
Table of Contents

Foreword	xix
Acknowledgments	xxi
Chapter 1—Introduction to Transportation Planning	1
Introduction	1
A Transportation Planning Framework.....	2
Changing Context for Transportation Planning.....	5
Organization of This Handbook	8
References	9
End Notes.....	9
Chapter 2—Legal Framework for Transportation Planning	11
Introduction	11
Basic Concepts	11
Federal Government	13
Institutional Structure	13
Federal Law Affecting Transportation Planning	17
State Government.....	27
Institutional Framework	28
State Law Affecting Transportation Planning.....	31
Transportation Finance—Idaho, Virginia and Massachusetts.....	31
Comprehensive Land Use and Transportation Planning—Oregon	33
Corridor Protection—New Hampshire.....	34
Travel Demand Management Initiative—State of Washington	35
Consultation with Local Governments—State of North Carolina	35
Consultation with Freight Providers—State of Oregon	36
Environmental Protection—State of New York	36
Local Government	37
Summary	42
End Notes.....	43
Chapter 3—Urban Travel Characteristics and Data Collection	45
Introduction	45
Transportation System Characteristics	46
Functional Classification	46
System Extent.....	47
System Usage	47
System Performance.....	48
System Condition	57
Urban Travel Characteristics.....	57
Population Characteristics	57
Trip Purpose.....	63
Travel Patterns	68
Temporal Distribution	69
Modal Usage	70
Estimating Travel Characteristics and Volumes	72
Definitions	72
Traffic Count Techniques	75
Data Collection Standards	79

Highway Performance Monitoring System.....	80
Travel Time Studies	81
Travel Surveys	83
External Surveys	86
Internal Surveys	87
Trip Generation Data	92
Modal Studies.....	93
Parking Needs Studies	93
Transit Studies	95
Pedestrian Studies	97
Goods Movement Studies	98
Truck Interview Techniques	100
Truck Weight Studies	102
Statistical Considerations	103
General Observations	103
Descriptive Statistics.....	104
Probability Distributions.....	108
Sampling and Inference.....	111
Summary	119
References	119
End Notes.....	120
Chapter 4—Urban Travel Demand Modeling.....	123
Introduction.....	123
Brief Historical Perspective.....	123
Travel Demand Models.....	125
Four-Step Models	126
Activity-Based Models	135
Simulation Models	141
Linkage to Air Quality Modeling	142
Computer Software.....	143
Conclusions.....	144
Acknowledgments	144
References	145
End Notes.....	148
Chapter 5—Environmental Considerations in the Transportation Planning Process.....	151
Introduction	151
Environmental Considerations in Transportation Planning and Decision-Making.....	151
Considering Environmental Impacts at the Systems Level	152
Planning in Project Development	155
Linking Environmental Considerations Between Systems Planning and Project Development	157
General Principles Regarding Content and Level of Detail.....	161
Types of Impacts	161
Appropriate Level of Detail.....	164
Extent of Impact	165
Role of Travel Forecasting and Traffic Analysis.....	165
Land Use and Economic Development Impacts	166
Land Use Impact Analysis Framework.....	167
Social Impacts.....	172

