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THE INFORMATION SYSTEM FOR THE REALIZATION OF REHABILITATION PROJECTS

BY

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Abstract. In order to optimize the process of rehabilitation of residential buildings, it is necessary to create a national database that allows the identification of buildings according to the parameters that define it. Within this study, a database was created for the Areni Neighborhood from Suceava Municipality, Suceava County, using the Microsoft Office Access program that helped classify buildings according to a number of defining criterion and sub-criterion. The results obtained were presented graphically using topographic plans and orthophotographic plans.

Keywords: database; residential buildings; neighbourhood; information; Suceava.

1. Introduction

The decision to rehabilitate one or more residential buildings involves a series of technical, organizational, economic, administrative, etc. actions that set

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in motion a complex gear trough which there are organized and used adequate resources in a structured and controlled manner established in the context of a set of constraints (terms, costs, quality requirements, etc.).

In this respect, it is necessary to know and apply a set of coherent and ordered procedures that are based on a good analysis and use of the information regarding the various technical, economic, investment, legislative, management, specific characteristics of the realization of the rehabilitation projects.

2. Information System for the Implementation of Rehabilitation Projects

In order to be able to solve the aforementioned problems, the persons involved in the implementation of the rehabilitation projects have to use two important requirements: knowing and acting competently. These two requirements are materialized in:

• being permanently informed about the technical, economic, risk, energy, etc. factors, specific to the implementation of rehabilitation projects;

• having information structured on categories and levels of importance, used regarding possible methods of execution under technical and economic conditions.

In view of the above, it can be stated that the elaboration and execution of a rehabilitation project implies the use of a complex information system due to the diversity of the actions and the component stages.

An information system consists of all the methods and tools used for collecting, recording, transmitting as well as processing and capitalizing of the information needed to carry out a rehabilitation project, thus ensuring the transmission of information from decision makers to all operational levels.

Such a system consists of the following elements:

• **Information source -** represents the set of data used to design a construction project in all component stages;

• **Data -** represents the set of descriptions of a phenomenon, stages or action, constituting the input components in processing and which by conversion becomes information;

• **Informational circuits** - represents all the connections between different stages of the actions within a rehabilitation project;

• **Information flows** - represents the totality of the information flowing through the information circuits;

• **Information procedures -** represents all methods and techniques of representation, querying, ordering of data;

• **Information management tools -** the data of all equipment and software products that process and obtain the final information.

Due to the complexity and diversity of actions and processes that characterize the realization of a rehabilitation project, it is necessary to have extensive and well-established information sources that allow quick access and the possibility of making rigorous decisions related to the project implementation.

- Databases reflect the pattern of the data contained. Three database models are known:
- Tree structure;
- Network type;
- Relational.

The database in tree structure (Figure 1) operates with elements that have hierarchical subordination relationships (1 - n) so that each element is hierarchically subordinated to a single element, and subordinates one or more elements.

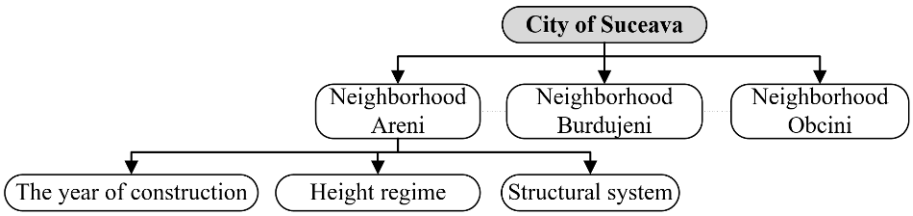


Fig. 1 – Database in „Tree" structure.

The network type database (Fig. 2) provides links of any kind between elements (1 – 1, 1 – n, n – m) so that any element can be directly linked to other elements.

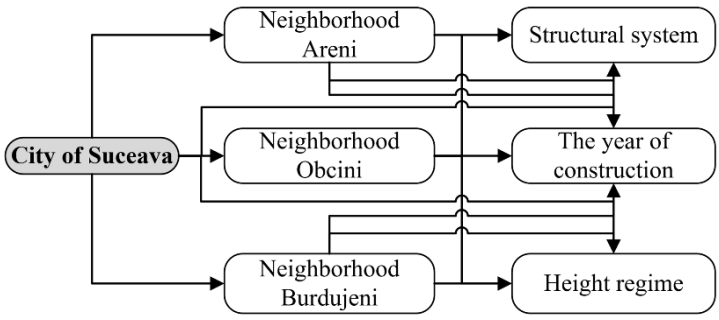


Fig. 2 − „Network" type database.

