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A city transport system versus shopping centres – using the geographical context of Łódź (Poland) as the example

Miejski system transportowy a centra handlowe w przestrzeni Łodzi

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Doctoral dissertation abstract

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Abstract

The dissertation, whose main object of research are the interactions between a city transport system and its environment, is one of the outcomes of the science project funded by the National Science Centre (No. 2019/33/N/HS4/01733). Due to the complexity of the researched issue, the author decided to take a closer look at one of such interactions – the relationship between the transport subsystem that is composed of vehicles, and shopping centres. A study was conducted pertaining to the proposed research hypothesis that a transport system affects the amount of traffic generated by shopping centres, which in turn affect how efficiently that system functions. This hypothesis assumes that the researched relationship should be bidirectional. On the one hand, the city transport system, by providing transport accessibility, influences the attractiveness of shopping centres and thus affects the amount of traffic generated by those facilities. On the other hand, by inducing vehicular traffic, shopping centres influence the efficiency of the city's transport subsystem composed of vehicles. Due to the fact that a transport subsystem of vehicles cannot exist in isolation from other elements of a city transport system, the author, in his considerations and research procedure, included also the impact of other elements of such a system on the amount of traffic generated by shopping facilities. The following were chosen as the study area: the transport system of Łódź, and the shopping centres located within the administrative boundaries of that city. The main objective of the dissertation is to detect regularities in the relations that occur along the CITY TRANSPORT SYSTEM – SHOPPING CENTRES axis. In order to achieve it, it was helpful to look for answers to two questions fundamental from the standpoint of the research. Which components of transport accessibility have a significant impact on the amount of traffic generated by shopping centres? What significance does the strength of the impact of mobility created by shopping centres have on the functional efficiency of the transport subsystem of individual vehicles?

The study used methods grounded in two scientific disciplines: socio-economic geography and traffic engineering. These included on-site investigations as well as cartographic and mathematical modelling techniques. The former were carried out to identify factors that would explain the volume of traffic generated by shopping centres, and to measure traffic intensity in Łódź shopping centres. Cartographic techniques were used to present the results of individual stages of the research procedure, as well as to measure and analyze transport accessibility. Mathematical modelling was used to measure the impact of the transport system on the volume of traffic observed in shopping centres, as well as to measure the impact of said traffic on the functional efficiency of the transport system.

The applied research procedure is reflected in the structure of the dissertation, which begins with an introduction to the research subject-matter, outlining the objectives and scope of the dissertation as well as explaining the terms relevant to any raised issues. The next part of the paper contains theoretical considerations on the relations occurring between a transport system and its environment. This chapter first presents said relations in broad contexts, only to later show their main vectors: transport accessibility and mobility. It ends with a closer analysis of literature on said relations and narrows the transport system's environment down to one sphere of socio-economic life – shopping and visits to shopping centres. The following chapter of the dissertation combines two natures: that of an overview, and that of a monograph. It presents the subsystems and key elements of transport systems while illustrating the phenomena in question, using Łódź as the example. Much similar is the next chapter, entitled "Determinants of the amount of traffic generated by Łódź shopping centres". It presents issues established in literature, pertaining to the most important characteristics that may affect the volume of traffic generated by shopping centres, while also presenting the results of a study on them conducted in Łódź. The above-mentioned chapters focus on providing information about the explanatory variables that are used in Chapter 5. This part of the paper synthesizes and verifies which of the determinants of the amount of generated traffic are important in creating the traffic that is associated with shopping centres. And so Chapter 5 answers the first of the research questions presented above. The following chapter measures the opposite direction of the CITY TRANSPORT SYSTEM – SHOPPING CENTRES relation. It shows to what extent shopping centres influence the efficiency of the transport system, using microsimulation modelling for this purpose. Time effectiveness of movements made within the road network in the vicinity of shopping centres was adopted as the measure of efficiency.

The conducted study made it possible to verify the proposed research hypothesis by showing that a transport system is a significant determinant of the amount of traffic generated by shopping centres. However, only the products of two transport subsystems (that of individual vehicles, and that of public transport) significantly explain the volume of traffic observed in shopping centres. An observation that is extremely valuable – not just from a cognitive but also from an applicational point of view – is that models built based on a set of variables containing a 'geographical element' provide possibilities of extremely accurate predictions about traffic generated by shopping centres. This is a helpful hint not only for geographers, but also for experts in the discipline of traffic engineering which, until now, has generally used models

based on static explanatory variables that are merely the characteristics of shopping centres, without giving them a geographical context.

At the same time, the study measured the local incidence of the phenomenon of limited efficiency of the transport system resulting from the functioning of shopping centres. Therefore, the bidirectionality on the axis of relations between a city transport system and shopping centres has been revealed.