MODELING THE TRAVEL DEMAND IN A COUNTY ROAD PUBLIC TRANSPORT SYSTEM.

Ilie Sorin[1], Mitran Gabriela[1]
[1] University of Pitesti
sorin.ilie@upit.ro

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Abstract: Increasing the attractiveness of a transport system requires the knowing of current situation of the interaction between the supply and the demand. This paper aims to estimate the level of transport demand associated with public transport by regular services in a county transport system. To highlight the interaction between transport supply and demand, a transport model was realized using specialized software, modeling the user choices concerning: the decision of making or not the travel for some reason or purpose, the travel destination, the transport mode used and the route traveled in a time reference period.

1. INTRODUCTION

Intense using of private transport is a problem in the current passenger transport. The motorized private traffic across Europe has increased despite continued and even dramatic rises price of the fuel in recent years. This modal relocation is the result of major social and economic changes that have occurred in recent years, with influences on the lifestyle. Countering this trend to the use of individual transport imply in addition to campaigns on energy efficiency and environmental protection, promotion of alternative transport modes, namely public transport, particularly by increasing the attractiveness of this transport modes. The attractiveness of public transport is characterized by several parameters, including duration of access to the public transport station, time scheduling of routes, in vehicle travel time, transfers number needed to travel between an origin to a destination pair, comfort, commodity and safety of transport. The proposal of measures to increase the attractiveness of the public transport system can be achieved in a reorganization of the system. In this paper the authors present a first step in the process of reorganizing the road public transportation system in County Dambovita, aimed at increasing the attractiveness of this mode of transport, namely estimation of travel demand.

2. THE SUPPLY IN DAMBOVITA COUNTY PUBLIC TRANSPORT SYSTEM

In the analyzed situation, there are 125 routes in County Dambovita, served by 20 carriers, performing public transport services passengers by regular services (Figure 1).

Analyzing the road network in relation to the main cities in the county and taking into account the mobility of the population of interest areas (industrial, mainly), is distinguished a main transportation pole of public transport, the city of Targoviste, county residence and some secondary transportation poles placed in the cities of the county: Moreni, Gaesti, Pucioasa, Titu, Fieni (Figure 2) [4].

