

PUBLIC TRANSIT PLANNING AND OPERATION

THEORY, MODELING AND PRACTICE



AVISHAI CEDER



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Theory, modelling and practice

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Contents

Preface	xiii
Chapter 1 Introduction to Transit Service Planning	1
1.1 Motivation	2
1.2 The operational planning decomposition process	4
1.3 Service and evaluation standards and their derivatives	9
1.4 Viability perspectives	13
1.5 Outline of other chapters	16
References	18
Chapter 2 Data Requirements and Collection	21
2.1 Introduction	23
2.2 Data-collection techniques	24
2.3 Data requirements	27
2.4 Basic statistical tools	30
2.5 Literature review and further reading	37
References	41
Chapter 3 Frequency and Headway Determination	49
3.1 Introduction	51
3.2 Max load (point check) methods	52
3.3 Load profile (ride check) methods	56
3.4 Criterion for selecting point check or ride check	60
3.5 Conclusion (two examples)	64
3.6 Literature review and further reading	73
Exercises	79
References	80
Chapter 4 Timetable Development	81
4.1 Introduction	83
4.2 Objectives, optional timetables and comparison measures	84
4.3 Even headways with smooth transitions	90
4.4 Headways with even average loads	94
4.5 Automation, test runs and conclusion	98
4.6 Literature review and further reading	113

Exercises	115
References	116
Chapter 5 Advanced Timetables I: Maximum Passenger Load	119
5.1 Introduction	121
5.2 Even max load on individual vehicles	121
5.3 Optimization, operations research and complexity	127
5.4 Minimum passenger-crowding timetables for a fixed vehicle fleet	130
Exercise	137
References	137
Chapter 6 Advanced Timetables II: Maximum Synchronization	139
6.1 Introduction	141
6.2 Formulating an OR model for synchronization	142
6.3 The Synchro-1 Procedure	145
6.4 The Synchro-2 Procedure	146
6.5 Examples	148
6.6 Literature review and further reading	154
Exercises	159
References	161
Chapter 7 Vehicle Scheduling I: Fixed Schedules	163
7.1 Introduction	165
7.2 Fleet size required for a single route	168
7.3 Example of an exact solution for multi-route vehicle scheduling	170
7.4 Max-flow technique for fixed vehicle scheduling	172
7.5 Deficit-function model with deadheading trip insertion	176
7.6 Depot-constrained vehicle scheduling	188
7.7 Literature review and further reading	193
Exercises	196
References	198
Appendix 7.A: The maximum-flow (max-flow) problem	200
Chapter 8 Vehicle Scheduling II: Variable Schedules	207
8.1 Introduction	209
8.2 Fleet-size lower bound for fixed schedules	210
8.3 Variable trip-departure times	214
8.4 Fleet-size lower bound for variable schedules	220
8.5 Fleet-reduction procedures	223
8.6 Experiences with bus schedules	229
8.7 Examination and consideration of even-load timetables	233
Exercises	237
References	240
Appendix 8.A: Deficit-function software	241

Chapter 9	Vehicle-type and Size Considerations in Vehicle Scheduling	249
9.1	Introduction	251
9.2	Optimization framework	251
9.3	Procedure for vehicle scheduling by vehicle type	253
9.4	Examples	257
9.5	Vehicle-size determination	266
9.6	Optimal transit-vehicle size: literature review	268
	Exercises	276
	References	278
Chapter 10	Crew Scheduling	279
10.1	Introduction	281
10.2	Vehicle-chain construction using a minimum crew-cost approach	282
10.3	Mathematical solutions	290
10.4	A case study: NJ commuter rail	294
10.5	Crew rostering	300
10.6	Literature review and further reading	305
	Exercises	309
	References	312
	Appendix 10.A: The Shortest-path problem	315
Chapter 11	Passenger Demand	319
11.1	Introduction	321
11.2	Transit demand, its factors and elasticity	322
11.3	Example of a demand forecasting method and process	330
11.4	Multinomial logit (MNL) model	336
11.5	Literature review and further reading (O-D estimation)	338
	Exercises	341
	References	341
Chapter 12	Route Choice and Assignment	343
12.1	Introduction	345
12.2	Route choice using waiting-time strategy	345
12.3	Proportion of passengers boarding each route	349
12.4	Proportions derived for regular vehicle arrivals	352
12.5	Passenger assignment based on route choice	354
12.6	Literature review and further reading	358
	Exercise	362
	References	363
Chapter 13	Service Design and Connectivity	365
13.1	Introduction	367
13.2	Service-design elements	368
13.3	Scheduling-based solution for operational parking conflicts	374
13.4	Optimum stop location: theoretical approach	381

