MATHEMATICAL MODELLING OF ENGINEERING PROBLEMS
Vol.2, No.1, 2015, pp.13-16
http://dx.doi.org/10.18280/mmep.020104

STUDY OF THE TIME-COLLOCATION OF SIGNAL LAMP AT INTERSECTION

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ABSTRACT

The paper deliberates the affection of roundabout and crossroads for the urban traffic .Firstly, the Webster method is quoted to calculate the cycle of signal lamp, and then the time-collocation of signal lamp which is got investigated and surveyed-data are used at the VISSIM to simulate the traffic condition, finally, it is concluded that the traffic volume of crossroads is slight better than the roundabout.

Keywords: Traffic management, Traffic signal control, VISSIM micro simulation, Signal lamp interval time.

1. INTRODUCTION

With China's rapid economic development, people's living standards continue to improve, this convenient and efficient tool for automobile also entered thousands of households, the growing motor vehicle ownership has brought serious traffic problems, people to delay on the road of time is also in constant increase. Fan Ran in the [1] through a variety of simulation software analyzed and compared a variety of simulation software, and combining with the case of Beijing city found the problem. Li Keping compared the calculation method of countries change interval in [2], discussed the influencing factors, and put forward the calculating standards of China's green light interval, detailed calculation steps etc. He designed the traffic survey scheme of Taishan Avenue in [3] combined with the actual situation, and carried on the design of signal phase and signal timing plans, increased its capacity. Research of an intersection in Harbin by Yan Ruixue in [4], was optimized in two aspects of time and space, improve the traffic efficiency. Luo Meiqing in [5] elaborates the validity of VISSIM software in the practical application in detail, and the combination of Changchun City Gongnong square intersection simulation, which shows the practicability of the VISSIM simulation software. The [6] describes the microscopic traffic simulation is an efficient and safe analysis tool, and it can provide a controllable, repeatable environment research and evaluation performance. In [7] are introduced the use of VISSIM software in detail. In [8] Wang Zhibiao described the traffic simulation model and traffic flow model, analyzes the current research condition of domestic and abroad, and introduced the use of VISSIM software. Ci Yusheng introduces the principle of cellular automata in [9], the establishment of cellular automata simulation model, the influence of the connection point of entrance condition through simulation experiment on the ramp, have certain reference significance.

This paper considers the impact of the roundabout and crossroads for city traffic. Through the relevant formula and the algorithm and the mentioned above, as the intersection of the configuration is more reasonable timing scheme, combined with VISSIM simulation software to compare the roundabout and intersection traffic capacity.

2. TRAFFIC THEORY

The method of Webster is based on the vehicle delay time minimum as the optimization target, therefore, its core content is to calculate the length of the vehicle delay and the optimal cycle time. Here the cycle length is established on the basis of the calculation of the vehicle delay, it is a more commonly used calculation method in the traffic signal control currently.

The next Formula is the method of Webster:

$$C = \frac{1.5L + 5}{1 - Y} \tag{1}$$

Where C is the optimal period; L is the loss of cycle time, usually taken as 3; Y is the key of car flow ratio summation. Currently widely used signal method is through the following formula.

$$I = Z/U_a + T_s \tag{2}$$

That I is the calculative interval of green light; Z is the distance from the stop line to the conflict point. U_a is the speed of vehicles in the crossing. T_s is the vehicle braking time. When calculating the change interval of I<3s, with the yellow light time of 3S; when I>3s, the 3S with the yellow light, the rest of the time with the red light.

3. EXAMPLE

Between using the data from the September 25, 2014 -10 month 25 days, we choose to work on 17:00-18:30 evening peak as the survey period. This paper is mainly use of the VISSIM to simulate the traffic situation, in this simulation, we must investigate data include: 1) lane width and lane number of satellite square rotary office; 2) lane width and the number of lanes straight office is connected with the satellite square; 3) to set out the traffic flow entrance place; 4) through the turntable models; 5) survey satellite around the Plaza road condition information. Observations were recorded every 5 minutes for a period of time.

Weixing square is located in the Chao yang District of Changchun City, is a standard non priority roundabout traffic hub. The people of the North Main Street, 9 Lane two-way, followed by 3 straight road crossings and 1 straight road crossing and left back into the lane, 5 crossing; the people of Nantong Main Street, 8 Lane two-way, followed by 3 straight road crossings and a straight road and left back into the lane, 4 straight out crossing; West We Guang Jie, two-way Lane 3 straight road, crossing and 1 straight road crossing and left back into the lane, 3 straight out crossing; East Satellite Road, two-way lane, 3straight road crossing, 3 straight out crossing.

