

# Development of Methods and Software for Automated Preparation of Maps of Urban-Planning Regulation of the Territory of Municipalities

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## Abstract

Traditionally, maps of urban planning regulation are created by operators-cartographers with the help of instrumental GIS. The developed methodology and software allow to automate the preparation of maps of urban-planning regulation of the territory of municipalities.

## 1 Introduction

The urban development regulation is the activity regulation on territories-development, including cities and other population centers that is carried out in accordance with the Urban development Code of the Russian Federation by the authorities with citizens in the form of: 1. general spatial planning; 2. Land Zoning; 3. detailed / draft land planning; 4. architectural and construction design; 5. construction activities, major repairs, reconstruction of capital construction objects.

Accompanying element is the institution of land parcels affordance for the construction and reconstruction of capital construction objects. The system of urban development regulation (the system of the legal urban development regulation) is the legally organized set of organized structures that make efforts to create a legal basis and information conditions for urban development activities and to control the urban development activities. The regulation is conducted on behalf of the authorities in accordance with the established procedures. This regulation is carried out by the authorities (territorial planning, Land Zoning, detailed / draft land planning, architectural and construction design and construction activities - for facilities which can be created by the authorities) and the real estate developers (both architectural and construction design as well as construction activities) [1].

The urban development regulation can be carried out in the presence of the three components: 1. ordered set of public subjects of the urban development regulation; 2. procedures organized under the laws of the urban development regulation; 3. ordered set of differentiated actions -urban development regulating tools [2].

Traditionally, maps of urban planning regulation are created by operators-cartographers with the help of instrumental GIS, which requires significant labor resources, amounts to 70% of the cost of developing maps. In addition, there are errors due to the human factor. The developed methodology and software allow to automate the preparation of maps of urban-planning regulation of the territory of municipalities [3].

## 2 Urban planning maps

The following basic elements (components) are created (defined) in the composition of urban planning maps [4]:

Functional zones are zones for which boundaries and functional purposes are defined by the documents of territorial planning.

Urban-planning zoning - zoning of territories of municipal formations with a view of definition of territorial zones and an establishment of urban-planning regulations.

Territorial zones are zones for which boundaries and urban planning regulations have been defined in the rules of land use and development.

The rules of land use and development are a document of urban planning zoning, which is approved by the regulatory legal acts of local self-government bodies and in which territorial zones, urban planning regulations, the procedure for applying such a document and the procedure for making changes to it are established.

The preparation of the territorial planning projects is carried out to identify the elements of the planning structure, establish the boundaries of common areas, the boundaries of the zones of planned placement of capital construction facilities, determine the characteristics and order of the planned development of the territory.

Red lines are lines that denote existing, planned, modifiable boundaries of common areas or boundaries of territories occupied by linear objects or intended for placing linear objects.

Territories of common use are territories that are unhindered by an unlimited number of persons (including squares, streets, driveways, embankments, coastal stripes of public water bodies, squares, boulevards).

Element of the planning structure is a part of the territory of the settlement, city district or inter-settlement territory of the municipal district (quarter, microdistrict, planning district and other similar elements) [5].

### 3 The process of automated preparation of urban planning maps

The procedures are performed in a spatial data base containing orthophotoplane, state real estate cadastre data.

