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Height regulations as a method of managing architectural-historic environment

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Abstract. In the framework of present day scientific heritage management paradigm, it is actual to develop new methods of architectural and historical environment development control. For this reason, the purpose of this work is to work out an innovative method adjusted to Samara local contexts. Taking into account regional legislation, housing development morphology, peculiarities of Samara regular plan and historic parceling, the area of each historic household has been divided into three parcels: one along the block's outside perimeter, and two inside the block. The housing development that is located within the borders of the marked parcels obeys and is restricted by conditions of perception from the ensemble of the street's perimeter and as related to separate title objects (monuments). For each of the parcels the limit of housing height in meters has been determined. The feasibility of height regulations is based on constructing sections, which help to take into account the local specifics, distances, separating objects and the correlation between their heights and the relief's marks. All heights in section have been calculated with the help of specially developed software – the city's 3D map. The suggested method may be used as part of protection and town-planning documents.

1 Introduction

The "architectural – historic environment" of cities implies the system of spaces created by man and nature by means of architecture and town-planning, and having a *realized* historic-cultural value and integrity, characterized by awareness, individuality and self-identification (identity code). "Local identity as opposed to anonymity" is seen today as one of social indicators of cities' sustainable development [1, 2]. Architectural – historic environment may be looked at from two viewpoints: the necessity to preserve its integrity and variety (protection vector) and the predeterminacy of its development processes (renewal vector) [3]. The antagonism between the vectors of preservation and renewal of architectural-historic environment in Russian cities under the conditions of transfer to market economy intensifies. On the opposite, e.g., in American cities in the latest 25 years "it has seldom been necessary to choose between new housing and protecting historic heritage" [4].

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In many Russian cities the process of building new houses in their historic centers not always looks systematic and well-thought over. It is often preferred to derive maximum commercial profit from territorial reserves' development. Overall area yield becomes the benchmark of construction. The regulations imposed by projects of protection zones for cultural heritage objects, which are developed for each monument separately in accordance with applicable legislation, are fragmentary, and they don't contribute to perception of architectural-historic environment in its integrity and continuity. But "if a city hopes to go global, preservation of historic heritage has to be a part of its strategy" [4].

Managing the architectural – historic environment of cities is of dual character, two subjects of this type of activity are singled out. On the one hand, these are state authorities that work in the sphere of town-planning and aim their efforts at sustainable development of architectural – historic environment by means of town control. On the other hand, these are state authorities in charge of heritage protection, and their main mission is to preserve heritage. One instrument for managing cities' architectural – historic environment is protection documents (protection zones projects). Besides matters of heritage protection are touched upon in town-planning documents (cities' general layouts, rules regulating use and development of land). A reasonable compromise between preservation and renewal of architectural – historic environment is the main task facing town-planning regulations. The conflict between town-planning documents, describing the trends for transformation, and protection documents that contain measures aimed at preserving architectural-historic environment, the conflict between town-planning and protection subjects of activity aimed at managing heritage often leads to appearance of disharmonious new housing development in cities' historic centers. Improving the methods of the regulation of architectural-historic environment must contribute to solving the problem.

2 Methods

As a part of developing environmental approaches to cultural heritage protection, in Russian town-planning science the following methods have been established: 1) evaluating compositional – view influence of architectural monuments and limiting the force of visual interaction with them; 2) developing the city's spatial composition, basing on the projections of volume-and-spatial accents on panoramas and on the city's plan (the latter is symbolically called "vertical general layout"). Both methods implied using phototheodolite survey from the selected points for visual perception, and in this respect they were rather labor-consuming. In recent years the method of visual-landscape analysis of conditions that accompany perceiving cultural heritage objects inside their historic and natural environment has appeared, based on the French experience of doing such sort of work [5, 6]. The essence of this method is selecting the city's main spatial dominants, for which observation sectors are established, forming a view forward "to the monument" and a view back "from the monument", that are the basis for vertical restriction of new housing's parameters. The results are obtained empirically, by means of graphical analysis, on-site investigations and photo fixation. Using the latter method, in Russian capital cities special documents are worked out that restrict the height of new housing, i.e. industry schemes for the landscape-compositional analysis of architectural-historic environment. Such documents are made up basing on the relevant local legislation (town-planning codes of the cities of Moscow and St Petersburg) to detailize the cities' general layouts. According to such an industry scheme, in Moscow the limit of new housing height has been set at 75 meters. On the industry scheme marginal values of new housing height are put for each cadastral land lot located within the borders of the city's historic center.

