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Planning of the Traffic System in Urban Environments

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Abstract

The traffic system performs a great extent of exchange with the environment, and is closely connected in addition to that. The planning of the traffic represents today one of the aspects of the integrated environmental planning in the urban area. The need for the ever bigger surfaces intended for traffic subsystems on the one hand, and the incapacity to sufficiently secure those surfaces, creates additional problems for the planners. Thus, the approach to the planning of the traffic network must be of interdisciplinary type. By that it must be taken into account that each city and its traffic system have various characteristics, in the sense that each city area has its specific traffic layout. For this reason, it is impossible to generalize and come to a universally applicable solutions, but it is necessary to research and test the possible solutions.

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1. Introduction

The development of the urban environments and their traffic basis must be observed as an overall process in space and time. The traffic system carries out a wide range of interchange with its environment that makes its interaction with the environment considerably close. For this reason, traffic planning in urban environments represents one of the aspects of environmental planning.

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Traffic planning within a city can be approached in various ways, mainly depending on the character of the tasks within which traffic is planned (general or detailed city plan, conceptual or main design). But, in any case, it is necessary to provide for a double-natured approach:

- Traffic is considered as: a separate system, functionally organized so as to provide for coordinated functioning of its subsystems expressed through the street network, the network of public and quiescent traffic and through diverse types of transport;
- As a subsystem of the urban system traffic can be envisaged as a consequence and together with the period of the arrangement of the urban activities, i.e. their concentration, and dispersion. [1-5]

2. Traffic planning stages

The traffic planning procedure can be divided into four fundamental stages:

- Constitution of an information basis;
- Situation analysis;
- Planning and forecast basis;
- Evaluation and choice of a solution.

Especially important for the constitution of an information basis, besides the data-collection from statistic sources, are the data gathered by traffic analyses. Usually, such traffic researches include the following:

- Household surveys;
- Surveys of the external cordon;
- Surveys of the passengers on the terminals of public, suburban and intercity transport,
- Traffic counting control,
- Recording of the technical and exploitation features of the basic street network and the network of the public city transport lines

Surveys are carried out with the purpose of determination of the sources and destinations of the transport, its reasons as well as the social and economic characteristics of the population (income, motorization level, mobility, household size, number of employed members per household etc.)

The external cordon surveys provide data on the source-target, transit, individual, and freight traffic because the survey conducted on the public transport terminals is supposed to provide for data on transport by public means. The traffic counting is meant to determine the intensity and structures of traffic on access roads to urban zones and within the street network. Traffic counting yields information on traffic flow, which is used in the situation analysis for the calculation of the street network capacity exploitation and identification of critical sections.

The recording of the technical and exploitation features of the basic street network and the public city transport lines includes the recording of average velocities of the vehicles in the traffic flow, the geometric elements of the street network the type and quality of pavements, the traffic pattern, the frequency and capacity of the public transport lines etc.

In the analysis of the traffic system condition, the overall collected data are interrelated and then decomposed to the details that enable for understanding of the basic principles of spatial, time and type-related traffic distribution. Fig. 1 shows the spatial distribution of the source-target traffic and Fig. 2 demonstrates the distribution of transport per hours of the day.

