Queuing Models for Vehicle Flow on Crossroads

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The limited road capacity and increasing traffic have become a severe problem in many countries. The paper presents the mathematical model describing movement of vehicles through adjustable crossroads. The model is based on the theory of queuing.

One direction vehicle flow throw an adjustable crossroads is considered as a multiserver system with changeable intensity of service, in case of a red light an intensity of service is equal to zero. We use a model with a bounded turn, the number of positions is equal to quantity of cars which can be located in a quarter on all strips. If all places in the turn are occupied then an approached car leaves system. Thus approach permit to obtain periodic steady-state distribution for arbitrary intensities of input flows. These are steady-state results assume that the arrival pattern remains the same throughout a period large enough to get steady-state conditions. Analytical model is proposed to estimate residual queues that exist at the end of red phase at traffic signal on fixed-time plan. The dependence of the basic parameters of work (the average length of turn, probability that the quarter is completely occupied, the probability of free movement) on values of entrance system parameters is investigated. These steady-state distributions are compared with those obtained through a simulation model.

Several performance criteria may be used to evaluate a signalized intersection, such as average number of stops per vehicle, average queue length, and average stop delay. The multicriteria problem of optimal duration of traffic light cycle is studied.

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