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STUDIES ON THE IMPLICATIONS OF CHANGING PUBLIC TRANSPORT COMPANY HEADQUARTERS IN THE CITY OF SIBIU

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***Abstract*—**The paper summarizes important economical and environmental implications and some advantages and disadvantages of relocating the Tursib headquarters out of the city. Tursib SA is the urban transport company in Sibiu. Sibiu has had an economic, social and touristic continuous development. Urban transport is one of the main factors in developing activities that are dedicated to integration in the European Community. There are being considered data about a new infrastructure, reducing chemical and noise pollution, traffic decongestion and the possibility to use the highway to reach the end of lines. The entire problem can be integrated into the concept of sustainable transport system. One of the main factors defining sustainable cities is their modern public transportation.

***Keywords*—**decreasing pollution, infrastructure, sustainability, urban transport

I. INTRODUCTION

SIBIU was the European Capital of Culture in 2007. A few years before, and since then, the city has had an economic, social, cultural and tourist unprecedented development. New industries were created, the historic area was completely rehabilitated, big trading centers have been opened, tourism has increased considerably and the airport has also developed its activity. As a result, public transportation in Sibiu has been affected, and thus reconsidered, extended and optimized.

It is well known that every city has public transportation problems and that great resources (material, human, informational, economical) are being involved to optimize various transportation problems (Reliability, Frequency Speed, Accessibility, Price, Lack of information, Vehicle condition, Comfort, Aesthetics).

While environmental problems are of strategic nature all over the world, public transportation (PT) in addition to cycling and walking is agreed to be a sustainable alternative to private car use. A better understanding of these aspects of PT quality must attract car users. Public Transportation services have the potential to attract private car users by improving the quality of the service [1].

There are significant differences in car and PT travel duration. Using conceptually corresponding models for car and PT travel duration calculations is the key to achieving a reliable analysis of modal accessibility disparity. Travel durations and network distances between all orginisans destinations have been taken into consideration and calculated using three different models for each travel mode, here named as simple, intermediate and advanced model (Helsinki). The Euclidean distances between all origins and destination were computed [2]. The processes involved in developing a new public transportation network are not entirely new. Several studies about public transportation reform have been made and by direct observation details the processes have been involved in regulation of public transportation as well as the design of the new public transport network. The critical factors have been determined, factors that led to implementing the reform and that also revealed how this is applicable to cities worldwide (Malta). Sustainable cities are defined by their modern public transportation [3].

Equity has been a major concern of public transportation provision and is utterly required by legislation in many countries. Lorenz curves have been used in order to geographically compare public transportation supply in Melbourne to a broad measure of demand (population and employment distribution) [4].

Fixed-route transport development in metropolitan areas can be defined using a graph-theoretic evaluation. The use of graph-theoretic tools and metrics may capture network economies of a large scale and density as well as interaction effects that arise in the topological structure and operational conditions of the system. Adopting such measures as connectivity, modularity and robustness increases the flexibility of the decision-making process according to various policy objectives, in contrast with

the strict criterion of travel time minimization [5].

Technological change and incremental technology, at various levels, are believed to have played an important role in the success of urban public transport. Special attention is given to the role played by the dimension and organization of public transportation markets in the rates of adoption of different public transport modes [6].

The sustainable development of Sibiu considers all options of urban transport: public or private transport, people or goods, with different action sources.

The transportation company in Sibiu will move its headquarters out of the city, thus making it necessary for the impact of these changes (in the overall activity of the transport company) to be studied and (also) related to the changing routes, environmental pollution in different areas of the city and citizen satisfaction.

II. MATERIALS AND METHODS

As a research program, we used the GIS program (Geographical Information System).

Geomedia is a software package used for displaying geographical data. The Tursib routes have also been created by using Geomedia Professional.

In order to set the routes, they first have to be represented on an already existing map. The first step is to create a database where more than one class of elements, entities and interrogations can be saved.

The databases can vary in types, given the fact that Geomedia Professional accepts Access, Oracle, Cad, MGDM and MapInfo databases. After connecting to a database, we define the coordinate system that is going to be used. For the route map we used a pre-defined coordinate system (Fig. 1). In order to add the image, there were created two types of entities: one as a point and one as an image. Then, the coordinate points will be added to the point entity and through this entity we create a reference for the image.

