CONTENTS

		Page
vc	DLUME 4	
Pre	eface	xv
11	Transportation Infrastructure Costs in Canada Ashish Lall	889
	I. Introduction	889
	II. Road Costs in Canada, 1980–1988 Background and Purpose Data and Methodology Results Addendum: Sensitivity of Road Costs to Pavement Life	891 891 892 896 898
	III. Rail Costs and Revenues, 1982–1987 Background and Purpose Data and Methodology Results	904 904 904 906
	IV. Civil Aviation Costs in Canada, 1980–1988 Background and Purpose Data and Methodology Results	917 917 917 922
	Appendix 1: Data Sources for Road Costs in Canada	925
	Appendix 2: Data Tables	927
	Appendix 3: Data	930
	Appendix 4: Data Tables	932
	Endnotes	933
12	Road Costs Fred P. Nix, Michel Boucher and Bruce Hutchinson	937
	Summary	937
	Glossary	941

1. Introduction	943
1.1 Purpose of Research	943
1.2 Scope	943
2. The Physical Characteristics of Roads	945
2.1 Introduction	945
2.2 Road Design	945
2.3 Pavements	946
2.4 Bridges	962
2.5 Maintenance	962
3. TAC Data Base on Road Costs	963
3.1 Source Data	963
3.2 Adjustments	968
4. Vehicle and Traffic Data	971
5. Pavement Economics	973
5.1 Introduction	973
5.2 Maintenance Costs	974
5.3 Resurfacing Costs	975
5.4 Construction or Reconstruction Costs	976
5.5 Minimum Life-Cycle Costs	980
5.6 Optimal Road Costs	985
6. Costing Methodologies	987
6.1 Introduction	987
6.2 Applications	990
6.3 Costing Studies	992
7. Costing	1000
7.1 Introduction	1000
7.2 FHWA, U.K. and Australian Methods	1001
7.3 An Exploratory Attempt to Allocate TAC's Costs	1003
7.4 Marginal Costs	1007
8. Conclusions	1010
Endnotes	1015

	Appendix A: Vehicle and Traffic Data	1017
	Appendix B: Calculation of Equivalency Factors	1030
	Appendix C: Analysis of Maintenance Expenses	1032
	Appendix D: Computations of Road Costs	1034
	Appendix E: Exploratory Cost Allocation	1041
	Appendix F: Estimating Marginal Pavement Costs	1049
	Notes to Appendices	1054
	Bibliography	1055
13	Environmental Damage from Transportation VHB Research & Consulting Inc.	1059
	Summary	1059
	Purpose	1059
	Scope and Method	1059
	Status of the Data	1059
	Main Findings	1060
	Conclusions and Recommendations	1060
	1. Introduction	1061
	2. Methods for Estimating Environmental Damage:	
	Theory and Application	1062
	2.1 The Environment	1062
	2.2 Sources of Environmental Damage	1063
	2.3 Methods for Assessing Impacts	1064
	2.4 Evaluation of Alternatives	1067
	3. Methods for Evaluating the Social Costs of Environmental	
	Damage: Theory and Applications	1067
	3.1 The Economic Approach to Evaluation	1067
	3.2 Types of Value	1070
	3.3 Methods for Assessing Benefits and Costs	1073
	3.4 Application of Evaluation Methods to Environmental	
	Damage	1078

4.1 Damage Due to Changes in Resource Requirements 4.2 Damage Due to Changes in Physical and Chemical	1080 1081
Discharges 4.3 Ecological Analysis	1086 1116
5. Overview of Estimates of Environmental Damage Social Costs5.1 Value of Environmental Damage5.2 Application and Limitations of Estimates	1117 1117 1121
Costs of Environmental Damage Between Different Modes of Passenger Transportation 6.1 Application and Limitations of Estimates	1121 1124
7. Major Obstacles to Estimating Social Costs of Environmental Damage7.1 Theoretical Issues	1125 1126
 8. The Potential for Research to Improve the Precision of Estimates 8.1 Biophysical 8.2 Economic 8.3 Recommendations 	1133 1134 1137 1138
Endnotes References	1140 1141
Deregulation and Competition in the Canadian Airline Industry Steven A. Morrison	1149
I. Introduction	1149
II. Industry Concentration	1150
III. Fares	1155
IV. Load Factors	1163
V. Fare Regressions	1168
VI. Conclusions	1172
Endnotes	1173

