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GIS Application for Improving Housing Conditions in Substandard Roma Settlements in Serbia

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1 ABSTRACT

In order to tackle socio-economic inequality problems of Roma minority population in Serbia, Serbian Government has adopted in 2009 the Strategy on Improvement of the Status of Roma in the Republic of Serbia (Roma Strategy). During last 7 years, this Roma Strategy has been implemented by different entities and through various projects, dealing with some of the major identified issues of Roma community in Serbia, like: substandard living conditions; low or no income at all; legal and other discriminations; lack of rights on social care and/or health insurance; etc.

Within the programme "We are here together – European Assistance for Roma Inclusion", the Organisation for Security and Co-operation in Europe Mission to Serbia (OSCE Mission to Serbia) provides technical assistance to the Serbian Government in implementation of the mentioned Roma Strategy. Since 2013, part of this assistance has aimed at creation of an information system, that is, centralized GIS application for the substandard Roma settlements (SRS) in Serbia. The main purpose of this GIS application is to support the Ministry of Construction, Transportation and Infrastructure (MCTI) together with local governments, to register, monitor and analyse quality of housing within SRS in Serbia, and make right decisions for improvement of Roma community living conditions in future.

Thus, in order for affordable housing solutions for SRS in Serbia to be identified and then proposed by MCTI for funding, the OSCE Mission to Serbia has implemented project "Mapping of substandard Roma settlements in GIS" for building GIS application for SRS. This project consisted of two main groups of activities: (1) spatial and alphanumeric data collection on SRS, and (2) GIS application building for SRS housing conditions monitoring and decision-making. As part of project methodology, the first conceptual data model for SRS was created using UML language. Based on this model, questionnaire for alphanumeric data collection on SRS housing conditions was developed, while spatial data for SRS boundaries were collected using CAD tool and orthophoto maps for each site where these settlements were located within Serbian municipalities. Also, in order for SRS data collection activity to be performed efficiently, network of 16 field co-workers throughout Serbia was established and appropriate training was provided. Finally, as second part of project methodology, collected SRS data were subject of quality verification before their conversion and integration within SQL database, which was basis for creation of appropriate GIS environment using QGIS open-source software advantages.

The aim of this article is to present project methodology and main results. First, recent activities on Roma community housing improvement in Serbia would be listed and the OSCE project "Mapping of substandard Roma settlements in GIS" would be presented. Then, selected methodology for the project aim and outputs achievement would be described. In following chapter, OSCE project main results would be presented together with their main characteristics and first data analysis results. Finally, project methodology and results would be discussed and conclusion would be made, including possible implications and future steps towards improvement of Roma community housing conditions in Serbia.

2 BACKGROUND

Starting in 2002, Serbian Government has adopted several strategic documents and measures to improve Roma community living conditions in Serbia; also, it participated in launching the international Decade of Roma Inclusion initiative in period 2005–2015. However, despite invested efforts, implementation of all policies and measures within education, employment, health and housing domains for Roma community has faced serious difficulties in Serbia.

According to Vuksanović-Macura (2012), noticed implementation difficulties in the housing domain are due to a poor understanding of the problems of Roma settlements, a lack of updated data and maps for the same, as well as a shortage of financial resources, among the other things. On the other side, lack of social inclusion, as one of the two main problems of Roma community in Serbia, has also territorial or spatial aspect. (URL2) This means that lack of Roma inclusion is not merely a consequence of individual or Roma community as a whole position in existing Serbian social structure, but result of existing substandard housing

conditions within Roma settlements, produced by number of mutually connected problems, such as unemployment, poor public services, absence of roads, low income, etc.

In 2002, there were 593 settlements registered in Serbia with poor –i.e. substandard- housing conditions. Majority of those settlements were populated prevailingly by Roma population, and most of them had problems, such as (URL1):

- Legally unregulated status;
- Ownership status on land unregulated;
- Lack or poor utilities and infrastructure in general;
- Low worthiness and weak sanitation standards of houses;
- Overpopulation;
- Unregulated, poor and living environment with health risks; and
- Absence of other public services in settlements, and difficulties or obstacles for using these services in their neighbourhood.

Relaying on the spatial development vision, aims and objectives of the Serbian government, Spatial Plan of the Republic of Serbia for period 2010-2020 has identified two main models, that is, scenarios for SRS improvement (URL1):

(1) Retention and upgrading of housing conditions in those Roma settlements that (can) satisfied minimal quality standards of life; and

(2) Building new residential capacities for resettling population of those Roma settlements that lack basic standards of life.

In order for these two models to be planned and implemented in integrated, informed, justifiable and organized manner, following sustainable housing principles and measures prescribed by Serbian Government (URL1) and UNECE (URL2), up-to-date data on SRS need to be collected and mapped for establishing efficient monitoring and decision-making tool and process for Roma community housing in Serbia.

