Research on the Traffic Capacity of a Roundabout Considering Large Vehicles

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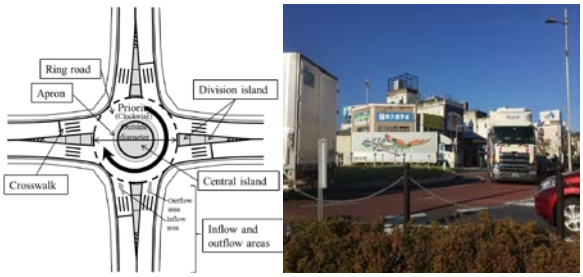
1. Introduction

The Ministry of Land, Infrastructure, Transport and Tourism's Road Bureau issued a notification for the desired roundabout structure summarizing the applicable conditions and points to consider when planning and designing a roundabout as one of the circular level intersections in August 2014.[1] This notification shows the traffic capacity under general conditions as an indication of the applicable range of roundabouts based on the knowledge obtained so far in foreign countries. In the future, it is necessary to consider the case where the proportion of large vehicles is greater to advance the verification based on the operational properties of vehicles in Japan. In this research, the simulation of traffic flow (hereinafter referred to as "simulation") was conducted based on the time-headway obtained from an observation at an actual roundabout to analyze the influence of large vehicles on the traffic capacity of roundabouts.



(Left) Figure-1: Figure of a standard roundabout
(Right) Photo: The condition of running large vehicles observed on an actual road

2. Outline of observation on actual road

At the roundabout in front of JR Hitachitaga Station, we ran three large vehicles additionally at the peak of the morning rush-hour period to observe the operational behavior of vehicles, including general vehicles. And we calculated the parameters, such as minimal time-headway of the ring road that can affect traffic capacity, for each possible combination of vehicle types (small and large).

3. Simulation results

In the simulation, a case where the total amount of incoming traffic into a roundabout is 1,000–3,000 vehicles/hour was set at the pitch of 100 vehicles/hour to calculate the total amount of traffic that could enter the ring road for each case. Figure 2 shows the results of the simulation at the large vehicle mix rate of 0, 10, 20, and 30 %. The traffic capacity when the large vehicle mix rate is 0 % was calculated to be approximately 2,200 vehicles/hour. The traffic capacity decreased as the large vehicle mix rate increased. When the large vehicle mix rate was 30 %, the traffic capacity was approximately 1,600 vehicles/hour, resulting in a decrease of traffic capacity by approximately 26 %.

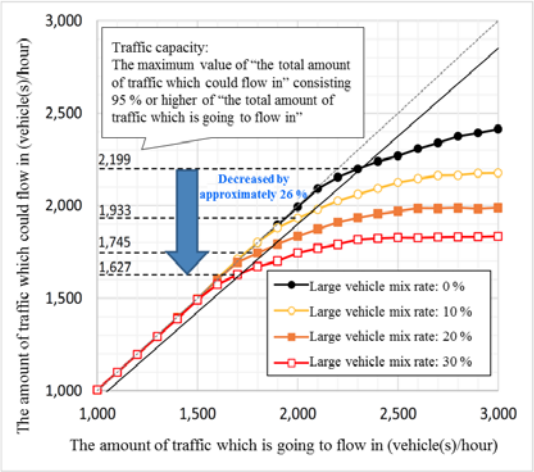


Figure-2 Result of calculation of the traffic capacity of all inflow areas of intersection

4. Summary

The findings obtained in this research can be utilized by road administrators who are considering the introduction of a roundabout into an intersection where the traffic amount of large vehicles is large. We will continue to work on the research toward the popularization of roundabouts that are effective for the safe and smooth flow of traffic in the future.

☞For details, refer to the following:

1) The website of the Ministry of Land, Infrastructure, Transport and Tourism
http://www.mlit.go.jp/road/sign/kijyun/pdf/20140901tuuti.pdf