at the present stage is increasing due to the in-depth search for and restoration of cultural heritage objects of the Ukrainian people.

The urgency of the topic is also intensified by the fact that the latest computer technologies are not only widely used in the issuance of maps, but also cover a wider range of interests, including the processing of cartographic materials and remote sensing data, as well as the construction of a CMM for them.

Babyn Yar is a tract on the north-western outskirts of Kiev. Stretches from Cyrilovskaya Street in the direction of Melnikov Street between the Cyril Church and the street of Elena Teliga. During the German occupation of Kiev in 1941-1943, Babyn Yar was the site of massive shootings by German invaders of the civilian population and Soviet prisoners of war; Jews and Gypsies - on an ethnic basis, as well as party and Soviet activists, underground members, members. Organization of Ukrainian Nationalists (mostly OUN members), hostages, "saboteurs", offenders of the curfew and others. In just two days, on September 29 and 30, 1941, nearly 34,000 Jews were shot. Massive executions in Babiy Yar and the Syretsky concentration camp near him were held later, until the liberation of Kiev from occupation [1].

Different publications give different figures of the total number of Babyn Yar destroyed - from about 70 thousand to 200 thousand people. In 1946, the Nuremberg trial estimated an estimated 100 thousand people, according to the findings of a special state commission to investigate Nazi crimes during the occupation of Kiev.

The Siberian concentration camp (in German sources - Kyiv-West, German-Kiev-West) is a concentration camp created by the German occupation authorities during the Second World War in June 1942 in the northwest of Kiev in the region of Syrtsya. Was intended for prisoners by the decision of the Gestapo. Subordinated inspection of the Third Reich concentration camps. According to German sources, from July 1942 until the spring of 1943, the camp functioned as an external command (division) of the concentration camp Sachsenhausen. The number of victims in the camp - more than 30 thousand [1].

These two objects are the most famous sights on the tragedy of the Second World War in Ukraine, so it is logical to represent this area in the form it was in the 40 years of the last century.

Analysis of recent research and publications

If to analyze literary sources devoted to building a digital model of terrain with the help of GIS-technologies, then they are a buzzword of both domestic authors and foreign ones.

The modernization of the most precise historical centers in their works was presented by such Ukrainian scientists as NA Gavrilyuk, MM Dragan, Onoprienko A.M., Tryputina N.P. and others, but among non-overseas abroad, the works are Lerma J.L., Garcia A. [2], Arnoud de Boer [3,4], Breure L., Spruit S., Voorbij H [4].
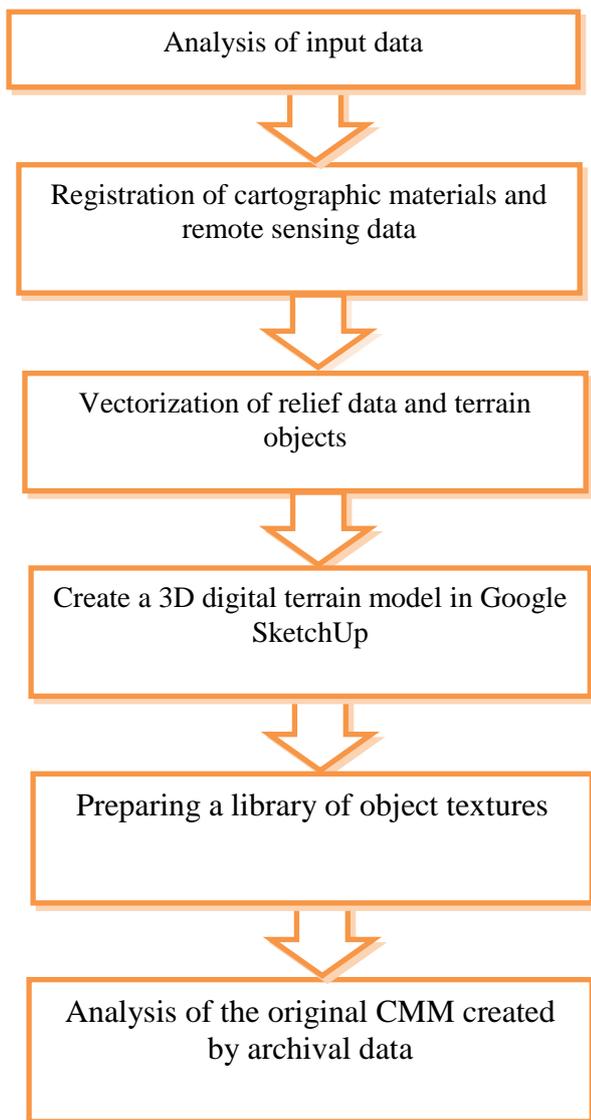
We also proposed one of the possible technological schemes for the creation of a digital model of terrain in the 40-50-ies of the last century, most of whose objects have not survived to this day. Historical digital model of the area of the Syretsky district of Kiev until now was not created. Only the created digital models of relief of one of the components of this model, namely Babyn Yar [5,6], were served.

Setting objectives

The subject of the study is the methodology for creating a historical digital terrain model based on archival data.

Presentation of the main research material

The following technological scheme (Fig. 1) is proposed on the basis of the input archival data of the Syrec region:

Fig.1 Technological scheme of creation of historical DTM

The flowchart contains the following steps:
- Analysis of input data
- Registration of cartographic materials and remote sensing data
- Vectorization of relief data and terrain objects
- Create a 3D digital terrain model in Google SketchUp
- Preparing a library of object textures
- Analysis of the original CMM created by archival data

Fig. 2. Topographic plan of 1956 scale 1: 5000

The archived aerial photograph of 1943 [7] depicts the Babini Yar Territory, the Syrets concentration camp and the nearby cemeteries.

