

## Measuring relation between technical and social infrastructure

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### Abstract

*The paper discusses the possible contribution of urban infrastructure systems for a sustainable social development of towns and local communities. It refers to traffic infrastructure in particular, and its key role in accessibility of social infrastructure facilities<sup>1</sup> in its tributary area.*

*Urban, especially traffic infrastructure along with social infrastructure build balanced regional settlements' network and adequate relation between smaller and middle cities in region with other settlements, which together improve living conditions for local population, reducing their need for migrations and emigrations. Moreover, it leads towards optimal rural urbanization, better use of local potentials and sustainable integrative intra – regional process.*

*Further, based on these premises, the paper offers the selection of responsive, local specific indicators aimed to better urban planning methods and planning of social and urban infrastructure in Serbia.*

### Introduction

Urban, especially traffic infrastructure along with social infrastructure build balanced regional settlements' network and adequate relation between smaller and middle towns in region with other settlements, which together improve living conditions for local population, reducing their need for migrations and emigrations. Moreover, it leads towards optimal rural urbanization, better use of local potentials and sustainable integrative intra–regional process.

The influence of the traffic infrastructure on the living standard of the local population is significant - both the influence of the local and the transit network. Although the positive effects prevail, there are also some negative ones. If we wish to measure this influence, it is necessary to choose valid criteria and indicators related to the development of the traffic infrastructure and settlements' network and activities.

The influence of communication/traffic factors on the concept of social infrastructure planning

If we take as an assumption that the region (in a physical sense) makes the integrative framework for the development of social infrastructure, than we have to point up its most important elements: characteristics of the typology of the settlements' network, characteristics of the traffic network and topographic characteristics as well as their mutual influence.

Development of the traffic connections and services is vital when we deal with any segment of the spatial development. Isolation and underdevelopment of some areas is caused mostly by bad traffic conditions, and vice versa: in most cases, highly developed area and its integration in the wider region are the result of quality and diversification of the traffic connections.

Settlements' network and connections between the settlements are very important. There are great differences between macro and micro level, regarding relations between regions as well as inside the region, especially dealing with the centre and its tributary area. This is the direct consequence of the physical/traffic relationship as a factor of the integration.

In order to make an appropriate groundwork for the social infrastructure planning for wider areas, the correlation between traffic connection and functional complexity of the towns and the other settlements must be regarded. For example, it can be attained by combining parameters of dispersion and size of the settlements with parameters of traffic equipment – volume, quality and density of the network and spatial distribution of the different categories of roads. We should also involve possibilities for connecting the settlements at the same hierarchical level, especially when we talk about badly functionally equipped settlements.

Regarding the factors of the natural environment, development of the traffic network factors and the system of settlements we can classify settlements correlating their position and traffic network: 1) road settlements (located by the main regional and national roads), 2) peripheral (by the local roads) and 3) isolated (far from local roads). When we take into the consideration this classification along with the characteristics of the social infrastructure network in settlements, we must perceive that they are mutually related and conditioned. In fact, the typology of settlements should rely upon the total development level of settlements that depend on their position by the roads and central places and on characteristics of the social infrastructure network.

The analysis of settlements' relationship should also involve the economic factors (such as distribution of economic centres, productive communications, flows of investments and goods, etc.); migrations of the population; technological and telecommunication linkages; social linkages (between social groups and individuals); service and infrastructural connections, as well as politically administrative linkages which together determine the quality of connections. Nevertheless, all these elements highly depend on physical connections – kinds, quantity and quality of traffic connections.

Natural constraints of locations for settlements are much reduced lately, due to social and political climate, which was in some recent periods favourable (to a certain extent) for the development of infrastructure network in Serbia. Therefore, the development of the traffic network has taken the vital role in including peripheral parts of the region into the general development processes.

However, the topographic characteristics remain very important element when discussing the cost of the spatial development - moreover, they even change its direction. Having in mind the fact that plain terrains (less than 200m height above sea level) cover about 15,6 percents of total surface of central Serbia, comprise 627 villages (about 15,2 percent of total number of villages in Serbia), almost all larger towns and the most important traffic corridors in Serbia, while everything else is situated in mountainous areas, criteria and parameters that include topographic characteristics are even more important.

We can consider the terrains that incline between 0-15 percent as favourable for the construction. The positive influence of the local road on the development of settlements is within the zone of 10 km, but main roads should affect the zone of about 20 km. Local traffic network is important for the rural areas.

