FEATURES OF CRUSTAL DEFORMATION CONSIDERATION IN VALUATION OF REAL PROPERTY UNITS

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ABSTRACT:

The influence of floods and landslides on the size and shape of real property units is discussed. Criteria for the selection of potentially hazardous lands affected by the Earth's surface deformations are identified. The effectiveness of cadastral information system updating by means of deformation characteristics is demonstrated. Basic modern geodetic methods of deformation monitoring which are used in the Russian Federation are determined. How to improve the cadastre valuation and establish the necessity of deformation consideration in cadastral information system is considered.

1 INTRODUCTION

The most part of the Earth's surface is slopes. The slope is a part of the surface with angles of more than 1°. They occupy more than 3/4 of the land area. The greater the slope, the greater the gravity, which can destroy contact between the particles of rocks and move them down. Structural features of slopes contribute to gravitation destruction: the instability of rocks, the alternation of different layers, the slope and the ground water. The relief is mainly characterized by the angle of the surface. A more favorable one for building is a relief with the angle from 0.5 to 10%. At these angles siting of streetswith optimal angle and construction of buildings without large excavation is possible. Low relief (to 0.5%) makes it difficult to organize drainage, and steep relief raises the cost of construction.

Every year in the various regions there are strong floods of the rivers, which flood large areas. Mudslides bring high disasters to people. They destroy settlements, residential and industrial buildings, railways, highways and hydraulic engineering constructions. Many mountainous areas are influenced by landslides and collapses. Collapse is the fast separation of the mass of rocks on a steep slope, happened due to the loss of stability of the slope surface under the influence of different factors (aerations, erosion and abrasions in the slope basis, etc.). On the steep slopes (30° and more) the rockfalls are widespread. Being a kind of the collapses, the rockfalls are the cases of the movement of single stones or small groups. The cause of rockfalls is blowing or washing out of the soil, pushing of soil, and also processes of freezing and melting of ice under them. Rockfalls are most dangerous on highways, industrial and the steep slopes of the Pamir, the Altai, the Tien Shan and the Caucasus (Blick, G., 2003). Displacement of the coast of Novosibirsk reservoir is shown in Figure 1, 2.

Figure 1, 2. Displacement of the coast of Novosibirsk reservoir

Additionally, in the mountainous areas snow and avalanches bring destruction. Each natural disaster has the physical essence, the inherent, the emergence reasons, the driving forces, the character, the stages of development and the features of impact on environment. Despite these differences of natural disasters, they share common features – the large spatial scale, the considerable influence on environment, the strong impact on the person. Affected by natural disasters, real property units have

different kinds of deformation. Therefore, the effect of flood and landslide on size and shape should be considered in cadastral information system.

2 GEODETIC METHODS OF DEFORMATION MONITORING

In geodetic practice it is accepted to consider deformation as a change of location of object relatively to any fixed object (Manetti L 2010, Lim, M., 2011). The main purpose of observation is the determination of deformation size for its stabile and effective use. Deformation observation is a complex of measurement and description procedures for identification of the emergence reasons.

The fundamental method of studying crustal deformation is a geodesic method that provides an objective characterization of spatial processes. The results of geodetic monitoring give spatial coordinate basis for the integration of other geoecological methods and for adoption of administrative decisions. Monitoring deformation of the Earth's surface is performed by means of geometric and trigonometric land surveying (trigonometrical leveling, hydrolevelling, microlevelling), photo and stereo photogrammetric methods. Basic modern geodetic method of deformation monitoring used in the Russian Federation is the trigonometrical leveling (Ustavitch G. A., 2014).

Its main advantages are high accuracy and speed of measurements, simple and inexpensive standard equipment, ability to perform measurements in difficult and limited conditions. The most important factor of system of geodetic control is the integrated approach to solving the problem. The results of geodetic monitoring meet the interests of all organizations and companies – designers, builders, operating organizations.

To control the development of deep deformations of the Earth's surface geodesy applies modern satellite geodetic technologies and geophysical (magnetic) methods of measurement of depth of landslide deformations, and methods of statistical and mathematical modeling forecasting with consideration of the perturbation of the Earth's surface (Erol S., 2013).

SSUGT's specialists carry out constant monitoring of the coast of Novosibirsk reservoir and its destruction influenced by wind and wave erosion (Figure 3, 4**)**. At the initial stage areas where erosion processes are most intense are identified. For this purpose space imagery data taken at different times were used (Seredovich V. A., 2010).