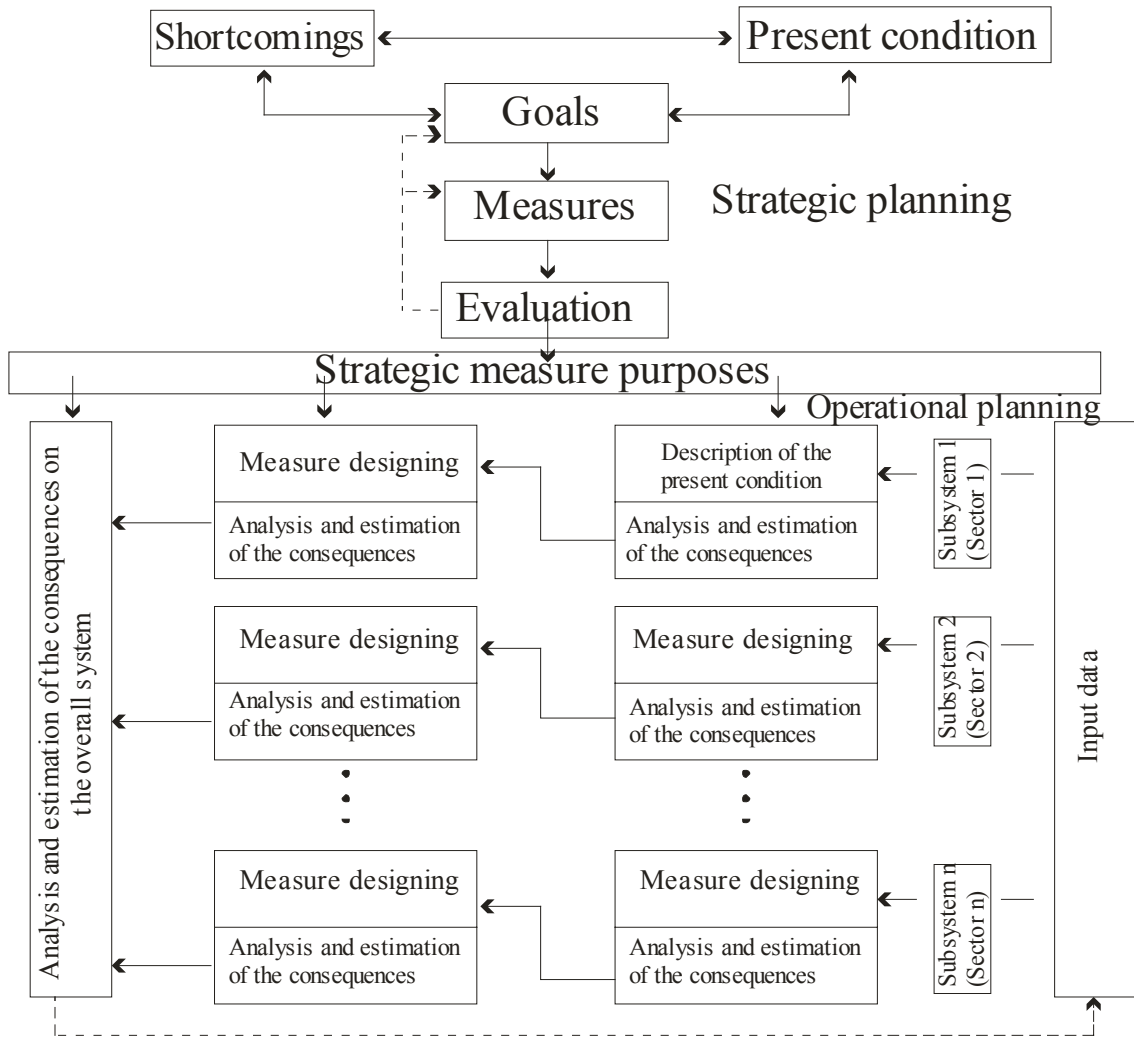


Fig. 1. Strategic and operational planning

The surface-purpose plan is used for traffic forecast. The variables used for analysis of commuting are the population, number of employees and level of motorization. But, before addressing traffic simulation on the planned network, journeys are distributed onto an idealized network that is the airline connection between the centers of neighboring zones. This provides for a “wish-line network” that considerably helps the planner in conceiving the variant solutions of the future traffic system

