

ANALYSIS OF THE TERRITORIAL ACCESSIBILITY MODEL IN ALBA IULIA MUNICIPALITY

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Abstract: *One of the reasons for the elaboration of this work is the desire to implement modern methods and techniques of cartographic analysis in order to obtain results that express both visually and in terms of value the level of accessibility of the population to various public administrative institutions in Alba Iulia, as well as their ability to act in different situations.*

This is why we consider it appropriate and topical to carry out a study that classifies a specific geographical area into a certain risk category in terms of accessibility to a specific emergency situation.

Keywords: *GIS, Geomatics, Network Analyst, Proximity, Database, Facilities, Service Area*

1. Introduction

GIS (Geographical Information Systems) technology has in recent years become increasingly popular and used in a multitude of fields because most human activities have spatial location as an important element.

Today, integrated GIS solutions applied in administration provide spatial functionality, uniform standards, reliable and interoperable databases between the administrative institutions that manage them, leading to better governance and ease in making the right and quickest decisions, in the optimal time.

2. Materials and Methods

The database creation

The main source of input in performing spatial network analysis and applying useful models for calculating service areas in the vicinity of administrative institutions is vector databases.

In order to obtain a correct analysis, it is necessary to design a database that meets the requirements of the conceptual model structure. The correctness of this depends on the correctness of the results obtained and, consequently, on the measures to be taken by the decision-makers in the administrative institutions.

The creation, organization and management of the data was done in the Arc Catalog module and the editing of the data - in Arc Map. For good management all vector structures in the project are stored in object-relational databases. The attached attribute table will contain information about street names, street profile, component elements, arterial category, technical details, traffic information, regulated property, etc.

An important point to bear in mind is that the vector structures representing the street network must be continuous for the purpose of spatial editing and must not overlap with themselves.

In the development of spatial network analysis models with application in administration it is necessary that the attribute table also contains information on the length of the vector segments expressed in metres, the average speed of travel on certain road segments expressed in km/h and the travel time of each road segment expressed in minutes.

Name of the database	Structure	Type	Attribute
Street network	vector	line	Length(m) Travel speed(km/h) Travel time (minutes) One-way
Intervention services	vector	point	Service name
Route points of interest	vector	point	Building numbers
Education	vector	point	Educational units
Traffic restrictions	vector	line polygon	Type of restriction

Table 1 Database structure

Selection of points of interest

The operation of the SMURD service is based on the collaboration between the Emergency Situations Inspectorate "UNIREA" of Alba County and the Emergency Reception Unit of Alba County Emergency Hospital. The ALBA County Ambulance Service is permanently at the disposal of the inhabitants of Alba County and has the capacity to provide transport and emergency medical assistance in optimal conditions. As I have already pointed out, emergency situations are problems of today's society, problems that cannot be avoided and that have a certain degree of difficulty, depending on a number of factors.

Generating map products that expose service areas can help to solve some of the problems imposed by certain restrictions or barriers.

Graphical visualisation can help decision-makers in administrative institutions to take action to improve these critical services. Time is often of the essence in these situations, a few minutes can mean the difference between life and death.

We have also chosen to study school establishments because they involve a large number of children, the very people most important to us, whose lives and safety are paramount. House numbers also play an important role, we believe, because all these emergency services use the address as a landmark, with incidents being located by address.