Relational database (Table 1) are databases in which elements are two-dimensional tables that have a structure of attributes, records, domains, and

values. Easy and error-free management is done using tables with a normal shape.

Table 1

„Relational" Data Base

Cod	City
SV	Suceava
VD	Vatra Dornei
GH	Gura Humorului

Cod	Neighborhood
BJ	Burdujeni
AR	Areni
OB	Obcini

In practice, the relational model has been imposed in the face of the above-mentioned ones because of the more practical approach.

There is a software level between the database and system users, called Database Management System (SGBD) - (Database Management System). A computerized database can be generated and maintained either by a group of application programs specific to this purpose or by SGBD (Fig. 3).

The Database Management System (SGBD) is an application interpreter, receiving from the users requests for access to the database, interpreting them, executing those operations, and returning the result to users.

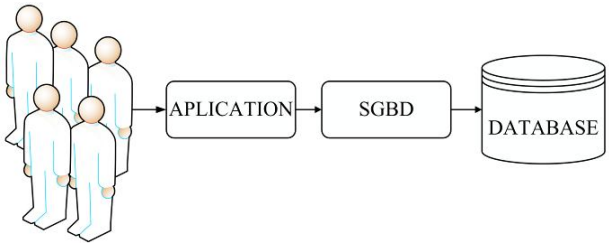


Fig. 3 − Components of the database system.

In order to optimize the rehabilitation methods, we propose the creation of a database at the level of local or central public administrations, comprising two types of data: written data (user-filled) and documents (files uploaded by users) (Fig. 4).

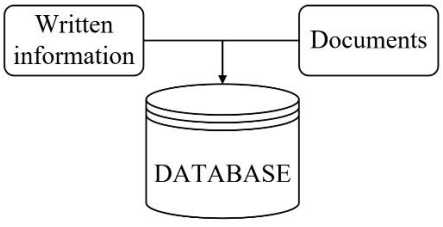


Fig. 4 − Content of databases.

With the help of such databases, the information can be easily managed and reports on the status of the existing built-up fund can be obtained, reports that are needed to make the rehabilitation decision.

The databases can be made in different software programs, the most common being:

- Microsoft Office Acces;
- Microsoft VisualFoxPro;
- OpenOffice.org;
- Microsoft SQL Server;
- ORACLE Database.

2.1. Classification Criteria for Existing Residential Dwellings

Residential buildings can be classified according to all the parameters that define it and participate in its conception, design, execution, operation and post-use, and aims at grouping buildings according to a set of criterion and sub-criterion and obtaining the necessary information in the rehabilitation process. For the classification of residential buildings, we propose the following basic criteria, as shown in Fig. 5.

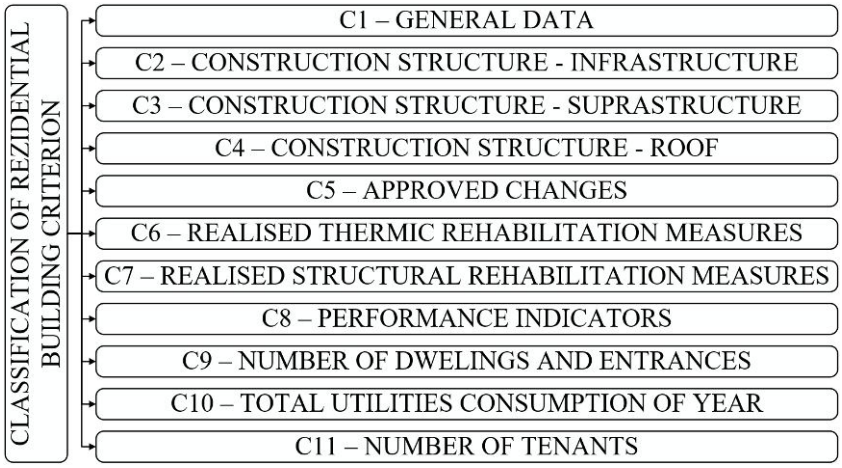


Fig. 5 − Classification of residential buildings criterion

Each criterion in the main structure is composed of other sub-criterion, which in turn, if wanted, can be detailed to the desired level of precision. In the proposed study, a level 1 breakdown of the criteria in Fig. 5 was made, for which we proposed a set of sub-criterion as shown in Table 2.

