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BOOK 'PUBLIC TRANSIT PLANNING AND OPERATION: MODELING, PRACTICE AND BEHAVIOR' REVIEW

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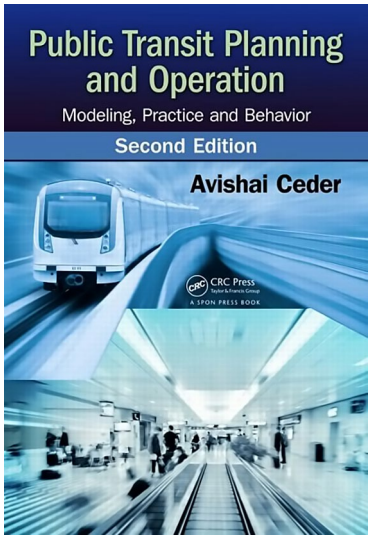

Book cover of the second edition of this book (Ceder 2016)

This book is the second edition of the former first edition of book ***Public Transit Planning and Operation: Theory, Modeling and Practice*** by Avishai Ceder (2007). As Avishai Ceder reminisces in the preface of the second edition of this book (Ceder 2016), it has been his more than 40 years of teaching, research, and hands-on experience that has pushed him to write the first and this second edition of the book and to construct it in such a way that it will help not only teachers, researchers, and students in the area, but also practitioners in the field. The personal motivation, basic organization, purpose and intended audience of this second edition of the book have not largely changed since the first edition was published in 2007 (Ceder 2007) and later translated into Chinese (Ceder 2010). However, significant revisions and necessary updating have been made in this new edition. The second edition of this book is still oriented to establish a sort of a bridge between the world of transit practitioners and the world of transit researchers and academic professionals for the purpose of narrowing the gap between these two worlds. The aim of such a bridge is to increase opportunities for collaboration and interaction so as to improve transit service and, no less important, its image.

This second edition of the book is mainly constructed from two thirds of the first edition and one third comprises updated and new material that are the latest research results of the author, together with his students, during the last seven years. In this new edition, four chapters – Chapter 5, 8, 12 and 15 – are significantly revised, and three chapters – Chapter 13, 14 and 19 – are completely new chapters. This second edition of the book is organised in five parts:

1) overview of transit planning and data collection needs (Chapters 1 and 2);
2) design and optimization of transit timetables and of vehicle and crew scheduling (Chapters 3–9);
3) passenger demand and assignment analysis (Chapters 10 and 11);
4) transit service, network and route design, encompassing scheduling and behavioural elements (Chapters 12–17);
5) transit reliability, operational strategies and future operations planning developments (Chapters 18–20).

The initial part of this book is composed of two chapters. The first introductory chapter provides an interesting description of the author's motivations for writing the first edition and this second edition of the book. Then, it presents a real-life description of the transit operations-planning process, a comprehensive overview and a critique of currently used standards and guidelines for transit service planning, and the main components

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affecting the viability of a transit service from both the passenger and agency perspectives. The outline of the other chapters, the links between each chapter and the main core of the transit-operation planning process are described in detail at the end of the chapter. Chapter 2 discusses transit data-collection systems including manual and automated techniques, automatic vehicle monitoring sampling considerations, and some notes on passenger surveys. Five primary transit-data-collection techniques–point check, ride check, deadhead check, passenger survey, and population surveys–are first described for collecting proper data at the right amount in a cost-effective manner. The need for certain data elements in order to provide an opportunity for achieving service enhancements is then discussed in the data requirements section. Finally, this chapter introduces some basic statistical tools that are employed in almost every phase of the transit-data acquisition, handling, and interpretation.