Fig. 1 Display of points of interest - emergency services

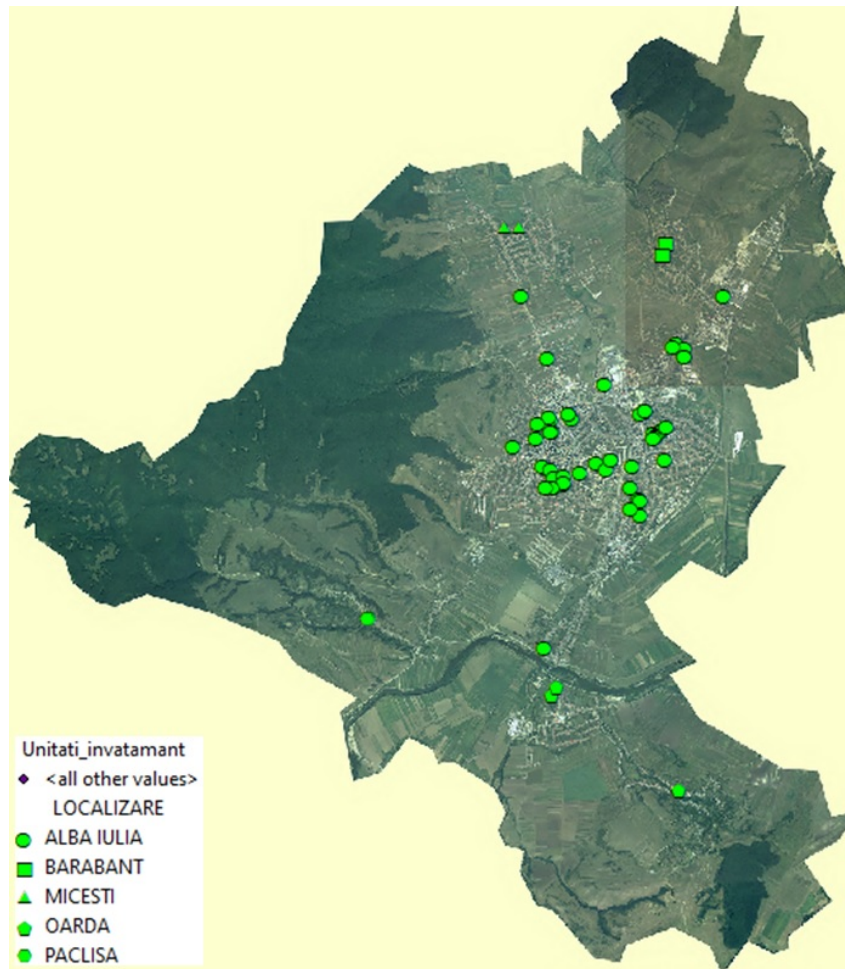


Fig. 2 Display of points of interest - educational establishments

Development of the territorial accessibility model

Using the Network Analyst extension - Service Area function within the ArcGIS geoinformation package, it is possible to evaluate territorial accessibility and determine service areas according to the points of interest taken into analysis and the infrastructure on which accessibility is made, according to a variable considered as cost. This variable considered can be time or distance.

Name of the database	Structure	Type	Attribute
Street network	vector	line	Length(m) Travel speed(km/h) Travel time (minutes) One-way
Intervention services	vector	point	Service name
Educational establishments	vector	point	Location of school units Name of school units

Table 2 Database structure of Service Area

When accessing the New service area function, the software automatically creates its own database structure. This unpopulated structure will be used to support the accessibility analysis, which is structured into categories according to their role in the analysis.

The first category is represented by facilities, the databases used for spatial identification of targets for which accessibility analysis is performed. Within this category three distinct types of facilities are identified: Error-identified facilities representing facilities as a vector, point database, for which errors were identified when loading into the extension, Location-identified facilities representing facilities as a vector, point database, which will be considered in the accessibility analysis, and Unlocated facilities representing facilities as a vector, point database, which will not be considered in the accessibility analysis for various reasons (they are located far from the road network, etc.).

The second category is databases used to impose traffic restrictions on certain road sections or roads, using vector databases. Traffic restrictions on specific road sections or roads can also be included in the accessibility identification model by means of Point Barriers, Line Barriers or Polygon Barriers databases. Each of these constraints can be divided into several categories, depending on the type of constraint and the impact of that constraint within the spatial analysis model.

A very important category in terms of the structure of the unpopulated databases, automatically created by the program when the Service Area function is accessed, is the category of databases that will store the results of the network analysis model run. In the Lines category will be stored databases representing streets for which a certain average access time has been calculated, in the Polygons category will be stored the polygon vector database, representing territorial areas with a certain access time, calculated from the facilities considered.

Since the automatically created database is unpopulated with vector spatial data, for running the model it must be filled with the required data.