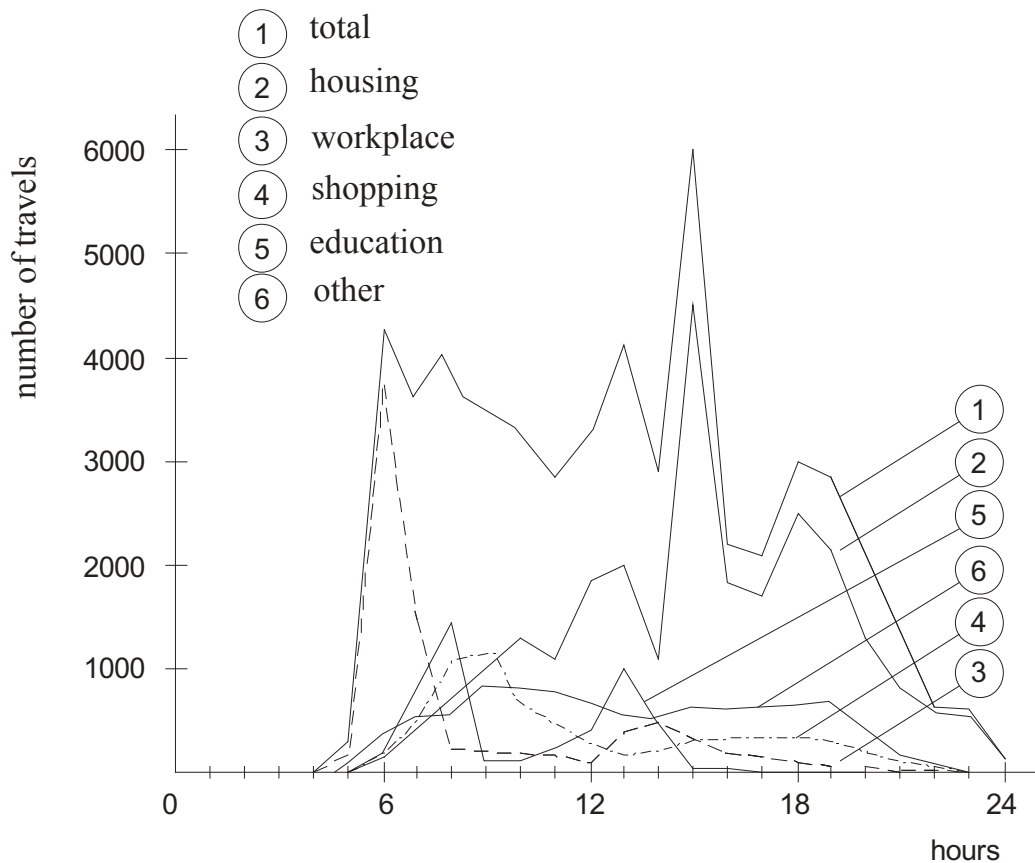


Fig. 2. Journey distribution as per the hours of the day

The parameters of estimation of the variant solutions are obtained on the basis of testing that again makes use of journey distribution models.

The choice of the most favorable variant the traffic planning process is not completed, but enables for checking the plan realization and appropriate audit within the continual planning process.

3. Strategic and operational planning

The elaboration of the traffic system plan entails diverse tasks, starting from the relatively narrow tasks as is the planning of the steps in the building of traffic infrastructure constructions, or traffic subsystem exploitation, towards the widest task of introduction of networks or sections of new transport type. For this reason, it is necessary to highlight two basic levels of planning, which are the strategic and the operational planning.

The strategic planning process includes the definition of purposes and measures to reach them through elaboration of concept solutions and their evaluation on the basis of the condition. It is important to emphasize that the measures in certain subsystems are verified through their influence on the overall system. Any omission or formal effectuation of these analyses and the estimation of the consequences is frequently the main reason of problems in physical and traffic development

The result of the process of planning the already achieved development is a plan document defining the purposes of the development and the measures for their realization as according to the needs and capacities of the plan region, by necessary coordination with the development purposes and measures defined for the wide environment.

The strategic plan, as a basis leads to an approach to the operational planning of traffic subsystems, that is, to an establishment of operational measures, analysis and estimation of the consequences and evaluation of the subsystem and the system as a whole. Fig. 3 demonstrates one of the possible solutions of the primary city network of the Skopje central area.



Fig. 3. Alternative solution for the center of the city of Skopje (streets and railway lines)

4. Planning and design of the primary and secondary road network

Planning and design are synonyms and it is a question of whether there is a clear distinction between the processes defined by these terms.

In the case of the primary network or of a section thereof, designing and building of the constructions of such a network is of key importance for the overall development of the city, meaning that the primary network shapes the physical, economic and social development of the area. The planning process in the secondary network is objectively different, as the offer of traffic services is primarily the outcome of the need to meet the existing, as well as the planned demand on the required service quality level. In other words, the planning, designing and functioning of the secondary network (or a section because of that) appear consequently to economic development, to spatial development and traffic service demand.

Fig. 4 shows the relation between physical planning, designing and estimation of the impact on the primary and secondary network. It is a question of a leading process. When primary network is in question, the leading process is designing in its widest sense, which includes all planning aspects of the problem, as are the spatial, economic, environmental, social and other. The leading process on the secondary network is of spatial, that is, of city planning

nature, implying the necessary level of design-related research as physical verifications of the planners’ solutions, meaning that the planning and street designing is a planning process within the leading urban planning.