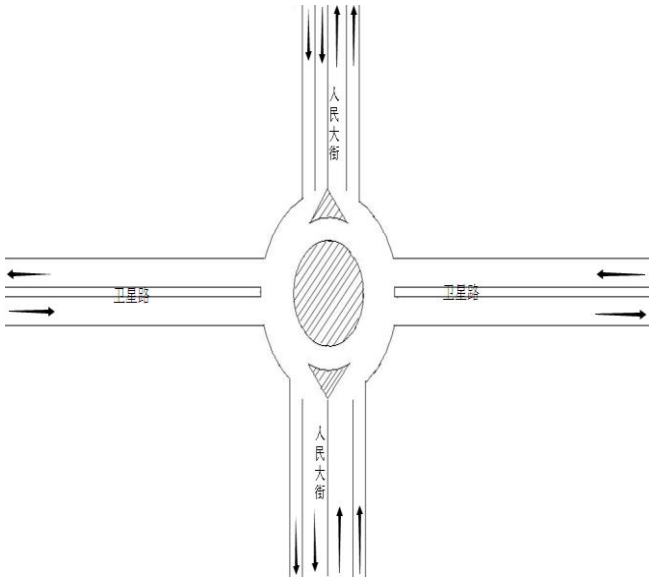

Figure 1. Traffic layout

For now, formula (1) is used frequently to calculate the cycle of signal lamp, in this paper, L=3, Y=0.919, so it is known that c=116.96(s) which can rough taken as 117(s).

Table 1. The traffic investigation data

models / flow / time	Large Vehicle		Mid size Vehicle		Light-Duty Vehicle		The cumulative number of equivalent standard
	come	away	come	away	come	away	
17:00-17:05	4	10	3	7	114	127	303
17:05-17:10	5	13	3	8	91	153	320
17:10-17:15	6	13	0	9	154	137	366
17:15-17:20	3	8	1	3	71	134	246
17:20-17:25	4	10	3	5	76	116	250
17:25-17:30	7	16	1	5	91	137	309
17:30-17:35	4	18	0	4	85	139	298
17:35-17:40	7	11	0	6	115	129	310
17:40-17:45	7	6	1	3	136	112	295
17:45-17:50	7	4	0	6	72	143	260
17:50-17:55	4	13	1	12	96	115	288
17:55-18:00	14	16	0	8	96	143	335
18:00-18:05	4	12	0	5	109	120	287
18:05-18:10	7	15	0	0	97	143	306
18:10-18:15	6	8	0	1	90	143	277
18:15-18:20	3	7	1	3	60	112	210
18:20-18:25	2	9	1	3	77	83	201
18;25-18:30	9	3	0	0	71	88	195

To improve the traffic volume of intersection and decrease the queue time during peak time, we can change original roundabout into crossroads which is controlled by a signal lamp, and max the traffic efficiency through regulating the phase and cycle of signal lamp.

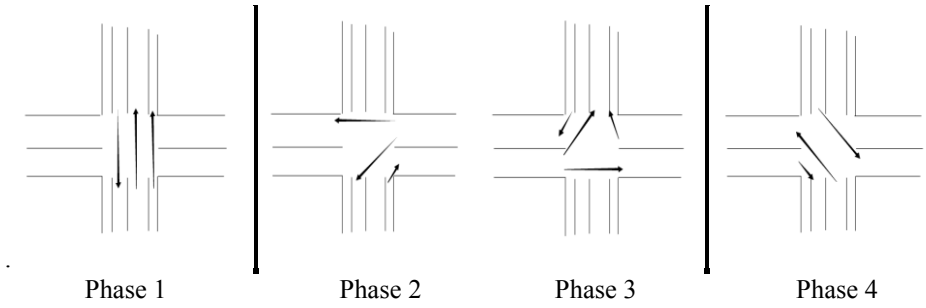

Figure 2. Phase

Table 2. The data detector operating results around the island and the crossroads

sections / type flow	1.8.9	3.4.5	6.7	15.16.17	2.10.11.12	13 14
round	107	99	136	121	37	41
intersection	126	119	155	143	45	61

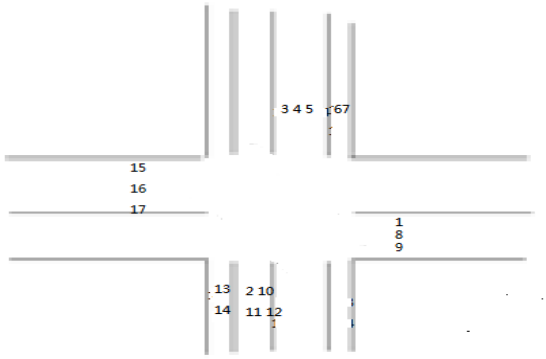

Figure3. Crossroads and section map

Take an example like right of the straight road; it is consist of 3 lanes which are cataloged as 1, 8, and 9 by the VISSIM. During 0~300 (s), the traffic volume at truncation surface (detect data section) is 126.

Through the simulation, it can generate the corresponding file to reflect the data detector, time and queue length detector's condition in the VISSIM project folder respectively. The data detector is used in this paper to evaluate the traffic volume of that intersection. It can be concluded from the consequence that the traffic volume of crossroads is higher than roundabout at the same section and time.

4. CONCLUSION

In this paper, we through digital simulation, draw the conclusion of the intersection traffic capacity better than the round capacity, it has the certain reference value to the planning problem in the development of the future road of city.

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