Using such a method in a big provincial city, like Samara for instance, is not possible for a number of reasons: 1) absence of legitimated rights for the overwhelming majority of sites located within the borders of the historic centre, and this doesn't allow using the system of land tenure as a basis for differentiating height regulations; 2) the regular plan that, as opposed to landscape structure, levels out the perception of architectural-historic environment and limits the number of visual points, bringing zones of the object's visibility in the housing range to a common scheme. A number of works by distinguished Russian scientists are devoted to the matters of regulating housing development in Samara [7, 8].

In 2013, as a development of the above-mentioned and as a part of working out documents for legal zoning of the city of Samara (the Russian Federation), a special method has been suggested for regulating new housing development in the cities that have a regular plan structure. It is based on Italian, among others – Milan – experience of managing the development of architectural-historic environment [9], when the territorial reserves of historic blocks are divided into perimetral and inside-the-block.

3 Results

In the historic center of Samara, as in most cities of Middle Volga Region, the regular plan formed during the period of "regional reform", in 1775-1785, combines with a relatively even landscape – the terraces that go down to the Volga and Samara rivers. In such a situation the visibility of housing development is ensured mostly from historic streets, and the depth of "perception corridor" depends on the object's height.

Average size of a regular historic block in Samara is 126x252m, the overall area is 3,2 hectares. Basing on international experience and the specifics of perceiving the architectural-historic environment of a regular city, the following have been singled out in the structure of historic blocks: 1) perimetral housing development perceived from the street; 2) housing development located inside the block, which forms the block's private space. The perimetral housing development is distinguished by its high architectural-aesthetic standards. It is often formed of cultural heritage objects. On the average it occupies 1,2 hectares of the block's overall area, which is 1/3 of the block. In case new housing development appears in this part of the block, it has to obey the ensemble of historic streets. The height of the new housing located along the blocks' perimeter is also determined by the existing historic dominants, city accents, other title objects, which in the course of work have been specially pointed out on the historic-cultural key plan as the town-forming ones, the basis of the city's composition.

The housing development located inside the block is of non-public character, these are household backhouse buildings, in most cases they need sanation, and often have got no historic or cultural value. About 2 hectares or nearly 2/3rds of the block are areas inside the block, which are the potential territorial reserve of the city's historic centre. New housing development may follow the historically established parceling of the block, obey the visual restrictions without breaking the traditional panoramas and views of the city, and be of "hidden reconstruction" character [10]. The developed methods of the regulation of architectural-historic environment allow increasing the height of houses in the direction of the block's centerline, i.e. to the deep. The new houses located in the area inside the block should not have a height that will make them dominant from the viewpoints that form the view of the ensemble of historic streets and the panoramas of the city from the Volga and Samara rivers [11]. As there does not exist an established modern system of land tenure (duly registered land ownership) for regulating the height of new housing development in the historic centre of Samara it is proposed to take as a basis the proportions of historic

households that can differ depending on the morphology of housing development [12]. The proposed methods, thus, are based on the principle of historic parceling. The area of each block is marked by the borders of historic households that have been demarcated in accordance with the materials of mapping survey of Samara dating back to 1929-1932 taken from the project designer's archive and with account of the existing land-use system. Historic land tenure (parcel) is regarded as an economic lever for preserving the objects of cultural heritage relevant to it.

