

A Study on Microscopic Simulation of Roundabout's Capacity

Xu Luwei, Liao Hui, Huang Chonglin

Guangdong University of Petrochemical Technology, Maoming, China

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Abstract: The capacity of roundabout by using the simulation software VISSIM, which mainly focuses on the use of this software. By using the method of weight calculation, the factors of affecting the capacity of roundabout are concluded, and at last, through modeling and simulating the roundabout in Maoming, the analysis results are reached just as the physical truth.

1 Introduction

Roundabout is a special form of intersection, which commonly used in heavy traffic areas in cities and towns. By setting a roundabout in the center of it, the vehicles can be organized into the roundabout, and drive around it in a counter-clockwise direction. Through the motion of shunting, interleaving, and the confluence of vehicles, the traffic conflict points are turned into intertwined points, which reduce the severity of vehicle conflicts. The application of it not only improves the security rate of vehicle, but also makes the vehicle run smoothly. But some special situations may appear. For example, when the flow of each single inlet or outlet outweighs its inherent capacity, the roundabout shows impediment to the flow of traffic, causing traffic jams easily or even locking phenomenon. Thus the study on microscopic simulation of roundabout's capacity is particularly important.

Roundabout has been used in China's urban road in a early time, and plenty of scholars have studied it. But most scholars mainly investigate the effects of vehicle's flow to intersection's capacity, ignoring the important influence of non-motor vehicles on roundabout. With the rapid development of electric vehicles in recent years, the patterns of road and vehicle have been reclassified, and the proportion of those cars requires us to optimize the model of roundabout.

2 The Process of Establishing Simulation Model

When configuring the annular intersections, firstly, select the editing control signal button of signal control on the topmost menu bar. After a new signal timing scheme created, select the simplest fixed timing to set up. Fig. 1 is an example of signal timing scheme.

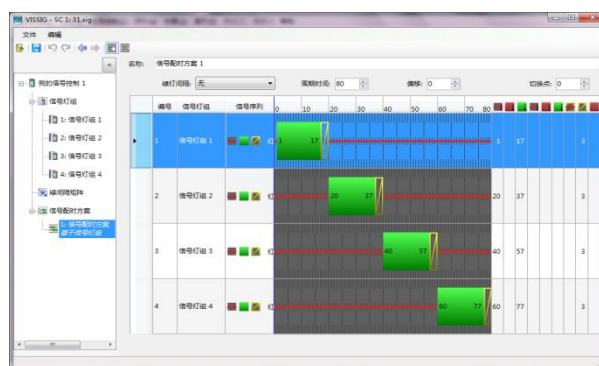


Fig.1 Signal timing scheme

Thereafter, some unresolved conflicts contained in the signal lights of the intersection can be dealt in conflict zones, and then the effect with all the conflicts is resolved, which is shown in Fig. 2.

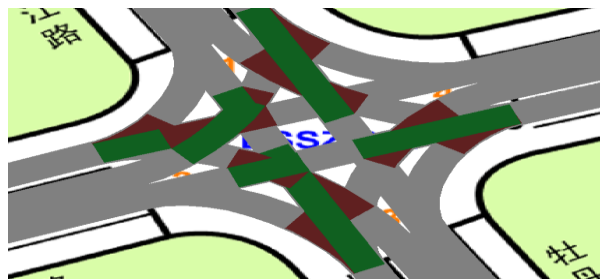


Fig.2 The treatment effect in the conflict zone

3 Study of Factors Affecting Roundabout's Running

In this paper, the analytic model is a roundabout that has four branches with no signal controlled. To make the outputs of simulation more representatives, here specially making the same proportion between geometric conditions of those four branches and the flow as well as the steering ratio inputted. the data and simulating road networking shown as Tab.1.

Tab1. Geometric dimension of simulating analytic model

Name	Value
Radius of roundabout	50[m]
Lanes in roundabout	2
Number of lanes in each inlet	2
Number of lanes in each outlet	2
Lane length	3.5[m]

Through the principle of Given a proposed two, separately changing those affecting factors like the average parking distance, additional portion of safety distance, multiple portion of safety distance and acceptable deceleration. Meanwhile, when keeping other factors unchanged, and then we can use VISSIM to calculate their weight values.

4 Case Application

4.1 Operating Characteristic of Roundabout in the Example.

This paper mainly analyzes the roundabout in Maoming city, and its running states is like Fig. 3.

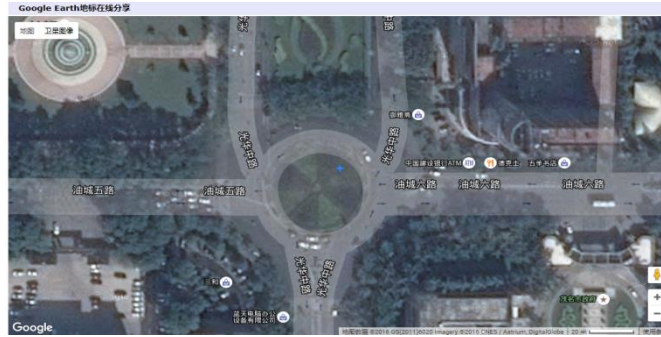


Fig 3. Satellite imagery of roundabout

4.2 Investigation Data of Roundabout in the Example.

In this investigation to the roundabout, many methods have been combined: high angle shot with unmanned aerial video, filed investigation, filed measurement, and data collecting shown below in Tab.2.

Tab.2. Geometric conditions of roundabout

Name	Number of lanes	Width of lanes	Radius
Ring inside lane and roundabout	2 lanes	4.0[m]	30[m]
East inlet	Two-way four lanes	4.0[m]	——
South inlet	Two-way four lanes	3.5[m]	——
West inlet	Two-way four lane	3.5[m]	——
North inlet	Independent two-way four lane	4.5[m]	——

4.3 Establishing of Simulation Model and Calculation of Intersection's Capacity.

Through the actual monitoring data, we can detect the average delay of operational vehicles in different period in roundabout by using VISSIM. This is the output of each flow and average delay in different time, shown in Tab.3.

Tab.3. Data of flows and average delay in different time

Period	Flow of vehicles [pcu/h]	Flow of non-motor vehicle [pcu/h]	Total flow [pcu/h]	Average delay [s]
1	1800	1605	3405	1.1
2	1800	1605	3405	4.1
3	2200	1605	3805	8.1
4	2400	1605	4005	10.3
5	2600	1605	4205	16.8
6	2800	1605	4405	19.1
7	3000	1605	4605	28.2
8	3200	1605	4805	45.6
9	3400	1605	5005	112.8

From the results of delay in Tab.3, it is easier to know that delay time in period 8 and 9 changes dramatically. According to the criteria of classifying service level in China's non-signalized intersection, at this time, the traffic is in congestion, which causes big delay. And that is the reason why the actual capacity of this roundabout is the sum of flows of vehicles and non-motor vehicles in period 8, which is 4805pcu/h.

5. Conclusions

This paper mainly applies the simulation software VISSIM to establish and analyze the roundabout model, introducing the process of building simulation model. In the process, data simulation and practical calculation are combined to ensure preciseness. Making use of the principle of given a proposed twoto study the effect that various evaluation parameters have made on the maximum queuing length and running time when operating the software VISSIM. Finally, we take the roundabout in Guanghua-Guandu Road Maoming City as an example, calculating and analyzing its capacity. During the process, considering the non-motor vehicles account for a large proportion of flows, we calculate it and vehicles respectively, which lead to practical results.

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