This is why the situation in Serbia is more than poor, having in mind that more than 60 percent of local roads in central Serbia do not have a modern roadway. (Malobabic. 1999). Most of these roads are non-categorized and seasonal. The terrains with inclination more than 70 are exposed to erosion, while those that incline 7-150 have major constraints. The inclination more than 6-70 is a significant constraint for building a traffic network, whilst the inclination more than 80 is problematical for the building construction and the physical development of the settlements (Vriser 1978).

Natural conditions are of the great importance for future improvement of traffic network, since they significantly raise the costs of its construction. The characteristics of relief and the distribution of rivers determinate the length and quality (category) of the road and lessen the possibilities of making direct connections between the settlements. The quality of the terrain (capacity, portability, stability, the sate of underground water current) is the most important reason for increasing the road construction costs.

The development of the traffic network enables the larger density of economic facilities, since the traffic network can serve smaller, more dispersed facilities. At the same time river and railroad traffic network is much more convenient for larger economic facilities. Road network can have larger density and is more flexible than the railroad. The most rational option is planning of the complementary railroad and road network whenever possible. Day-travel number from home to work is one of the most appropriate criteria for valuation of functional relations in a region, which is at the same time common area for the labor market (Kokole 1969).

From the point of view aimed to accessibility of social infrastructure services, the presence of main regional traffic corridors in area can have quite different influence. If there is adequate connection between local and main regional and national traffic, or if the main traffic network is at the same time in the function of local one, the accessibility can be improved. On the other hand, main regional corridors can require autonomy and separation from other communications in order to serve more properly for transit communications, which is one of its basic functions. In that case, there is no good relation between main corridors, local traffic network and social infrastructure services, because these communications cannot take part in providing settlements in the tributary area. Moreover, they can usually represent the physical barrier between two parts of the integrated area from the point of view of using services of social infrastructure, and even the obstacle between two parts of the same settlement.

The experiences in United States, for example, are in favour of the concept of social services that relies a great deal upon very good traffic infrastructure. In this case, the social infrastructure network is very rational but has a very good accessibility to services thanks to very good traffic equipment – diverse and high-quality road network and adequate public transport. Therefore, school buses or mobile health units can successfully overcome relatively big distances of services (considering Serbian standards for social services).

In Serbian circumstances, however, the concept relies upon greater dispersion of services rather than on better traffic infrastructure. The Serbian National Planning Act (1996) tried to promote the concept of rationalization of public services, including services of social infrastructure, counting on soon and substantially improvement of traffic infrastructure in Serbia. Such a concept required both enormous time and resources, and it did not achieve significant results yet. This fact especially refers to local network in the mountainous regions.

We should not forget that the total length of the main corridors affect to general statistical view of traffic equipment of some region and at the local level – making it better than it really is, since it doesn't always

have positive effects. In order to value properly the quality of the traffic network itself and related to accessibility of social infrastructure services, we should get to know all relevant characteristics of a particular region. This is also the requirement for defining the future planning arrangements in Serbia referring to relation between social and traffic infrastructure.

## The state of development of traffic network in Serbia and its relation to social infrastructure

The general framework for rural areas in Serbia characterize very old population, rural settlements losing inhabitants and getting smaller, at the same time with very poor communal standard and almost no good traffic connections. This valuation can be applied particularly on some 4000 villages in central Serbia. More than 40 percent of them have less than 500 inhabitants (Malobabic, R. 1999.). The emigrational characteristics of settlements indicate very negative trends of urbanization and deagrarization in rural areas. The reasons for these emigrations can assign to inappropriate level or inaccessibility of social services.

In past few decades in Serbia, conditions of a very low development of the settlements' network, where very small villages prevail (by total number of settlements) did not go along with the urbanization concept of encouraging concentration of inhabitants and activities in a few big centres. One of the areas of concentration – the Sava/Danube way, linked to the direction of the international and regional traffic/communication corridor – has reflected to the consolidation of the major towns' network and other settlements around. Most of the towns that were not so favourably situated, did not reach important growth and were not integrated – nowadays they are singular, independent community centres. As a result of this trend, the process of emptiness of the small towns occurred, and they have become too small to take over the role of centre for a community of settlements because it did not have the minimal number of inhabitants and other conditions for rational organization of urban functions.