The area of historic households where there is a conventional territorial reserve has been divided into 3 parcels with different height restrictions (Fig. 1a): 1) the parcel of the block outside perimeter (the depth is determined by the width of the historic housing development "body" forming the historic ensemble of the street), including monuments and (or) territorial reserves, where new housing development regulations are determined by the average height of the existing buildings located along the red line; 2) the first inner parcel of a household ("lacuna"), which is usually a courtyard flanked by wings, that provides insolation breaks; 3) the second inner parcel of a household which is usually filled with inside-the-block housing development.

a)

b)

Fig. 1. Scheme of the height regulations of Samara historic center housing development (the part for approval): a – parceling of historic blocks with regard to historic households and morphology of housing development; b - a fragment of the height regulations for approval (the height is shown in meters).

The housing development within the marked borders is determined and regulated by its perception from the direction of a perimetral street ensemble or with reference to individual title objects (monuments).

The housing development of the first and second inner parcels generally should not be perceived from the direction of the historic street.

For each of the marked parcels the limit of houses height is defined in meters (Fig. 1b): 1) the regulations of the parcel, within the borders of which an existing object of cultural heritage is located, are determined by the latter's height parameters; 2) the maximum permissible parameters of new housing development within the borders of territorial reserves are determined by the results of landscaping-compositional analysis; 3) regulations of the parcel, within the borders of which an object disharmonious in the context of its height characteristics is currently located, can have a dual parameter reflecting the current state and the height characteristics of new housing development in case of replacement construction or reconstruction.

Town planning and protection documents are drafted in compliance with the relevant legislation as an approvable part and a substantiating part (Fig. 2a).

A similar division into approvable and substantiating parts is specified by the scheme of the height regulations of the historic center of Samara.

Height regulations are based on the construction of sections going through the most remote observing point of the object-monument (the title object, the dominant or the accent) and the potential new construction site (Fig. 2a).

Construction of sections, as well as supplementing flat patterns and panoramas, gives an idea of the permissible height correlations of objects-monuments and surrounding existing and new projected housing development.

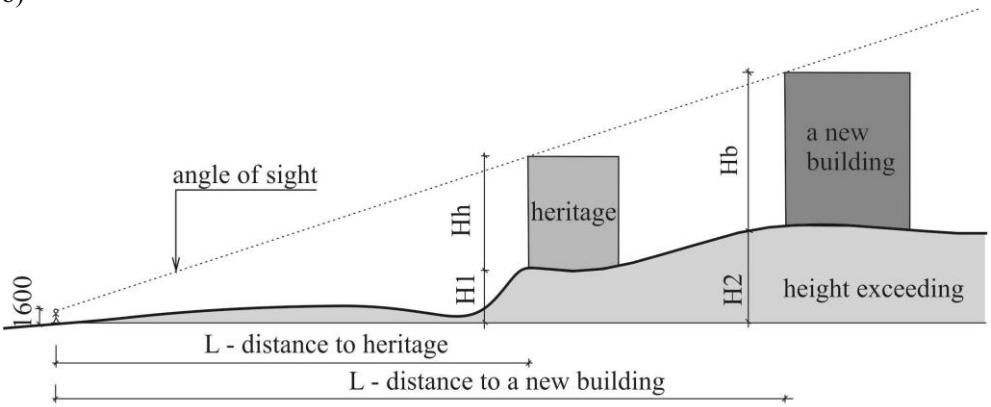
The sections allow to take into account landscape features, the distances between objects and their height correlations with regard to relief marks (Fig. 2b).

All heights in sections are calculated using the software specially designed for Samara - a three-dimensional map of the city.