15	The Effects of U.S. Airline Deregulation: A Review of the Literature Ron Hirshhorn	1175
•	1. Background	1175
	2. General Effects: Overview	1176
	3. Main Sources of Gain from Deregulation	1177
	4. Airline Fares	1184
	5. Service Quality	1187
	6. Service to Small Communities	1188
	7. Air Safety	1189
	8. Industry Structure and Competition What Has Occurred? What are the Implications of These Structural Changes? Structural Change and Government Policy	1191 1191 1195 1197
	Conclusion	1200
	Appendix A: The Optimal Load Factor	1202
	Endnotes	1204
	References	1208
16	An Analysis of the Canadian Intercity Scheduled Bus Industry Richard Lake, L. Ross Jacobs and S.T. Byerley	1211
	1. Introduction	1211
	2. What the Bus Industry and Public Told Us	1213
	3. Inherent Characteristics of Buses	1217
	4. Canada's Scheduled Bus Industry	1219
	4.1 The Intercity Scheduled Industry	1219
	4.2 Regulatory Environment	1223
	4.3 Carriers Overview	1232
	5. Comparative Fare Levels	1247
	Introduction	1247

	6. Com	petition	1254
	6.1	Intermodal	1254
	6.2	Intra-Modal	1257
	7. Carri	er Cost Structures	1263
	8. Cros	s Subsidization	1265
	9.1	ts of Economic Regulation in Other Countries Regulatory Reform	1269 1269
	9.2	Evidence — Effects of Reduced Regulation	1271
	10. Mon	opoly Power	1277
	11. Carri	er Subsidies	. 1278
		I Saskatchewan	1279
	11.2	2 Michigan	1280
	12. Gove	ernment Ownership of Carriers	1282
	Mu	nicipal Government Ownership	1283
	Pro	vincial Government Ownership	1283
	Fed	eral Government Ownership	1285
	13. Scen	ario for the Future	1287
	Appendi	x A: History of Regulatory Responsibility for	
	Interci	ty Bus Transportation	1292
	Endnote	3 '	1296
17		Services: Economic Analysis Schwier and Richard Lake	1299
			4000
	1. Intro 1.1	ouction Rail's Inherent Characteristics	1299
	• • • •		1300
	. 1.2	,	1302
		Rail's Performance	1304
	2.1	VIA's Performance 1980–1989	1304
	2.2	Performance Changes 1989–1991	1308
	2.3	1989 Performance by Service	1309
	2.4	Other Rail Passenger Services and Financial Results	1315
		Compared with VIA	
		Passenger Cost Model	1318
	3.1	Typical Model Results	1321

4.	Project	ed Cost Recovery by Service Group	1326
	4.1	Western Interprovincial	1328
	4.2	Eastern Interprovincial	1329
	4.3	Low-Density, Short-Distance Regional Services	1331
	4.4	Corridor Services (Montreal–Ottawa–Toronto)	1332
	4.5	Southwestern Ontario	1334
	4.6	Remote Services	1335
5.	Interna	itional Rail, Particularly Amtrak, Comparability	
	with V	A	1335
	5.1	Recent Amtrak Performance	1337
	5.2	Amtrak Performance by Service Category	1339
	5.3	Comparison with VIA	1341
,6.	Potent	al Effect of Differing Amtrak and VIA Mandates	1355
	6.1	VIA and Amtrak Mandates	1356
	6.2	Re-equipment and the LRC Example	1358
	6.3	Consequence of Continuance Without a Longer Term	
	I	Mandate	1359
7.	VIA's C	Corporate Management	1360
8.	Remot	e Rail Services	1362
	8.1	Remote Areas Captive to Rail	1364
	8.2	Remote Access Issues	1371
	8.3	Options for Remote Services	1373
	8.4	Analysis of Individual Routes	1375
	8.5	Remote Rail Policy	1382
9.	Perspe	ctives for Viability of VIA Services	1383
10.	The Co	st of Eliminating VIA Services	1387
	10.1	Labour Severance	1388
	10.2	Short-Term Contracts for Supplies and Other Services	1390
	10.3	Terminating Leases	1390
	10.4	Unfunded Pension Liability	1391
	10.5	Winding Down the Company	1391
	10.6	Premature Loss of Traffic	1391
	10.7	Mitigation of Environmental Damage	1391
	10.8	Sale of Cars and Locomotives	1392
	10.9	Disposal of Infrastructure	1393
	10.10	Disposal of Stations	1393

