Application Research of Real-time Data Traffic Simulation Technology Based on VISSIM

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Abstract: With the development of digital age and the progress of science and technology, computer technology has been applied to traffic simulation. Traffic simulation technology can analyze the accidents in complex road traffic in detail and put forward effective methods. It is a tool to simulate the time and space changes of traffic. This technology can also provide an effective scheme for signal control. There are many kinds of traffic simulation technology. This paper mainly talks about the traffic simulation technology of vissim real-time data. Through the detailed analysis of the real-time data provided by vissim, the technology of modern transportation is improved and the traffic is promoted.

1. Introduction

With the improvement of people's living standards and the continuous growth of vehicles, transportation facilities have been unable to withstand more pressure from vehicles, which has had a serious impact on traffic. It can be seen that the traditional traffic simulation technology poses a serious threat to the transportation management mode and cannot conform to the development of modern transportation technology. Through the analysis of VISSIM data model, we can investigate and react to the specific traffic conditions, reflect the real traffic conditions, promote the rapid development of the transportation industry, and improve the scientific and technological level of the transportation industry.

2. Overview of Traffic Simulation Model

2.1 Introduction of car-following model adopted by VISSIM

The accuracy of traffic simulation model mainly depends on the quality of traffic flow model, such as vehicle driving behavior in road network. Unlike other less complex models, which use continuous speed and deterministic car-following model, VISSIM adopts a psychological-physiological driving behavior model established by Wiedemann in 1974. The basic idea of the model is that once the driver of the rear car thinks that the distance between him and the preceding car is less than his psychological (safe) distance, the driver of the rear car starts to slow down. Since the driver of the rear vehicle cannot accurately determine the speed of the preceding vehicle, the speed of the rear vehicle will be lower than the speed of the preceding vehicle for a period of time. When the distance between the front and rear workshops reaches another psychological (safe) distance, the driver of the rear vehicle begins to accelerate slowly. From this cycle, an iterative process of acceleration and deceleration is formed.

The random distribution of vehicle speed and space thresholds can reflect the individual driving behavior characteristics of the driver. The Karlsruhe University of Technology in Germany conducted several field tests to calibrate the parameters of the model. Regular on-site testing and model parameter updates ensure that changes in driving behavior and improved vehicle performance are adequately reflected in the model.

In multi-lane sections, VISSIM allows drivers to consider not only the vehicles in front of the lane (default is 2), but also the vehicles in adjacent lanes on both sides. In addition, at a distance of 100 meters from the intersection parking line, the driver's vigilance will be improved.

In VISSIM, traffic flow is simulated by moving the "driver-vehicle-unit" in the road network. Drivers with specific driving behavior are assigned to specific vehicles, and the driver's driving behavior is in one-to-one correspondence with the technical performance of the vehicle. The following is a schematic diagram of the following model:
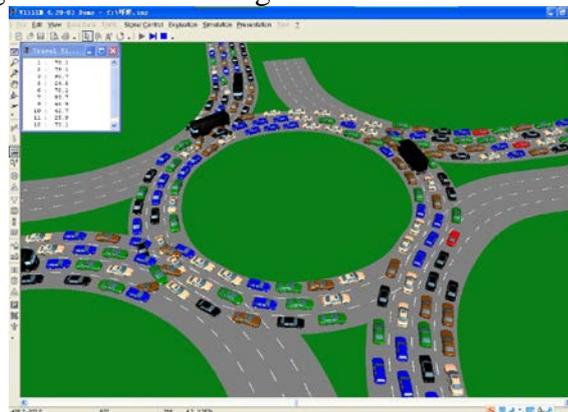
2.2 Application range of the car model

VISSIM can simulate many urban and non-urban traffic conditions, especially suiTable for simulating various urban traffic control systems. Its main applications are: (1) design, inspection and evaluation of signal control stimulated by vehicles. (2) Analysis and inspection of the capacity of the bus priority scheme. (3) Analysis of toll facilities. (4) Ramp control operation analysis. (5) Path analysis and impact analysis of variable information flags, etc.

3. Data needed for the construction of VISSIM model road network

3.1 Static data needed in VISSIM simulation process

Static data is the most basic facility of network construction. The main application of static data is to control the simulation and test of induction signal intensity. And the simulation section mainly includes the starting point, the end point and the middle point. Different sections have different directions and different lane sections. Different connectors are needed between each section, and the location and length of the section at the bus stop are also determined. The position between each signal light and the parking line and the reference information of the composition of the signal light between each other must have specific data, the position and length of the detector. The location of the bus must record the message and keep a certain record of static data, which lays a good foundation for the establishment of the simulated road network.

3.2 Dynamic data required during the VISSIM simulation process

This kind of dynamic data is mainly used in the simulation program, but in the process of testing the program, dynamic data cannot be applied. Such dynamic data information, including the traffic volume and traffic composition on all road sections that have just entered the road network, must be recorded in detail. The location of the decision-making location of each driving path should be differentiated and classified in detail according to different time and different vehicles. The position of intersections without signal control should be monitored, because each signalized intersection has certain restrictions on steering and yellow frames.