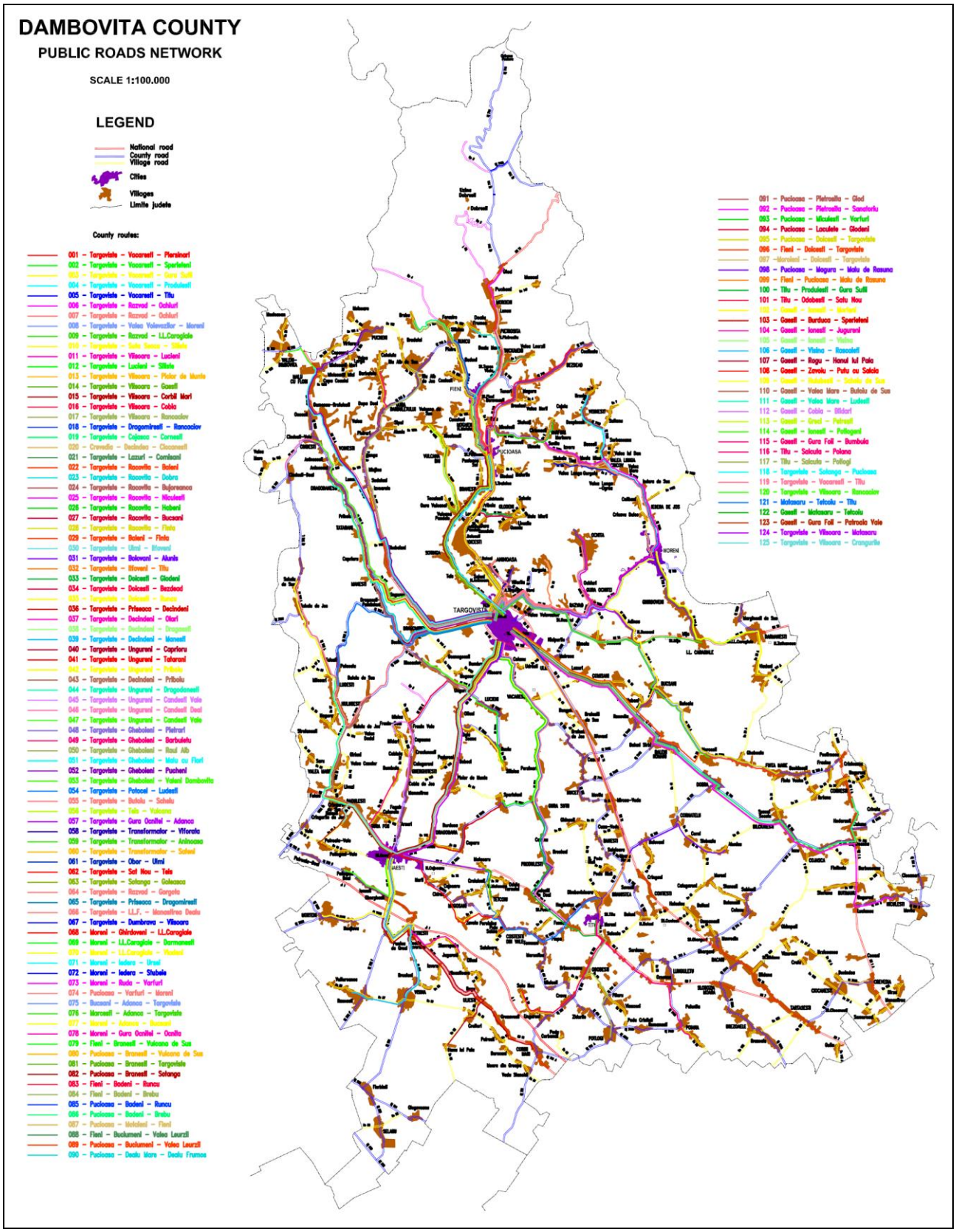

Figure 1. The county's public transport network – lines routes.