The middle town's network in central Serbia is imbalanced and underdeveloped because of the lack of some categories of settlements and unfavourable functional structure. This is predominantly the consequence of the influence of some political and economical factors. These mostly negative effects caused the lagging of some sectors, for example traffic /communications and technical infrastructure (Milicevic 1990), which are very important for the development for the settlement's network. The delay in the development of the main and local technical infrastructure, particular traffic as an essential factor, presented the constraint to the regional industrial growth. Practically it meant that the territorially peripheral, mountainous and underdeveloped areas had to be excluded from the most important flows of the development (Saljic, Bjelica et al. 1987.)

Mostly, mountainous areas that have underdeveloped economy, public services and other urban functions, also have a serious problem with traffic and technical infrastructure and services. The main problem in these areas is there is no support for future development that could give rise to other elements or activities. Regional roads are not favourably dispersed and are of a very poor quality, but even worse situation is with local roads.

The general appraisal is that the traffic equipment in central Serbia is marked with great differences, connected to region considered. Mountainous areas have significant problem with road communication because the network is incomplete and of a bad quality and the settlements are not properly linked. The connections are rather good amongst settlements of a higher level, such as towns – community centres.

Thus they fulfill a condition for further concentration of urban activities, which is not the case with smaller places. If we consider traffic and service equipment of settlements, we can recognize “polarized areas”, in sense that areas of the central places are very well equipped, while the tributary and peripheral areas are equipped very bad.

Mountainous rural areas in central Serbia have significant tourist potentials, but they suffer from the lack of infrastructural equipment and communal and social services, which is among basic conditions for rural development (Tomic 1997). Having in mind very unfavourable morphological structure of the settlements’ network, it is even bigger problem because it requires much more financial resources for it’s equipment. These rural areas, undoubtedly very interesting for its natural values and environment, with special climate demand non-standard traffic (especially local) network, which is much more expensive, both in the phase of construction as well as in the phase of exploitation (Dabic, Milijic 1999.). The railroads are practically excluded. Thus, these areas are accessible maximally at the 1000m height above sea level due to technical conditions.

## **Towards a selection of indicators referring to traffic and social infrastructure**

In Serbia, the operationalization of this segment methodology is mostly linked to urban planning, although it can also be linked to traffic infrastructure planning. Most of the criteria, norms and parameters are defined few decades ago and have not been changed since. Nevertheless, the approach included in the recommendation for planning and programming the towns and other places (which was forgotten in the meantime) still up to date: “Recommended values are to be used in ideal conditions, but when put into the concrete urban situations, realistic climate and topographical conditions – they ought to be modified for the local cases” (“Recommendations for planning and programming towns and other places”, Federal Institute for urbanism and communal issues, 1968).

European experiences show that the new approach ought to be included in selecting the criteria and parameters related to social infrastructure planning. The accessibility of social services is often named as a main criteria from which derive a lot of other criteria and parameters.

The criteria relate to the development of the settlements’ network, which is important for the development of the social services – or to be more precise – the relationships / communications between rural centre and other places depend on mutual traffic connections as a condition of supplying small places.

Some authors in Serbia emphasize the position and the importance of the settlement in the network depend, above all, on accessibility of services needed daily and occasionally (but often) (Bajic-Brkovic 1994). If we assume that occasional needs could be consumed in the nearest middle-size centre, than the main criterion of accessibility refers to daily needs. In Serbian circumstances we have permanent situation of limited resources, which produces the approach of concentration of activities in defined centres, or ones with such prospective, provided that the minimal number of inhabitants includes the tributary area. Following this approach, the selection of criteria has been used in Serbian planning practice:

- the elementary school should be organized for 2-3,500 inhabitants (4-grade school), if public school buses are provided for the distances over 2 km; the 8-grade elementary school in the settlement of 3-10000 inhabitants or if the public school buses are provided for the distances over 3km;

- primary health facilities are to be organized at the distance of one hour travel isochrones (such as ambulance, pharmacy), fro other (occasional) needs are to be organized at the distance of two hour travel isochrones;
- children day-care facilities should have range of 1,5km.
- criteria for evaluating the settlements' network should rely upon parameters as follows: (1) number of settlements in the local community; (2) the average demographical size of the settlements; (3) the average demographical size of the settlements, excluding the community centre; (4) average number of settlements on 100 km<sup>2</sup>; and (5) local community population density.
- criteria for evaluating the quality of traffic network should rely upon parameters as follows: (1) total length of roads; (2) road network density (km'/km<sup>2</sup>); (3) total length of the roars with modern roadway; (4) total length of local roads; (5) the share of length of the local roads in total length of roads in the community.