4. Construction of VISSIM simulation road network

4.1 VISSIM simulation road network establishment process

Vissim is used in the simulation process. It takes a certain amount of time to invest in building the road network. In the process of building the road network, it needs to go to the actual intersection to carry out the investigation, including the specific parameters of the road intersection. In fact, these parameters have specific data on professional maps, so professional staff are required

to study the data on maps and to store the data to a certain extent. The data to be used is extracted from the map, and finally stored in the vissim road network file, so that the construction time of the road network can be saved. At the same time, it can also reduce manpower and financial expenditures, reduce economic expenditures, and bring more convenience to the construction of road networks.

4.2 Establishment of Road Network

The VISSIM application can describe two road segments as a continuous road segment according to their corresponding connections, and can also describe the entire road network. In the process of establishment, the intersection and the road network need to be established. When building, you need to have two softwares, Link and Connector. The first software is mainly to describe the number of lanes to see if it is a lane or multiple lanes. This software can perform a detailed analysis of the connection status of the road section, combined with the actual road conditions. In the process of establishment, a detailed analysis of the connection facilities of each crossing is required, and distinctions are made after the entrance and exit. First, the setting between the entrance and the connector. If the function of each lane has a certain similarity among ordinary roads, it can be represented by a multi-lane Link. However, during the establishment process, if the functions of the two lanes are different, and the vehicle cannot change lanes during the driving process, it needs to be represented by two links. Secondly, in the construction process of simulation road network, Link is the main application software. Only when the properties of road sections change, such as the reciprocal number of vehicles and the way of speed-limited roads change differently in the course of driving, it is necessary to link different Links. Vehicles in the process of driving on Connector can not change lanes at will, so in the process of setting up the main road, do not set too long connectors. These two kinds of software also have some overlap in the process of operation, but the overlap of these two software should not be too long in the process of road network construction. In the process of describing the turning of vehicles at intersections, it is generally not possible to allow vehicles to change lanes or overtake. In this process, Connector is needed to describe the turning path.

4.3 Establish certain driving rules

In the process of road operation, there is a certain traffic flow. In the process of vehicle driving, vehicles will be affected by road facilities and the driving conditions of adjacent vehicles. In the course of driving, the traffic rules will be changed according to the time and place. Therefore, each traffic rule should be detailed and described before the simulation technology analyzes the vehicle. The general rules are set in the control of speed, priority and control rules for the traffic lights.

The first is the rule of speed control. In the course of road driving, no other vehicle affects the operation of the vehicle, and if there is no certain traffic rules to restrict it, the vehicle travels on the basis of the road facilities in accordance with the desired speed. When the free-flow speed of the VISSIM road network changes, the flow rate is continuously increased, and the driving conditions of the vehicle are changed to some extent. This requires limiting the speed of the vehicle within a certain range of the road section. During the running of the vehicle, the vehicle speed can only be restored to the normal range after the road section with these restrictions. The second is the principle of priority. A traffic conflict occurs during the driving of a general vehicle. This type of traffic conflict mainly refers to the presence of a member of a traffic conflict who is already aware of the danger of an accident. And to a certain extent, it has taken active and effective measures to avoid danger and avoided serious accidents. The formulation of the priority rules is mainly the right of passage to conflict traffic. It is a parking line and a conflict sign associated with this parking line. According to the situation of the road condition that he said, the vehicle must be controlled according to the parking line. The length of the conflict area is also defined, including the minimum headway spacing. In the simulation operation process, according to different situations, there are different definitions of the headway spacing. Third, the principle of signal control. According to the different built-in fixed pair signals, the corresponding control can be carried out, and the signal modeled by the external signal state connector can also be used to control the intersection. And this

software can also be used in conjunction with other signal control logic design software, and through a series of external interfaces, the cooperation between the series of software can be controlled. The signal controller in the software has its own independent number. The minimum control unit of each signal lamp group has different control logic, and the control of the signal lamp group of the signal controller is different. In the application process of this road network, the signal control intersection can not only use fixed timing signal control system, but also use external signal control system. And after the application of VAP module, it can also carry out dynamic module control and realize the optimal configuration of modules.

4.4 Issues to be noted in the establishment process

In the process of vehicle driving, it is necessary to have a certain understanding of the driving requirements of each section. In the process of vehicle control of each section, according to the specific conditions of each section, specific analysis should be carried out. According to the process of the section, the change of vehicle speed is recorded in detail, and different road condition schemes are formulated according to specific data. Using vissim's real-time data reference can provide sufficient data reference for data analysis in traffic simulation, as well as detailed analysis of specific data to find more specific solutions. It will save more time for the investigation of specific data in the road network construction process, promote the good operation of the transportation industry, and bring more convenience for the development of traffic simulation technology.

5. Conclusion

In summary, it can be seen that vissim real-time data is applied to the traffic simulation technology, which can provide detailed distribution of vehicles while driving on the road, and can also perform effective monitoring. It lays a solid foundation for the good operation of traffic, and can provide detailed reference to the technical performance of the driver according to the driving situation of the vehicle, and provide data analysis for the development of transportation. And the real-time data of VISSIM can also make a comparative analysis of the optimal bus schemes, promote the good operation of road traffic, and provide parameters for the development of traffic technology. At the same time, the data analysis of VISSIM can provide more help for the database in the traffic system. When there are traffic problems, it can effectively refer to the detailed data, bring more convenience to the traffic and reduce the traffic congestion.

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