Table 2

Criterion and sub-criterion for the classification of existing residential buildings

C1	GENERAL DATA	C5	APPROVED CHANGES
C1.1	Height regime	C5.1	Destination changes
C1.2	Number of underground levels	C5.2	repartitioning
C1.3	Height of the underground floor	C5.3	Horizontal expansions
C1.4	Height of the ground floor	C5.4	Vertical expansions
C1.5	Current floor height	C5.5	Thermal rehabilitation
C1.6	Height of the superstructure	C5.6	Structural rehabilitation
C1.7	Country name	C6	REALISED THERMAL REHABILITATION MEASURES
C1.8	Name of the county	C6.1	Heat-efficient exterior carpentry
C1.9	Municipality / city name	C6.2	Surface of thermo-insulated exterior walls
C1.10	Neighborhood name	C6.3	Surface of the floor surface thermal insulation
C1.11	Street name	C6.4	Floor area over the last insulated layer
C1.12	Street number	C6.5	Type of joinery used on exterior walls
C1.13	Building number	C6.6	Type of thermal insulating material used in the walls
C1.14	Year of construction	C6.7	Heat insulating material used on the floor above the ground
C1.15	Type of dwelling	C6.8	The type of thermal insulating material used on the floor over the last level
C1.16	Built-up area	C6.9	Total value of thermal rehabilitation works
C1.17	Perimeter of the building	C6.10	Initial energy class
C1.18	The class of importance	C6.11	Price of exterior joinery per square meters
C1.19	Category of importance	C7	REALISED STRUCTURAL REHABILITATION MEASURES
C2	CONSTRUCTIVE STRUCTURE - INFRASTRUCTURE	C7.1	Initial Class of seismic risk
C2.1	Type of foundation system	C7.2	Consolidation method used
C2.2	Type of foundations	C7.3	Designed explotation duration
C2.3	Material type	C7.4	Duration of rehabilitation works
C2.4	Nature of the ground foundation	C7.5	Total value of consolidation work
C2.5	Conventional pressure	C8	PERFORMANCE INDICATORS
C2.6	Plastic pressure	C8.1	Seismic risk class
C2.7	Geotechnical risk	C8.2	Energy class
C3	CONSTRUCTIVE STRUCTURE - SUPRASTRUCTURE	C8.3	Performance class
C3.1	Structural system	C9	NUMBER OF DWELINGS AND ENTRANCES
C3.2	Rigidity of the floors	C9.1	Number of entrances
C3.3	Floor types	C9.2	Number of studio apartments
C3.4	Layout of structural vertical elements	C9.3	Number of 1-room apartments
C3.5	Ceramic elements type	C9.4	Number of 2-room apartments
C3.6	Type of mortar	C9.5	Number of 3-room apartments
C3.7	Brand of the masonry	C9.6	Number of 4-room apartments
C3.8	Brand of the mortar for masonry	C10	TOTAL UTILITIES CONSUMPTION OF YEAR
C4	CONSTRUCTIVE STRUCTURE - ROOF	C10.1	Electricity
C4.1	Roof type	C10.2	Hot water
C4.2	Terrace type	C10.3	Cold water
C4.3	Surface of the Terrace%	C10.4	Methane gas
C4.4	Waterproofing protection	C10.5	gigacalories
C4.5	Type of waterproofing protection material	C10.6	The year
C4.6	Loft type	C11	NUMBER OF TENANTS
C4.7	Number of slopes	C11.1	Average number of tenants
C4.8	Loft Thermal comfort	C11.2	Year
C4.9	roof framing type		
C4.10	How to use the loft		
C4.11	Cover type		
C4.12	Thermal insulation layout in the loft		
C4.13	Floor area%		
C4.14	Attic Surface%		

The matrix for detailing the criterion in sub-criterion is as follows:

$$C1 = \begin{pmatrix} C1.1 \\ \vdots \\ C1.n \end{pmatrix} \quad \text{where,} \quad C1.1 = \begin{pmatrix} C1.1.1 \\ \vdots \\ C1.1.m \end{pmatrix} \tag{1}$$

where: C1 – name of the selection criterion; C1.1 – name of the selection sub-criterion.