Part two, covering the design and optimization of transit timetables and of vehicle and crew scheduling (Chapters 3–9), remains relatively unchanged except for some necessary updating of Chapter 5 and 8. Chapter 3 introduces four different demand-based frequency-setting methods, two based on point-check (max load) data and two on ride-check (load profile) data, to derive frequencies for a single transit line that may be chosen by transit operators with respect to their data collection system available and dispatching policies. Criterions for selecting point-check or ride-check data collection techniques based on old load profiles are also discussed. Chapter 4 and 5 present advanced methods of constructing timetables. Approaches and procedures for deriving even-headway and even-load timetables are described in detail in Chapter 4. However, all these procedures are applied on a route basis. Following Chapter 4, Chapter 5 provides an updated practical framework and tools for improving and optimizing the construction and setting of transit timetables. Four methods for developing alternative advanced timetables are provided. The first method creates timetables with even passenger loads at different maximum load points for individual vehicles as opposed to a single maximum load point (across all vehicles in one hour). The second method creates timetables using mixed fleet sizes to obtain: (a) even headways and even average load, and (b) minimum empty-seat kilometre and minimum passenger wait time. The third method creates minimum passenger-crowding timetables for a reduced fixed vehicle fleet. The fourth method creates timetables with maximum synchronization, i.e., maximizing the simultaneous arrivals of vehicles at transfer points so as to minimize passenger transfer waiting times. The Operations Research (OR) optimization techniques used in these methods are provided in this chapter. Chapter 6–8 provide methods for transit vehicle scheduling with respect to fixed schedule, variable schedule, and multi-type vehicle size. The procedures introduced for transit vehicle scheduling are mainly based on a step function, called Deficit Function (DF). Chapter 6 first provides simple methods for ascertaining the minimum fleet-size required for both single-route and multi-route vehicle scheduling without interlining. Then, the DF-based approach with Dead-Head (DH) trip insertion is used to reduce the number of vehicles required. Procedures for DH trip insertion and constructing vehicle trip chains are provided. Finally, the depot-constraint balanced vehicle scheduling problem is discussed. Following Chapter 6 and 7 extends the DF approach to include possible modifications in the creation and editing of trip timetables and vehicle schedules (blocks). In addition to DH trip insertions, shifting departure times based on some acceptable tolerances, i.e., schedulers may consider a variable, instead of a fixed schedule, is used to further minimize vehicle fleet size. Methods of deriving the fleet-size lower bound when with or without using DH trip insertions and shifting departure times are allowed within their tolerances are discussed. Finally, the effect of shifting scheduled departure times on even-load timetable is presented. Following Chapter 6 and 7, Chapter 8 further provides two updated optimization procedures – DF-based procedure and min-cost flow procedure – for multi-types vehicle scheduling problem. Chapter 9 demonstrates some of the optimization concepts behind the problem of assigning crew (mainly drivers) to vehicle schedules with the minimum cost involved. An updated list of some known available transit vehicle and screw scheduling software is provided. Among these software, the *Optibus*, which is an algorithm-based *SaaS* platform optimizing scheduling of vehicles and crew in real-time, is briefly described in this new edition of the book. The introduced vehicle and crew scheduling optimization process are mainly realized in a human-machine interactive manner. The main advantage of using this interactive interface is that the scheduler can interact and incorporate his/her expertise in the generated schedule while receiving recommendations and feedback from the optimization engine. However, some useful meta-heuristic methods, such as genetic algorithm, simulated annealing, tabu search, for transit vehicle and screw scheduling problems are not well addressed in this book.

Part three, regarding passenger demand and assignment analysis, remains largely unchanged except for the necessary updating of literature review and further reading. Chapter 10 gives a comprehensive overview of the factors affecting passenger demand and their sensitivity (elasticity) and methods designed to predict passenger demand. Estimation methods for predicting Origin–Destination (O–D) matrices and how best to forecast ridership are also presented in this chapter. Chapter 11 presents passengers dilemma in route choice among alternative routes; the route choice is then incorporated into transit-assignment modeling at the network level. However, the frequency-based and schedule-based User Equilibrium (UE) or System Optimal (SO) transit assignment topics are not fully addressed in this book.