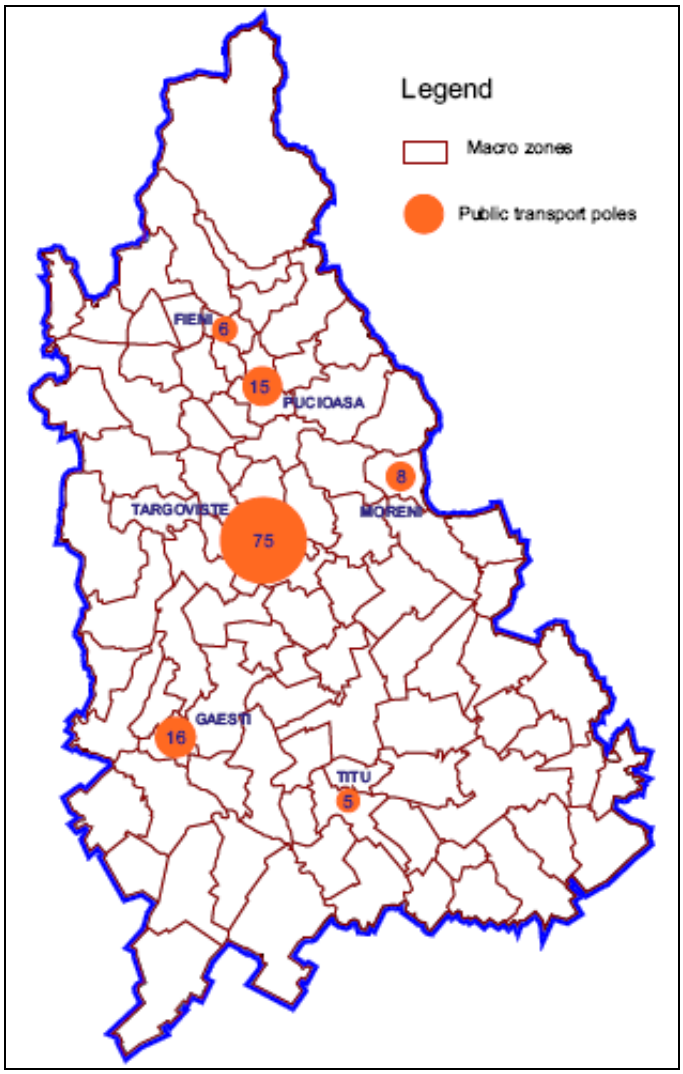

Figure 2. Main and secondary transport poles – number of lines routes.

3. THE ESTIMATION OF TRAVEL DEMAND IN COUNTY PUBLIC TRANSPORT SYSTEM

The demand for transport services has a high degree of quality and differentiation. There is a wide range of types of transport demand, differentiated by different times of day, day of week, depending on the purpose of travel, type of goods, the speed and frequency importance of travel and not only.

The traffic flow is the result of interaction between transport supply and demand [2], the organization and operation of transport system form a closed loop system.

In Figure 3 is presented the logical scheme of the process of organizing a public transport system. Information on the operation at a given time together with data on land use and socio-economic data specific to the study, are inputs to the model of transport. The informations resulting from the transport model, the level of service provided by the public transport system, in folding terms of supply transport on the spatial and temporal caracteristics of demand transport is the base for evaluation the current transport system and recommendations on the reorganization of its. The results obtained by implementing the previous recommendations are the inputs for another moment of time in the process to organizing the analyzed transport system.

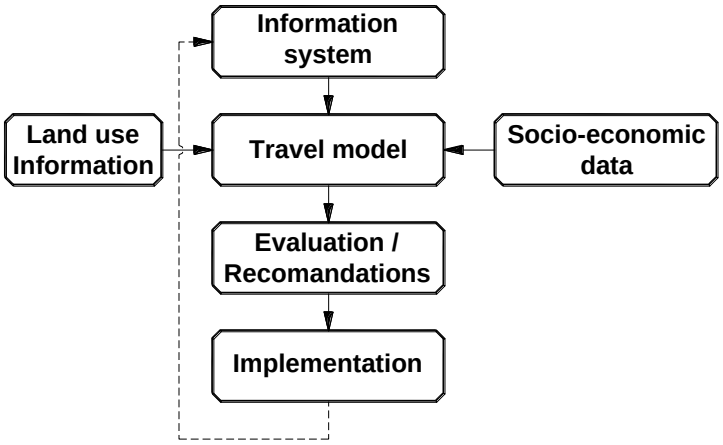

Figure 3. Organizing a transport system process – the logic diagram.

The model can be defined as a schematic and simplified representation of a complex reality in order to quantification, representation achieved through a relationship between the relevant variables of the phenomenon. The transport model consists of modeling the interaction between transport network, land use and transport demand (Figure 4).