This is needed because some SRS have existed for decades in Serbia, but authorities have only started finding out about them when they were presented with data and analyses resulting from the mapping and enumerations. To this end, in the past two decades around 50 different initiatives for SRS improvement have been launched in Serbia requiring the mapping of individual settlements or a large number of Roma settlements at one time. (Vuksanović-Macura, 2012) The only mapping project of Roma settlements on national level included merely identification of their spatial distribution, that is, just relative –point data- locations collection without detailed data on SRS boundaries or the other housing conditions information. (Jakšić and Bašić, 2005)

Therefore, in order for relevant decisions and efficient actions on side of Serbian authorities for SRS improvement to be taken, Vuksanović-Macura (2012) confirms that quality and scope of existing SRS maps and data need to be upgraded, and methodological approach for data collection and management further standardized. Due to limitations of national funds and capacities, no one in Serbia was able to take necessary measures in this direction, so international programmes and funds have been identified as main sources for implementation of social inclusion and sustainable housing objectives for Roma community in Serbia.

3 GIS APPLICATION FOR IMPROVING HOUSING CONDITIONS IN SUBSTANDARD ROMA SETTLEMENTS IN SERBIA

Starting in 2001, the OSCE Mission to Serbia is supporting the integration of the Roma community, and dedicates considerable efforts in achieving the aims and objectives of the Decade of Roma Inclusion 2005-2015 in Serbia. (OSCE, 2009, 2013)

As part of these efforts and within its mandate, the OSCE Mission to Serbia is implementing since 2013 IPA-funded programme “We are here together – European support for Roma inclusion”. (OSCE, 2013) This programme is supporting implementation of the Roma Strategy in Serbia (URL3), and it is aimed to address existing social and economic discrimination issues and vulnerability of Roma community in general by

improving access to basic human rights, like civic participation, employment, education, healthcare, social services, and adequate housing.

Being one of the mentioned programme aims, i.e. integration measure, adequate housing for Roma community in Serbia has included number of activities for long-term improvements of existing living conditions. Among those activities is, also, SRS mapping and development of information system – i.e. GIS application-, which is in a focus of this article. According to the programme objectives, it is expected that GIS application would help monitoring housing conditions in SRS, and support decision-making, housing improvement proposal writing as well as follow-up of chosen affordable housing solutions implementation by the national government.

Thus, to assist MCTI to monitor and make informed and timely decision for improving housing conditions of Roma community in Serbia, the OSCE Mission to Serbia has launched in 2013 a project for mapping and building GIS application for the SRS on national level. In this way, the OSCE Mission to Serbia has supported standardization of methodological approach to Roma housing conditions data management and analysis, and provided first national GIS database for SRS as an initial platform for future initiatives within sustainable housing domain for Roma community in Serbia.

4 PROJECT METHODOLOGY

The project titled "Mapping of substandard Roma settlements in GIS", which was implemented during 2014 and 2015, was aimed to enable the usage of the GIS technology advantages for SRS data management for the first time in Serbia. The main purpose of the project was to build efficient tool for SRS monitoring by national policy decision makers, which could additionally support already invested efforts by the Serbian Government, municipalities and OSCE for improving housing conditions for Roma community in Serbia.

Accordingly, project methodology framework was built for achieving the identified objectives and targeted functionalities of the future SRS database, that is, GIS application (Živković and Đorđević, 2015):

- To ensure municipal and national coverage and detail of information for SRS;
- To include the collection of both spatial and alphanumeric data on SRS;
- To provide platform for monitoring status and types of substandard quality assessment for each SRS;
- To develop conceptual data model for SRS needed for GIS database structuring and future GIS application interoperability with the other key databases in Serbia, as well as data from the other similar Roma community projects in Serbia; and
- To support standardization of methodological approach to the SRS issues management in Serbia in future.

Following above functional requirements from GIS application for the SRS monitoring and decision-making, project methodology included next 4 operational steps:

(1) Project scope definition, i.e. definition of SRS;

(2) Development of conceptual data model for SRS;

(3) Selection of data collection methods for spatial and alphanumeric data on SRS; and

(4) Identification of data quality, conversion and integration approaches for building GIS database and application.

4.1 Definition of SRS

Responding to the needs for standardization and data interoperability, project scope and methodology were identified based on the definition of substandard settlements given by the UN. (Živković and Đorđević, 2015) Similar to the Spatial Plan of the Republic of Serbia definition (URL1), this definition recognizes the following criteria as the key ones for the substandard settlements identification:

- Inadequate access to potable water;
- Inadequate access to sanitary and other infrastructure;
- Poor quality of housing units;

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- Overpopulation in terms of average density of population per unit area of the settlement; and
- Uncertainty of the legal status of houses on plots.

