Preface

Over the last decades, roundabouts have been increasingly used in building new at-grade intersections and in changing the layout of existing intersections. Therefore, we decided that it would be useful to collect, in one volume, the methods and procedures used to evaluate the operating conditions of this type of intersection.

The organization of this book is as follows:

Chapter 1 deals with the definitions of capacity, capacity indices for roundabouts, and parameters linked to waiting phenomena at entries, i.e., delays and queue lengths.

This is preceded by an introduction to the fundamental concepts associated with statistical equilibrium and steady-state conditions. These general concepts of the theory of systems and control are applied to roundabouts.

Chapter 2 starts with some examples of capacity formulas, selected from the three types that are available in today’s scientific and technical literature. Then, some criteria for taking into account the effects of pedestrian flows on entry and exit capacities are presented. The remaining part of this chapter is dedicated to the calculation procedures for flows entering the roundabout, to the capacity in case of saturation or oversaturation of one or more entries, and to simple capacity and total capacity.

Chapter 3 covers the analysis of waiting phenomena under steady-state and transient conditions.

The material in Chap. 3 includes the standard key results of simple probabilistic (Markovian) and deterministic queuing systems, as well as the results of some special time-dependent solutions for waiting phenomena.

Chapter 3 has a more general scope because it presents results that may be used both for roundabouts and for any at-grade intersection.

Chapter 4 deals with the application of the results and methods discussed in the previous chapters for the evaluation of waiting times, queue lengths, and levels of service of roundabouts. The calculation procedures illustrated are meant for operating conditions characterized by undersaturated, saturated, or over-saturated entries.

Chapter 4 ends with the determination of the level of service of a roundabout.
All the chapters include worked examples that have been developed in sufficient detail to explain as clearly as possible the formulas and the procedures presented in the book.

We do hope that the expository format that we have used, which is characterized by a plain style and supported by worked examples, will help the reader to easily understand and be able to use the materials discussed in the book. We also hope that this layout will help the highway traffic engineers analyze the operating conditions of roundabouts.

Chapter 5 presents criteria to evaluate roundabout performance reliability. After introducing and justifying the adoption of reserve of capacity and rate of capacity as performance functions, the discussion is developed using a general calculation criterion in which the values that are involved in the limit state service condition – traffic demand and entry capacity – are random variables described by their probability density functions, that is to say by their distribution functions.

A lower level criterion is then identified with which, on the basis of the estimation of suitable statistics of the performance function, a reliability index is calculated that can be compared to a prefixed reference value.

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