

Models of traffic capacity in roundabout inlets in ideal conditions

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Abstract

Purpose: The primary aim of this monograph was to develop of a model of vehicle flow in single-lane roundabouts in Polish conditions as a classical and ideal model in the group of roundabout intersections and present a systematic characterization of essential characteristics of streams of vehicles which are moving in these intersections. Another aim of the study was construction of the models of traffic for turbo roundabouts. No models of vehicle flow and methods of calculation of their traffic capacities have been developed in Poland to date to be recommended for turbo roundabouts, despite the presence of a great number of these intersections. Proper development of models of vehicle flow in turbo roundabouts for the purposes of calculation of traffic capacity of their inlets necessitated detailed development of models of vehicle flow on two-lane roundabouts, which represented the third and the main aim of this monograph.

Design/methodology/approach: The theory of acceptance of headways in the main stream was used to allow for modelling actual traffic and road conditions in the intersections with very high accuracy. Furthermore, in the description of distribution of headways between the vehicles moving on a single traffic lane a spline function dependent on traffic conditions in a particular lane was adopted. The psychotechnical parameters of drivers in individual types of roundabouts (i.e. critical gaps for drivers from inlets and headways between the vehicles entering the intersection from the queue in the inlet) were described using functional dependencies based on mean driving speeds of the vehicles in the area of the intersection. The factors which determine the conditions in the vehicle stream in the main lane of the intersection were described using specific functions obtained based on empirical investigations.

Findings: *The principal scientific achievement of the monograph is development of models of traffic capacities in single-lane, two-lane and turbo roundabouts in ideal conditions. As for roundabouts, traffic capacity at the inlet in ideal conditions is termed initial capacity. An important element of the monograph is also the results obtained from author's own research which represent supplementation for current knowledge of modelling the behaviours of vehicle streams in roundabouts and analysis of traffic capacity of roundabouts.*

Research limitations/implications: *The main limitations include the fact that the process of road traffic is a complex phenomenon which is difficult to be described because it is affected by a significant number of random factors which are characterized by substantial variability of the adopted values. Processes of road traffic involve humans, who exhibit different behaviours in different situations while the varied behaviour in the same conditions is often very difficult to be modelled. All these elements cause that the construction of the models of vehicle traffics in the area of roundabouts is a complex problem that necessitates multifaceted investigations and analyses.*

Practical implications: *The models of initial capacity proposed in the monograph for single-lane, two-lane and turbo roundabouts offer great opportunities for applications since they allow, with a relatively high accuracy, for development of a new method of evaluation of traffic capacity for these types of roundabouts. The method can be successfully used for calculation of traffic capacity of roundabouts located both in and outside build-up areas in Polish conditions with varied degree of load in the inlets to vehicle streams.*

Originality/value: *The utility benefit of evaluation of traffic capacity in the inlets to roundabouts, including analytical and regression constructions of the models for the effect of different characteristics on functioning and traffic capacity is the data obtained in the monograph, which can be used for supporting the decisions on using the roundabouts in concrete road and traffic conditions and development of adequate tools that support evaluation of traffic conditions.*

Keywords: *Roundabouts; One-lane roundabouts; Two-lane roundabouts; Turbo-roundabouts; Roundabout capacity.*

Reference to this monograph should be given in the following way:

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