

PUBLIC TRANSIT PLANNING AND OPERATION

THEORY, MODELING AND PRACTICE



AVISHAI CEDER



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Theory, modelling and practice

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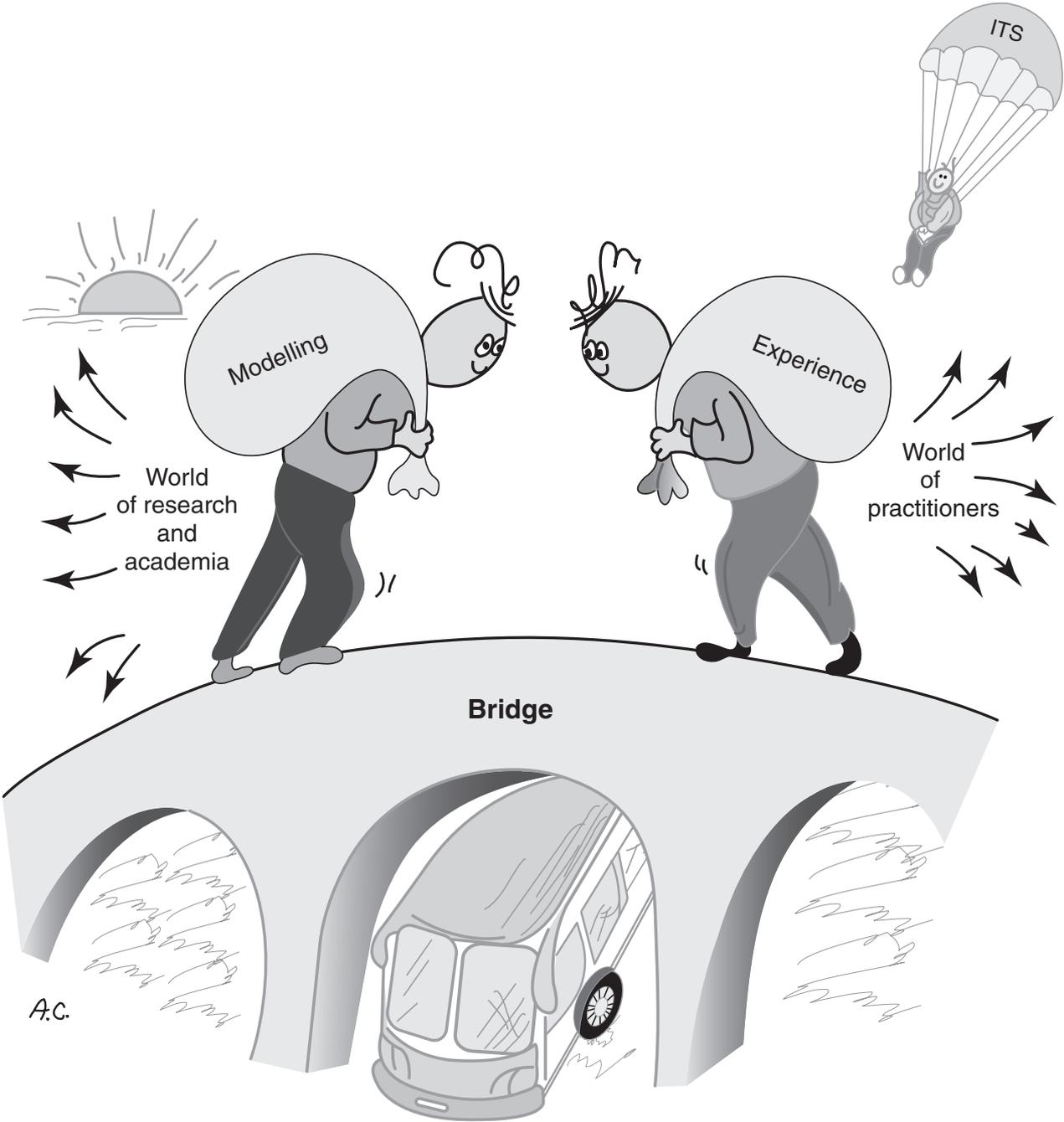
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To my late Dad, Samuel (who worked for a large bus agency as a driver and treasurer for over 30 years), to my Mom, Anna, with wishes for many good years, and to my triumvirate, Roy, Ohad and Dror

