

# GEOINFORMATION SYSTEM “THE PROTECTION OF RUSSIAN HISTORICAL-CULTURAL HERITAGE ON THE EXAMPLE OF SVERDLOVKS OBLAST”

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## ABSTRACT:

This manuscripts contains the description of the 3-years project made by the Ural Regional Center of Geoinformation “Uralgeoinform” and makes only the brief review of the project that makes possible the protection of the objects of historical and cultural heritage in Sverdlovsk region.

Modern state of collection and storing of materials on monuments of historical-cultural heritage (HCH) is characterized by the variety of documents used for establishing of archives, registries and accounting documents. Services for information accounting and storing is spending much time for preparation and issuing of necessary materials both to customers and own departments including executives (agreement-legislative, inspector, information-analytical, rehabilitating, branch of architectural monuments, accounting). The materials used by these services are rather various: text documentation, historical records, technical passports, layouts of land sites, floor plans, results of stereophotogrammetric survey (digital models of facades, drawings of measurements), photo-materials and so on. With the increase of information flow it becomes more and more complicated to carry out accounting, storing, issuing and joint application by various services and customers. The development of modern technologies allows to optimize joint work of services, that become an impulse for establishment the basis for a concept of geoinformational system “Historical-cultural heritage of Sverdlovsk oblast” (abbreviation GIS HCH SO).

## INTRODUCTION:

The aim of the project is solution of the tasks of state protection of objects of immovable historical-cultural heritage of Sverdlovsk oblast.

GIS HCH SO is a geoinformational system of a state body of protection, directed on collecting, storing and application of information on the objects of historical-cultural heritage and their territories, and also the possibility of quick and effective monitoring and analysis of obtained information.

The main task of the project is to establish an open geoinformational system characterizing the state of objects of HCH SO.

Subdivisions of state bodies of protection and use of monuments of history and culture should have the possibility of operative reaction on demands from the side of external services, activity of which concerns the questions of rent, insurance and use of monuments. In connection with this question GIS must include a block of automation of protection-rent activity. It is a complex task including development and introducing of a system of automated document circulation between subdivisions and the authority of the body of monuments protection, and also a module of complex analysis

allowing to carry out specialized requests to thematic data bases and generate information-analytical reports of various content

### 1. Structure of GIS HCH SO

#### 1.1. Electronic achieve.

Fourteen historical cities, about 3000 historical, archeological and architectural monuments are placed on the territory of Sverdlovsk oblast. All of them are protected by federal, regional and local (municipal) power. The Ural rock paintings (The Neiva river, Kapova and Ignatievka caves) are the most

interesting monuments among the fine arts of the ancient population of this territory.

The specialists from the Ural Regional center of geoinformation “Uralgeoinform” within 3 years develop the project that allows to automate the processes of data using, saving and processing. Such data is collected from documental funds of the Sverdlovsk regional state cultural institution. Today the following technologies were developed:

1. The technologies of fund transmission to electronic form.
2. The methods of electronic achieve saving and using.
3. The bank of different cartographic materials.
4. The spatial co-ordination and conjunction of the objects of the cultural-historical heritage.
5. the technology of creating the historical-architectural plans
6. the projects of protected zones with the help of geoinformational technologies and 3D-modeling.

The following steps of creating electronic achieve are expected:

- preliminary classification of the organization documental funds over the carries and types of information along with the choice of the technology for scanning and hardware.

The fund consists of:

- over 10000 documents on the paper media (technical and accounting passports, historical references, pictures),
- over 1000 materials of stereophotogrammetric survey (diapositives, the plans of stereophotogrammetric survey of monument facade’s and interior’s), plans,

schemes and smooth-delineation maps and plans. All of them are of different scales.

For transmission all these documents into electronic form different scanners (drumming, plotting, stereofotogrammetric) and digital cameras were used. The processing of the scanned data begins with noise and handicaps filtration, compression and digitalization if necessary. The digitalization was made with the help of different GIS, text recognition in Abbyy Fine Reader). Then the data was achieved and written to CD/DVD. The achieve formation finished by information transmission from graphic objects to database.

The access to the data from electronic achieve realize through operative achieve consists of the compressed data and references to the long-term achieve on CD/DVD. The operative electronic achieve is the database managed by SOD MS SQL Server. This database has all necessary information from real achieve of organization.

The long-term electronic achieve is the base for geoinformational system. It allows to analyze and to make the perspective plans for protection both singular objects and the territories in the whole.

The connection between electronic achieve and spatial data in geoinformational system "InGeo" is made by informational system InMeta (the developer is the Center of System Investigations, Ufa city, Russia). The system is worked under SOD MS SQL Server. The user can work both in geoinformational component and process the information from the wide database of electronic archive. That allows uniquely describe the cultural objects and gives the opportunity of operative visualization and quick database control.

The works of collecting and making up the correct normative documentation is leading now. In such documents the special requirements for electronic achieves are described. Today the size of this achieve is about 100 GBt that consists of the electronic document copies, maps and databases.