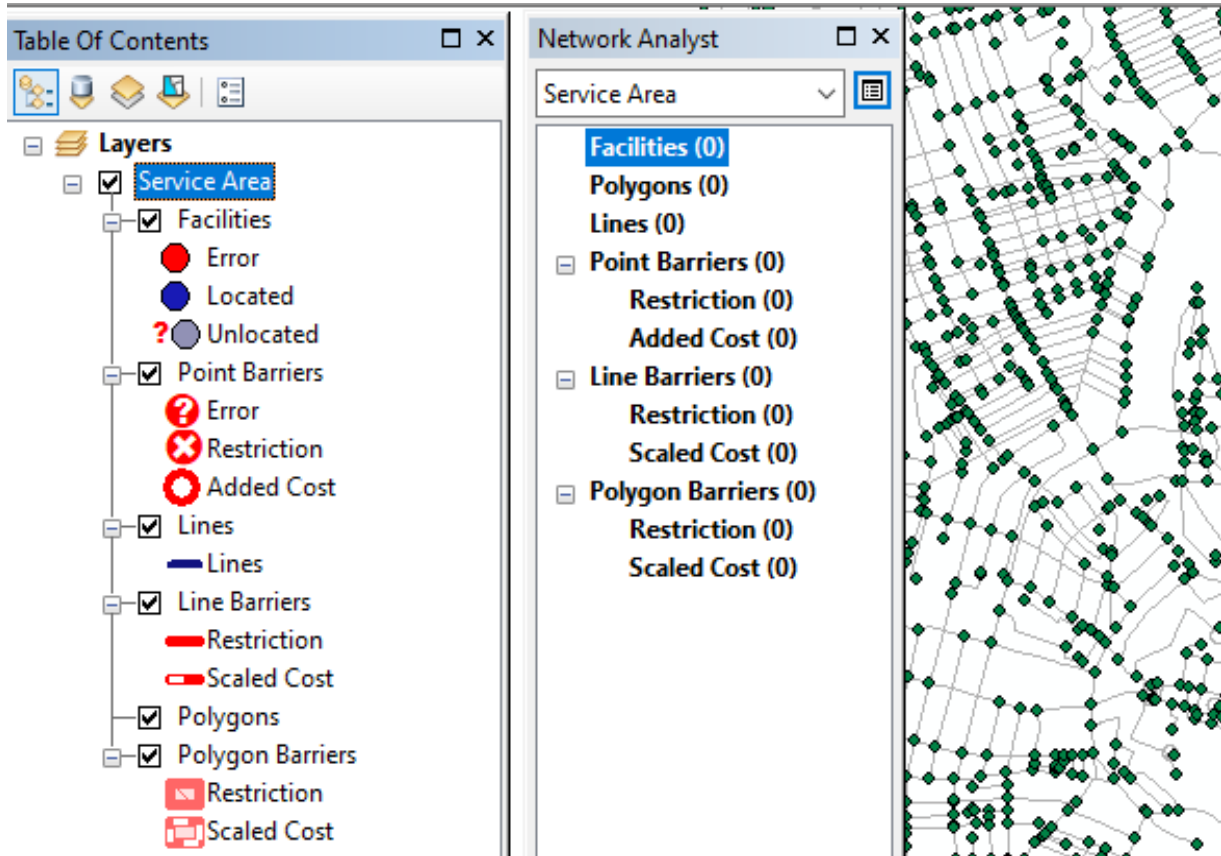


Fig. 3 Network analyst window-New Service Area

The parameters concerning the creation of the service area in the vicinity of the points of interest studied, namely in the first case the Alba Ambulance Service (referred to in the project as Ambulanta) and SMURD Alba (referred to as SMURD) are the impedance, the traffic restrictions related to one-way traffic, the direction of analysis and the ways of representing the results.

3. Results and Discussion

The results of the analysis are automatically saved in a spatial vector database of line and polygon type, made when accessing the Service Area function under the Lines and Polygons category. Thus, within 1-3 minutes a large part of Alba Iulia municipality can be served, namely the central area of the city and the neighbouring village Bărabanţ.