	10.11 Disposal of Maintenance Facilities	1393
	10.12 Disposal of Other Assets	1394
	10.13 Release of CN and CP Assets	1394
	10.14 Other Potential Cost Impacts	1395
	Endnotes	1396
	Appendix A: Notes to VIA Route-Specific Data	1403
	Appendix B: VIA's Operating Cost Structure	1404
	Appendix C: Cost Element Allocation Rationale	1405
	Appendix D: Notes to Amtrak Route-Specific Data	1412
	Appendix E: Canadian Views on Rail Transportation	1413
18	Airport Investment and Pricing Policies A. Cubukgil, S. Borins and M. Hoen	1419
	1. Introduction	1419
	2. Evolution of Canadian Airport Planning	1420
	2.1 Institutional Background	1420
	2.2 The Planning Framework	1425
	2.3 The Policy Context	1431
	3. The Airport Investment Problem	1439
	3.1 Theoretical Considerations	1440
	3.2 Vancouver International Airport	1447
	3.3 Lester B. Pearson International Airport	1460
	4. The Airport Pricing Problem	1471
	4.1 Theoretical Principles	1471
	4.2 Capacity Allocation Options	1476
	4.3 Pricing Policies in Action	1485
	5. A Framework for Efficient Planning and Decision Making	1491
	Endnotes	1497

9	Travel Demand Behaviour: Survey of Intercity	
	Mode-Split Models in Canada and Elsewhere	1503
	Eric J. Miller and Kai-Sheng Fan	
	1. Introduction	1503
	1.1 Study Purpose	1503
	1.2 Report Organization	1504
	2. Discussion of Issues	1505
	2.1 Introduction	1505
	2.2 Level of Aggregation	1505
	2.3 Travel Market Definition	1509
	2.4 Model Specification	1510
	3. Aggregate Intercity Travel Demand Models	1511
	3.1 Introduction	1511
	3.2 The CTC Model	1513
	3.3 Investigations Into Model Functional Form	1519
	4. Disaggregate Intercity Travel Demand Models	1529
	4.1 Introduction	1529
	4.2 Overview of Disaggregate Choice Models	1530
	4.3 Summary of Early Non-Canadian Models	1533
	4.4 Canadian Revealed Preference Models	1534
	4.5 Stated Preference Models	1562
	5. Summary, Conclusions and Recommendations	1579
	5.1 Introduction	1579
	5.2 Value of Time, Demand Elasticities and	
	Model Substitutability	1579
	5.3 Functional Form and Modelling Approach	1584
	5.4 Directions for Model Development	1585
	Endnotes	1587
	References	4500

20	Price Elasticities of Intercity Passenger Travel Demand Richard Laferrière	1597
	1. Introduction	1597
	Comparison of Models and Market Descriptions 2.1 Four Representative Markets 2.2 Probability Models: Precise and Approximate Elasticity Measurements	1599 1599 1601
•	 Price Elasticities of Passenger Travel Demand 3.1 Properties of the Models 3.2 Presentation of Results 3.3 Representative Market 3.4 Individual Markets 	1602 1604 1609 1611 1616
	4. The Effects of Aggregation on the Calculation of Elasticities and on Estimates	1623
	5. Formulating Price Elasticities and the Modal Substitution Index5.1 Description of Demand Models5.2 Deriving the Modal Substitution Index	1627 1627 1636
	6. Models Excluded from the Analysis 6.1 Description of Excluded Models	1637 1638
	7. Conclusion	1639
	Appendix 1	1641
	Endnotes	1642
	References	1642
21	Differential Taxation of Canadian and U.S. Passenger Transportation Ken McKenzie, Jack Mintz and Kim Scharf	1645
	1. Introduction	1645
	2. Methodology	1646
	3. Principal Results of the Comparison of Canadian Modes	1653
	4. Principal Results of Canada–United States Comparisons	1660

	Appendix A: Derivation of Effective Tax Rates	1665
	Appendix B: Statutory Tax Rates and Aggregation Data	1675
	Appendix C: United States Statutory Tax Rates and Aggregation Data	1687
	Endnotes	1689
	References	1697
22	Notes on Intercity Passenger Transportation Technology Richard Lake	1699
	Introduction	1699
	I. Fundamental Principles Speed Energy Consumption Alternative Fuels Greenhouse Effect	1699 1700 1700 1700 1702
	II. Technological Prospects Forecasting Transportation Technology Aviation Guided Ground Passenger Travel Road Marine Intermodal	1704 1704 1706 1710 1712 1715
	Endnotes	1717