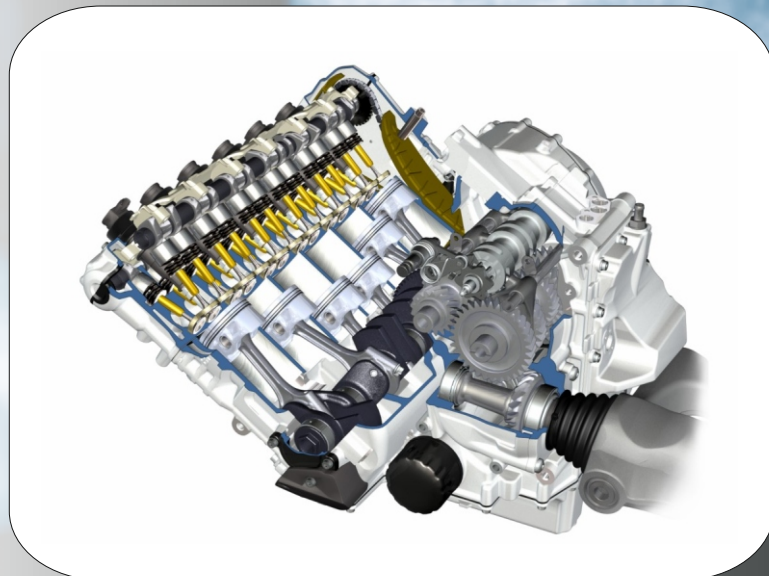


International journal
for science, technics and
innovations for the industry



MACHINES
TECHNOLOGIES
MATERIALS

YEAR XI **Issue 1 / 2017** **ISSN PRINT 1313-0226**
ISSN WEB 1314-507X



Published by
Scientific technical
Union of Mechanical Engineering "INDUSTRY 4.0"



MACHINES. TECHNOLOGIES. MATERIALS

INTERNATIONAL SCIENTIFIC JOURNAL

PUBLISHER

SCIENTIFIC TECHNICAL UNION OF MECHANICAL ENGINEERING “INDUSTRY 4.0”

108, Rakovski Str., 1000 Sofia, Bulgaria

tel. (+359 2) 987 72 90,

tel./fax (+359 2) 986 22 40,

office@stumejournals.com

www.stumejournals.com

ISSN PRINT 1313-0226, ISSN WEB 1314-507X, YEAR XI, ISSUE 1 / 2017

EDITOR-IN-CHIEF

Prof. D.Sc. DHC Georgi Popov,

President of Bulgarian Scientific and Technical Union of Mechanical Engineering

EDITORIAL BOARD

MEMBERS

SCIENTIFIC COMPETENCE

Prof. Dimitar Damyanov	Automatisation of production
Prof. Dimitar Karaivanov	Mechanics of machines
Prof. Dimitar Stavrev	Technologies and materials
Prof. Dimitar Yonchev	National and industrial security
Prof. Galina Nikolcheva	Machines tools and technologies
Prof. Hristo Shehtov	Automatisation of production
Prof. Idilija Bachkova	Automatisation of production
Prof. Ivan Kralov	Mechanics of machines
Prof. Ivan Parshorov	Technologies and materials
Prof. Ivan Yanchev	Machines and technologies
Prof. Ivo Malakov	Automatisation of production
Prof. Kiril Angelov	Industrial Management
Prof. Lilo Kunchev	Transport Equipment and Technology
Prof. Lubomir Dimitrov	Machines and technologies
Prof. Miho Mihov	Agricultural machinery
Prof. Miroslav Denchev	Ergonomics and design
Prof. Mladen Velev	Economics and Marketing
Prof. Nikolay Diulgerov	Technologies and materials
Prof. Ognyan Andreev	Production management
Prof. Petar Kolev	Transport Equipment and Technology
Prof. Roman Zahariev	Robotics
Prof. Sasho Guergov	Robotic systems and technology
Prof. Tsanka Dikova	Technologies and materials
Prof. Vitan Galabov	Mechanics of machines