The used coordinate points are (extremities of the routes)

1) *Dumbrava (24:05:13.46; 45:47:22.46) - South,*
2) *Promenada Mall (24:10:13.35; 45:46:28.23) – East,*
3) *Sibiu Railway Station (24:09:40.71; 45:48:00.37) – North,*
4) *Bricomat Store (24:06:50.98; 45:45:14.59) – West.*

The image has been created by taking Google Maps printscreens that have been connected using a graphics editing program. The image has been inserted using the "Insert Interactive Image" command, whereas the georeferencing (assigning the coordinate points according to the map locations) was done by using the "Registration" command. This can be achieved by positioning the coordinate points over the corresponding locations to these points, thus helping to automatically calculate the distances between two or more points. The map can be slightly modified depending on the positioning and the size but the changes are insignificant if the coordinate points have been properly chosen and correctly positioned (Fig. 2).

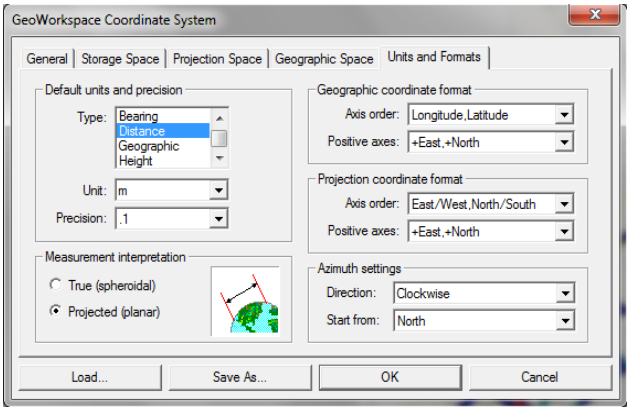

Fig. 1 Defining the coordinate system

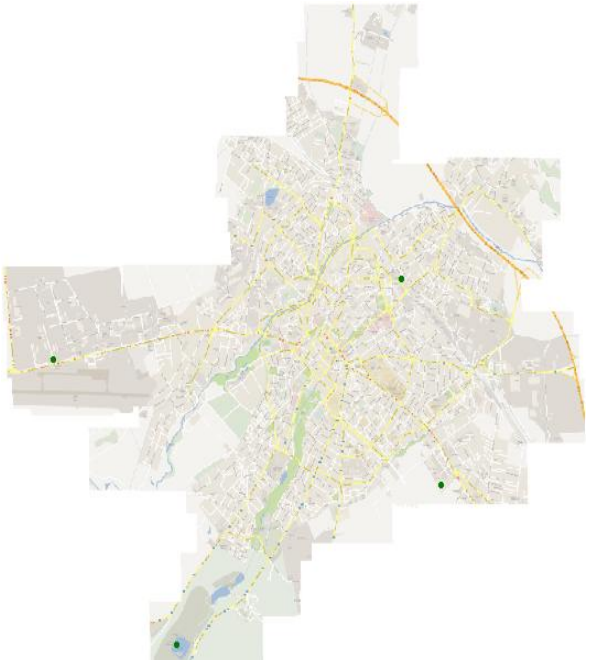

Fig. 2 The georeferencing map of Sibiu

After georeferencing the map, a class of entities has been created for each route that includes the following characteristics: 1) Code (with the primary key), 2) Length (automatically calculated), 3) Number of busses, 4) Time spent in traffic,5) Number of stations (Fig. 3). By the use of this information, queries can be performed in order to reveal the total length of a route, the number of the stations or the necessary number of busses.

A route consists of two entities (round trip). In order to find out the total length of a route, it is necessary to create a buffer zone on the specified route, so that it includes both elements drawn in its class. Then, an "Aggregation" type of query is performed in order to view the sum of the two entities.

This structure is to be repeated for all the routes to find out the total length for each one.