Fig. 3 Archived aerial image 1943

The input data of the work is the archival topographic plan of the Syretsky district of Kyiv, as of 1956, scale 1: 5000 (Fig. 2) and archival aerial image was obtained in 1943 (Fig. 3).

In this topographical plan, the Siberian district of the city of Kyiv in 1956 is displayed. The section of the relief is 1 m, the road cloth with the names of the streets, the boundaries of the sites and the time of the land is shown in detail.

Using the SASPlanet program, a fragment of the current map was loaded on the area under study, from which the coordinates of the reference points were obtained. The reference points were chosen identically for all graphic materials saved from wartime. Figure 4 shows an example of one of these points.

Fig. 4. Example of marking of reference points

The topographic plan was registered with twelve reference points with a maximum error of 0.5 m, and the archived aerial image was geometrically transformed using a polynomial mathematical model of the second power, all along the same 12th reference points. The maximum error of geometric correction was 2 meters.

After that, the relief insulations from the topographical plan of 1956 were vectorized and stored in a shape-format (Fig. 5).
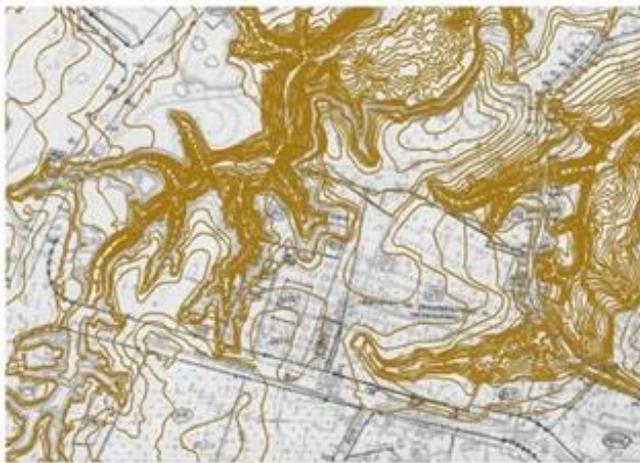

Fig. 5. Vectorized insular relief as of 1956

From archival aerial images, buildings, roads, cemeteries and Syretsky concentration camp were interpreted and vectorized as they were in 1943.

Next, all shape-files were imported into the Google SketchUp software package.

In Google SketchUp, the first step was to build a three-dimensional DMS along the 1956 lines.

With the help of the command button "tool out of contours", the area, for which it is necessary to construct the relief, is highlighted. The result is a smoothed pattern of terrain with horizontal lines (Fig. 6).
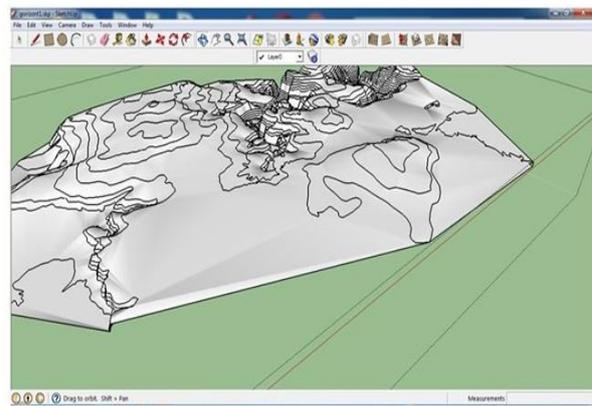

Fig. 6. The smoothed digital relief model is constructed in 1956

Google SketchUp has a powerful database of standard textures that has been used to build historical DMM since most objects are no longer in-house.

After all layers were applied, 3D models of such objects as relief, Syretsky concentration camp, cemeteries (Jewish, Kirilivka, Lukyanovskoye, Karaimskoe, Military), roads, and buildings were constructed. A complete visual picture of the Syretsky district of Kyiv as a grain of the last century was obtained (Fig. 7).
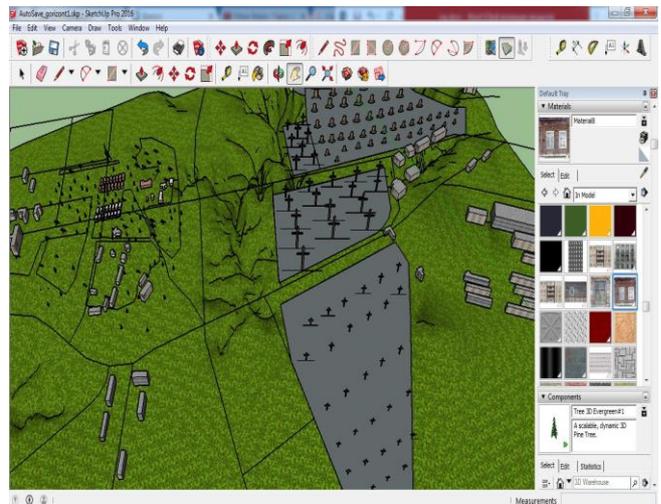

Fig. 7. DTM Syretsky district of Kyiv

Conclusions

The result of this work is to highlight the following two points:

• one of the possible methods for creating a CMM combining the use of archival aerial and map data with modern materials is proposed.

• A DMM has been created, covering the ensemble of historical objects of the Syretsky district of Kyiv.

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Technology of creation of digital terrain model for example Syretskiy district of Kyiv, using historical data

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In the article be considered one of the possible methods of creation of historical digital model using archival cartographic materials and remote sensing data.

In the proposed technological scheme the DTM of Syretskiy district of Kyiv the last century was created