The three-dimensional model of Samara was created in 2010 by "Samara-Informsputnik" (supervisor Chernov A.V.). It has a high level of detailization, and in particular the accuracy of the coordinate and altitude position of objects (Fig. 2c).

a)

b)



c)

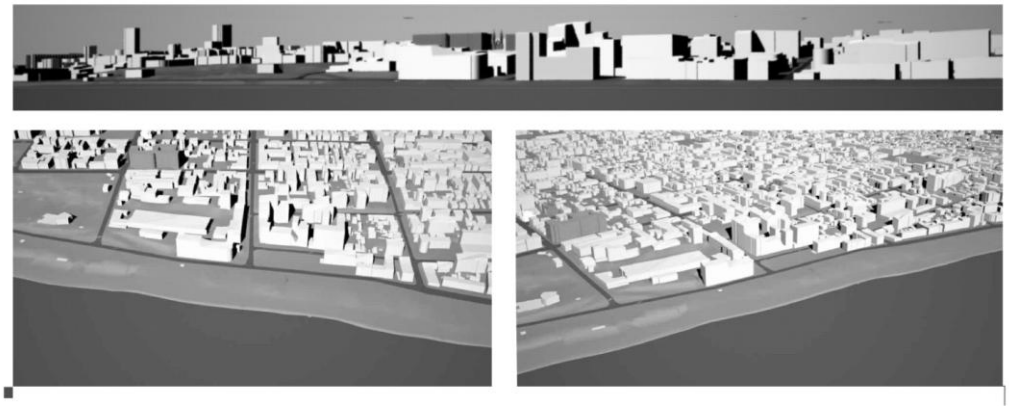


Fig. 2. The scheme of the height regulations of the historic center of Samara (substantiating part): a - a fragment of the substantiating part of the height regulations (marking of sections and observing zones); b – calculation of the permissible height of new housing development, considering the topographical relief; c - the converted three-dimensional city model that is used for calculations.

The digital model reproduces the topography relief of the city and the height of each building, and also displays about 100 title objects forming the image of the city. To develop

height regulations the three-dimensional model was converted into AutoCAD. That allowed to automate the construction of sections in the direction of the selected vectors of perceiving the cultural heritage and to carry out automatically the height parameter analysis of existing and projected housing development. The accuracy of data obtained in the laboratory was experimentally proved in practice by means of photo fixation of heritage objects in visual "corridors" and in the panorama of the city.

4 Discussion

Altitude parameters adjustment has long been used in the spheres of urban planning activities and cultural heritage protection. However, in most cases different regulations for perimeter and intra-building were observed. These regulations took account of planning restrictions, but did not consider the landholding system. The regulations were not differentiated within each of cadastral parcels, either. In this respect, the designed method has a high degree of variability and makes it possible to use territorial resources of the city to the maximum extent possible without detriment to the cultural heritage. Empirically derived parameters of the new building development, shown on a schematic plan of the city, can be easily verified by using the city 3D maps. Application of 3D maps allows to consider the excess topography terrain elevations while projecting the height of new buildings.

The theoretical value of the study lies in the new automated method of adjusting the height of new buildings, which can be applied to the existing regular plan of the city. The practical significance of the research lies in the ability to use the developed method in the work of town-planning activities and heritage preservation authorities. The method allows to develop historical parts and new housing without detriment to the cultural heritage.

In perspective, we plan to automate the selection of specific sections which give the possibility to determine maximum permissible altitude parameters of new building developments. It will bring the method to the user level. In addition, further research can be aimed at creating similar methods for older cities with irregular planning schemes.

Conclusions

The automated method of high-rise new building developments control, designed by the example of Samara city in an architectural and historical environment, is aimed at optimizing management processes of historical cities development. Altitude reconstruction modes differentiated within each household make this method flexible. High accuracy of maximum parameters of historical households' territories use and their testing on 3D-map of the city makes it possible to avoid urban planning mistakes. The fact that parameters of new building developments were thoroughly correlated with the height of every building on the street and as well as with urban landmarks helps preserve the integrity of every historical ensemble of the city.

In conclusion, it should be noted that the created method can be used as a part of both town planning and protection documents, and become a well-grounded tool for controlling the process of preservation and reconstruction of architectural and historic environment of the cities with a regular plan.

Further studies may be aimed at creating an affordable custom computer program. This program, requiring no special professional skills, could then be used by developers, builders and other people interested in the development of historic centers of different cities.

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