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REGULATING THE FLOW OF TRANSPORT WITH ALLOWANCE FOR THE INTERVAL OF MOTION

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Abstract

Purpose: *We show that the regulation of traffic is especially important under conditions of infrastructure. The aim was to show that the objectives of traffic light regulation is to minimize and, where possible, exceptions meetings conflicting streams of vehicles. The authors show that the applied aspects of optimization of traffic lights is to eliminate mash situation and ensure the safety of all road users.* ***Methods:*** *The method used in the comparison is to select the best technical solution, feasibility to test mathematical tools and engineering for the practical implementation of the proposed technical solution.* ***Results:*** *The results of the study is repeated then that shows the organization of the preconditions for the introduction of traffic light regulation based on the calculation cycle of the traffic light object. It is proposed to cycle more than 120 seconds, as if waiting longer allowing drivers can count signal lights faulty and start moving to the blocking signal. The main tasks of traffic light regulation is to minimize and, where possible, exceptions meetings conflicting streams of vehicles and eliminate mash situation and ensure the safety of all participants. An important part of the work on the introduction of traffic light regulation is the calculation cycle of the traffic light object. For reasons of safety, cycle time of more than 120 is considered unacceptable, since the longer waiting signal allowing drivers can count faulty lights and start moving to the prohibitive signal.* ***Discussion:*** *In conclusion, the article revealed that the divergent forms of regulation of the intersection can also be used for general stress on public roads. The methods of testing for the road tion type.*

Keywords: crossroads; method; movement control.

1. Introduction

There is now standard equipment in a variety of sensors, including contact detectors, electromagnetic detectors, radiation detectors; information processing tools and management controllers, control lights, and money management traffic, such as traffic lights, allowing relatively efficiently and inexpensively implement a continuous process of information gathering detectors transport, processing and delivery controllers corresponding commands on the traffic lights to regulate traffic on the highway according to the proposed ways [1]. Thus, correlating the number of cars entering the highway at a speed or density of traffic, you can always keep the traffic on the highway within a designated threshold speed or density of traffic, such as under speed of 60–90 km / h [2]. This range of speeds of traffic on the highway, as will be shown below, is the most effective [3]. Thus on the highway does not arise cork and well maintained safety distance between cars.

2. Revelance

Saturation flow is determined by the respective formulas or tables and depends on many factors, including: the width of the roadway (lanes); longitudinal slope on the approaches to the intersection; the state of the road surface; visibility intersections driver; presence in the area of the intersection of standing pedestrians and cars, etc. Each of the factors having the correction factor is different in saturation flow value [4].

F. Webster proposed for the calculation of cycle traffic light facility empirical formula is known characteristic drawback – chosen confounding factors [5].

3. Analysis of recent research

The purpose of the work. Another negative feature of this method is that with high traffic and insufficient throughput Cross (low values Mn) the amount calculated phase coefficients Y tends to unity and the cycle (see. Formula (1)) – to infinity [6].

On the evidence in this paper the calculations the duration of cycle traffic light object method proposed by F. Webster, at the intersection of the average, typical for the city. Was selected intersection 1 and 2 million city. Scheme intersection indicating the directions of movement of vehicles and pedestrians shown in Fig. 1.

4. The main material research.

Given the uneven arrival of vehicles to the intersection, the English researcher F. Webster [7] proposed an empirical formula for calculating the cycle of traffic lights traffic facility with minimum delay [8], which is widely used in world practice [9]

$$T_c = \frac{1,5 + Tn + B}{1 - \gamma} \qquad (1)$$

Where

$$T_n = t_n \times F \qquad (2)$$

F – number of phases of traffic light at this intersection object;

t_n – most of the time values calculated intermediate cycles in each phase;

$$T = \sum_{1}^{n} y_{ij} \qquad (3)$$

y_{ij} – phase coefficients are determined for each of the directions of movement at a crossroads in this phase adjustment:

$$y_{ij} = \frac{N_{ij}}{M_{Hij}} \qquad (4)$$

Where N_{ij} – traffic for the period of day unit. / h; MH_{ij} – saturation flow in this direction this phase regulation units / hour.