2.2. Managing Technical Books for Buildings Using Databases

The technical books for buildings consists of the whole set of documents relating to the design, execution, reception, operation, maintenance, repair and follow-up of the construction behavior in operation, which the investor made available to the reception committee.

The technical book for buildings contains the basic documentation and the centralizer with its component parts as well as, in the absence of any parts thereof, all technical and economic documents - reports, technical expertise or documentation drawn up for the purpose of delimiting on objects / parts of objects, drawn up in viewing single-phase reception.

The basic documentation includes the following chapters:

• Chapter A: Design documentation;
• Chapter B: Execution Documentation;
• Chapter C: Technical Documentation on Reception;
• Chapter D: Technical documentation on tracking in-service behavior and the interventions on the construction.

The way of keeping and archiving the technical book used in urban planning departments is done in physical form, on paper, a situation that hinders access to information and in some cases has led to the destruction, deterioration or loss of documents. In order to optimize rehabilitation methods, access to information should be made easily using modern data management tools (Fig. 6).

Fig. 6 − Methods of management of technical books for building.

The proposed optimization method consists of creating a database for the completing the database with the documents related to the permitting phase and the chapters A, B, C and D of the technical building book.

Access to this information should be allowed to persons involved in the assessment and rehabilitation of existing buildings. Such a measure will allow the assessment and rehabilitation of residential buildings to be shortened.

The structure of the proposed database for managing existing fund information is shown in Fig. 7.

