

12th International Conference "Organization and Traffic Safety Management in large cities",
SPbOTSIC-2016, 28-30 September 2016, St. Petersburg, Russia

Calculation of Traffic Capacity of Signaled Intersections

Alexandr Chubukov ^{1a}, Valeriy Kapitanov ^{2b}, Olga Monina ^{2c}, Valentin Silyanov ^{1d*},

Ulrich Brannolte ^{3e}

¹ Moscow Automobile and Road Construction State Technical University (MADI), 64 Leningradskiy prosp., Moscow, 125319, Russia

² Scientific Research Center of Road Traffic Safety of the Ministry of the Interior of the Russian Federation, 17 Poklonnaya str., Moscow, 121170, Russia

³ Bauhaus-Universität, 13d Marienstr, Weimar, 99423, Germany

Abstract

In order to calculate traffic capacity of signaled intersections, it was suggested to apply an approach based on the concept of congestions. The paper states examples of traffic capacity calculation.

© 2017 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the organizing committee of the 12th International Conference "Organization and Traffic Safety Management in large cities"

Keywords: signaled intersections; traffic capacity; congestion

1. Introduction

Increase of traffic intensity leads to situations when it becomes impossible to provide a satisfactory level of traffic servicing with the help of only traffic light signaling means. Congestion at a section of the road traffic network with traffic signals is a situation when the average duration of the vehicle delay exceeds the length of the traffic signaling cycle [Kapitanov and Khilazhev (1986), Federal Road Agency (Rosavtodor) (2012)]. In this case, the queue length can increase, reaching the length of the road intersection. Further development of the road blocking paralyzes larger parts of the road network and disorganizes the traffic in whole.

* Corresponding author. Tel.: +0-000-000-0000 ; fax: +0-000-000-0000 .

E-mail address: a.b.chubukov@mail.ru^a, valerij47-k@yandex.ru^b, monina612@yandex.ru^c, silyanov@bk.ru^{d*}, ulrich.brannolte@bauing.uni-weimar.de^e

Congestions can be divided into systematic (stable) and occasional. The cause of occasional congestions can be different random factors, such as accidents or emergency situations. Systematic congestions are characterized by periodic repetition in time and stability in space. Such congestions occur in certain directions of movement at the same sections of the road traffic networks, during “rush hours”, as a rule.

Basically, optimization of traffic control implies challenging of forecasting, recognition and elimination of pre-congestion situations, preventing road blocks, which requires exclusion of causes of traffic overloading by means of redistributing of traffic flows onto alternative routes. The traffic control system should promptly inform the drivers on possible traffic congestions and recommend bypass routes [Kravchenko (2013)].

2. Main text

2.1. Methods

Methods of traffic flows control in the situation of congestions can be divided into methods of on-line control and methods which are based on the input data on parameters of traffic flows referring to the time prior to the moment for which the impact is calculated. Input data of the latter methods can apply to any other “standard” situations. The method of control based on the analogue of the “library” of free traffic flows control applications can serve as an example [Kapitanov and Khilazhev (1986), Plotnikov (2010), Transportation Research Board, National Research Council (2000)]. For example, M-number of standard situations for the object was revealed in the result of field observations. Corresponding exposure is calculated for each such situation. The system measures different traffic flow parameters, and if these parameters are close to those of some standard set out of M-number situations, the system completes appropriate actions.

2.2. Examples

Let us consider an example of a simple intersection of two-way roads and multi-phase control of actions and characteristics of traffic flows.

Let us introduce the following variables: q_{ik} (intensity of i^{th} flow in the k^{th} phase), C_{ik} (congestion flow corresponding to the i^{th} flow), g_k (duration of enabling traffic signal k), l_{ik} (time loss per a cycle related to the traffic flow with the intensity q_{ik}), n (the number of control phases) (Fig. 1).

In accordance with the diagram of the queue relieving (Fig. 1), the driver spends some time on starting and acceleration under fully intensive enabling period after the green signal starts. After a few seconds, the intensity of queue relieving reaches its peak value and stabilizes (the flow of loading). Fig. 1 shows time interval revealing the effective duration of the green signal g , which is defined as the time interval during which cars move across the stop line (under piecewise-constant approximation of the output flow intensity).

Download English Version:

<https://daneshyari.com/en/article/5125270>

Download Persian Version:

<https://daneshyari.com/article/5125270>

[Daneshyari.com](https://daneshyari.com)