4.2 Conceptual data model

In next step, complying with the previously identified SRS definition as well as the project functional requirements related to expected outputs and results, a conceptual data model for SRS domain in Serbia was built using:

- UML language advantages; and
- International and national data management standards (ISO19115, i.e. INSPIRE, Serbian NSDI), where possible, as well as project needs.

4.3 Data collection

Selection of the methods for alphanumeric and spatial data collection for each SRS was adjusted then to the adopted SRS definition (4.1) and the conceptual data model (4.2).

The questionnaire method was used for collecting alphanumeric data on the SRS housing conditions. Created questionnaire in Excel file format consisted of total 26 questions, where most of them were of closed-end type. Advantages of this method for the SRS data collection and project aim achievement assumed:

- Simple filling in of the questionnaire and easy analysis of collected responses;
- Reducing risk of errors when filling in questionnaire; and,
- Assuring for the collected data to be enough standardized for GIS technology implementation.

The CAD technique combined with the Spatial Units Registry data and georeferenced orthoimagery, obtained both from the Republic Geodetic Authority (http://rgz.gov.rs/), was used for collecting spatial data on SRS boundaries.

As output, separated Excel file with alphanumeric data and CAD file with boundary data were created for each SRS identified in Serbia on the municipal level.

In addition to above listed methods for data collection for the SRS database, additional methods used within this phase of the project included data generalization, classification, and others.

Finally, organizational model for the SRS spatial and alphanumeric data collection on the field demanded formation and training of a small network of 16 associate experts, consisting mostly from the employees of urban planning offices in municipalities, coordinators for national minority issues, and other local-level professionals dealing with the housing issues of vulnerable social groups.

4.4 GIS application building: data quality, conversion and integration

In order for collected SRS data to be smoothly converted and integrated with the other data in GIS environment, project-specific data quality assessment procedure was conducted in view of achieving the goals of the project. This data quality assessment procedure for collected spatial and alphanumeric SRS data assumed their verification against the four standard quality criteria: completeness, consistency, accuracy and logical sense of the data.

After quality verification, SRS data were converted from Excel and CAD formats to the SQL database using the developed conceptual data model and other rules set for the output GIS application.

Finally, integration of SRS data with the other vector and raster data within GIS environment was based on different Web technologies and accepted data management standards, making thus SRS GIS database and resulting application scalable and extendable. Also, due to limited project budget as well as current trends in data management, proposed GIS software solution was required to be open-source one.

5 GIS APPLICATION FOR SUBSTANDARD ROMA SETTLEMENTS MONITORING AND DECISION-MAKING

In compliance with the established methodological framework and project aim, project team has produced and delivered two main outputs: 1) conceptual data model, and 2) GIS application.

5.1 SRS domain model

The conceptual data model for identified SRS issues and their descriptions was created using the UML language advantages.

Developed model includes 8 main objects or entities (Fig.1), and it covers basic issues for SRS status monitoring, evaluation and decision-making in Serbia. Modelled SRS objects could be grouped in the four categories (Živković and Đorđević, 2015):

- Data on relevant administrative, statistical and cadastral units for each SRS;
- General data on SRS, such as basic demographics, history and relative position to the other settlements;
- General data on access to utilities and transport network for each SRS;
- General information on the legal-property relations at the level of individual SRS, and those identifying the existence and status of the current planning documents, as well as the type of land ownership.

Created conceptual SRS model is in line with local as well as certain ISO19000 and INSPIRE standards, where applicable. It is expected that applied data standards for SRS model would ensure GIS database and application scalability and extension in future, as well as simple connectivity, integration and exchange of SRS data with the other databases that contain information relevant for Roma housing conditions improvement.

