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The Method of Determining the Number of Phases in the Traffic Light Cycle on the Allowable Intensity of Conflicting Flows

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Abstract

Reduction of vehicles delay at the main urban transportation routes is one of objectives for traffic management on the road network.

To improve performance of signalized crossings, the method for evaluation of the possibility to add vehicle flows with internal conflicting flow tracks in traffic light cycle phases. Allowable intensity ratios of conflicting traffics without signalization established by GOST R 52289-2004 are taken as a basis of decision on additional flows inclusion in phases. The example of incremental determining of allowable intensities of minor turning flows is made at preset intensity of main flows.

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1. Introduction

In the absence of any crossing limitations there are always pairs of conflicting flow with crossing tracks or interflowing at the entrance to one lane. If the intensity of these flows is insignificant, drivers yield the right-of-way to vehicles having way priority in accordance with the provisions of Traffic Rules (the RF Government Regulation No 1090 of 23.10.1993) (hereinafter referred to as the Rules), and positive control with traffic lights is not required. In this case the Rules established the right-of-way at the following diagrams of interacting flows conflicting to each

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other (Fig. 1). Vehicles moving on routes shown in Diagrams 1 and 2 are complied with the requirement to yield the right-of-way to direct contra flow and contra one making a right turn. Traffic Diagrams 3 and 4 are implemented when using additional traffic light sections to pass left-turn (Diagram 3) and right-turn (Diagram 4) flows at low capacity of left lanes and availability of temporary boundary intervals [ROSSTANDART (2004), Lobanov (1990), Shelkov (1995)] allowing safe manoeuvres.

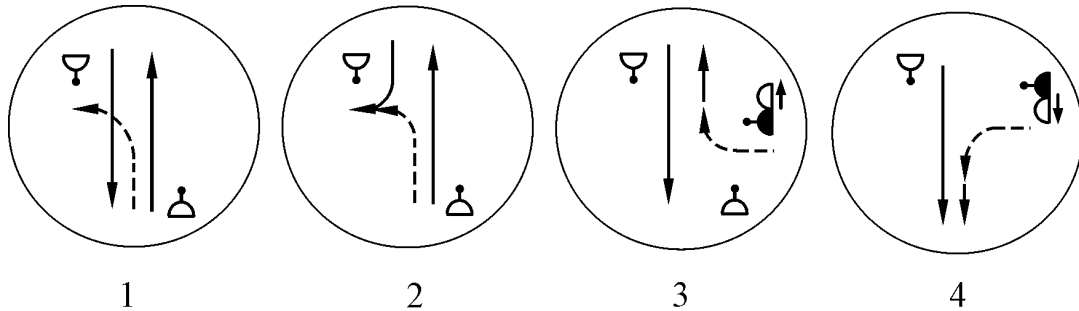


Fig. 1. Diagrams of right-of-way of flows conflicting to each other which are allowed by the Rules.

2. Determination of the condition for allowable intensity of conflicting flows in one phase

According to the presented provisions of the Rules, in each pair of conflicting flows there are the main flow having the right-of-way at the dangerous area and minor flow which vehicles shall yield the right-of-way to the main flow. Secondary flows are shown as dashed lines in the diagrams of Figure 1.

With increasing intensity and decreasing the number of acceptable boundary intervals per hour the number of time intervals to pass vehicles on the routes of minor flows is reduced, and when determining their intensity it is necessary to use signalization by means of conflicting flows priority [ROSSTANDART (2004), i. 7.2.14]. Values of allowable intensity of conflicting (crossing) flows on the main and minor roads without signalization are specified as per this item – (Condition 1 for use of signalization).

Thus, a condition when the specified intensity of the minor flow $N_{\min/giv}$ does not exceed the allowable intensity $N_{\min.al}$ at the specified intensity of the main flow $N_{\text{main } giv}$ shall be conflict allowability at intersection between the flows of the main and minor roads.

$$N_{\min.al} \geq N_{\min.giv}; \text{ at } f(N_{\text{main.al}}) \quad (1)$$

3. Analysis of conflicting flows interaction

To solve a matter on successive pass of conflicting flows in one phase, which tracks are shown in Figure 1, Condition 1 may be used to implement signalization for crossing flows [ROSSTANDART (2004)]. In this case factor K_H taking into account speed (or time intervals) differences shall be used at direct (through) and turn passing of intersections. Multiple measurements of time intervals of intersections passing in various directions allow determining factor K_n . For left-turn flows, factor $K_{n.l}$ is 0.6–0.7, for right-turn ones $K_{n.r}$ is 0.7–0.8, depending on a turn radius value (or roadway width).

The diagram (Fig. 2) of interacting flow tracks below confirms the allowability for use of above Condition 1 [ROSSTANDART (2004)] to the analysis of conflicting flows pass without signalization, not only crossing but interacting by the diagrams shown in Fig. 1.

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