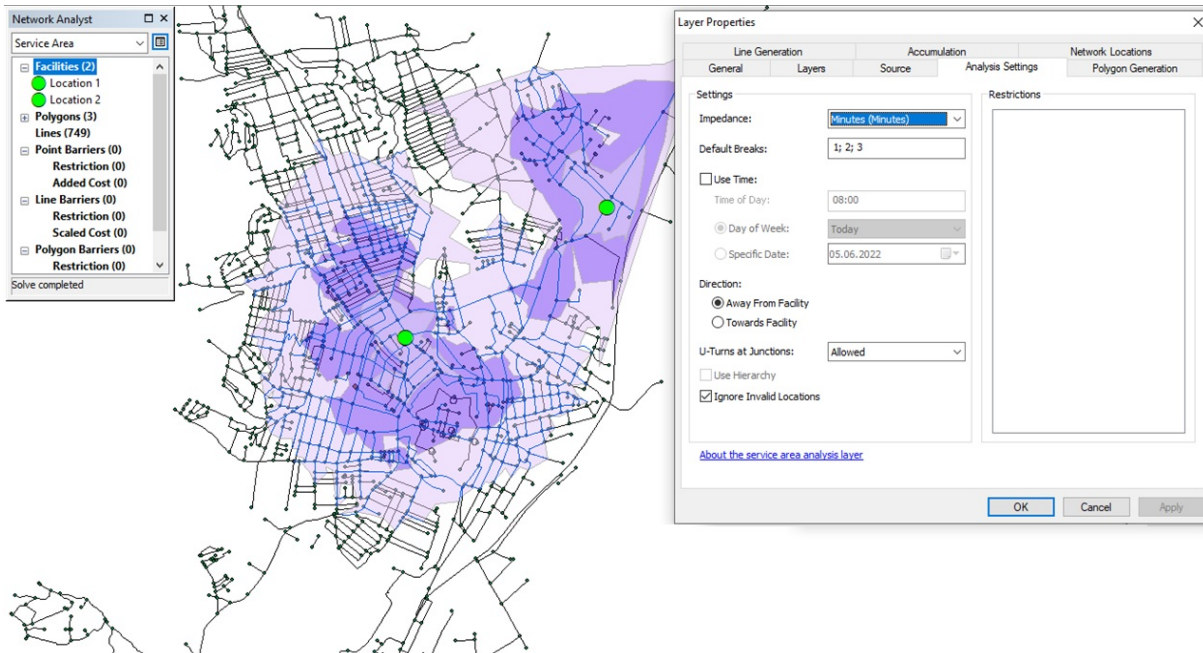


Fig. 4 Service Area analysis result for 1,2,3 minutes interval

Within 5 minutes it serves almost the entire municipality of Alba Iulia (except for a few streets in Partoș) and Micești (except for a few more distant streets), the entirety of Bărăbant and a small part of Oarda and Pâclișa.

If we superimpose the educational units on the map, we can see that 6 locations can be reached in 1 minute, and almost all of the analysed locations can be reached in 5 minutes, but the educational units in Oarda, Pâclișa and Partoș remain problematic.

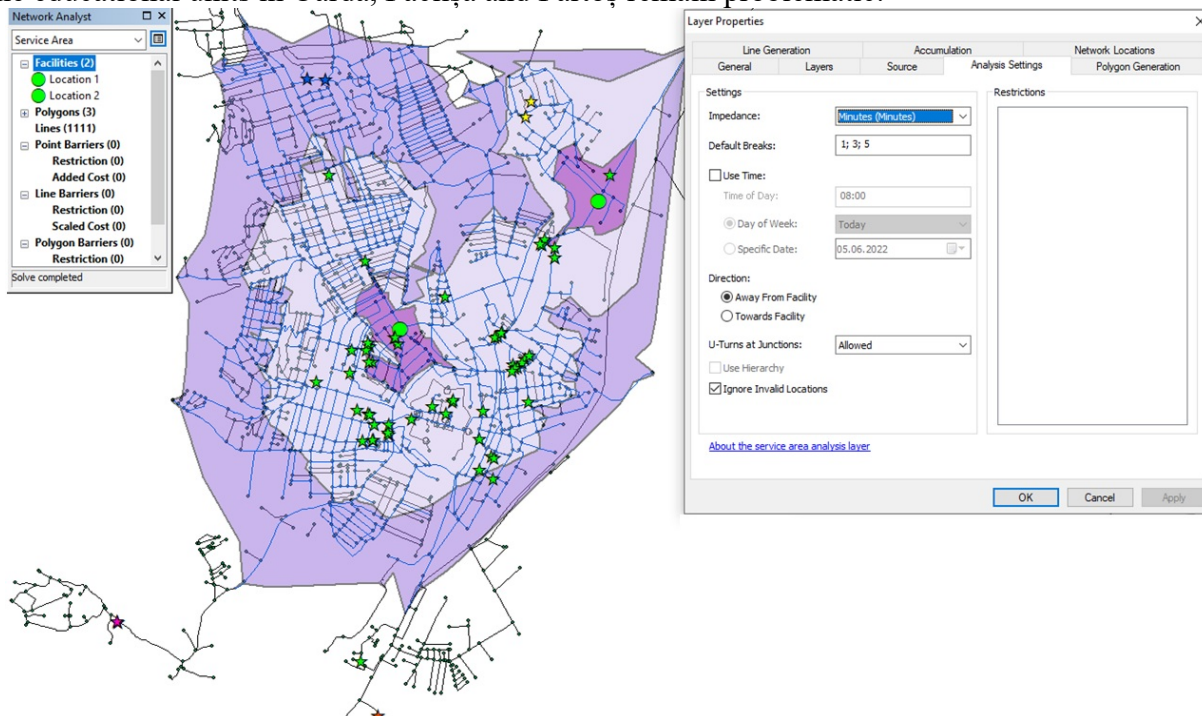


Fig. 5 Service Area analysis result for 1,3,5 minutes interval

As can be seen from the figure below it takes 15 minutes for an ambulance or SMURD crew to reach Oarda, Pâclișa and part of the Partoș district.