On one of the streets organized by tram (str. 1), st. 2 is the width of the carriageway is sufficient for the movement of vehicles on 5 bands, while across the

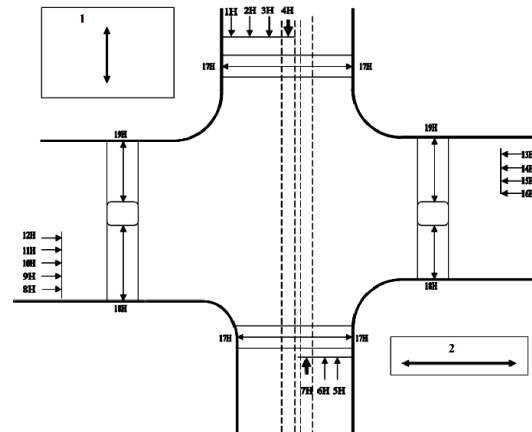intersection of bandwidth does not exceed 3.5 m [10].

Fig. 1. Scheme section with numbered areas

Fig. 2 cartogram shows the intensity of traffic in these units during rush hour (on the intersection scheme presented in Fig. 1, cartogram rotated 90 °).

As can be seen from the formula (1) in the calculation of cycle traffic light object must use the TP – the length of time the intermediate cycles. To ensure safety and to the changing area and a large intersection in calculating this figure adopted equal to 5 seconds.

In phase coefficients calculated by the formula (2) and promtakta duration specified above, the cycle determined by the formula F. Webster, takes a negative value that is fundamentally impossible:

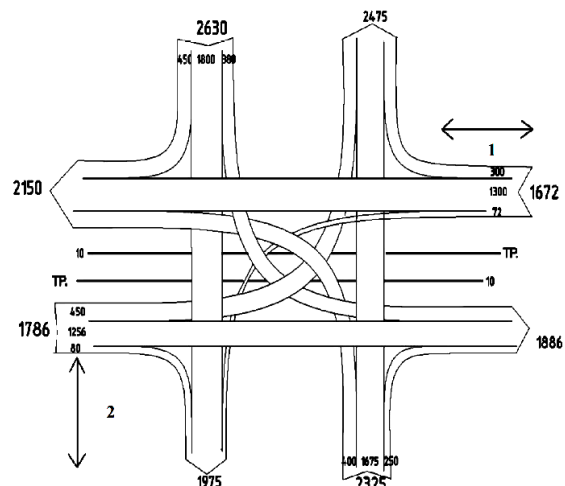Tc=(1,5×5×3+5)/(1–(0,40+0,53+0,51))=
=27,5/(–0,44)=-63c

Fig. 2. Cartogram intensity of transport (U / h) flow

To analyze the reasons for getting negative value cycle time of traffic light object in this paper in the form of conventional proposed various options for traffic at the same intersection:

1. With bandwidth of 3.5 m, 3-phase regulating traffic light object and the maximum intensity of traffic, which accounts for one lane that is 400 units. / H, the cycle will be:

$$Tc=(1,5×5×3+5)/(1–(0,23+ \\ +0,3+0,33))=27,5/0,44=196c$$

In this case, the adopted conditions, the cycle of traffic lights facility exceeded maximum value (120 seconds).

2. When the band width of 3.5 m, 2-phase regulating traffic light facility and maximum intensity of traffic, which accounts for one lane that is 400 units. / H, the cycle will be:

$$Tc=(1,5×5×2+5)/(1-(0,23+0,33))=27,5/0,44=63c$$

Based on the values for the theoretical calculation method F. Webster at this crossroads is meaningful strip width of 3.5 m, 2-phase regulating the traffic light and the object at the maximum intensity of traffic, which accounts for one lane in each phase, no more than 400 units. / H. The negative value of cycle time of traffic lights object (-83 c) may be due to the fact that the intersection of 1 and 2 in the 3-phase mode, the traffic light object maximum intensity of traffic to one lane in each phase is More than 600 units. / H.

The above formula shows that the 3-phase cycle and phase coefficients quest to 0,3-0,35 cycle tends to absurd values.

For example, at traffic light object y1, y2, y3, respectively equal to 0.3; 0.35; 0.25, will cycle 185:

$$Tc=(1,5×9+5)/(1–(0,3+ \\ +0,35+0,25))=18,5/0,1=185c$$

The value of the phase factor of 0.35 is obtained with a width of 3.5 m carriageway and intensity of 650 buses. / H. Accordingly, y, 0.25, will be received in the bandwidth of 3.5 m and intensity of 463 buses. / H.