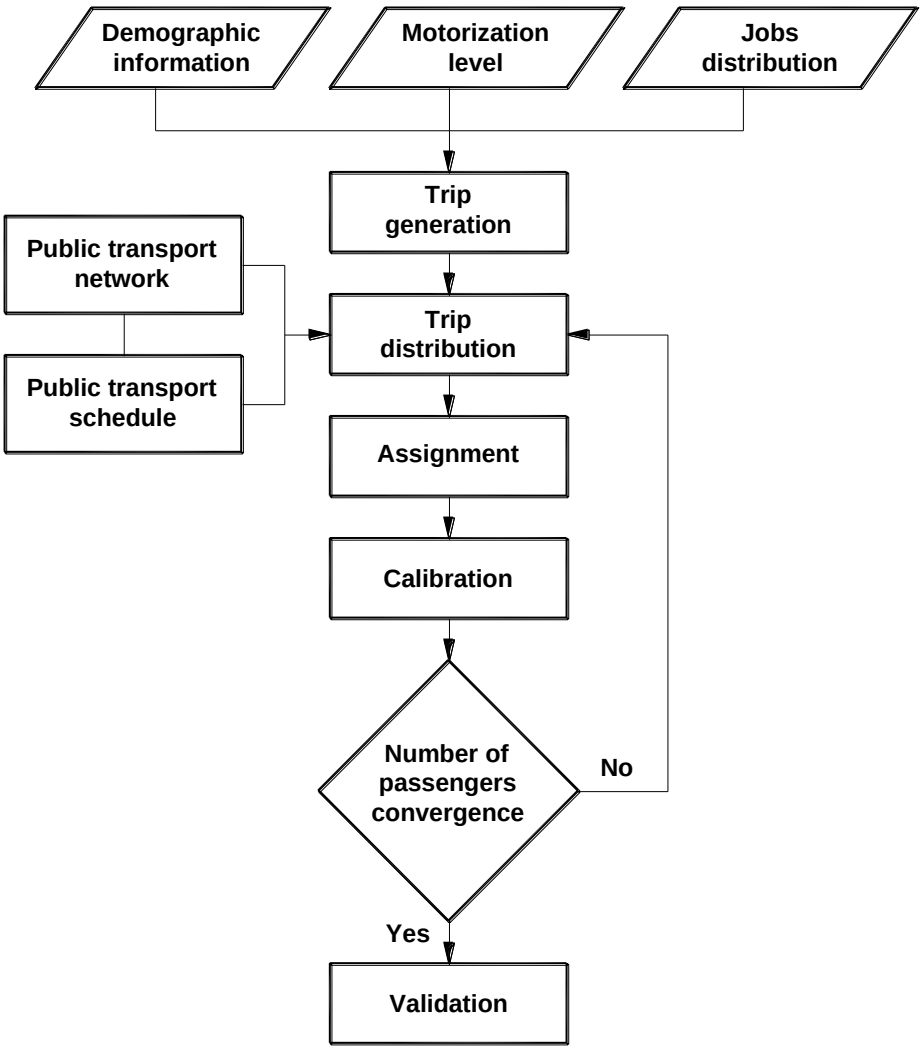

Figure 4. Transport model – the logic diagram.

The demand models formalize user choices concerning: decision making or not travel for some reason or purpose, travel destination, mode of transport used and route traveled in a time reference [3].

For estimating transport demand in County Dambovita was used the software system PTV Visum, system specialized in transport planning, transport demand modeling and management of transport networks [1]. In this software was applied classical procedure for analysis and planning of transport demand, which involves the following steps: *i) trip generation; ii) trip distribution* and *iii) trip assignment.*

3.1. TRIP GENERATION

Using the socio-economic characteristics of the zones, concentrated in the associated centroids (Figures 5 - 7), the number of inhabitants, the number of people commuting, the number of car ownership as input in a multiple linear regression model was estimated the number of trips generated by each traffic zone in the studied area (Figure 8).

$$N_{gen} = a_0 + a_1 \cdot p_a + a_2 \cdot C + a_3 \cdot N_v \ \ [trips/hour] \qquad (3.1)$$

where:

- N_{gen} *is the number of generated trips for each traffic zone;*
- p_a *is the active population for each zone;*
- C *is the number of people commuting;*
- N_v *is the household car ownership;*
- a_0, a_1, a_2, a_3 *are coefficients for calibration of the regression model.*