MACHINES. TECHNOLOGIES. MATERIALS

INTERNATIONAL SCIENTIFIC JOURNAL

ISSN PRINT 1313-0226, ISSN WEB 1314-507X, YEAR XI, ISSUE 1 / 2017

EDITORIAL BOARD FOREIGN MEMBERS

Prof. Adel Mahmoud	IQ	Prof. Marian Tolnay	SK
Prof. Ahmet Ertas	TR	Prof. Mark Easton	AU
Prof. Andonaq Londo	AL	Prof. Mart Tamre	EE
Prof. Andrei Firsov	RU	Prof. Maryam Ehteshamzade	IR
Prof. Andrzej Golabczak	PL	Prof. Michael Evan Goodsite	DK
Prof. Anita Jansone	LV	Prof. Movlazade Vagif Zahid	AZ
Prof. Aude Billard	CH	Prof. Natasa Naprstkova	CZ
Prof. Bojan Dolšak	SI	Prof. Oana Dodun	RO
Prof. Christian Marx	LI	Prof. Oleg Sharkov	RU
Prof. Dale Carnegie	NZ	Prof. Páll Jensson	IS
Prof. Ernest Nazarian	AM	Prof. Patrick Anderson	NL
Prof. Esam Husein	KW	Prof. Paul Heuschling	LU
Prof. Ewa Gunnarsson	SW	Prof. Pavel Kovac	RS
Prof. Filipe Samuel Silva	PT	Prof. Per Skjerpe	NO
Prof. Francisco Martinez Perez	CU	Prof. Péter Korondi	HU
Prof. Franz Haas	AT	Prof. Peter Kostal	SK
Prof. Genadii Bagliuk	UA	Prof. Juan Alberto Montano	MX
Prof. Georg Frey	DE	Prof. Raul Turmanidze	GE
Prof. Gregory Gurevich	IL	Prof. Renato Goulart	BR
Prof. Haydar Odinaev	TJ	Prof. Roumen Petrov	BE
Prof. Hiroyuki Moriyama	JP	Prof. Rubén Darío Vásquez Salazar	CO
Prof. Iryna Charniak	BY	Prof. Safet Isić	BA
Prof. Ivan Svarc	CZ	Prof. Sean Leen	IE
Prof. Ivica Veza	HR	Prof. Shi Xiaowei	CN
Prof. Jae-Young Kim	KR	Prof. Shoirdzan Karimov	UZ
Prof. Jerzy Jedzejewski	PL	Prof. Sreten Savićević	ME
Prof. Jean-Emmanuel Broquin	FR	Prof. Stefan Dimov	UK
Prof. Jordi Romeu Garbi	ES	Prof. Svetlana Gubenko	UA
Prof. Jukka Tuhkuri	FI	Prof. Sveto Cvetkovski	MK
Prof. Kazimieras Juzėnas	LT	Prof. Tamaz Megrelidze	GE
Prof. Krasimir Marchev	USA	Prof. Tashtanbay Sartov	KG
Prof. Krzysztof Rokosz	PL	Prof. Teimuraz Kochadze	GE
Prof. Leon Kukielka	PL	Prof. Thorsten Schmidt	DE
Prof. Mahmoud El Gammal	EG	Prof. Tonci Mikac	HR
Prof. Manolakos Dimitrios	GR	Prof. Vasile Cartofeanu	MD
Prof. Marat Ibatov	KZ	Prof. Yasar Pancar	TR
Prof. Marco Boccione	IT	Prof. Yuriy Kuznetsov	UA
		Prof. Wei Hua Ho	ZA

