

# Structural-Functional Model of the Information Systems of City Planning

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**Abstract** On the basis of modern the technologies information database of seismicity and seismic risks in information system designed for city planning is developed. System includes maps of detailed seismic zoning (DSZ) of North Ossetia-Alania and map of seismic microzonation (SMZ) of the territory of Vladikavkaz city.

**Keywords:** seismicity, information system, database

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## 1. Introduction

Governments in all countries are obligated to ensure the work of the infrastructures of different forms to provide the comfort of vital activities and safety of citizens. Management of physical infrastructure requires the linkage of different systems and, correspondingly, informational infrastructure. Infrastructures of three-dimensional data (Spatial Data Infrastructures (SDI)) play important role, because information about the position of one or other object or another plays the key value in control of all systems, which are controlled and are governed by public authority, for example, such as roads, utility networks, systems of public health and others. Like the majority of the forms of infrastructure, SDI also ensure platform for the economic development of the country or region.

## 2. Objectives

According to city planning code of RF the information systems of the city planning (ISOCP) are the systematized set of the documented information about the development of territories, about their building, about the land sections, about the objects of capital construction and other necessary for the realization of city planning information [1]. In this definition the information system can be both the manual and automated.

In the wide understanding ISOCP - meta-system (system of systems) [2], which ensures the information support of the set of the diverse processes of subsistence and development of city. Such integrated system includes several classes of software:

- GIS (geographical information system),

- SED (system of electronic document turnover),
- DBMS (Data Base Management System),
- EAR (control system of electronic administrative regulations),
- CSCI (classification system and coding information), web-portal,
- and also organize access to SIEI (system of interdepartmental electronic interaction).

The purpose of conducting the information systems of the city planning is the provision of government, local authority, physical and legal persons the reliable information, necessary for the realization of city planning, investment and other economic activity, conducting land exploitation.

The information about the seismic danger and the seismic risk of the territories, which are basic in the building in the seismically dangerous regions, in our opinion, occupies special position.

Seismological studies for different purposes, including the tasks for the branch of construction, are carried out in our country already more than a century. The seismic danger assessment in this case, as a rule, is reduced to the calculation of maximally possible seismic actions, which must be considered with the building in the seismic regions. The value of seismic danger is shown in the specific parameters (marks) on the maps of the seismic zonation of one territory or another. In our country are three levels of the seismic zonation depending on tasks and necessary detail of seismic danger mapping:

- the general seismic zoning (GSZ) - for the entire territory of the country;
- detailed seismic zoning (DSZ) - for the limited areas and the separate regions;
- seismic microzonation (SMR) - for the cities, the populated areas and the construction sites.

As a result a series of studies in 2006-2010 yr. according to the seismic danger assessment the center of

geophysical studies created the original maps of the detailed seismic zonation (DSZ) of republic North Osetia-Alaniya [3,4], the map of seismic microzonation (SMZ) of Vladikavkaz city [5,6]. The work on the composition of similar maps for other populated areas at present is conducted. It is obvious that the cartographic materials must correspond to the world level, presented to three-dimensional data and, in the first place, possess the possibility of the direct start in any contemporary information systems [7-13].

Thus, the purpose of our work consisted of the creation of the information database of seismicity and seismic risks in the information system for city planning.

### 3. Methods

The existing automated systems of city planning, cadastral system, and also other information resources were examined [14].