13.5	Connectivity measures and analysis	388
13.6	Literature review and further reading	399
	Exercises	400
	References	404
Chapter 14 Network (Routes) Design		407
14.1	Introduction	409
14.2	Objective functions	410
14.3	Methodology and example	419
14.4	Construction of a complete set of routes	428
14.5	Multi-objective technique	438
14.6	Literature review and further reading	445
	Exercises	449
	References	452
Chapter 15 Designing Short-turn Trips		455
15.1	Introduction	457
15.2	Methodology	458
15.3	Candidate points and example	458
15.4	Excluding departure times	462
15.5	Maximum extensions of short-turn trips	467
15.6	Literature review and further reading	476
	Exercise	478
	References	480
Chapter 16 Smart Shuttle and Feeder Service		481
16.1	Introduction	483
16.2	Minimum fleet size required for a circular (shuttle) route	485
16.3	Routing strategies	487
16.4	Simulation	490
16.5	Case study	494
16.6	Customer survey	498
16.7	Optimal routing design: base network	503
16.8	Optimal routing design: algorithm	507
16.9	Implementation stages	509
16.10	Literature review and further reading	513
	Exercise	516
	References	519
Chapter 17 Service Reliability and Control		521
17.1	Introduction	523
17.2	Measures of reliability and sources of unreliable service	525
17.3	Modelling of reliability variables	530
17.4	Passenger waiting time at a stop	537
17.5	Advanced reliability-based data and control	542
17.6	Techniques to resolve reliability problems	546

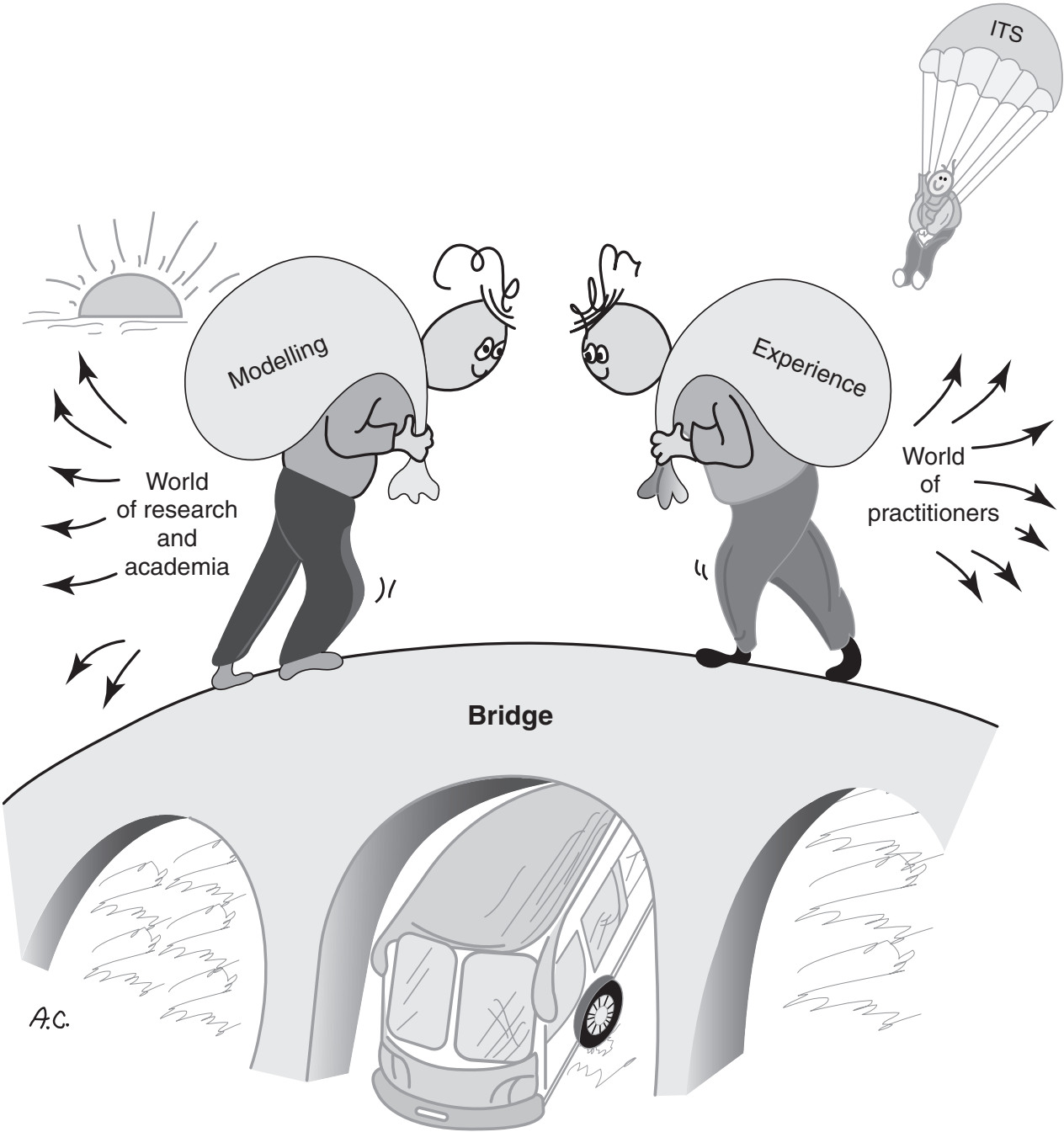
17.7	Literature review and further reading	555
	Exercises	563
	References	566
Chapter 18	Future Developments in Transit Operations	569
18.1	Introduction	571
18.2	Multi-Agent Transit System (MATS)	575
18.3	Vehicle encounters on road segments	578
18.4	Developments in transit automation	584
18.5	Literature review and further reading	586
18.6	Concluding remark	591
	References	591
	Answers to Exercises	595
	Author Index	607
	Subject Index	615

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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