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Preface



Preface

Chapter outline

Personal motivation
Purpose and intended audience
Organization
Website and remarks
Acknowledgments

Personal motivation

The following story may serve to help understand the stimulus behind this book: A ship is sailing through a stormy ocean, and a little girl, who happens to be the captain's daughter, is playing on the deck when all of a sudden a large wave carries her overboard into the sea. The captain, who sees this from his post, immediately orders his sailors to jump into the ocean and save the girl, but no one dares for fear of risking his life. In desperation, the captain turns to the passengers and asks them for help while promising that whoever saves his daughter will get anything he or she wants as a reward. Again, no one reacts. But then suddenly a man with a long beard, who had been standing by the railing, lurches overboard into the sea. The sailors throw him a life preserver, and fortunately he manages to lift the little girl safely back on deck and into the arms of her father. The captain then hugs the man, who is thoroughly drenched, and says he will give him anything he wants, just name it. The hero's response: "I don't want anything. I just want to know who pushed me. . . ."

What pushed me, actually started some time between 1967 and 1971, when I was a bus driver for EGGED (the National Bus Company of Israel), whose 4000 buses make it one of the largest bus companies in the world. Before gaining a bus driver's licence, I had a theory about the way one should drive a bus; now I have a bus driver's licence – and no theory. The second motivation for writing this book came from my consulting work at EGGED from 1975–1985, when I was exposed daily to planning and operational problems in the public transit field. The third motivation came in 1981. I was at Massachusetts Institute of Technology (MIT) in Boston where, together with Professor Nigel Wilson, I was to give a new summer session course on Transit Operations Planning. This course became an annual offering until 2003.

From all these foregoing activities, I internalized the following realization: experience is what you get when you are expecting something else. My teaching of transit operations planning has taken place at universities in Adelaide, Boston, California, Hong Kong, Israel, Melbourne, Rome, and Sydney. Indeed, it has been my more than 30 years of teaching, research, and hands-on experience that has pushed me to write this 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.

Purpose and intended audience

This book uses the concise term 'transit' to refer to public transit or public transportation or public transport; all three expressions are commonly used.

A major goal of this book is to establish a bridge between the world of practitioners and the world of research and academia for the purpose of narrowing the gap between these two worlds. I hope that such a bridge will also lead to opportunities for collaboration and interaction in order to improve public transit service and, no less important, its image. Henry Ford once said: “Failure is only the opportunity to start all over again more intelligently.” With this in mind, the book intends to introduce a few new ways of thinking about: (a) already implemented and investigated transit themes, while combining retro-perspective thoughts and cumulative experience; and (b) new concepts and ideas.

One of the main features 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. At the same time, every chapter contains a literature review and a further reading list. Practitioners may have some difficulty in comprehending the sections with mathematical notation, but hopefully they can grasp the substance of the material and its practical implications. Researchers and academic professionals may find some of the sections unnecessarily detailed, but they should be aware that the book is also aimed at practitioners and undergraduate students, thus requiring more explanation. In summary, this work follows the notion that: (1) it is better to ask twice than to lose your way once; and (2) clarity is no less important than certainty.

Organization

Each chapter opens with a section containing information and remarks for practitioners, called ‘Practitioner’s Corner’. In fact, one can never tell which way the train went by looking at the track: for a practical decision, one needs more information. The purpose of these Corners is to impart guidance about sections of the chapter that are appropriate and sections that are perhaps too difficult for practitioners, thus allowing the less academically inclined to flow with the book and capture its substance.

The organization of the book is described in Chapter 1. Generally speaking, five groups of themes are addressed:

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 3–10).
3. Passenger demand and assignment analysis (Chapters 11 and 12).
4. Transit service, network and route design, encompassing scheduling elements (Chapters 13–16).
5. Transit reliability and future operations planning developments (Chapters 17 and 18).

