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Analysis of Traffic Operation Performances at Roundabouts

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Abstract

The traffic operation performances at roundabouts are complicated under the influence of confluence operations. On the basis of the Mengxi square in Zhenjiang city roundabouts survey using video cameras, some parameter performances of different vehicle types on weaving sections and circulating lanes are analyzed, which included the velocity distribution, the gap distribution, as well as the distance distribution of lane changing. Based on the analysis, some of the conclusions are as follows: 1) The vehicle velocity of inner circulating lane is larger than the outer circulating lane 2) The entry vehicle velocity is smallest 3) The distribution of entry gaps is different from circulating gaps 4) the characteristics of vehicle teams are mostly same in different lanes 5) When the type is bigger, the lane changing distance is smaller 6) For the same type, the distance of lane changing shows ladder-like distribution.
The research result will be a base for improving the capacity of roundabouts.

Keyword: Roundabouts; Confluence Section; Velocity; Gap; Lane Changing

1. Introduction

1.1. Backgrounds

In order to avoid the conflict between entry vehicles and circulating vehicles, there are a mass of confluence operations at roundabout weaving sections. The performance parameters are difficult to be determined due to the great complexity of traffic performances at roundabout weaving areas. In this paper, according to the analysis of various kinds of data obtained by using video cameras, several performance parameters were calculated, including the velocities of circulating lanes and confluence sections, the gaps of circulating vehicles and confluence vehicles and the position of lane changing. The statistical regularities were analyzed, and the general performances were summarized for operation performances at roundabout confluence sections.

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1.2. Research Review

Traffic operation performances at roundabout weaving sections include the regulation of the velocity distribution, the headway distribution of confluence vehicles and circulating vehicle, and the distance distribution of lane changing. Turner calculated the flow rate, average travel time, and the delay of roundabouts under a certain traffic condition. They also analyzed the advantages of roundabouts differentiating from other intersections. By simulation software, Sisiopiku et al. compared the differences among stop control, priority control, signal control, and roundabout control under different traffic conditions, including flow rate, proportion of turning orientation, and number of entry lanes. Troutbeck et al. proposed a method for calculating critical gap of roundabouts and compared various methods. Several scholars intensively explored the capacity and operation performances of the on-ramp and off-ramp of expressways.

2. Date Collection

Mengxi square roundabout in Zhenjiang, China, is chosen as a measure object, which is located in the unsignalized intersection of Mengxi road (north entry and south entry), Xuefu road (east entry) and Zhengdong road (west entry). The diameter of the roundabout is 60 meters. The measure area is the circulating and confluence section between Mengxi road (N) and Zhengdong road. The waving section comprises three lanes which is numbered 1, 2, 3. The traffic flow was surveyed using video cameras from 7:50 to 8:20 on April 17, 2012. Some parameter values can be obtained by replaying the video. The flow rate of west entry of Zhengdong road is 1299 pcu/h and the weaving area is 2077 pcu/h.

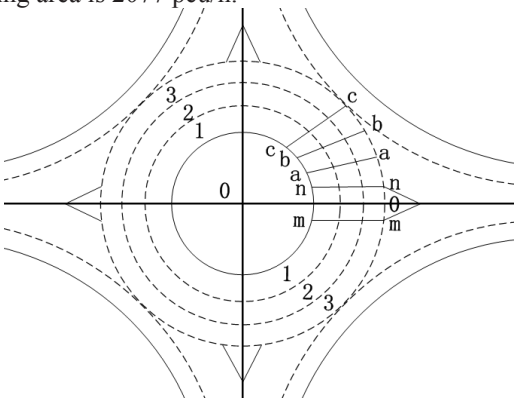

Fig. 1. Position and distance of date collection

In order to collect traffic flow data, some auxiliary lines are drawn on the roundabout in Figure 1. Survey data on m-n section and a-b-c section are chosen to analyze some characters of circulating vehicles and confluence vehicles. According to the different lane changing form, the entry flow are divided into three categories: Type 1(To Lane 3), Type 2(To Lane 3-2), Type 3(To Lane 3-2-1).The start point for lane-changing analysis is spot 0. 594 circulating vehicles on m-n section, 565 circulating vehicles on a-b-c section and 509 vehicles of entry-flow are surveyed separately. There are 324 vehicles, 208 vehicles and 62 vehicles distributed in lane 1, lane 2 and lane 3 during the section m-n. At the same time, 197 type 1 entry vehicles, 185 type 2 entry vehicles, and 127 type 3 entry vehicles are observed.