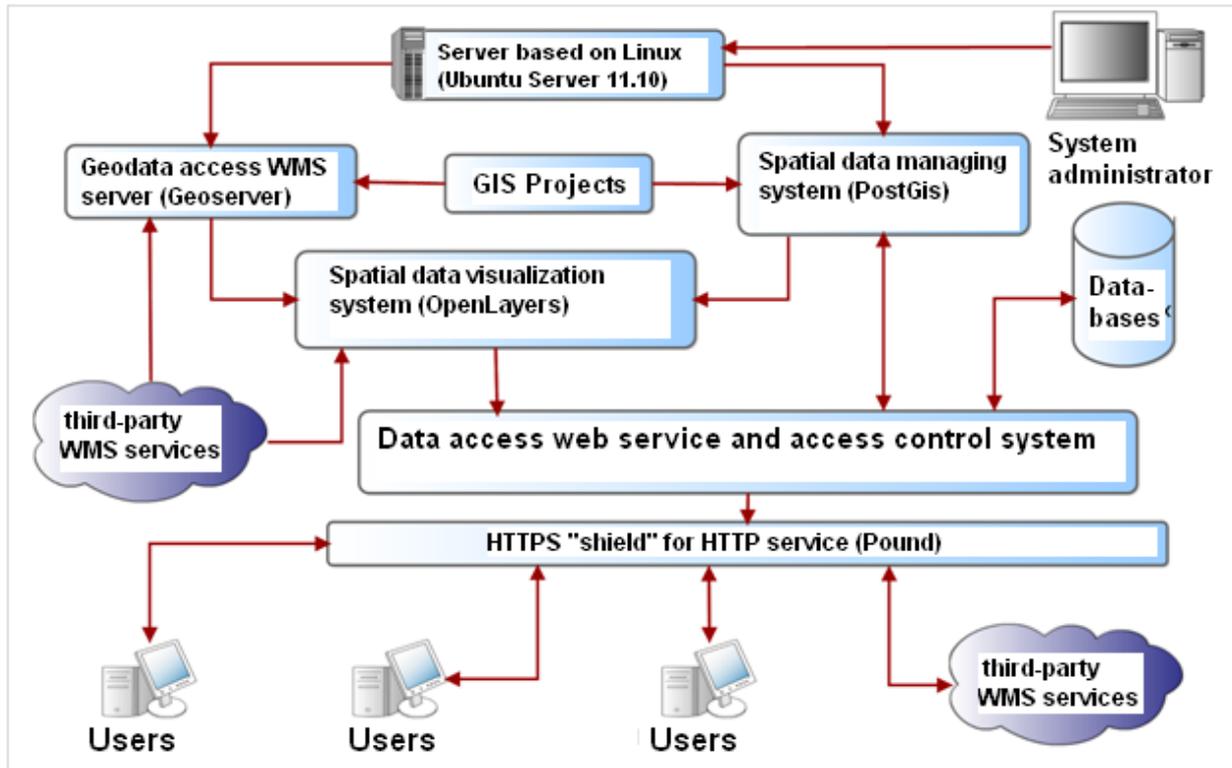


Figure 1. Structural-functional model of ISOCP

As a result of conducted investigations we have developed structural-functional model ISOCP, which makes it possible to create information system for the needs of user, with the retention of compatibility with other products, built according to this model, and also with a number of the already existing systems (Figure 1).

For developing the web- service is selected the specification Web Map Service (WMS). Protocol WMS is the standard of the open geo-three-dimensional consortium – Open Geospatial Consortium (OGC) and is supported by the majority of applications [15]. On the basis of OGC specifications is created the large part of special software for developing the cartographic Web- services in the Internet. As the basis was selected Geoserver, as the product, which satisfies all necessary requirements, and also by compatibility with the Web- resource of united information system Seismic safety of Russia.

As the platform for the created program complex was selected the server, which works under control of the freely extended operating system Ubuntu Server 11.10.

### 4. Results

We developed the Web- interface of access and visualization of service data (on the basis of OpenLayers),

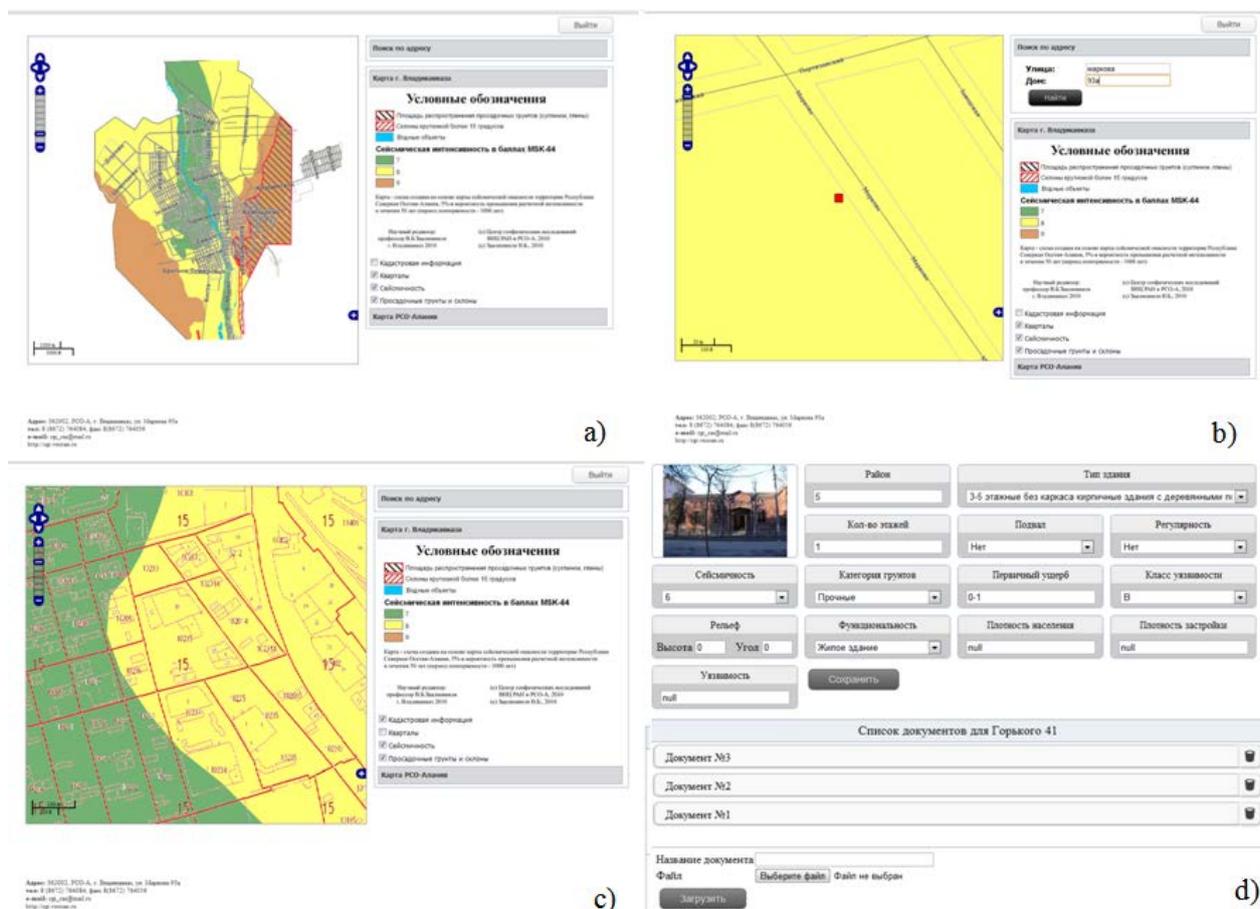
that possesses the necessary functional for the survey of the probabilistic maps of the seismic danger of RSO-A territory and the map of seismic microzonation for the mass building of the Vladikavkaz territory.

