

A Mixed Method Approach for Modeling Entry Capacity at Rotary Intersections

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Abstract : A rotary is a traffic circle intersection where vehicles entering from branches give priority to circulating flow. Vehicles entering the intersection from converging roads move around the central island and weave out of the circle into their desired exiting branch. This creates merging and diverging conflicts among any entry and its successive exit, i.e., a section. Therefore, rotary capacity models are usually based on the weaving of the different movements in any section of the circle, and the maximum rate of flow value is then related to each weaving section of the rotary. Nevertheless, the single-section capacity value does not lead to the typical performance characteristics of the intersection, such as the entry average delay which is directly linked to its level of service. From another point of view, modern roundabout capacity models are based on the limitation of the flow entering from the single entrance due to the amount of flow circulating in front of the entrance itself. Modern roundabouts capacity models generally lead also to a performance evaluation. This paper aims to incorporate a modern roundabout capacity model into an old rotary capacity method to obtain from the latter the single input capacity and ultimately achieve the related performance indicators. Put simply; the main objective is to calculate the average delay of each single roundabout entrance to apply the most common Highway Capacity Manual, or HCM, criteria. The paper is organized as follows: firstly, the rotary and roundabout capacity models are sketched, and it has made a brief introduction to the model combination technique with some practical instances. The successive section is deserved to summarize the TRRL old rotary capacity model and the most recent HCM-7th modern roundabout capacity model. Then, the two models are combined through an iteration-based algorithm, especially set-up and linked to the concept of roundabout total capacity, i.e., the value reached due to a traffic flow pattern leading to the simultaneous congestion of all roundabout entrances. The solution is the average delay for each entrance of the rotary, by which is estimated its respective level of service. In view of further experimental applications, at this research stage, a collection of existing rotary intersections operating with the priority-to-circle rule has already started, both in the US and in Italy. The rotaries have been selected by direct inspection of aerial photos through a map viewer, namely Google Earth. Each instance has been recorded by location, general urban or rural, and its main geometrical patterns. Finally, conclusion remarks are drawn, and a discussion on some further research developments has opened.

Keywords : mixed methods, old rotary and modern roundabout capacity models, total capacity algorithm, level of service estimation

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