Criteria and parameters referring to distribution of social services include the distance, beside the population quantum (minimal number of inhabitants), which indirectly involves the traffic network at the local level and it is the condition if it's implementation. For example, Serbian National Planning Act (1996) defined the global distribution of social services at different organization levels, similar as those mentioned above. However, National Plan did not define the conditions of comfortable travel/ access within assumed distances, regarded to qualitative local traffic network during the whole year that could reach the requires of safety, speed etc.

Distance of 10km is taken as an acceptable distance for rarely inhabited areas, using approximately 30-40 minutes for accessing the facility. It also includes adequate roadways. But in some areas – such as eastern mountainous parts of Serbia - there is no other way but to get to these facilities by foot. Therefore, we have to take into consideration the radius of 4,5 km that can be reached within one hour (Macura 2001.). If we take this criterion as a primary one, we can hardly talk about good access of facilities, because there are situations where 5 to 6 places gravitate to same primary health service point. Consequently, because of the difficulties for the people to reach the facilities, only 65 percent of the health services have been realized in the primary units (it should be about 80 percent). The program of the mobile health units could be the solution, but is not applied widely yet in Serbia. This program could enable the potential users relatively same level and accessibility of services, but the places have to be mutually connected very well, which is usually not the case. We should not neglect examples like those mentioned above because about 70 percent of Serbian territory has the same or similar characteristics.

We ought to mention that the most criteria and parameters used in planning practice in Serbia, referring to social and traffic infrastructure are not contextually adapted. They refer to typical, often even ideal situations, and could not be used directly in any particular situation. They are quantified and pre-defined by fixed size and are not flexible. If we assume that criteria should be relevant, measurable, relate to principles to which they refer, reliable, simple for use, and above all, contextually specific, than we could find a few to meet these requirements in Serbian planning environment. The OECD suggestion of selection of criteria and parameters, for example, give quite different and more precise answers related to accessibility of services:

- criterion: the access and quality of the health services– the indicator: the share of the number of inhabitants that could access to medical care within the distance of :  $d = 800, 1600, 2400m$ ;

- criterion: the access and quality of the educational services - the indicator: the share of pupils that could access to elementary school within the distance of :  $d = 800\text{m}, 1000\text{m}, \text{etc.}$ , or within  $t = 15 / 20$  minutes walk, etc.

Finally, we could reach the better formulation of criteria and indicators by watching them from the view of users. For, example, besides the distance of social infrastructure services, we should consider / use / measure the time / duration, the cost and the comfort of the travel (private or public transport, frequency of vehicles, etc.) other conditions (road category, morphology, climate) etc. This way, for the same distances, we can define quite different accessibilities of services that would include qualitative characteristics. In this way we could also measure the quality of the traffic network.

All these elements affect to the psychological component – sense of reach and accessibility of some settlement to urban services to which it gravitate. As seen, the traffic infrastructure makes the framework for successful servicing and positioning the central places in the settlements' network.

## Conclusion

The presence of main infrastructure, especially traffic corridors generates spatial and development consequences viewed at the regional (wider) level, and that is predominantly in the focus of interest. However, the local environment suffers from these consequences intensively. That includes the habited and inhabited space, as well as towns and smaller rural places. The position of the main regional corridors is connected to favourable natural /topographic characteristics. Thus, these elements together (natural conditions and the presence of corridor) generate strong changes in the settlements' network development and work as a strong migrational magnet – at the same time positively in the nearest environment, and negatively in the peripheral areas. On one side, we are faced with the increasing activity concentration, density and flows, while on the other side – the emigration, de-concentration of activities, and weakening the connections inside the settlements' network. These consequences obviously indulge the social infrastructure services, activities that support the settlements connections and living standard.

## Notes

- <sup>1</sup> The term “social infrastructure” refers to basic facilities and services, for instance: elementary (and other) schools, children day-care facilities, primary and other levels of health care and services, which together contribute to the living standard for the local population. If we talk about the rural areas, these urban functions are some of the most important in Serbia.

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