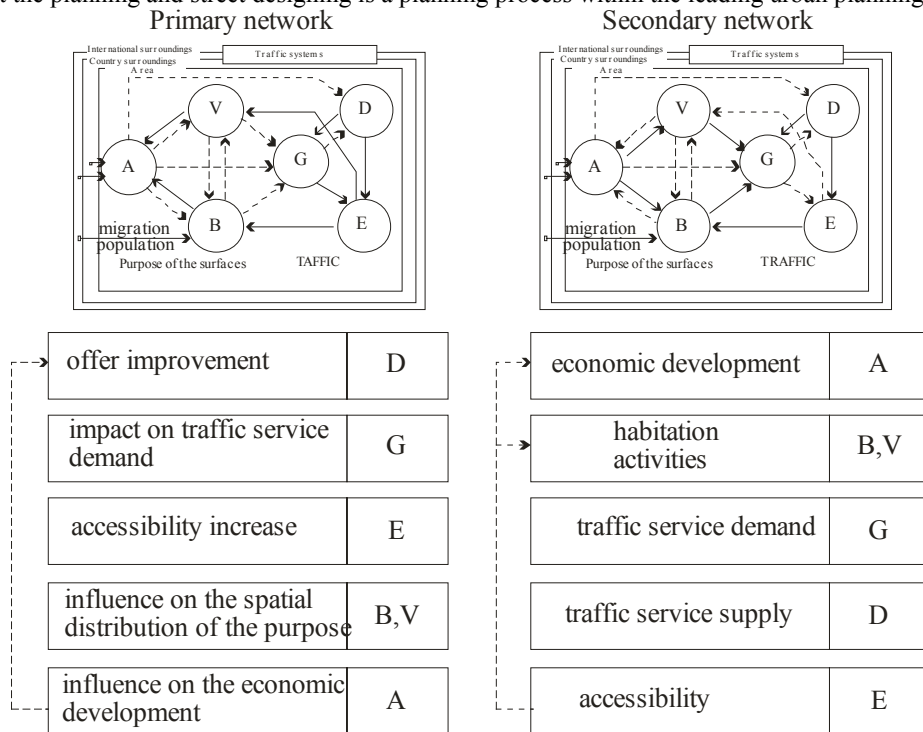


Fig. 4. General presentation of the conditionality of the spatial (urban) planning and street network (or section) design depending on the importance of the network (or section)

5. Summary

The traffic system performs a great extent of exchange with the environment and is closely connected in addition to that. For this reason the planning of the traffic represents today one of the aspects of the integrated environmental planning. The need for the ever bigger surfaces intended for traffic subsystems on the one hand, and the incapacity to sufficiently secure those surfaces, creates additional problems for the planners. Thus, the approach to the planning of the traffic network must be of interdisciplinary type. By that it must be taken into account that each city and its traffic system have various characteristics, in the sense that each city area has its specific traffic layout. For this reason it is impossible to generalize and come to a universally applicable solutions, but it is necessary to research and test the possible solutions.

References

- [1] Rešavanje na primarnata saobraćajna mreža vo centralnoto gradsko područje na grad Skopje [Solving the primary road network in the central city area of Skopje], Skopje, 164 p.
- [2] Maletin, M. Gradske saobraćajnice, [town traffic routes] Beograd, 1996, 375 p.
- [3] Vračarević, R. Osnovne zakonitosti saobraćaja u gradu, Planiranje, projektovanje i građenje gradskih saobraćajnica [The basic principles of traffic in the city, planning, design and construction of urban roads], Stručni seminar, 24 p.
- [4] Maletin, M., Andus, V. Osnove metodologije planiranja saobraćaja i prostora, Prostorni razvoj magistralnih koridora, Institut za arhitekturu i urbanizam (2003) Srbije-IAUS, Posebno izdanje broj 41, Beograd, 263 p.
- [5] Popović, Z., Puzavac, L., Lazarević, L. Rail Defects due to Rolling Contact Fatigue (2011) Building Materials and Structures, 54 (2), pp. 17-29.