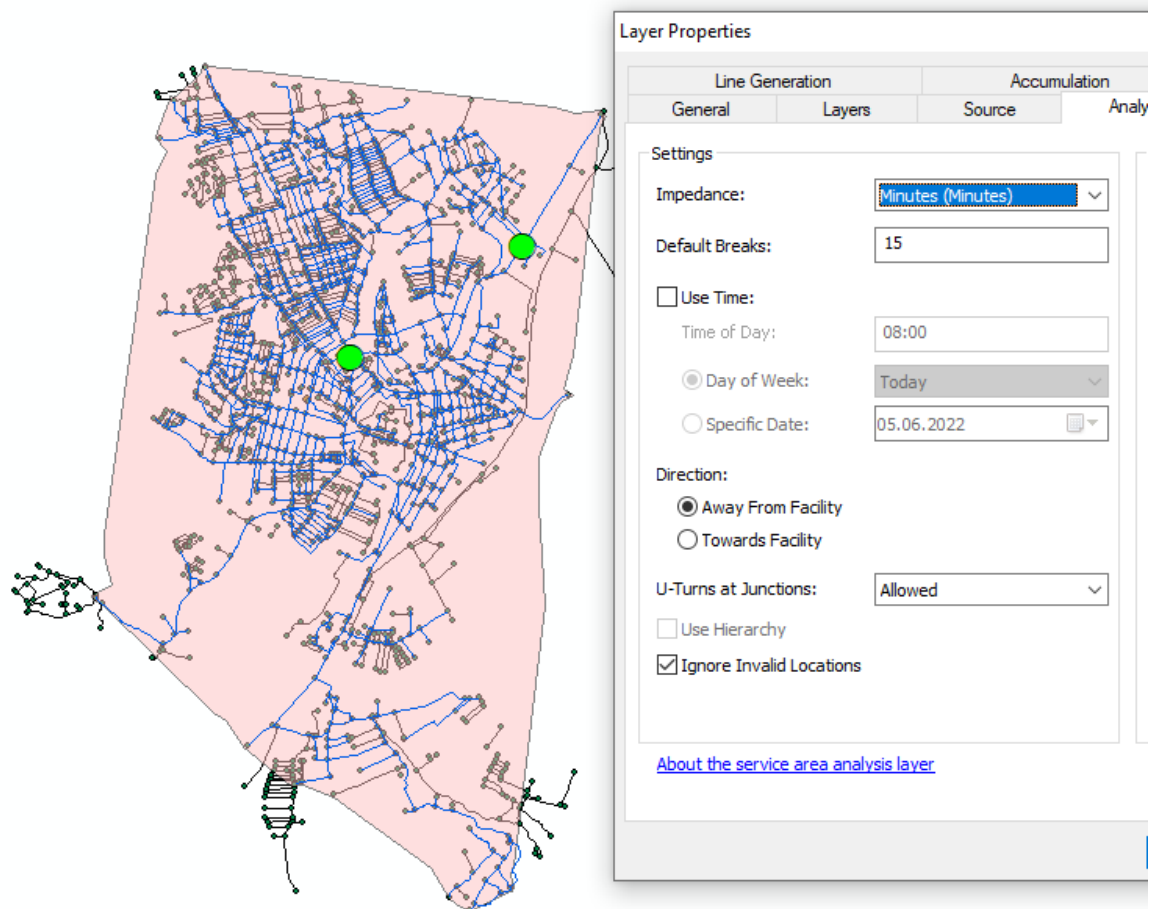


Fig. 6 Service Area analysis result for 15 minutes

4. Conclusions

The objectives of this work are to generate cartographic products that show the service areas in the vicinity of the ALBA County Ambulance Service and the Alba Iulia SMURD service. On the basis of these data, it is possible to analyse the different strengths or weaknesses of their geographical location and the area they can serve in a given timeframe and to make decisions that can make these services more efficient.

The database on streets within the study area is not complete, as the exact condition of the roads is not fully known. Also, the deteriorated condition of the roads in certain sectors or various works on the road infrastructure, blockages due to various causes or bad weather conditions may prevent the speed taken into account in the analysis from being reached. Subject to the shortcomings presented in this study, consultation of this material by decision-makers in administrative institutions may help them to take measures to improve these services of major importance to the population.

5. References

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