All the quantitative chapters offer exercises for practising the methods covered; of the book’s 18 chapters, only Chapters 1, 2 and 18 are without exercises. The answers to these exercises appear at the end of the book.

The literature review of papers relevant to the topic(s) covered in a chapter appears as the last numbered section of each chapter, except for Chapters 1 and 8 (the review for which actually precedes it, in Chapter 7). The reason for this order – instead of the traditional pattern of

starting a scientific article with a literature review, is to focus on each chapter's essence from the beginning, and only at the end to give the reader who may wish to broaden his or her knowledge of the particular topic, a kind of annotated reference list and an extended bibliography.

Website and remarks

The success of a professional book can be evaluated by the extent to which it succeeds in introducing new and improved ideas and methods. It is not only a matter of learning the book's content; it has to do, as well, with how much the volume can inspire the reader's imagination to think further. This concept has served as the guideline for the development of this book.

Indeed, the process of writing this book motivated the formulation of an interactive-software program, which may be found at this website: www.altdoit.com. This site (instead of the publisher attaching a CD) provides a highly informative graphical technique with which it is simple to interact. The user can interject practical suggestions, whose effects on the vehicle's schedule are immediately described. This useful tool, which relates more specifically to Chapters 7–9 and Chapters 12–15, will also assist the reader in solving some of the exercises and practical problems outlined in those chapters.

Finally, when lecturing this transit course, I tended to use humour at times because I believe in the insight captured by the English playwright George Bernard Shaw, who once said: "When a thing is funny, search it carefully for a hidden truth." More than once I have been asked to employ some of this humour (including the cartoons that I have also drawn) if I ever wrote a book. I have done this to some extent, especially in the Practitioner's Corners.

Acknowledgements

Many people have contributed to this book through their constructive feedback and encouragement. My views and understanding of the importance of public transit planning, service, and operations greatly benefited from my discussions with Professor Nigel Wilson of the MIT, with whom I annually shared the teaching of a summer course on the subject at MIT for 22 years.

I would like to acknowledge and thank Professor Hai Yang of the Hong Kong University of Science and Technology for his course material, including exercises on demand modelling in public transit (from which some of the exercises in Chapter 11 were drawn); Professors Yoram Shiftan and Shlomo Bekhor of the Technion-Israel Institute of Technology for their comments on demand modelling and transit assignment; Dr Yechezkel (Hezi) Israeli, who was my PhD student, for his contribution and remarks on transit-route modelling; the majority of Chapter 14 and part of Chapter 12 are based on his dissertation; and Moshe Flam for his contribution to future transit developments in Chapter 18. My appreciation to Yaron Hollander, a doctoral student at the University of Leeds, who contributed to the literature review of this book; and to my PhD student, Yuval Hadas of the Technion, whose thesis supported part of the last chapter of the book. Many thanks are also due to my Master's degree students, Shirin Azzam, Gali Israel and Shai Jerby, for their useful work and comments on the subjects of Chapters 9, 13 and 16,

respectively; and Yana Shnirman, an undergraduate student, for her practical comments on Chapter 10. Let me express my gratitude to Asher Goldstein, who provided me with editorial support. In this stream of acknowledgements, it will be only fair to thank the inventor of the treadmill, which has helped me stay in shape throughout the writing of this book.

Lastly, I offer my heartfelt thanks to my wife, Patricia (Shira) Tolentino Ceder, for her great encouragement, love and understanding. But also, and not least, for making dedicated use of her talent as an architect in doing the artwork for the figures in this work. Finally, a bouquet of affections goes to my three sons and daughter-in-law, Roy and Roni, Ohad, and Dror, as well as to my Mom, Anna, and my brothers, Tuli and Hagai and their families, all of whom helped me get through the difficult periods when writing this book.

I retain, of course, sole responsibility for any errors. I would be very pleased to gain feedback.

Avishai (Avi) Ceder
Haifa, Israel