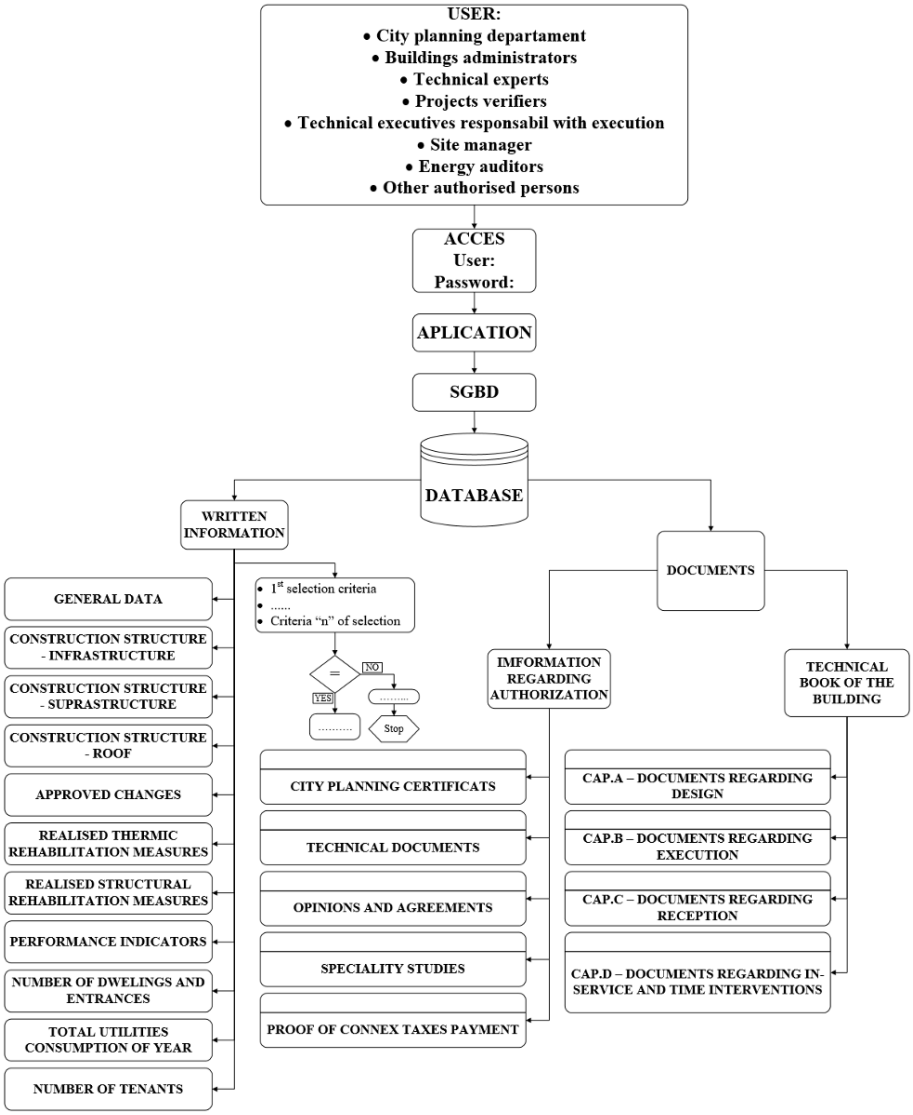


Fig. 7 − Database structure for managing information on built – up fund.

3. Classification of Residential Buildings in Suceava Municipality, Areni Neighborhood, Suceava County Using Databases

In order to optimize the methods of assessment and rehabilitation of residential buildings, we propose a relational database in the Microsoft Office Access program, which includes 11 evaluation criteria according to Fig. 8.

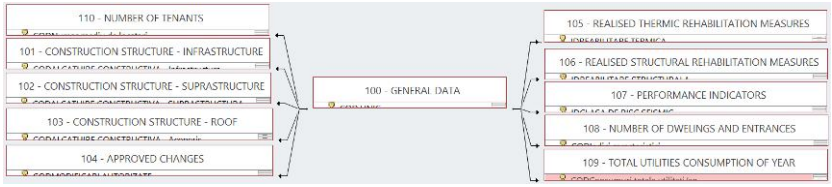


Fig. 8 − The structure of the existing building database and the relationship between the tables.

The relationship between the database tables of each building must be defined by a unique code so that the information can be transmitted between the tables. It therefore proposes, for the correct identification and avoidance of errors, a unique number defining each building individually. This number, as in the case of PIN or vehicle registration numbers, will be unique and will no longer be found at another building on the territory of Romania. The proposed number will be as in Fig. 9, being composed of two codified codes, namely "alpha 2 code" of Romania according to SR EN ISO 3166-1: 2002 "Code for the representation of country and subdivisions. Part 1: Country Codes "and county code according to" auto indicator for counties ". These two codes are filled in with the proposed codes for municipalities/towns, neighborhoods, and at the end of a number starting with 1 in each neighborhood. This will provide a unique code that will no longer be found in any other building on the territory of Romania, which will allow the creation of a national database.

Country indicative (*Ex.:România*)	**County indicative (*Ex.:Suceava*)**	**Mun./City indicative (*Ex. Suceava*)**	**Neighborhood indicative (*Ex.:Areni*)**	**Order number (*Ex. 1....n*)**
RO	**SV**	**SV**	**AR**	**1**

Fig. 9 – The structure of the unique code for residential buildings.

Within the research area it has been chosen the Areni Neighborhood from Suceava Municipality, Suceava County, for which 63 unique codes for residential buildings were proposed: ROSVSVAR01 → ROSVSVAR63.