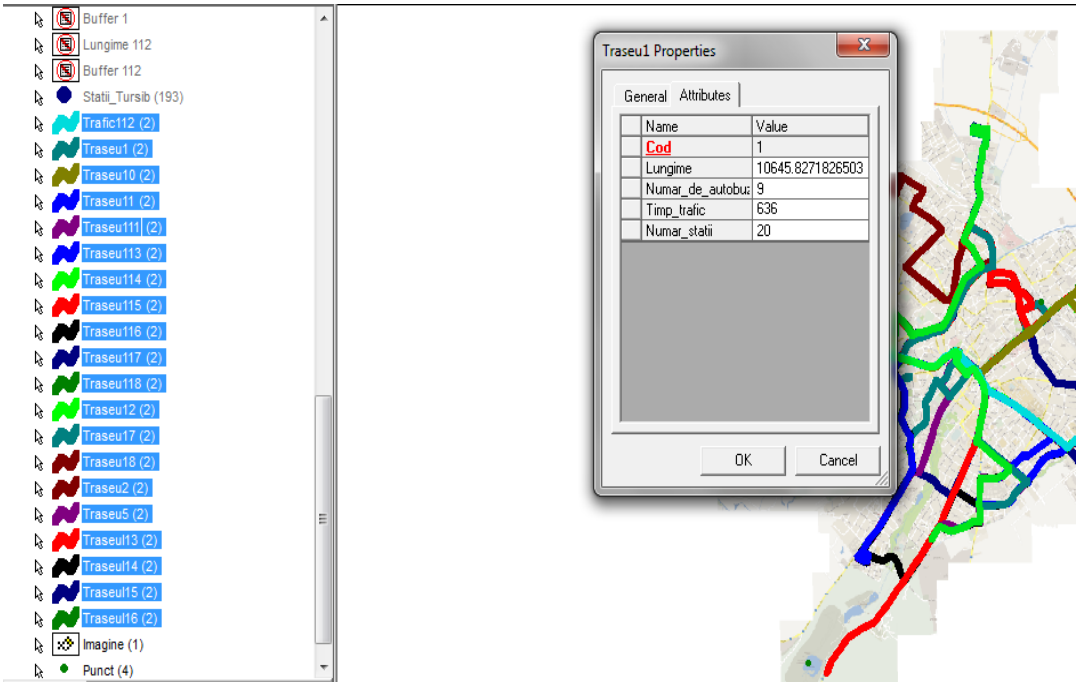

Fig. 3 Route drawing and assigned information for each route

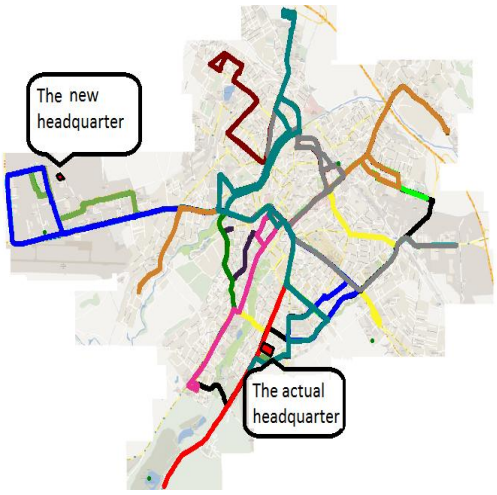

Fig. 4 Current and new headquarters of SC. Tursib SA company

After performing all the Buffer Zones and the Aggregation query type, a table must be completed for each route. This table contains the kilometers from the current headquarters as well as the kilometers made from the new headquarters total calculation (Fig. 4).

TABLE I
THE FRAMING AND THE WITHDRAWAL OLD ROUTES, IN KM PER ONE WEEK

Monday – Friday				
Km - Framing	Km - withdrawal	Km/Day	Nr. Courses	Km Total length
319.6	303.1	11803	695.5	12425.6
Saturday - Sunday				
Km - Framing	Km - withdrawal	Km/Day	Nr. Courses	Km Total length
321.3	295.8	10964	654	11581.1

The kilometers covered for the framing and the withdrawal of old routes are listed in Table I, while the new ones are listed in Table II.

TABLE II
THE FRAMING AND THE WITHDRAWAL NEW ROUTES, IN KM PER ONE WEEK

Monday – Friday				
Km - Framing	Km - withdrawal	Km/Day	Nr. Courses	Km Total length
718.6	734.6	11802.9	695.5	13256.1
Saturday - Sunday				
Km - Framing	Km - withdrawal	Km/Day	Nr. Courses	Km Total length
568.2	583	10964	654	12115.2

A synthesis of the data above is presented in Table III. One can observe that a greater number of kilometers is being traveled through when entering from the new headquarters, thus not a major one.