## 1.2 GIS HCH

The basic plans, the schemes of protected zones, the methods and techniques of 3D-modeling for volumetric visualization of architectural monuments and historical territories were developed within the geoinformational system.

The following graphic materials contain in GIS:

- 1) Digital maps on the territory of whole region:
  - a general map of scale 1: 1 000 000 - 4 sheet names
  - 60 sheet names of topographic maps of scale 1:2000000
  - topographic maps of scale 1: 25000 on the territory of Shigirskii peat moss bog (the archeological monument complex)
- 2) The town's plans of different scales: 1:5000-1:10000 – 279 sheet names.
- 3) The historical-architectural basic plans and the projects of protected zones.
- 4) The scheme of phased development of the city.

There is also the bank of the spatial data consists of: thematic data, the library of 3D monument's models and 3D maps of the whole historical territories.

More full structure of geoinformation system can be shown on an example of two the historical cities Verhoturie and Neviansk. You can see on the figure 1 the historical-architectural basic plan of Verhoturie city, made on the base of the city plan of scale 1:2000.



Figure 1. The plan of the Verhoturie town

The aim of creating such basic plans is to indicate all the immovable monuments, buildings and objects and communications between them. It gives the peculiarities of landscape reveals the valuable and disharmonious elements. It plays an important role for defining the protection zones.

Within the creating of historical-architectural basic plans the analyze of the city historical development was made. It can be used in the creating of schemes of phased development of the city.

With the help of such plans you can easily plan the future development of the historical city and define the monument territory.

The databases contained the information about the protected objects are connected with their graphic component in GIS.

The archeological monuments occupies the special place in the whole geoinformational system. The most popular are rock paintings (Kapova and Ignatievskaya caves). The peat moss bog near Shigirskoye Lake and Shuvakish lake are among the most popular in Russia. Their special value in good safety in peat of bones and trees. The wide spread of such monuments has resulted in use of maps of different scales (from general 1:1000000 and 1:200000) to surveying plans of scale 1:500. More over there is additional graphic information:

- basic plan
- situation plan
- the protected monument's zones
- the schemes of excavations
- photo materials
- stratigraphy

The use of system of satellite navigation (GPS) allows easily to determine and to applicate a place of a monument and its borders, to make the plan of excavations and discoveries.

## 1.3 The GIS applications

One of the component of created geoinformation system is the development of techniques of creation three-dimensional maps of historical territories with use of computer three-dimensional modeling

The 3D modeling allows to execute spatial positioning and evident volumetric recognition of separate objects, their mutual arrangement in historical territory, and also facades and parts of buildings with detailed display of their elements. Use of three-dimensional modeling is also rational because of representation of topographical features of historical monuments arrangement before designing their reconstruction and restoration.

Volumetric pictures are a remarkable material for virtual popularization of cultural objects in historical plan and in tourist activity.

3D modeling is especially important when you are going:

- to fix the current state of architectural monuments and their interiors
- to project the restoration and reconstruction of the objects
- to create 3D maps for landscape analyze, for urban planning, for urban monitoring.
- to create the library of 3D models of the cultural objects in geoinformational system.

For 3D modeling the modern software was used. The fast growth of modern technologies of 3D laser scanning and the traditional photogrammetry allows to get the reliable data about object.

Before digital photogrammetric stations there was the following technology:

- ground survey of the facades and parts of buildings (with a help of photographic field camera)
- creating their graphic images (with a help of analog stereo devices)
- digitalization
- creating 3D framework of the monument with a help of infloors plans and volumetric drawings
- creating 3D models in GIS and 3D software (Autocad, 3D Studio MAX and so on..)

Today the digital images for creating orthophotomaps are used. They are obtained by scanning photo images. The next processing is made with the help of Russian photogrammetric stations "Digitals" or "Talka".

3D modeling was made on the maps scaled 1:500 and 1:2000, which were made on the digital photogrammetric station "Digitals". It allowed to automate the photogrammetric processes and provided the new quality of processing.

It was made with a help of Microstation and Autocad. The visualization was made in 3D Studio Max. Figure 2 represents 3D model of the single object and the territory in the whole.

Figure 2. The territory Cremlin in Verhoturie town, Svyato-Troitckiy cathedral. The examples of using volumetric models of historic and cultural monuments.

For practical use of volumetric models the specialists of Uralgeoinform created new 3D editor "3D Konstruktor". With the help of it you can easily view and edit volumetric objects. Then you can solve some engineering tasks for urban planning in historical territories. This editor was written in Delphi 5.0 with the use of system of graphic standard OpenGL.

### Conclusions

This GIS is widely used on the territory of Sverdlovsk region and the created technologies can become the examples and bases for creating the similar systems in other territories. Surely the system has the number of problems. Firstly there is no proper normative-legislative base for information exchanging between different departments (rules of exchange and integration of different informational resources). Then there are no methods of organization for accompaniment and storing electronic documents and electronic achieves in the whole.

But we are sure that the development of informational flows in Russian Federation may solve all these problems