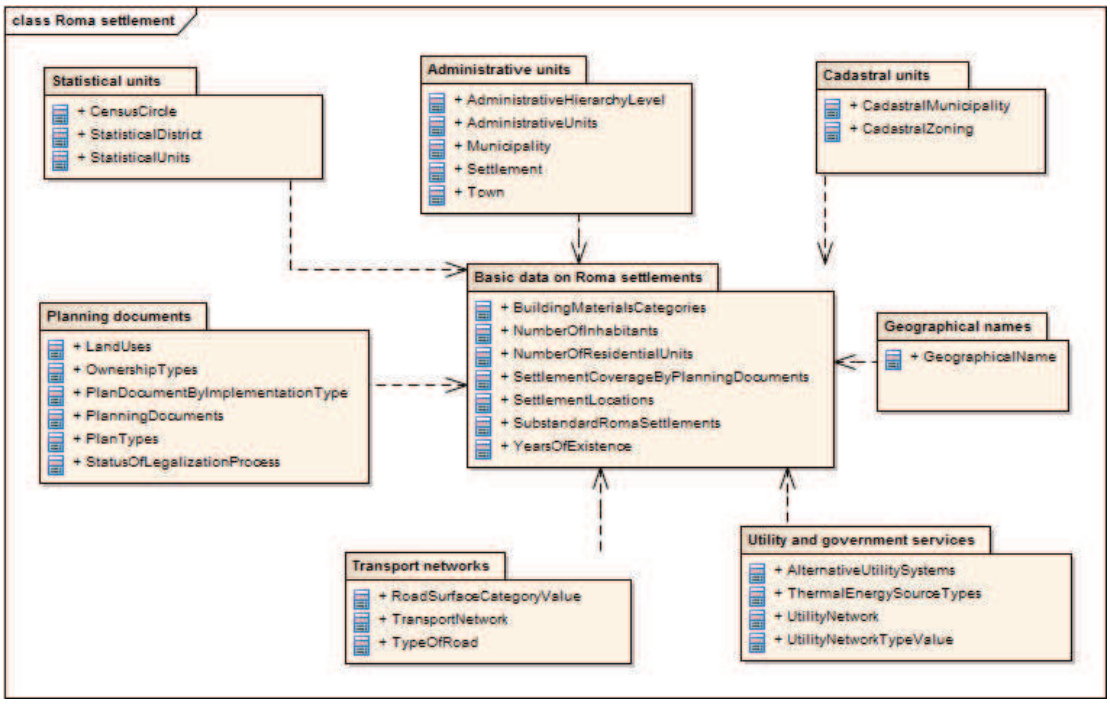

Fig. 1: Conceptual data model for SRS: overview (Živković and Đorđević, 2015)

Also, this conceptual data model supported the following project step (a) collection of alphanumeric data for the each SRS, by providing scope and content for questionnaire compilation in the Excel format, as well as (b) linking of SRS alphanumeric data via unique spatial unit ID to complementing SRS boundary data in CAD format.

5.2 GIS application for SRS management

Furthermore, developed conceptual model of SRS domain (5.1) provided basis for the structuring of GIS database in MS SQL Server 2014 software, and it streamlined SRS data conversion and integration with the other relevant data for SRS within the output GIS application, built using QGIS software advantages.

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5.2.1 SQL database

After SRS field data collection by local experts using selected methods and tools (4.3), and these data quality verification against project-specified criteria (4.4), alphanumeric and spatial SRS data were converted and integrated within MS SQL Server 2014 database.

First analysis of collected data in SQL database showed that substandard settlements of this type have been identified in more than half of municipalities in Serbia, as seen in Table 1. In general, there are 583 Roma settlements of this type in Serbia (NUTS0) in total (excluding Kosovo and Metohija). This is 3.4 SRS per municipality on average in Serbia (LAU1). On the level of districts (NUTS3), the average is 22.4 SRS, while per region in Serbia (NUTS2) there are on average 145.8 of these settlements.

Number of municipalities with SRS settlements	Number of municipalities with no SRS settlements	Total number of SRS settlements	Average number of SRS settlements per municipality	Average number of SRS settlements per district	Average number of SRS settlements per region
120 (71.01%)	49 (28.99%)	583	3.4	22.4	145.8

Table 1: Statistical overview of SRS in Serbia (Živković and Đorđević, 2015)

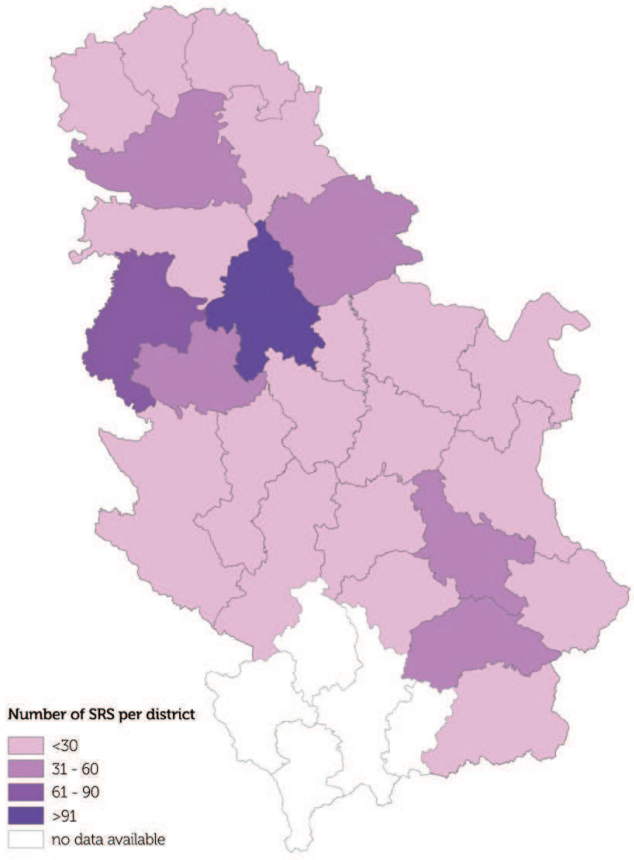

Fig. 2: Distribution of SRS in Serbia per district (Živković and Đorđević, 2015)