Air Quality/Energy	177
Air Quality	177
Energy	179
Historic, Cultural and Parkland Resources.....	179
Impacts on the Natural Environment	181
Consideration of Construction Impacts During the Planning Process	185
Considering Mitigation Strategies During the Systems Planning Process.....	186
Documentation of Environmental Considerations During the System Planning Process.....	186
References	187
Useful Web Sites	188
Credits.....	188
End Notes.....	188
Chapter 6—Land Use and Urban Design	191
Introduction	191
What Drives Development and Resulting Urban Form.....	191
Regional Planning and Provision of Public Facilities	192
Local Governmental Planning and Development Regulation.....	197
Land Owners, Private Developers and Financial Lenders.....	203
Austin	206
Lenexa	207
Land Use Modeling	208
Context-Sensitive Solutions.....	213
Access Management	216
Summary	217
References	218
Chapter 7—Evaluation and Prioritization Methods.....	223
Introduction	223
Characteristics of the Evaluation Process	223
Basic Concepts	225
Goals, Objectives, Evaluation Criteria and Performance Measures	225
Importance of Project or Alternative Definition	226
Defining Costs and Benefits	229
Costs Included in Evaluation.....	230
Cost Estimation for Transit Projects	230
Measuring Societal Costs and Externalities	232
Benefits Included in Evaluation	233
Estimating Costs and Benefits by Measuring Individual Preferences	235
Distributional Impacts and Equity	235
Least-Cost Planning	237
Evaluation Techniques	237
Selecting the Appropriate Analysis Method	238
Project Evaluation Period, Useful Life and Salvage Values	241
Definition and Use of Discount Rates	242
Capital Recovery Factor	244
Effects of Inflation	244
The Treatment of Risk and Uncertainty in Project Evaluation.....	245
Typical Problems, Issues and Errors in Project Evaluation	247
External Funds (Grants) are Subtracted from the Capital or Operating Costs of the Project.....	248
All Costs of the Project Are Not Included (Construction Period Delays, Energy Use).	248
Some Benefits Are Double-Counted.	248

Average Rather Than Marginal Costs/Benefits Are Used in the Analysis.....	248
Differences Between Market and Societal Costs (Prices) Are Ignored.....	248
An Inappropriate Discount Rate Is Chosen.....	249
Network and Other Important Effects May Be Ignored.....	249
Prioritization and Programming of Projects.....	249
Case Studies.....	252
MPO Regional Transportation Plan (RTP).....	252
Small Bus Life-Cycle Cost Analysis.....	253
One-Way Street Conversion in a Central Business District.....	255
Prioritizing Rail Transit Projects.....	256
The California Transportation Commission’s High Priority Guideway Projects Study.....	256
Summary.....	257
References.....	259
End Notes.....	261
Chapter 8—Asset Management.....	265
Introduction.....	265
What is Asset Management?.....	266
Recent U.S. History of Transportation Asset Management.....	266
Recent Legislation.....	267
AASHTO Initiatives.....	268
GASB 34.....	269
International Asset Management Scanning Tour.....	270
Domestic Asset Management Scanning Tour.....	270
Asset Management and Transportation Planning.....	272
Vision, Goals and Objectives.....	272
Performance Measures.....	274
Data Needs.....	276
Analysis Methods and Tools.....	278
Evaluation and Prioritization.....	283
Monitoring System Condition and Performance.....	287
Adopting an Asset Management Approach.....	287
Asset Management Challenges and Opportunities.....	289
Expanding Information Management Capabilities.....	290
Public-Private Partnerships.....	290
Outsourcing Contracts.....	291
Funding Constraints and Pressures for New Infrastructure Capacity.....	291
Multimodal Tradeoffs.....	291
Infrastructure Renewal.....	291
References.....	292
End Notes.....	294
Chapter 9—Statewide Transportation Planning.....	297
Introduction.....	297
What is Statewide Transportation Planning?.....	298
The U.S. Context: Role of the Federal Government.....	299
Nature of Statewide Transportation Planning.....	302
Defining the Focus and Boundaries of the Planning Effort.....	303
Identifying Transportation Issues and Opportunities.....	307
Identifying and Using System Performance Measures.....	309
Formulating a Vision, Goals and Objectives.....	312
Collecting and Analyzing System Performance and Condition Data.....	315