TABLE III
EXTRA KILOMETERS TO NEW HEADQUARTERS /WEEK

The analized period	The framing and the withdrawal old routes /week	The framing and the withdrawal new routes /week	Extra kilometers to new headquarters /week
Weekday	12425.6	13256.1	839.5
Saturday	6323.2	6650.6	327.4
Sunday	5257.9	5464.6	206.7

In order to have clearer perspective, we have created a SWOT analysis concerning the problem raised by headquarters changing for SC Tursib SA. (Table IV). The

analysis reveals that there are many more advantages than disadvantages.

TABLE IV
THE SWOT ANALYSIS

Strengths	Weaknesses
1) Reducing chemical and noise pollution inside the inhabited area; 2) Possibility of setting up a modern treatment of wastewater; 3) Traffic decongestion on an important street (Dumbrăvii Avenue); 4) Possibility to use the highway to reach the end of lines; 5) Dismantling the old fuel pump (fire hazard and pollution in the residential area). 6) If the actual fuel pump has to be decommissioned, the path length to the new pump might be significant	1) Lengthening marker distances; 2) Higher fuel consumption.
Opportunities	**Threats**
1) The possibility of building a residential complex in the old local office, or green areas; 2) Fluent movement on the Dumbrăvii Avenue, which connects tourist area outside the city.	1) Possibility of network congestion at the highway access

III. THE ROUTE AND STATIONS COVERAGE

The route coverage level in Sibiu has also been studied with regard to possible route changes for a wider coverage range. As an access distance from getting off the bus destination, a value of 500 (meters) has been set.

As Fig. 5 reveals, all of the stations covers the neighborhoods of Sibiu and the majority of the areas belonging to Sibiu except the red marked zones.

The red marked spots are quite large. Nevertheless, they are less inhabited marginal areas with a low industrial activity. Another such area can be found close to the city center (railway marshalling).

If by changing the headquarters, the coverage will be improved, the possibility of an increasing number regarding the passengers transported by Tursib is raised, therefore having great implications in attracting the passengers from personal car use area.

As far as fuel consumption is concerned, there have to be considered the following aspects for both bus transportation and by car:

1) *On all routes in Sibiu, Tursib transports during a working day (from Monday to Friday) an average of 7000 (passengers), making 12294.7(km). Considering the medium fuel consumption of a bus is 42 (liters)/100 (km), after making the calculations, we reach to a medium diesel fuel consumption of 0.7 (l /passenger/day);*
2) *If a car making (in Sibiu) 6 (km/day) and considering the cars medium fuel consumption is 9 (liters)/100 (km), has two passengers in it, it reveals a fuel consumption of 0.27 (l/passenger /day). It is obvious that in terms of fuel consumption and environmental protection it is advised to use public transportation at the expense of private vehicles.*

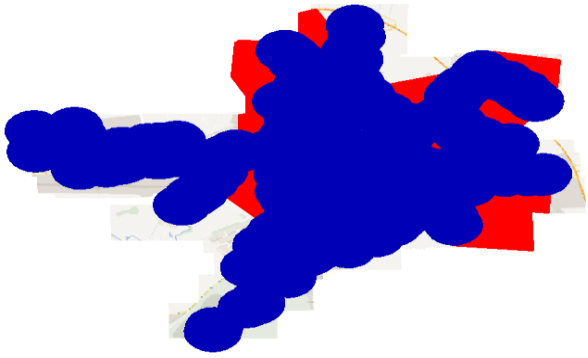

Fig. 5. The route coverage level in Sibiu

IV. CONCLUSION

Relocating the company involves extra kilometers for framing and withdrawal (e.g. 5% from the entire kilometers necessary for said framing and withdrawal). Although this is a considerable disadvantage, the relocation is unavoidable given the noise and chemical pollution from the current settlement. In addition, the relocation allows a more fluent traffic in the central area, due to the possibility to use the highway to reach the end of the lines.

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