In other words, SRS has been registered in 71.01% of all municipalities in Serbia. The total number of 583 SRS on which data were collected corresponds to the estimates previously made by the OSCE and relevant Serbian experts. However, unlike some previous Roma housing conditions research and surveys, this project results included also information on spatial boundaries and areas of all SRS in Serbia. Also, this project provides information on spatial distribution of the SRS characteristics, like distribution of different housing conditions (utilities, infrastructure, etc.), or legal and property ownership status of SRS per municipality. Besides compliance of collected SRS data with the standards needed for using advantages of the complex GIS tools and analyses, these data revealed certain patterns of SRS in different regions in Serbia (Table 2). Additionally, SQL database has created possibility for identification of approximate size and scope of activities and funds required for improving the SRS housing conditions in future.

SRS		Serbia[1]			
Housing conditions	Types	Belgrade region[2]	Vojvodina region	South and East Serbia region	Šumadija and West Serbia region
Position in relation to formal settlement	Integrated into a formal settlement	58%	53%	54%	46%
	On the outskirts of a formal settlement	24%	44%	41%	39%
	Outside a formal settlement	18%	3%	5%	15%
Number of years of SRS existence	< 15 years	10%	1%	5%	6%
	15-45 years	55%	34%	34%	41%
	> 45 years	35%	65%	61%	53%
Construction materials used to build housing units in SRS	Poor quality materials, unsuitable for construction purposes	42%	63%	38%	20%
	Materials that guarantee durability and safety	58%	37%	62%	80%
Size of the SRS	< 15 units	19%	31%	32%	40%
	15-50 units	48%	49%	39%	41%
	51-100 units	24%	13%	17%	12%
	101-200 units	6%	5%	6%	5%
	> 200 units	3%	2%	6%	2%
Number of inhabitants in SRS	< 100 inhabitants	28%	49%	52%	55%
	101 – 200 inhabitants	31%	34%	17%	28%
	201 – 500 inhabitants	31%	13%	20%	12%
	501 – 1000 inhabitants	9%	2%	6%	4%
	> 1000 inhabitants	1%	2%	5%	1%
Status of infrastructure networks in SRS					
Water supply system	0% units connected	38%			
	< 30% units connected	10%			
	30 – 70% units connected	22%			
	> 70% units connected	30%			
Sewerage system	0% units connected	74%			
	< 30% units connected	6%			
	30 – 70% units connected	9%			
	> 70% units connected	10%			
Electrical power system	0% units connected	8%			
	< 30% units connected	8%			
	30 – 70% units connected	16%			
	> 70% units connected	68%			
Road network – asphalt-paved roads	0% roads asphalted	26%			
	< 30% roads asphalted	26%			
	30 – 70% roads asphalted	18%			
	> 70% roads asphalted	30%			
Public lighting	0% roads with public lighting	33%			

[1] NUTS0 level
[2] NUTS2 level

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SRS		Serbia[1]			
Housing conditions	Types	Belgrade region[2]	Vojvodina region	South and East Serbia region	Šumadija and West Serbia region
	< 30% roads with public lighting	14%			
	30 – 70% roads with public lighting	22%			
	> 70% roads with public lighting	31%			
Heating	No heating	1%			
	Gas	0%			
	Electrical heaters	2%			
	Solid fuel	97%			
Organized solid waste collection service	Exist	60%			
	No exist	40%			
Type of urban/spatial plan that covers the SRS area	Municipal spatial plan	50%			
	General urban plan	19%			
	General regulation plan	21%			
	Detailed regulation plan	10%			
Housing units in SRS in legalization process	< 30% units	80%			
	30 – 70% units	12%			
	> 70% units	8%			

Table 2: Housing conditions in SRS in Serbia: general overview of SRS characteristics by region

5.2.2 QGIS application

The concept of GIS application for monitoring the SRS housing conditions and decision-making for their improvement has been created using internationally accepted standards for data management, like ISO TC-211 and OGC standards, as well as open-source software advantages.

This approach allowed intensive usage of available Web technologies as well as creation of all technological functionalities required by the project stakeholders, like distributed multitier/client-server architecture; centralized administration and maintenance; intensive usage of Web and Web GIS services; and, usage of GIS data and services by number of distributed users simultaneously.