CONTENTS

MACHINES

COMPARATIVE RESEARCH ON THE QUALITY OF AUTOMOTIVE STATORS CONDUCTORS WELDING OBTAINED THROUGH BRAZING AND TIG WELDING METHODS PhD, P. Eng. Pushev G., Chief Assistant Velev S., Prof. Dulgerov N.	3
STUDY OF RESISTING MOMENT INFLUENCE ON OPERATION OF HIGH-VOLTAGE INDUCTION MOTOR PUMP ELECTRIC DRIVE Assoc. Prof. Rachev S. PhD., Lyubomir Dimitrov, Ivaylo Dimitrov	7
ABOUT COMPUTER DESIGN OF MACHINE AND EQUIPMENT THE GENERAL MACHINE BUILDING Dinev G. PhD., Iliev Zh. PhD.	11

TECHNOLOGIES

APPLICATION OF LOW-FREQUENCY VIBRATION PROCESSING AT A PERFORMANCE RESTORATION OF STEAM TURBINE BLADES Candidate of Technical Sciences, associate professor Savinkin V.. Director of Remplazma LLP Kiselyov L., master, research associate Kolisnichenko S..Junior researcher mitry Koptyaev D..Master, research associate Derman A.	15
EXPERIMENTAL RESEARCH AND MODELING OF THE IMPACT OF PLASTIC DEFORMATION ON DIFFERENT MATERIAL CHARACTERISTICS Leo Gusel	17
IMPROVING THE RELIABILITY OF INSTRUMENTS FOR MEASURING AND THERMAL CONTROL OF OBJECTS OF DIFFERENT PHYSICAL NATURE BY THE FINISH ELECTRON-BEAM PROCESSING SURFACES OF OPTICAL ELEMENTS Associate Professor Ph.D. Yatsenko I, Professor dr. eng.Antonyuk V., senior researcher dr. eng. Kyrychenko O., Professor dr. eng. Vashchenko V.	20
STUDY OF EFFECT OF INITIAL AND SUBSEQUENT HEAT TREATMENT OF CON-STRUCTIONAL STEELS ON PROPERTIES OF JOINT WELDS PRODUCED BY ELECTRON BEAM WELDING Engineer Izyumov Artem A., Engineer Artem Gubko D.	24
A REVIEW OF RESIDUAL STRESS MEASUREMENTS BY HDM AND OPTICAL TECHNIQUES M.Sc.Barile C. PhD, Prof. Casavola C. PhD, M.Sc. Pappaletta G. PhD, Prof. Pappalettere C.	27
THE POSSIBILITY OF USING WASTE MOLD SAND FOR ADSORPTION OF ACETIC ACID Assoc. Prof. Štrkalj A. PhD., Assoc. Prof. Glavaš Z. PhD., Prof. Hršak D. PhD.	30
CALCULATION ALGORITHM FOR CYCLE LENGTH OF SIGNALIZED INTERSECTION Assist. Prof. PhD Saliev D.	33

MATERIALS

ALUMINUM NANOSTRUCTURED COATINGS AS ALIGNMENT LAYERS FOR LIQUID CRYSTAL MIXTURES Prof. Dr. Alexander G. Smirnov, Dr. Andrey A. Stsiapanau, Prof. Dr. Victor V. Belyaev, Dr. Denis N. Chausov	35
--	----

CALCULATION ALGORITHM FOR CYCLE LENGTH OF SIGNALIZED INTERSECTION

Assist. Prof. PhD Saliev D.

Technical University of Sofia, Faculty of transport, Department of Combustion Engines, Automobile Engineering and Transport, Bulgaria
durhan_saliev@tu-sofia.bg

Abstract: Traffic lights regulation reduces conflict points in intersection of traffic flows trajectory and provides their safety crossing. The main in installation of traffic lights is determination of a cycle length which guarantee minimum waiting time of traffic flows at the junction. The paper presents a calculation algorithm for the cycle length of a traffic light junction according to traffic flows intensity, saturation flows and day periods which are have deferent intensity.