Part four, concerning transit service, network and route design, encompassing scheduling and behavioural elements, includes six chapters. Among them, two chapters – Chapter 12 and 15 – are significantly revised chapters and two chapters – Chapter 13 and 14 – are completely new chapters. Chapter 12 first discusses tran-

sit service design elements, service strategies, possible actions for both existing and new transit services and standards and measures for system performance. Then, a Surplus Function (SF) model, which is basically a mirror image of the DF model, is introduced to solve the operational parking conflicts. In the next section, a network-based theoretical approach is provided to solve the optimum stop location problem. In addition, a bi-level optimization model is introduced to analyse the location of public transit stops considering uneven topography environment. The two new chapters, Chapter 13 and 14, discuss transit service coordination and network connectivity. Chapter 13 first presents measures and analysis for transit connectivity based on distinguished quantitative and qualitative attributes including the interpretation, significance, and application of each of the measures. Then, directions and tools for detecting weak segments in inter-route and inter-modal transit chains (paths), for possible revisions/changes, are presented. A method, based on max-flow concept in networks, is introduced to determine weak routes in the transit networks through an analysis to detect the bottlenecks existed in current transit networks. Finally, an application of the transit-connectivity measures in the area of social equity is described. Chapter 14 delivers the behavioral aspects of transit coordination and connectivity; it is based on surveys and behavioral modeling showing how people appraise routes with transfers, with some advantages, compared with routes without transfers. Some cognitive models, such as Cumulative Prospect Theory (CPT), Fuzzy Logic (FL), Just Noticeable Difference (JND), are used to investigate the effects of variation in out-of-vehicle times, travel time and cost savings on passengers' route choice behaviour. Chapter 15 establishes objective functions for designing a network of transit routes while complying with passenger, agency, and government perspectives. A six-element network design methodology, taking into account the activities of vehicle scheduling and timetabling, is described in detail with illustrative examples. Chapter 15 also describes some meta-heuristic methods to attain a reliable transit network including a scenario in which the demand is varied across seasons. A brief discussion of considering connected exclusive lanes within optimal solution of bus networks is also presented. Following Chapter 15, Chapter 16 and 17, which remain largely unchanged except for the necessary updating of literature review, discuss short-turn trips, smart shuttle and feeder service design. However, there is a lack of introducing some cyber-enabled and demand-responsive/interactive feeder/shuttle transit service that provides advanced, attractive and user-oriented minibus service to commuters, by aggregating their similar travel-demand pattern using online information platforms, such as Internet, telephone and smartphone apps.

The final part of the book includes three chapters regarding transit reliability, operational strategies and future operations planning developments. These three chapters, especially the new Chapter 19, are revised and updated largely using the recent research results of the author. Chapter 18 discusses the essential part of transit reliability and its impact on operations planning. It covers the subjects of measures of reliability, sources and indicators of unreliable service, bus-bunching phenomenon, variables affecting service reliability, models for estimating travel time and dwell time, statistical models for calculating of passenger waiting time and vehicle running time, features and benefits of Automatic Vehicle Location (AVL) systems, and an overview of techniques to improve reliability problems. Chapter 19 describes using new technologies, e.g., Vehicle-To-Vehicle (V2V) communication technology, transit operations using in particular operational tactics, the concept of flexible routing based on distributed computing and electronic user-operator communication to increase the reliability and connectivity of transit service. Chapter 20 discusses future developments in transit operations, and introduces some new concepts and ideas, such as new direct-transfer transit service concept, two-way monobeam elevated transit and dual-mode personal rapid transit system.

Chapters in the second edition of this book follow the same organization of those in the first edition of the book with an opening practitioner's corner introducing information and remarks for practitioners and an ending literature review and further reading list pointing out future research directions for researchers and academic professionals. Answers to the chapter exercises are provided at the end of the book. One of the main features of the second edition of the book is its stand-alone (self-contained) capability, obviating the need to look back and forth at other publications for comprehending the text. Another main feature of the book is the continued use of humours, including cartoons, stories and proverbs, which make this book interesting to read.

This second edition of ***Public Transit Planning and Operation: Modeling, Practice and Behavior*** continues to be a good, basic and coherent textbook. It provides a comprehensive treatment of most of the important topics in transit planning and operations, new and improved ideas and methods inspiring the reader's imagination to think further. It is appropriate for transit policy makers, teachers, researchers, students, and practitioners who are interested in the area of transit planning and operation.

A good book is a good friend. When I am reading this book, I feel like having good conversations with a good friend. This kind of conversations, like the actual ones I once had with Avishai Ceder in the coffee shop near his residence, makes me feel comfortable and confident.

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