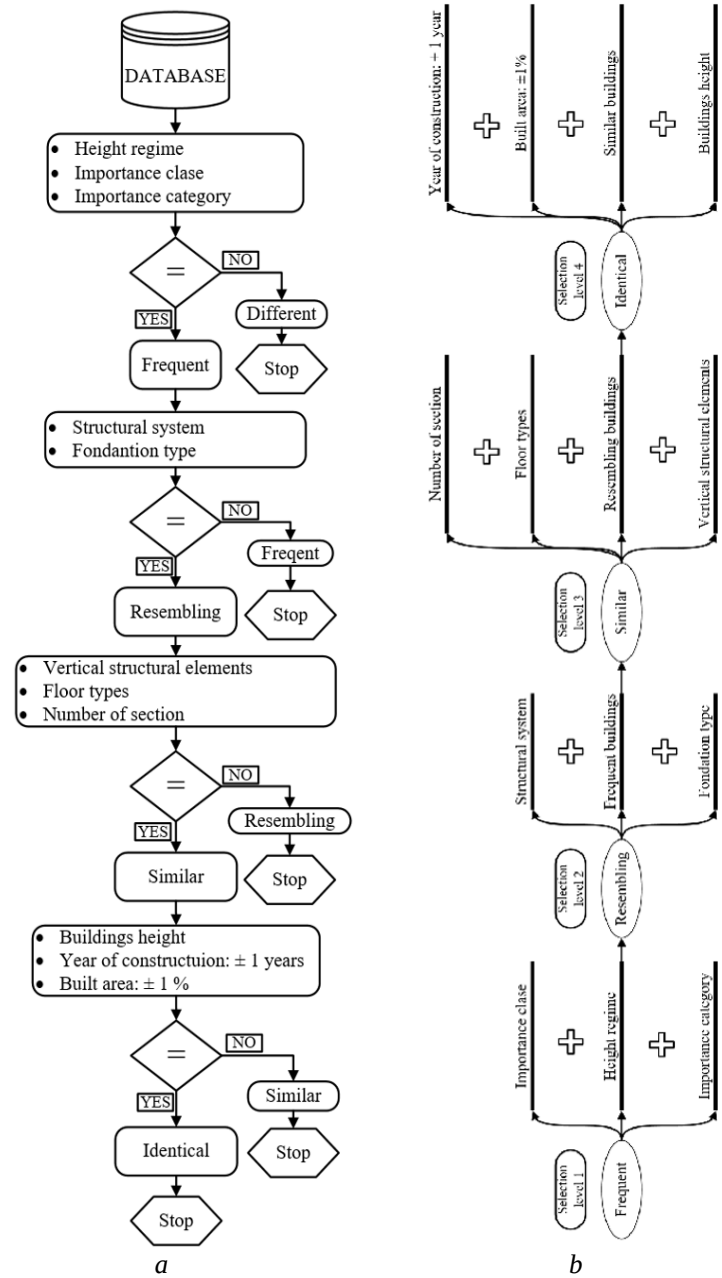
For the realization of the database a situation plan of the Areni Quarter (Fig. 10) was made with the help of which the built-up surfaces and the perimeters of the buildings were obtained, including their positioning in the field and the surface areas between them. The topographic information along with the information obtained from the fieldwork allowed us to obtain the data necessary to complete the database sub-criterion.

Fig. 10 – Situation plan for Areni Neighborhood from Suceava Municipality, Suceava County.

To optimize the rehabilitation process, it is proposed to identify and group buildings according to common criterion and sub-criterion. In Fig. 11, we propose the logical diagram and the sub-criteria that characterize a building, necessary to identify buildings with the same structural characteristics. Within the logic scheme, five building clustering methods have been proposed according to the common sub-criterion, namely:

- Different buildings;
- Frequent Buildings;
- Resembling buildings;
- Similar buildings;
- Shared buildings.

By applying the level 1 selection, all the collective buildings with equal values of the sub-criterion (height regime, importance class and importance category) are determined. If one of the sub-criteria is not equal, the buildings are considered "different" and if all the sub-criterion are equal, the buildings are considered as "frequent" collective buildings, or frequently encountered. By using the selection criteria, other types of reports can be obtained, parameterized according to the user's requirements.



a *b*

Fig. 11 – *a* – Logical scheme for grouping residential buildings; *b* – Sub-criterion for Grouping Residential Buildings.