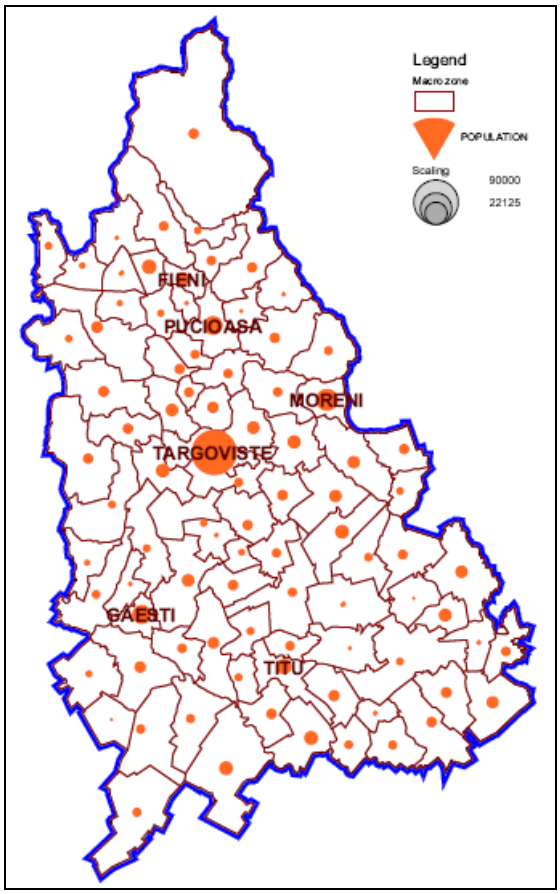

Figure 5. Territorial distribution of population in studied area.

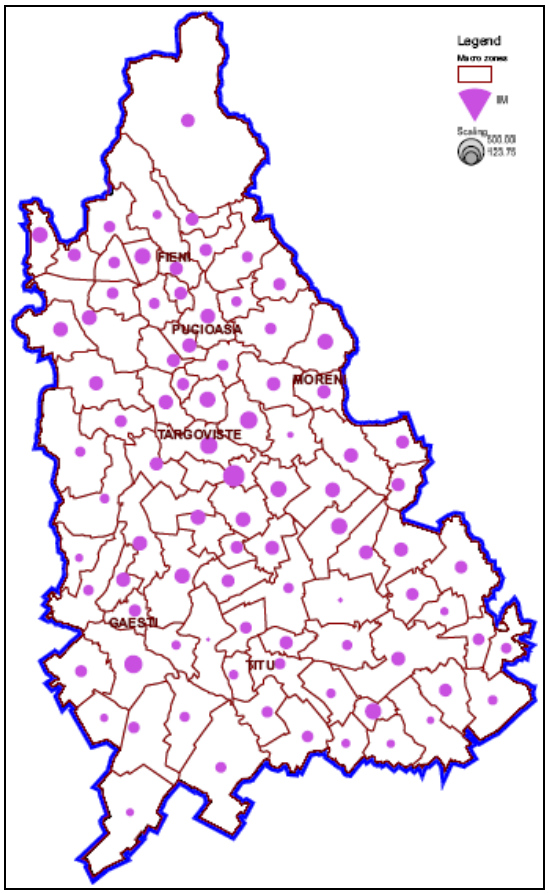

Figure 6. Motorization index in studied area.

3.2. TRIP DISTRIBUTION

The distribution models are used to estimate the choices of the people that travel for setting the destinations, resulting the origin-destination matrix.

