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主 論 文 の 要 旨

論文題目 A STUDY ON ESTIMATION METHODOLOGY FOR ROUNDABOUT ENTRY CAPACITY CONSIDERING PEDESTRIAN IMPACTS (横断歩行者を考慮したラウンドアバウト流入交通容量の推定手法に関する研究)

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論 文 内 容 の 要 旨

Entry capacity is one of the most important indices for performance evaluation of roundabout. In addition to circulating vehicles, pedestrian flow is another key conflicting stream having significant impact on entry capacity. The pedestrian impact is estimated in the existing method through an adjustment factor f_{ped} (Brilon et al, 1993) which was developed based on the roundabouts with standard design such as physical splitter island, crosswalk and distance of one-vehicle length between crosswalk and yield line. However, some of them, e.g. physical splitter island cannot be always satisfied due to space limitation, especially in Japan. In addition, it is supposed that pedestrian behavior such as pedestrian approaching side which affects entry driver behavior also have significant impact on entry capacity. Moreover, queuing vehicles in circulating roadway which is generated by the pedestrians across downstream exits will prevent entry vehicles from entering roundabout and result in reduction of entry capacity.

Therefore, this study aims to propose an estimation methodology for roundabout entry capacity which can appropriately reflect the Japanese situations considering pedestrian impact and various influencing factors, i.e. physical splitter island, pedestrian approaching side, far-side pedestrian recognition rate, distance between crosswalk and yield line and queuing exit vehicles blocked by pedestrians across downstream exits. This study is expected to apply for planning and implementing stage regarding the treatment of pedestrians and space issues in future.

In Chapter 1 the scope of the research is illustrated through providing some background information about performance evaluation for roundabout entry capacity. In addition, problem statement and objectives of the study are described and the research outline is shown.

Chapter 2 presents the state-of-the-art review on estimation methods of roundabout entry capacity from two aspects, macroscopic approach and microscopic approach. In the micro-

scopic approach, pedestrian impact is also considered through adjustment factor (Brilon et al. 1993). Since the adjustment factor which was developed based on standard roundabout design, e.g. with splitter island at entry/exit which cannot be always satisfied in Japan due to space limitation, an appropriate estimation method of roundabout entry capacity considering pedestrian impact is in urgent need to reflect the characteristics of Japanese situation. The estimation methodology in this research is developed through two approaches, simulation analysis and theoretical model. A simulation study is conducted for obtaining a reference of entry capacity and examining influencing factors which will be included in theoretical model.

In Chapter 3 the simulation study utilizing VISSIM 5.40 is calibrated based on empirical data which is observed in Japanese roundabouts. Then, a series of simulation experiments are conducted to identify influencing factors. It is found through simulation analysis that, entry capacity is reduced more significantly when more pedestrians are from far-side and more far-side pedestrians are recognized under the condition without physical splitter island. In addition, entry capacity is also reduced more when the distance between crosswalk and yield line is not long enough to accommodate one vehicle.

Based on these results, a theoretical model is proposed In Chapter 4 including the influencing factors which are examined in simulation study. The capacity of the subject entry is estimated considering two separated situations of circulating flow in front of the subject entry, flowing or queuing. Under the condition of flowing, entry capacity is determined by pedestrians, circulating flow and several influencing factors which were examined in Chapter 3. On the other hand, under the condition of queuing, the probability of exit vehicles queuing in circulating roadway due to the pedestrians across at downstream exits is considered. Accordingly, the entry capacity is the combination result of these two cases. Through sensitivity analyses it is found that the proposed model can reflect impacts of these influencing factors and the sensitivity of each influencing factor on entry capacity is consistent with the results which have been obtained in simulation analyses.

In Chapter 5, a comparison analysis is conducted between the proposed theoretical model and simulation output in order to interpret limitations of each method. Through comparison, it is found that simulation analysis provides lower entry capacity than theoretical model. The limitation of each proposed model is interpreted through such possible reasons as limited range of pedestrian demand in empirical data and strict assumptions in theoretical model. Since simulation analysis performs the safety edge of estimation results, a practical application is conducted based on the simulation output.

Finally, Chapter 6 summarizes research conclusions and provides some recommendations for future works. The suggestions of this practical method in application are also discussed in this chapter.