5. Conclusions

Traffic control on highways with intersections is made using traffic lights. When the blocking signal is turned on, the traffic flow is interrupted and cars accumulate before the intersection. After the enable signal is turned on, the cars begin to move in sequence: first the first one starts, the second moves, the second – after two seconds, etc. Thus, each car starts to move in a second, since everyone needs to have a minimum safety distance. For each subsequent car, the distance to the intersection increases. If we assume that the car behind the car occupies a gap of 6 meters, the second car will move to the intersection of 6 meters, the third – 12 meters, etc. Calculating the speed set shows that the second car will move to the intersection for one second, in total it will take two seconds to advance to the intersection, the twentieth – 40 seconds. Therefore, for each car takes consecutive 2 seconds. As a result, if the time of the authorization signal is 40 seconds, during this time, 20 vehicles will pass through the intersection, that is, the traffic capacity of the intersection with respect to one lane is 1/2, or 0.5 autos / s. However, behind the permissive signal the prohibiting signal of the traffic light turns on for 40 seconds. Thus, 20 vehicles will pass through the intersection in 80 seconds, and even with a pause for the three-second intermediate yellow signal, even less (~ 18), that is, the capacity $N = 18/80 = 0.22$ avt / s = 800 auto / h .

As a result, the throughput of a junction for one lane is about four times lower than the capacity of one non-stop lane at speeds in the range of 40-90 km / h.

If all cars before the traffic lights for a full cycle of changing signs (80 s) do not have time to pass, then the remaining waiting time will be twice as large and the average speed of cars on the highway drops with the same throughput of the highway. Therefore, the efficiency of the use of vehicles is further reduced because of this reduction in speed.

The bandwidth of the lane can be doubled if you pass cars through the intersection on the go, or without stopping. Then each separate column of cars passes the intersection without stopping, but the average efficiency of the use of vehicles will be half as much, since there is an interval between the columns equal to the time of the traffic light signal. However, compared to the usual traffic of cars through intersections with traffic lights with stops, the capacity for organizing non-stop traffic by columns through intersections rises twofold – from 800 au / h to about 1500 avt / h due to the continuous movement of the columns one after another without stopping.

The proposed method of regulating automobile traffic on the highway is that the intersection of the traffic intersection with the crossing is realized immediately. This ensures the maximum throughput

N for the intermittent transport stream. To do this, a stream of vehicles with breaks is formed, consisting of columns (pools), which immediately follow one another in a fixed interval, cross each intersection on the highway to the traffic light signal.

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А.Є. Гуль
Регулювання потоку автотранспорту з урахуванням інтервалу руху
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Мета: У роботі показано, що регулювання транспортного потоку особливо актуально в умовах становлення розвитку інфраструктури. Метою роботи було показати, що завданнями світлофорного регулювання є мінімізація і, по можливості, виключення зустрічі конфліктуючих потоків транспортних засобів. Автори показують, що прикладним аспектом роботи є оптимізація роботи світлофорів для усунення заторної ситуації й гарантування безпеки всіх учасників руху. **Методи дослідження:** Методами, використаними в роботі є: порівняльний – для вибору найкращого технічного рішення, техніко-економічний – для перевірки математичного апарату, а також інженерний – для практичного втілення пропонованого технічного рішення. **Результати:** показані передумови організації роботи по введенню світлофорного регулювання на основі розрахунку циклу роботи світлофорного об'єкта. Пропонується тривалість циклу більше 120 с, оскільки при більш тривалому очікуванні дозволяючого сигналу водії можуть вважати світлофор несправним і почати рух на заборонний сигнал. **Обговорення:** У висновку статті виявлено, що варіативні форми регулювання роботи перехрестя можуть бути використані також і для загального зняття напруги на дорогах загального користування. Запропоновано методики апробації для дороги нового типу.

Ключові слова: методика; перехрестя; регулювання; рух; учасник.

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Регулирование потока автотранспорта с учетом интервала движения

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Цель: В работе показано, что регулирование транспортного потока особенно актуально в условиях становления развития инфраструктуры. Целью работы было показать, что задачами светофорного регулирования является минимизация и, по возможности, исключения встречи конфликтующих потоков транспортных средств. Авторы показывают, что прикладным аспектом работы является оптимизация работы светофоров для устранения заторной ситуации и обеспечения безопасности всех участников движения. **Методы исследования:** Методами, использованными в работе, являються: сопоставительный – для выбора лучшего технического решения, технико-экономический – для проверки математического аппарата, а также инженерный – для практического воплощения предлагаемого технического решения. **Результаты:** показаны предпосылки организации работы по введению светофорного регулирования на основе расчета цикла работы светофорного объекта. Предлагается длительность цикла больше 120 с, так как при более продолжительном ожидании разрешающего сигнала водители могут посчитать светофор неисправным и начать движение на запрещающий сигнал. **Обсуждение:** В заключении статьи выявлено, что вариативные формы регулирования работы перекрестка могут быть использованы также и для общего снятия напряжения на дорогах общего пользования. Предложены методики апробации для дороги нового типа.

Ключевые слова: методика; перекресток; регулирование; участник движения.

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