Conceptually, architecture of built GIS solution consists of standard DBMS, where intensive data editing and advanced analyses would be performed using GIS desktop application, while the SRS and other relevant data (Google maps, Bing and OpenStreetMap, and others) would be accessible directly both via Web and Desktop GIS applications. The architecture itself is open one, and thus would allow MCTI, as the project owner and main end-user of the SRS GIS application, to easily integrate data from the other databases, being them either in vector, raster or some other formats.

This openness and flexibility of GIS application has been achieved by implementation of OGC standards, like WFS and WMS, which allow sharing and integration for SRS relevant data from the other sources, i.e. databases. On this way, for example, RGZ's Registry of Spatial Units data are integrated within SRS GIS environment by available WFS service; also, orthoimagery data from RGZ's database are available via WMS service; and, relevant data from the Statistical Office of the Republic of Serbia are shared using implemented KML standard; etc.

Also, available DBMS administrative tools within developed GIS application would secure simple extension and scalability of the created SRS data model (5.1).

Finally, user interface of GIS application for SRS data management is in local –Serbian- language.

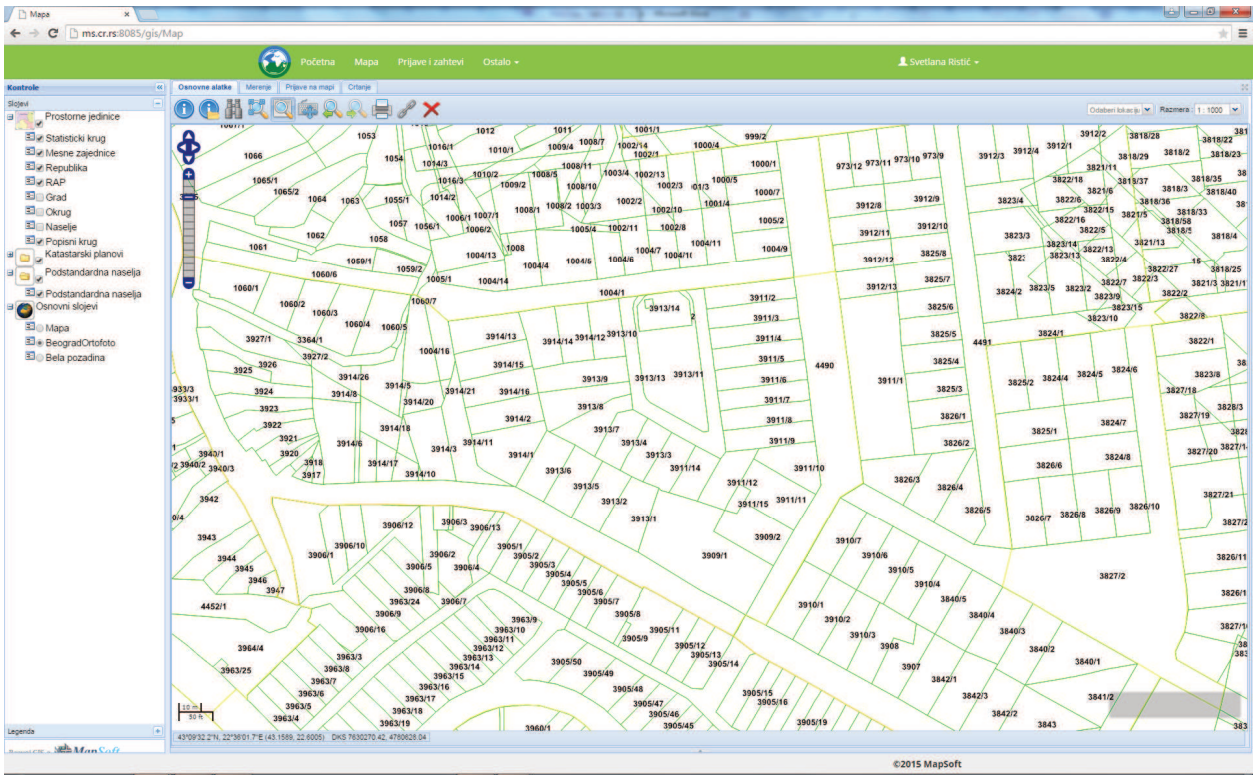

Fig. 3: Web GIS application for SRS housing and settlements conditions improvement: integration of geodetic maps data for SRS monitoring and decision-making (MapSoft, 2015)

Software platform for created concept of GIS application architecture is based on the several open source solutions today available:

- DBMS software: MS SQL Server 2014
- Desktop GIS software: QGIS
- Web GIS software: GeoServer, OpenLayers

On the technology side, taking into account current strict austerity measures of Serbian Government, implemented software platform would ensure next critical advantages:

- Free GIS software and minimal maintenance cost;
- Interoperability as well as compatibility with standard Web and GIS tools, data formats and software;
- Various analytical and visualisation tools available to many users at the same time;
- Simultaneous work with different data formats;
- Simple metadata administration;
- Easy roles and user rights administration; etc.