The results of applying the four levels of selection are presented graphically in Figs. 12 and 13. By integrating the proposed database with the

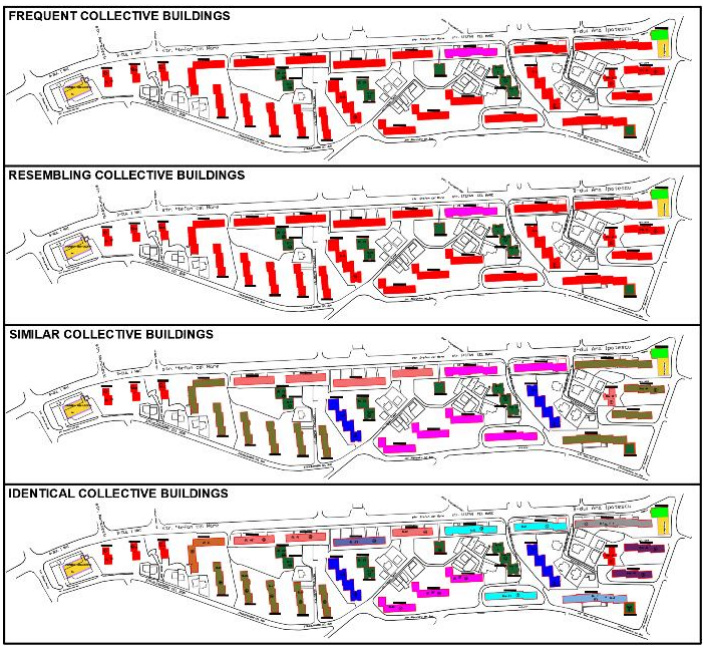


Fig. 12 – Representation of buildings according to the degree of similarity.

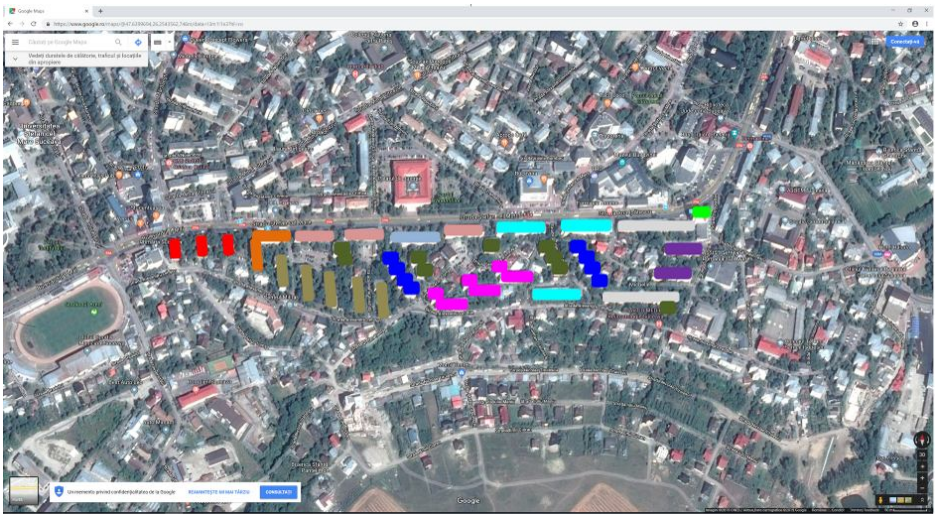


Fig. 13 – Representing identical buildings using the Google Maps platform

Google Maps platform or other similar platforms, you can get orthopedographic representations of the results of the user selection criteria. Such representations create a general or local overview of the situation of existing residential buildings at the level of an urban locality.

4. Conclusions

The current way of managing information on existing buildings does not allow the rapid extraction of the necessary information in the assessment and rehabilitation of residential buildings. It is therefore necessary to create a national database that allows the classification of buildings and the view of the information about them. This will lead to the optimization of the assessment and rehabilitation process of the existing built-up fund.

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INFORMAŢIONAL SPECIFIC REALIZĂRII PROIECTELOR DE REABILITARE

(Rezumat)

Pentru optimizarea procesului de reabilitare a clădirilor rezidenţiale de locuit se impune crearea unei baze de date la nivel naţional care să permită identificarea clădirilor în funcţie de parametrii care o definesc. În cadrul studiului s-a realizat o bază de date pentru Cartierul Areni din Municipiul Suceava, Judeţul Suceava utilizând programul Microsoft Office Acces cu ajutorul căruia s-au clasificat clădirile în funcţie de o serie de criterii şi subcriterii de clasificare definitorii. Rezultatele obţinute s-au prezentat grafic utilizând planuri topografice şi planuri ortofotografice.