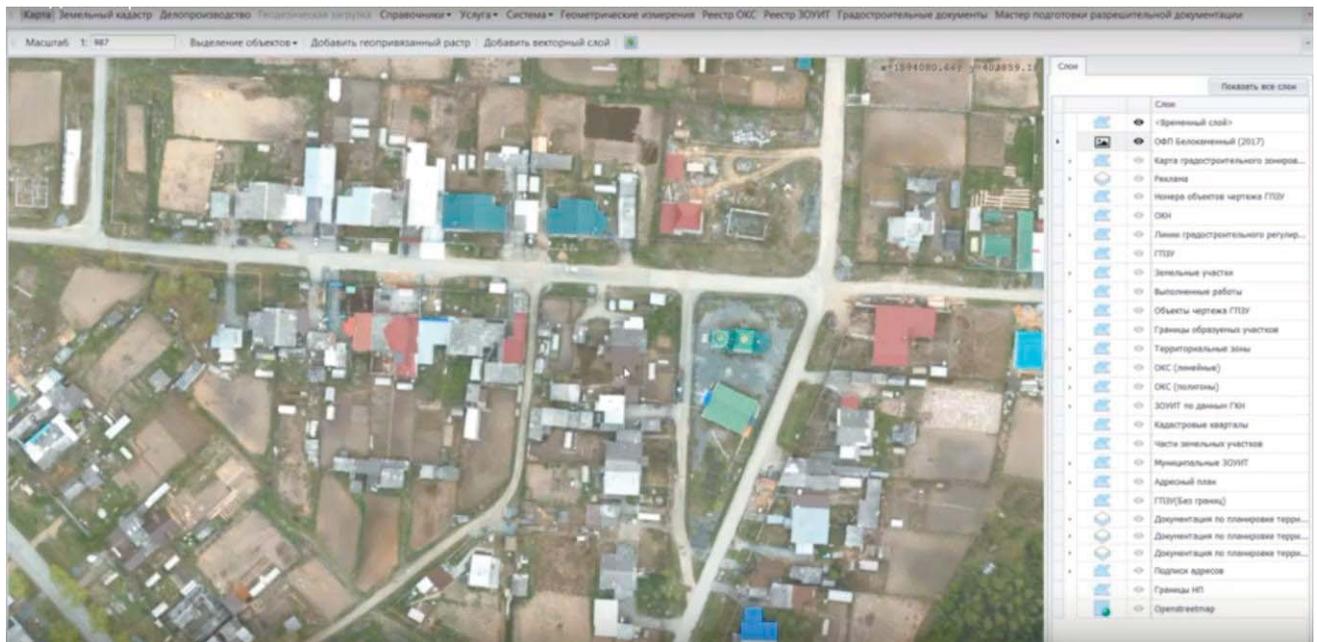


Figure 1: Orthophotoplane

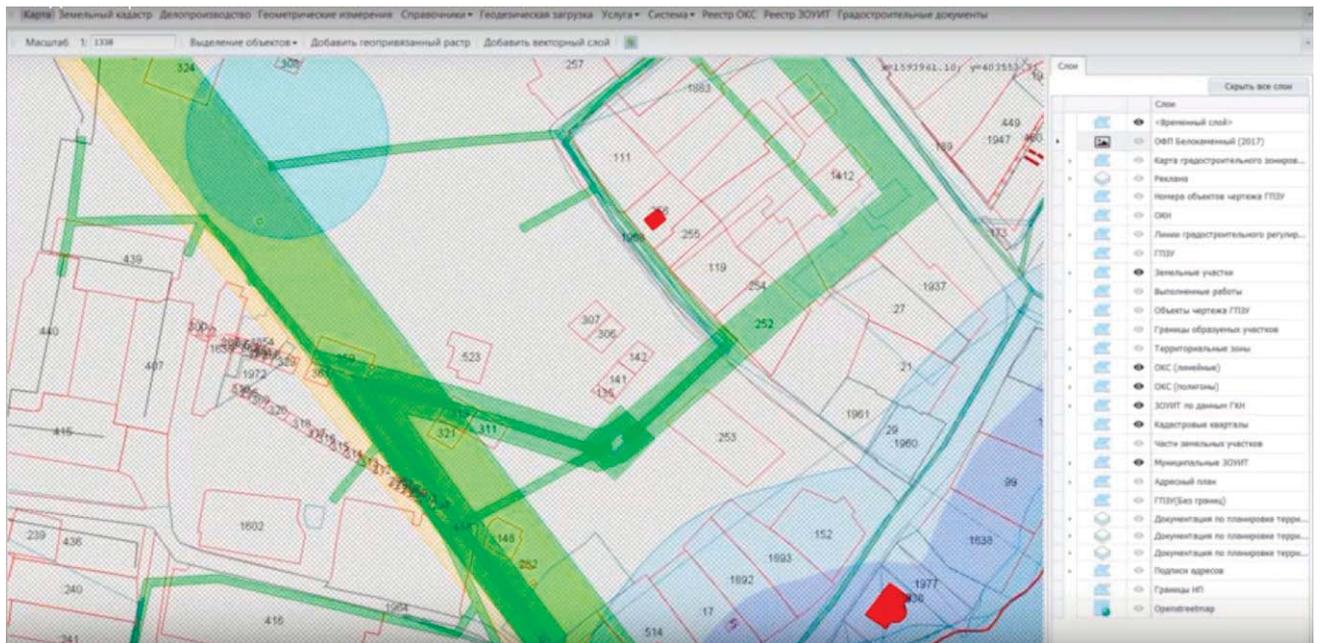


Figure 2: Real estate cadastre data

### 3.1 Stages of the process of automated preparation of urban planning maps

#### 1. Manual allocation of contours of built-up area on an orthophotoplane.

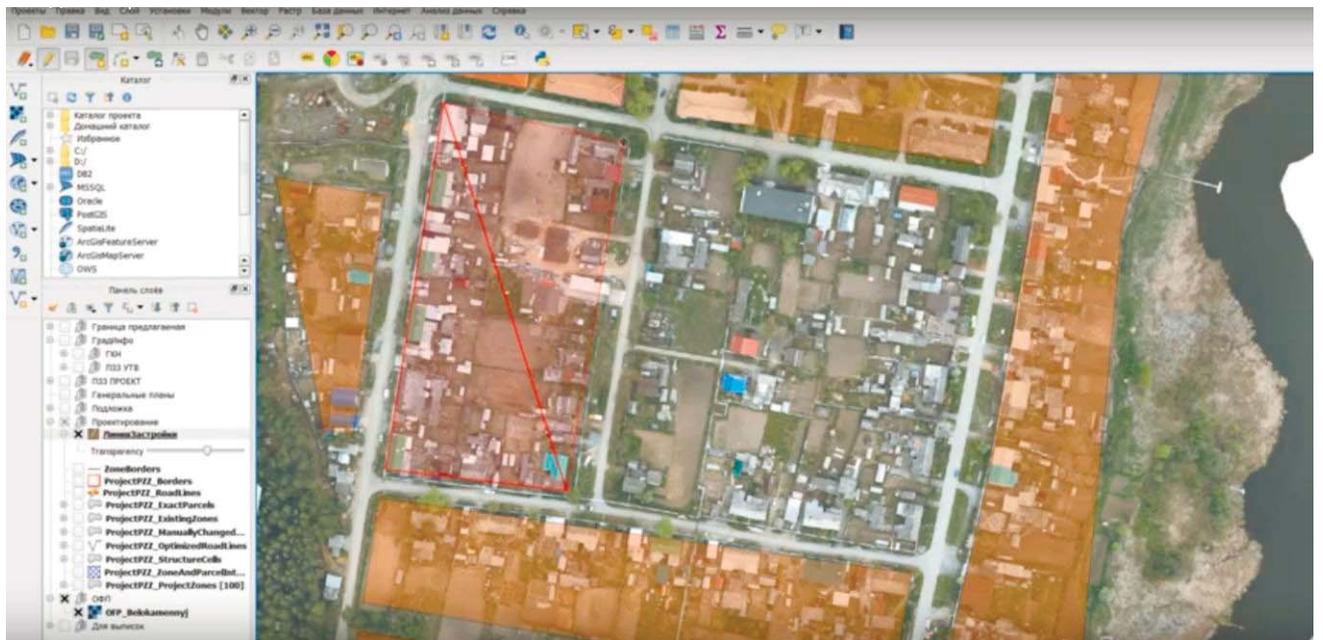


Figure 3: Manual allocation of contours of built-up area

2. Manual allocation of axes (middle lines) of streets without presentation of requirements to accuracy. At the same time, there is an automatic formation of public areas in the form of a buffer from the axis, with a size that meets the requirements of technical standards.

### 3.2 Automatic stages

Further on the basis of spatial data, scripts are run using the optimization genetic algorithm. With their help it is produced:

3. Automatic centering of the street axes relative to the contours of the built-up area.



Figure 4: Automatic centering of the street axes

4. Automatic correction of the boundaries of public areas to meet the requirement of non-intersection with the contours of built-up areas, but at an equal distance from the axis of the street throughout its entire length.