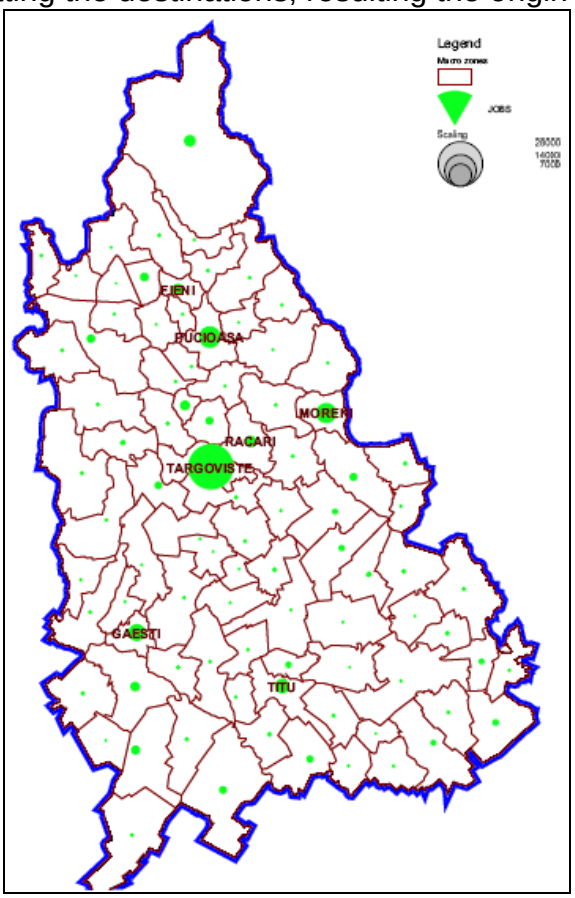

Figure 7. Jobs distribution in studied area.

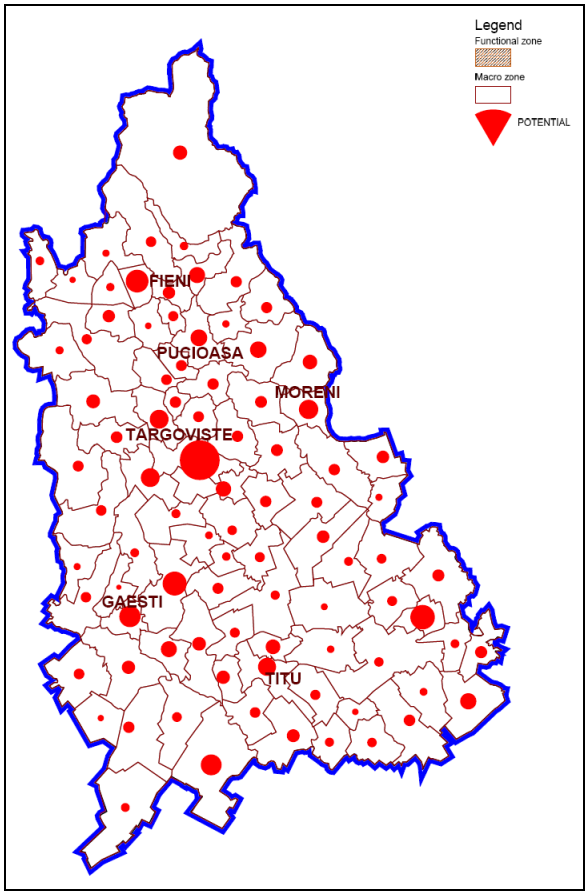

Figure 8. Trips generation potentials in studied area.

For trips distribution on destinations the gravity model was applied, whose the mathematical expression is:

$$T_{ij} = g_i \cdot a_j \cdot f(d_{ij}) \tag{3.2}$$

where:

- T_{ij} *are the flows estimated to be produced between the "*i*" and "*j*" traffic zones;*
- g_i *is the generation and application from "*i*" area;*
- a_j *is attract demand in the "*j*" area;*
- $f(d_{ij})$ *is the difficulties function in making travel between zones "*i*" and "*j*".*

The impedance function is the power function with negative exponent and the argument it is the travel time between two zones.

$$f(d_{ij}) = d_{ij}^{-\alpha} \tag{3.3}$$

where:

- d_{ij} [min] *is the travel time from zone "*i*" to zone "*j*" in the free flow traffic conditions;*
- α *is the parameter that characterizes the difficulties realisation of travel between zones "*i*" and "*j*".*

Following this process is resulting the global matrix Origin - Destination (O - D).

3.3. TRIP ASSIGNMENT

The next step in building the transport model was the assignment of O - D matrix on the considered public transport network. For O - D matrix assignment was used the procedure that takes into account the transport program, available in the public transport modules of the *Visum* software.