On main page it is necessary to pass authorization for obtaining the access to the data. Authorization has two-level, but it is transparent for the user. I.e., it is necessary to introduce only login/password, further system itself will conduct authorization not only on the Web- service, but also on Geoserver too.

Further loads the map of seismic microzonation of the Vladikavkaz territory (Figure 2a). On this page is realized the search for object with the address, with the highlighting of the corresponding section of map (Figure 2b).

Using navigation buttons on the map, it is possible to move away and to draw near objects, and also to be moved on it, in this case in the left lower angle there is located the scale rule, whose scale depends on degree of approximation to a map. Using the switches of the visibility of layers in the region of control it is possible to examine information user interested in, for example information about the cadastral survey (Figure 2b).

Each object on the map has extra information, in the form file or attributive information. As an example - the information of the Vladikavkaz city building seismic risk database (Figure 2d) [16,17].



**Figure 2.** a) the main page of Web- service with the map of Vladikavkaz city; b) the realization of the function of the search for object with the address; c) the output of cadaster information; g) the database of the building seismic risk

Analogously the map of the detailed seismic zonation of the republic North Osetia-Alaniya territory is represented, with the appropriate possibilities.

For mapping of data are developed the corresponding SLD- styles. Using PostGis the function of the search for objects with the address is realized. Other new technologies, such as web 2.0, AJAX and other were used too [18,19].

The problems of safety are examined and the system of access to information and differentiation of the users rights is developed. Using encryption protocol HTTPS we reduce to a minimum the possibility of the unsanctioned access to the data. The use of an asymmetric algorithm of coding RSA with a length of the key of 256 bits makes inadvisable the method of breaking by direct trial and error of key. The application of the signed certificate makes it possible to use maximum vulnerability of data link, making extremely complex the procedure of breaking.

## 5. Discussion

In conclusion it should be noted that in connection with the application of the latest technology and standards, there is a number of requirements, necessary for the correct work of Web-service. Survey must be achieved in the browser, which supports the standard of web 2.0. This makes work in the obsolete browsers impossible. The IE Explorer version are supported, beginning from the 6th version, Google Chrome, Opera 9 and above. The Mozilla Firefox is no supported. In the browser it is necessary to

include the support of JavaScript and the possibility to obtain and to store cookies (by default all browsers already have all disposed parameters).

The developed system is easily modernized and is the basis of the contemporary constantly supplemented information database of town-building activity for the investigated cities and the populated areas of North Ossetia uniting the results of all directions, which makes it possible to organically include the data in the federal All-Russian information system.

## 6. Conclusions

1. Geo-information systems (GIS) together with the systems of electronic document turnover (SED) are at present necessary component of state administration.
2. The adoption of city planning code led to the creation of many information systems of city planning (ISOCP). In this case the state cannot separate or introduce its own system ISOCP. This way is extremely ineffective, that blocks development and “self-” improvement of systems. At the same time, state can, and must regulate the protocols of the data exchange between the systems taking into account the requirements of safety, to develop the structures metadata, as for instance, this is already realized in the electronic system of “Roskadastr” (Russian land inventory).

3. By the force of practical need and demand the most flexible geo-information system proved to be the system of Roskadastr.
4. The developed structural-functional model of ISOCP makes it possible to create information system for the needs of user, with the retention of compatibility with other products, built according to this model, and also a number of the already existing systems.
5. The possibilities provision of using the cadaster map on the protocol WMS (in the form WMS- service) made it possible to use data in many applications both civil services and particular users.
6. Protocols WMS and WFS are the standards of the open geospatial consortium (OGS) and are supported by the majority of applications.
7. The use of protocol WMS makes it possible to ensure access to the seismicity and the risks data in the form of information division both into its own developed products and into the products of third developers.
8. On the basis of contemporary information technologies is created the database of the initial seismicity of the different level (probabilistic maps DSZ and SMZ) of territory RSO-A (detailed seismic zonation) and Vladikavkaz city territory.

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