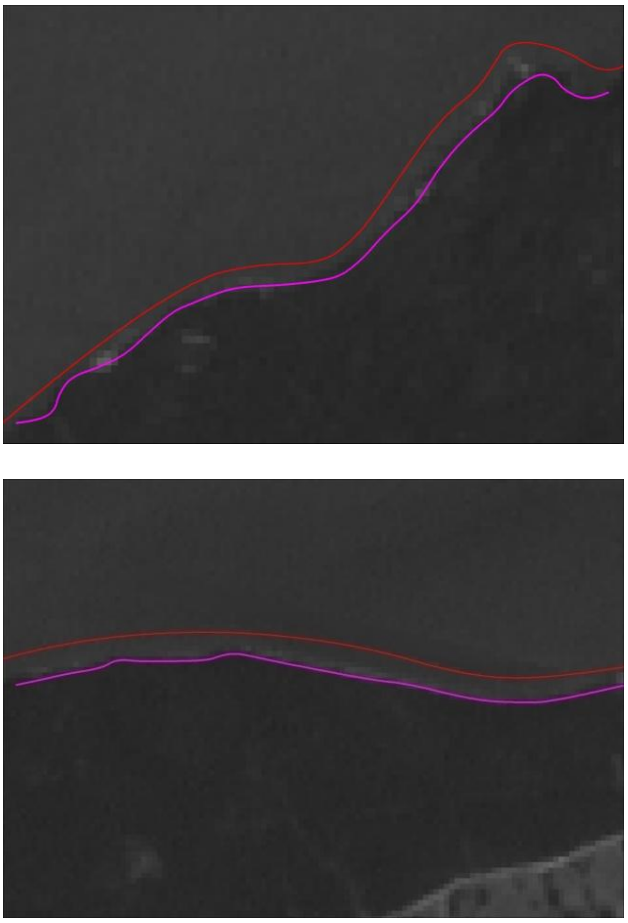
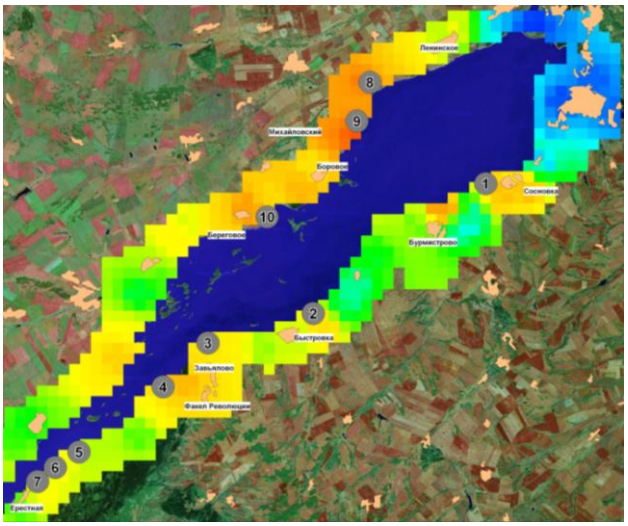


Figure 3,4. Space imagery data of the coast of Novosibirsk reservoir

Digital maps of the reservoir at different times were created through processing of automatic recognition of objects contours. According to the results, the shift map of the coastline for observed period was compiled (Figure 5**)**. For a detailed monitoring 10 reference points were established. Measurements on these points allow to rate erosion process and predict the speed and area of destruction (Dubrovsky, A. V., 2014).



Destruction of the coast during the period of 1979–2006 (meters)

200
180
160
130
110
90
70
40
20
0

Reference point

Settlement

Figure 5 Shift map of the Novosibirsk reservoir coast for the observed period

3 DEFORMATION CHARACTERISTICS FOR CADASTRAL INFORMATION SYSTEM

Determination of the areas with the crossed relief is difficult and not completely solved. Nevertheless, it becomes necessary to improve the technique and technology of problem determination in high-quality express-evaluation of real property units. Also land plots need reliable information about the current state of rock under them, constantly control of the basic parameters about the strength, stability and safety (Schwarz , 2002). It is efficient to upgrade cadastral information system date by means of deformation characteristics.

Criteria for the selection of potentially hazardous lands influenced by deformation of the Earth's surface are identified. All criteria of crustal deformation consideration can be divided in three groups:

1. Constant impact (tectonic movements, climate, hydrogeology, geocryology);
2. Slow change (flood and landslide, collapses, rockfalls and soil erosion);
3. Rapid change (earthquakes, human activities).

If the land is affected by one of these factors, in cadastral information system it is necessary to make a corresponding mark.

In modern cadastral information system it is necessary to take into account the changes in the geometric parameters of land plot, which have an impact on its cost. For this purpose it is necessary to introduce a decreasing coefficient:

$$K = \frac{S_p - S}{S_p} \quad (1)$$

where K – the coefficient (index) of deformation; S_p – the permissible deformation; S – the deformation during the observation period.

Maximum deformation of industrial and civilian high-rise buildings is 80-150 mm.

The cadastre valuation of the land plot based on coefficient of deformation is calculated:

$$C_{w/D} = C_{w/o\ D} \cdot K \quad (2)$$

where the $C_{w/o\ D}$ – cadastre valuation of the land plot without crustal deformation consideration ; $C_{w/D}$ – cadastre valuation of the land plot with crustal deformation consideration; K – the coefficient (index) of deformation.

4 CONCLUSION AND REMARKS

In cadastral information system the major role is played by the information about land plots, their parts and territorial zones characterizing the right the property relations of it, whereas quantitative and qualitative indicators of land resources, the dynamics of their changes in time and space and another characteristics are not considered.

This problem is urgent in the settlements, because the stability of the foundation and its bearing capacity determine the condition of constructions and the future safety operation of buildings.

Cadastre valuation depends on the stability of the Earth's surface under the object.

Nowadays the improvement the cadastre valuation by deformation consideration in cadastral information system is necessary.

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