Keywords: TRAFFIC FLOWS, CYCLE OF TRAFFIC LIGHT, TRAFFIC LIGHT JUNCTION

1. Introduction

Traffic lights regulate road traffic across junctions where the conflict zones between traffic flows are not separated from one another. They are applied in order to increase safety and traffic capacity. The major drawback of regulation with traffic lights there is a waiting time of all flows crossing intersection [2]. Traffic light regulation calls for the implementation of certain conditions. The most influential factor when deciding whether or not to use a traffic light at a given junction is the intensity of the traffic flows passing through this junction.

2. Prerequisites and means for solving the problem

The main issue when regulating junctions by traffic lights is how to determine the optimal cycle length for the existing road and traffic conditions. For achieving minimum waiting times, it is necessary to first determine the periods of the day when it is possible to use different cycle lengths to regulate the traffic at a given junction, thus differentiating rush hours from the other periods of the day.

The length of the traffic light cycle is to a large extent affected by the number and type of phases for allowing traffic to pass through a given junction. They are determined according to the specific traffic and road conditions for a given junction as follows:

- Intensity of traffic flows by direction, which largely affects the decision which traffic flow to cross the junction in each of the phases;
- Type of intersection – three-way intersection, four-way intersection, etc.;
- Junction configuration – the width and number of entry and exit lanes are decisive;
- Complexity of the junction – it depends on the number and type of conflict points between traffic flows;
- Others – coordination with other traffic lights, pedestrian crossings, left-turn prohibition and other considerations related to traffic organization in the junction area.

The safe passage of traffic flows between the different phases is ensured by the change intervals, which guarantee that the last car of the exiting traffic flow will have exited the conflict zone by the time the first car of the entering traffic flow reaches it. The change intervals depend on the configuration and geometric dimensions of the junction. From the point of view of crossing the junction safely, their duration is the part of the traffic light cycle which cannot be changed.

3. Results and discussion

The requirement for optimal cycle length was achieved by developing a cycle length calculation algorithm.

The basic input data for the algorithm are:

- Intensity of traffic flows crossing the junction (I_a), veh/s;
- Length of the period of the day whereof the calculations are

made (t_{pd}), s;

- Minimum green time for each phase ($t_{g\min}$), s.

The number and type of phases for allowing traffic flows to pass through the junction are determined successively. If traffic lights are available, they may not be changed.

The change periods are determined according to the established conflict zones during changes of phases. One of the methods used for this purpose is described by Moore [3].

The saturation flow is determined based on the calculated change period.

It is assumed that the change period for a given phase (t_{ii}) is equal to the transition time of a vehicle through the intersection (t_{pc}). It is determined with the help of a study which includes measurements of the time that the vehicles in the queue need to set off when the traffic light changes to green. The transition time of each car in the queue and the time between them are both measured. The results show that the headway between vehicles (Δt_{bc}) passing through the signalized intersection is one second.

According to the transition time of a car and the headway, the following values are determined:

$$A_e = \frac{t_{pc}}{\Delta t_{bc}}, \text{ veh} \quad (1)$$

$$t_p = 2t_{pc}, \text{ s} \quad (2)$$

Where:

A_e - Number of vehicles entering the intersection during the transition time of a vehicle, veh;

t_p - Transition time of A_e , s.

The saturation flow of a single lane of the roadway is determined:

$$I_{pl}^f = \frac{A_e}{t_p}, \text{ veh/s} \quad (3)$$

The saturation flow is determined by using (4).

$$I_p^f = I_{pl}^f * l_t, \text{ veh/s} \quad (4)$$

Where:

l_t - Number of lanes for the respective flow.

Each flow of the given phases requires enough green time (t_{ng}^f) to guarantee its smooth passing during the period of the day for which the calculations are made. The required green light time is calculated as follows:

$$t_{ng}^f = \frac{t_{pd} * I_a^f}{I_p^f}, s \quad (5)$$

After calculations for each flow are made, the sum of the green times required for each phase $\sum_{i=1}^n t_{ng}^{f_i}$ is calculated as well, where “i” is the number of phases.