3.4. CALIBRATION

The passengers number calibration in public transport vehicles operating as scheduled public transport for passengers in County Dambovita was made based on recorded data in 20 counting locations around the poles of transport in the county: Targoviste, Fieni, Pucioasa, Gaesti and Titu [4].

3.5. VALIDATION

The structure of validated travels flows for passengers public transport system through regular services in County Dambovita is represented in Figure 9.

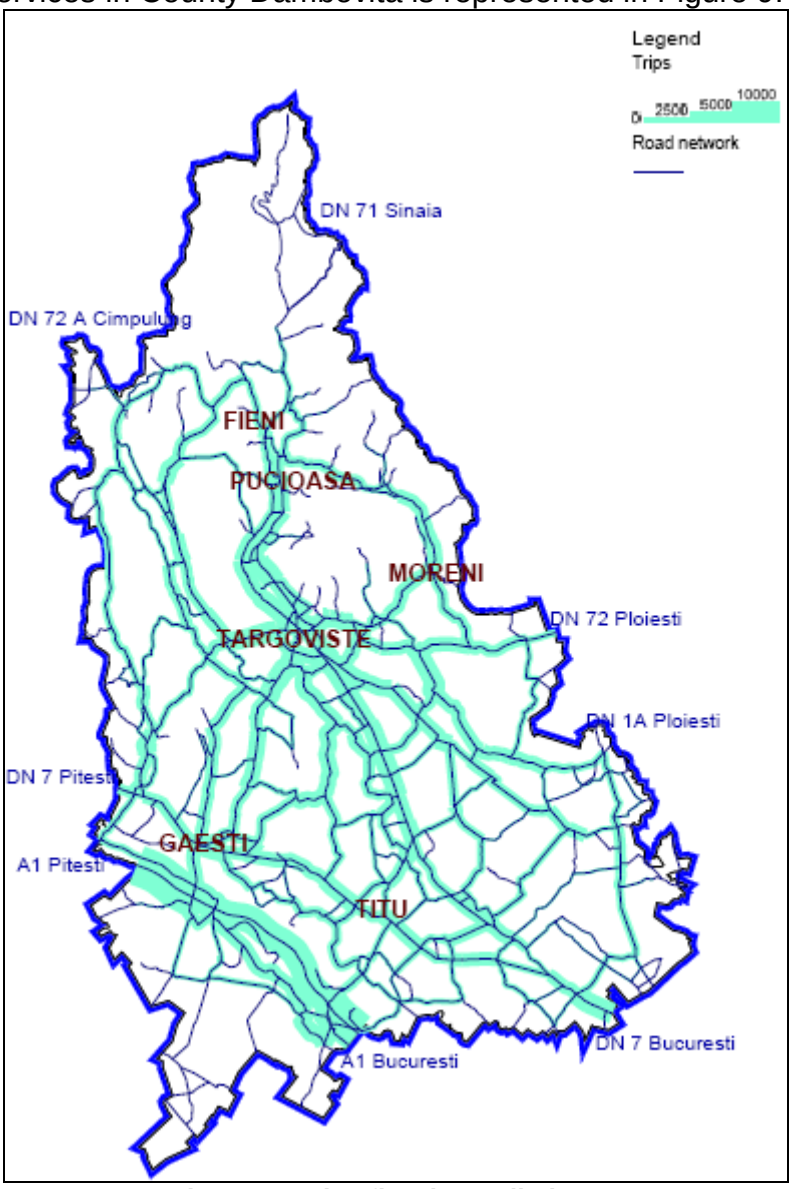

Figure 9. Trips flow in studied area.

4. CONLUSIONS

Building the road public transport model to County Dambovita provides an image of the inhabitants behavior of this county in terms of trips that they made using county public transport. Knowing the structure of transport demand is useful in determining the future organization of the schedule of county public transport system so that the level of service offered by this transport system to be as high.

References:

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