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Summary of the doctoral dissertation entitled
"Environmental assessment of transport solutions using road traffic simulations"

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The aim of the doctoral dissertation was the practical use of road traffic simulations to assess the impact of road infrastructure modifications on the level of pollutant emissions by vehicles involved in road traffic. Selected infrastructure solutions of the City of Poznań were analyzed, both those considered in the future as well as those implemented. Additionally, it was determined how traffic hindrances related to road repairs and investments within road junctions affect the emissions of vehicles. The analyzes carried out in the study also included an estimation of the emissions benefits related to the introduction of the environmental zones (Low Emissions Zones) in the form proposed by the author of the dissertation.

The simulation studies on the impact of road traffic organization on the level of exhaust emissions from the vehicles participating in traffic provided very important information, practically impossible to obtain in any other way. The research approach adopted in the study fills the research gap in the field of combining road traffic modeling and simulation with the analysis of the impact of this traffic on the level of environmental pollution based on real measurements (Real Drive Emissions). The obtained results are of great practical importance and contribute to conducting similar analyzes for other objects and areas.

As part of the dissertation, the recently started reconstruction of the Rataje roundabout was analyzed. The simulation showed that the reconstruction of the roundabout in accordance with the best of the proposed variants should result in a significant –by about 20% – reduction of NO_x, HC and CO_2 emissions within this junction compared to the current state. CO and PM emissions would decrease to a lesser extent. On the other hand, analyzes of the introduction of bus lanes (DOP) along Garbary and Mostowa streets showed that this solution does not bring clear-cut environmental benefits. Although the CO emission of vehicles moving there is reduced by several percent, NO_x emission increases to a similar extent. The introduction of bus lanes in the mentioned location has practically no impact on HC and PM emissions. CO_2 emissions are reduced by approximately 5%.

The procedure algorithm described in the study can be widely used in practice. It can be used, for example, by municipal units whose competences include tasks in the field of planning, preparation and implementation of infrastructure investments and traffic organization, in particular road managers, as well as organizers of public transport, both in relation to local governments (city and poviat) and provincial ones. It can also be used to determine the impact of planned transport systems on the emission level already at the initial stages of the development of local spatial development plans.

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