We calculate the sum of all change periods for the whole period of the day for which the cycle length is calculated by using the following equation:

$$\sum_{i=1}^n t_{ti} = t_{pd} - \sum_{i=1}^n t_{ng}^{f_i}, s \quad (6)$$

We determine the number of cycles for the period of the day whereof the calculations are made (N_{cp}):

$$N_{cp} = \frac{\sum_{i=1}^n t_{ti}}{\sum_{i=1}^n t_{ng}^{f_i}} \quad (7)$$

The cycle length is calculated as follows:

$$t_c = \frac{t_{pd}}{N_{cp}}, s \quad (8)$$

After calculating the cycle length, we calculate the green time for each phase of the cycle. For this purpose, the following ratio is used:

$$\gamma_i = \frac{I_p^{f_i}}{I_a^{f_i}} \quad (9)$$

The green time for each phase is calculated according to (9).

$$t_g^{f_i} = \frac{t_c}{\gamma_i}, s \quad (10)$$

One constraint of the algorithm is the provision of minimum green time for each phase.

A generalized block diagram of the calculation algorithm for cycle length for signalized intersection is shown in fig. 1.

The determined cycle length is optimal for the intersection in the existing traffic conditions. The lengths of the phases can be further optimized by following the algorithm described in detail in [1].

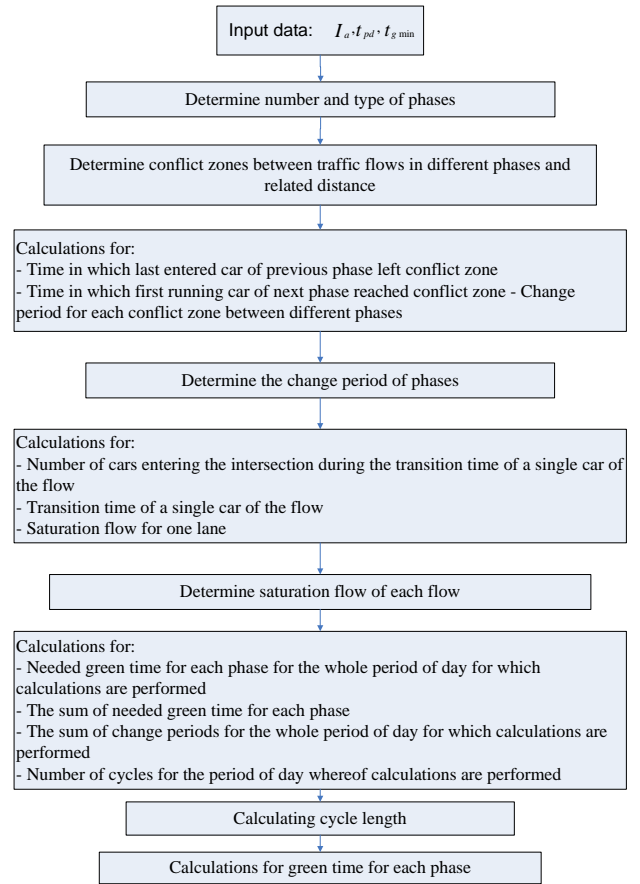


Fig. 1 Generalized block diagram of the calculation algorithm for cycle length for signalized intersection

4. Conclusions

The presented calculation algorithm for cycle length of signalized intersection has the following major advantages:

1. Allows calculation of the cycle length for each period of the day regardless of its duration.
2. The input data are determined by a single analysis of the intensity of traffic flows.
3. Little input information is required for the determination of change periods.
4. A value of the cycle length, which is optimal in the existing traffic conditions, is determined.
5. The determined green times guarantee the smooth passing of cars during the given period of the day.

References

- [1] Салиев, Д. (2013). Моделиране на пътнотранспортното движение при на стъпване на аварийни ситуации. Докторска дисертация, ТУ – София, София, България.
- [2] Сотиров, Д., 1983. Проектиране на пътища. София, Техника.
- [3] Moore, P., 2011. Streamlining phase intergreen measurement for traffic signal junction. Traffic Engineering and Control, July, pp.283-285.