On the functionality side, in respect to the project aim of the housing conditions monitoring and improvement decision-making for the SRS in Serbia, it is expected that developed GIS-based information system would provide more benefits, such as: 1) implementation of basic spatial and attribute data analyses of the SRS data on the territory of the Republic of Serbia; 2) making informed and timely conclusions on the general status of these settlements and the living conditions of the Roma population in them; 3) proposing and adopting strategic/tactical decisions regarding further activities to be taken by the line ministry (today MCTI) towards affordable and sustainable housing solutions; and 4) identifying the detailed needs of these settlements, investment priorities and the scope of the necessary resources.

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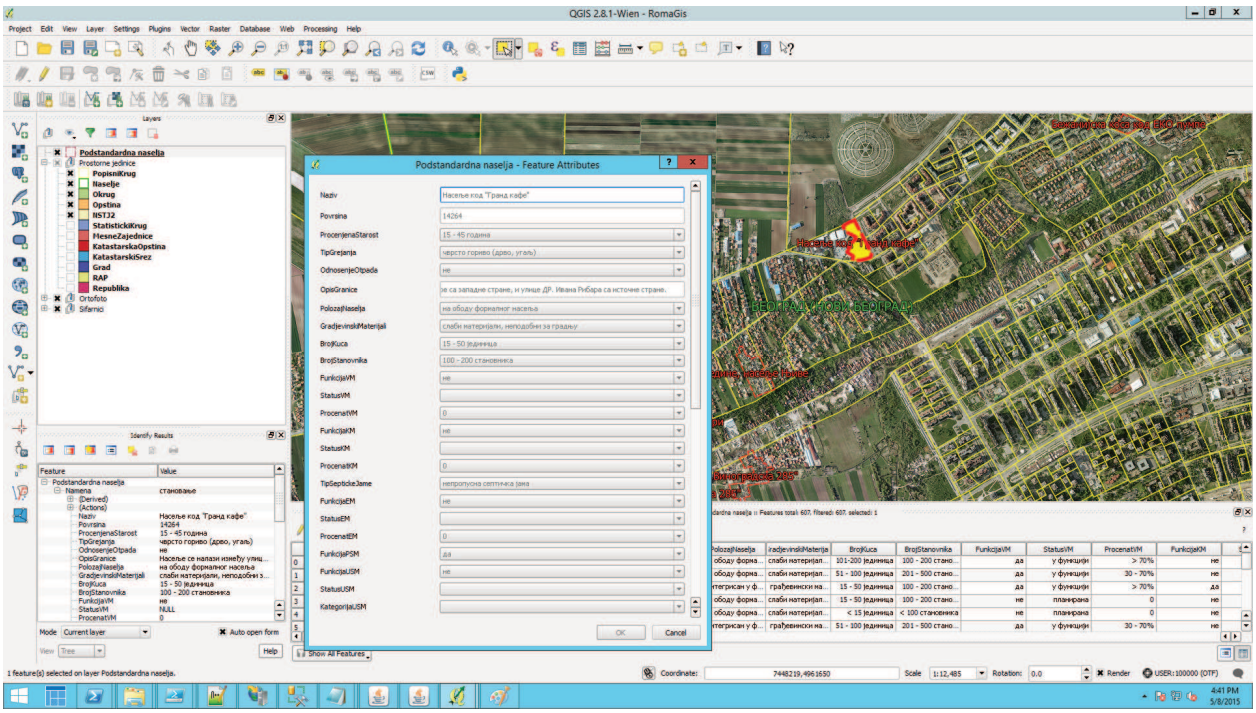

Fig. 4: Desktop GIS application for SRS housing and settlements conditions improvement: integrated vector and raster data for SRS monitoring and decision-making (MapSoft, 2015)

6 DISCUSSION

In line with the main project results presented in the previous chapter, as well as comparing them to the similar projects' results implemented before in Serbia, a number of advantages of the selected methodology can been identified. Some of these advantages include:

- Implementation of the applicable international and national data management standards, as well as open source software;
- Possibility of linking, sharing and/or integration SRS data with the other databases;
- Creating of first national GIS-based information platform on the SRS in Serbia;
- Possibility of a relatively simple replication of the project methodology for the other substandard settlements management in Serbia; etc.

The main disadvantages of the project results relate to the general character of collected SRS data, which are only estimations of selected housing conditions aggregated on the level of each individual SRS boundary in Serbia. This disadvantage is direct consequence of time and resources limitation of the project itself. Therefore, in future it should be launch new initiatives which would upgrade created GIS application to a more efficient and effective information platform, where housing conditions data within SRS would be more detailed and linked to each individual housing units (instead of SRS boundary data).