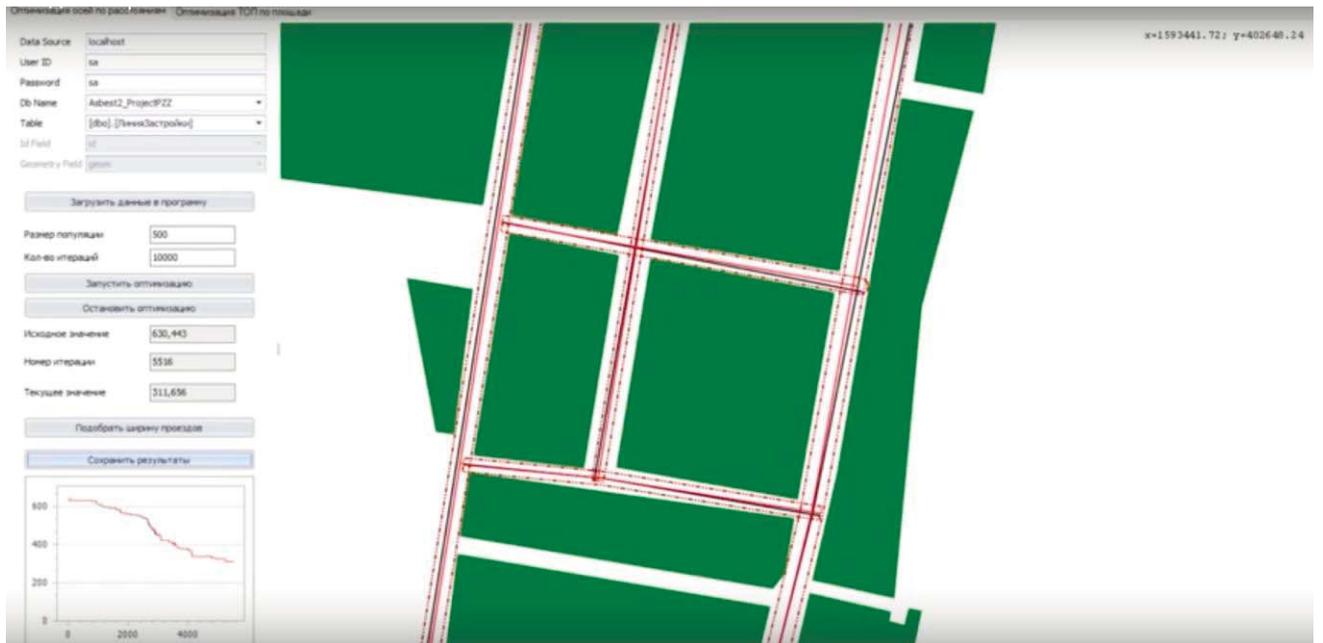


Figure 5: Automatic correction of the boundaries of public areas

Thus, quarters are obtained - elements of the planning structure and red lines, which together make up the project of planning the common use territory of the settlement.

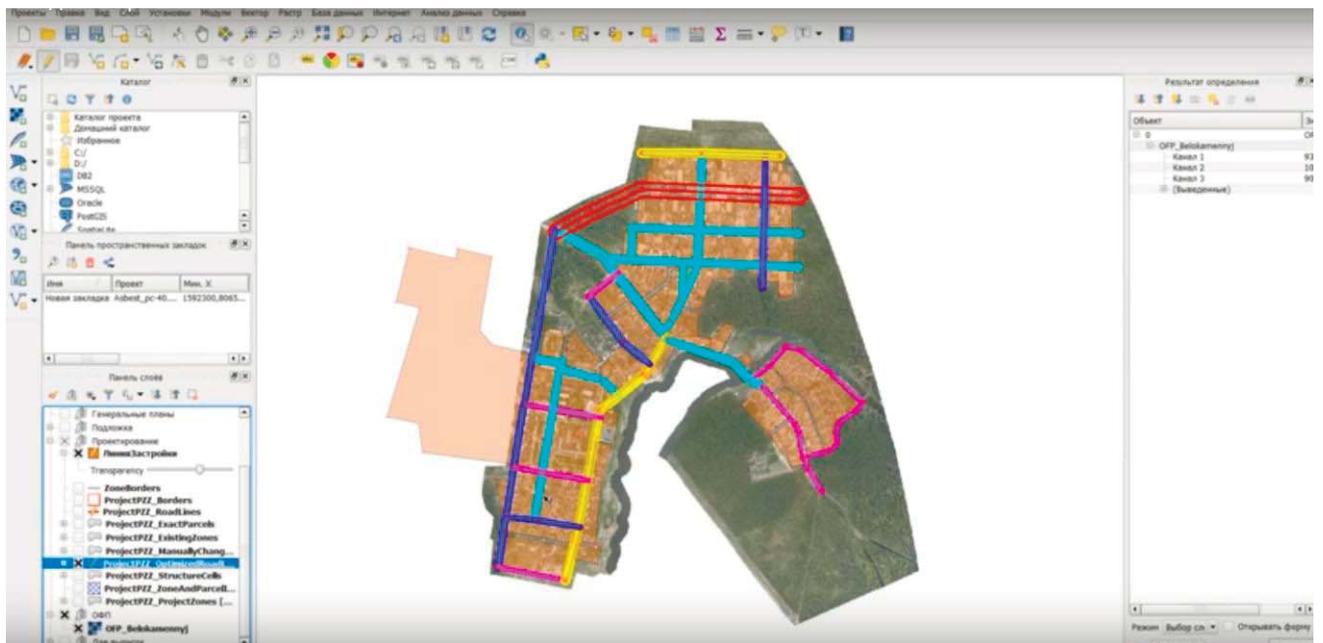


Figure 6: Project of planning the common use territory

### 3.3 Preparation of the map of urban zoning

5. To form territorial zones, blocks of land plots that are beyond their boundaries are automatically added to quarters with specified boundaries (corresponding to cadastral requirements).

6. Automatically determines the type of the territorial zone in accordance with the main types of permitted use of land and functional areas of the master plan.

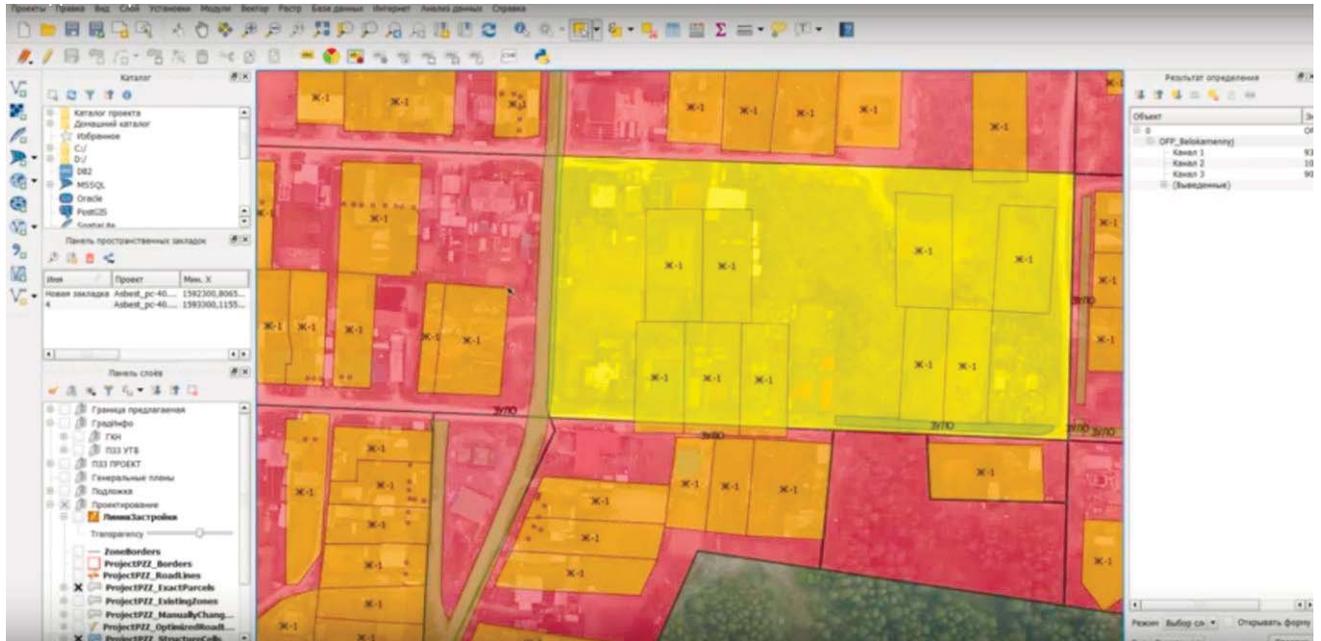


Figure 7: Preparation of the map of urban zoning

7. Automatically generated electronic documents in the xml format for state cadastral registration of territorial zones.

## 4 Conclusion

In the course of the work, a methodology and software was developed that made it possible to automate the preparation of maps of urban-planning regulation of the territory of municipalities. Thanks to this, the need for labor resources is noticeably reduced, the cost of card development can also drop noticeably. In addition, the number of errors caused by the human factor is reduced.

### Acknowledgements

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### References

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