Also, amount and details of newly collected updated data and information on SRS demonstrate positive and collaborative attitude of the Roma community in supporting the increasing number of initatitives for improvement of currently poor living conditions of this minority in Serbia.

Additionally, first SRS data analyses revealed that majority of this type of settlements are integrated into the formal settlements and that are built from materials that guarantee durability and safety, which would enable their (SRS) easier legalisation and integration into the local public services system. This positive finding is further underlined by the fact that all SRS in Serbia are covered by at least one type of planning document, which would contribute to the smoother realisation of future investments in the Roma community living conditions improvement. This also means that participation of the Roma minority representatives in spatial and urban planning processes as well as local development policy implementation in Serbia could be intensified in future.

On the other side, preformed SRS data analyses showed also that Roma population in Serbia are missing some the basic utilities, where the worst situation is with a heating, water supply and sewerage system and services.

Also, in future, maintenance of created GIS application for SRS demands the establishment of an adequate and continuous process of monitoring, evaluation and updating of all categories of data that had been subject of collection activities under this project. The same applies to the implemented technology, which demands keeping the pace with new ICT solutions and advantages on market.

7 CONCLUSIONS

As part of its technical assistance to the Serbian Government in solving the problem of substandard living conditions of the Roma minority population in Serbia, the OSCE Mission to Serbia has supported creation of national GIS application for SRS within the project "We Are Here Together-European Support for Roma Inclusion: Mapping of substandard Roma settlements in GIS".

During several months period, the project team formulated and implemented the appropriate methodology framework, and developed conceptual SRS data model and GIS application with database for 583 identified SRS in the Republic of Serbia. This initial GIS-based information system for SRS in Serbia would be used for monitoring and evaluation of each settlement quality of life, as well as for making relevant development decisions and proposals for affordable and sustainable housing options for Roma community in the future.

This GIS platform, which today contains only basic and general information on the each individual registered SRS, should regularly be updated, developed and enlarged in future, increasing the detail and scope of collected data. Listed activities are critical for achieving improvement of the elementary infrastructure and superstructure in these settlements, as well as for Roma population in Serbia to gain equal rights in terms of their living conditions.

Besides the new initiatives for upgrading here developed GIS information platform in the future, definition of basic criteria and priorities for the investment decision in improvement of identified SRS categories in Serbia may be the subject of a new project as well.

Also, as part of new activities towards the development of SRS in Serbia, the line ministry could consider launching an initiative to define, design and build an integrated information system for the domain of substandard settlements in Serbia in general. This means applying the experience in collecting data gained during this Project onto other substandard settlements in Serbia, and creating a single GIS information system to serve for improvement of the living conditions and reduction of poverty for the most vulnerable social groups in Serbia -including refugees- in the future.

8 REFERENCES

OSCE Mission to Serbia: European Support for Roma Inclusion, Belgrade, 2013. http://www.osce.org/serbia/119495?download=true

OSCE Mission to Serbia: Support for the Integration of Roma, Belgrade, 2009. http://www.osce.org/serbia/35884?download=true

URL1: Prostorni plan Republike Srbije za period 2010-2020 godine, Belgrade, 2010. http://195.250.98.80/media/zakoni/Zakon_o_prostornom_planu_RS-cir.pdf

URL2: The Geneva UN Charter on Sustainable Housing, Geneva, 2015. https://www.unece.org/fileadmin/DAM/hlm/documents/Publications/UNECE_Charter_EN.pdf

URL3: Strategy on Improvement of the Status of Roma in the Republic of Serbia, Belgrade, 2009. http://www.inkluzija.gov.rs/wp-content/uploads/2010/03/Strategija-EN-web-FINAL.pdf

JOVANOVIĆ, Slađana and BU, Robert: A study assessment of the situation in substandard Roma settlements in 21 municipalities in Serbia, OSCE, 2014. http://www.osce.org/serbia/162221?download=true

ŽIVKOVIĆ, Ljiljana and ĐORĐEVIĆ, Aleksandar: General characteristics of substandard Roma settlements in Serbia and a proposal for further development initiatives for the improvement of the living conditions of the Roma community, Belgrade, 2015. http://www.osce.org/serbia/159711?download=true

VUKSANOVIĆ-MACURA, Zlata: The mapping and enumeration of informal Roma settlements in Serbia, London, 2012. http://eau.sagepub.com/content/24/2/685.full.pdf+html

JAKŠIĆ, Božidar and BAŠIĆ, Goran: Umetnost preživljavanja: gde i kako žive Romi u Srbiji (The art of survival: where and how Roma live in Serbia), Institute for Philosophy and Social Theory, Belgrade, 2005.

MapSoft: GIS softver za podstandardna romska naselja, PowerPoint presentation, Belgrade, 2015.

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