Analyzing Transportation System Alternatives	320
Evaluating Transportation System Alternatives.....	323
Prioritizing Programs and Projects.....	323
Monitoring System and Program Performance	334
Performance Measures Pyramid.....	335
Statewide Modal Plans	337
Conclusions—Continuing State Planning Challenges	337
References	340
End Notes.....	341
Chapter 10—Corridor Planning.....	343
Introduction	343
Types of Corridor Plans	345
NEPA	346
Regional Transportation Plan.....	350
Statewide Transportation Plan	354
Relationship to Land Use/Urban Design.....	356
Corridor Planning Approach.....	357
Identifying Problems	357
Articulating Goals and Objectives	361
Identifying Alternatives	364
Analyzing Alternatives.....	370
Comparing or Evaluating Alternatives	376
Public Involvement.....	376
Corridor Study Outcomes.....	381
Summary	386
References	387
End Notes.....	388
Chapter 11—Metropolitan Transportation Planning.....	391
Introduction	391
Historical Context for Metropolitan Transportation Planning	392
The Early Years	392
Toward a Balanced Transportation System.....	393
The Modern Era.....	394
Institutional Structure for Metropolitan Transportation Planning.....	398
Core Characteristics of an MPO.....	398
MPO Planning Products.....	401
The Transportation Planning Process	405
Getting Started	405
Understanding the Problem and Creating a Vision.....	407
Goals, Objectives and Performance Measures	410
Data Collection/Management and Analysis.....	412
Evaluation of Alternatives	416
Financial Capacity.....	417
Project Prioritization	419
Public Participation.....	421
Special Topics for Metropolitan Transportation Planning.....	425
Security	426
Safety.....	426
Innovative Financing/Tolling/Congestion Pricing Partnerships.....	428
Asset Management.....	428

Environmental Justice.....	429
Management and Operations.....	429
Transportation Demand Management.....	430
ITS Planning.....	430
Conclusion	431
References	431
End Notes.....	433

Chapter 12—Activity Centers and Site Impact Analysis.....437

Introduction.....	437
Activity Centers—Characteristics and Concepts	438
Definitions	438
CBDs.....	439
Colleges, Universities and Medical Centers.....	445
SACs: Development and Characteristics	449
SACs: Planning	456
Transportation Access and Impact Analysis.....	472
General Considerations	474
Existing (Background) Conditions	477
Anticipated Travel Demands	480
Developing and Assessing Improvements	485
Reports.....	488
References	492
End Notes.....	493

Chapter 13—Rural Community and Tribal Planning.....495

Introduction.....	495
Rural Community Planning	496
Context.....	496
Legislative Requirements.....	497
The Job of Small Community Planners	498
Tribal Nations.....	498
Context.....	498
Legislative Requirements.....	499
The Job of Tribal Nation Planners.....	500
Planning for Small Communities and Tribal Nations	500
Challenges	501
Steps in the Transportation Planning Process.....	501
Conclusions.....	511
References	512
End Notes.....	513

Chapter 14—Transportation Terminals.....515

Introduction.....	515
Planning Studies for Terminals	516
Terminal Concepts and Processes.....	516
Analysis Techniques	518
Process Analysis	518
Processing Times	519
Waiting Times	522
Capacity.....	524
Delay and Service Times	524

Simulation	526
Pedestrian Flow Analysis	528
Market Research (Demand Estimation)	529
Terminal Design	530
The Terminal Design Process.....	530
Design Parameters and Guidelines	532
Life-Cycle Planning.....	532
Security	533
Information Systems	535
Ancillary Services.....	535
Environmental Impact Analyses.....	535
Passenger Terminals and Stops	537
Bus Systems.....	537
Bus Stops on Streets	538
Bus Stops/Stations on Freeways.....	541
Off-Street Bus Terminals and Park-and-Ride Facilities	542
On-Street Bus Terminals.....	549
Rail Systems	553
Light Rail Stations	555
Rail Rapid Transit (Controlled-Access) Stations	558
Commuter Rail Stations	563
Intercity Rail Stations.....	564
Waterborne Terminals	565
Ferry Terminals (Passengers Only).....	565
Ferry Terminals (Passengers and Vehicles)	565
Truck Terminals	568
System Operating Plan	568
Terminal Mission (Planning Criteria).....	570
Terminal Planning and Design.....	570
Terminal Site Planning.....	571
Truck Stops.....	572
Freight Rail Terminals	573
TOFC and COFC	575
Yards.....	576
Intermodal Developments	577
Multimodal Terminals.....	578
Passenger Multimodal Terminals	579
Freight Multimodal Terminals	582
Airports.....	583
Terminal Planning (Landside).....	583
Forecasts	584
Passenger Terminal Flow and Function.....	584
Terminal Concepts and Functions	586
Terminal Circulation and Distribution.....	591
Orientation and Signing	591
Airport Ground Access	595
Introduction	595
Data Needs for Ground Access Planning	597
Ground Access Modal Usage Patterns	598
On-Airport Roadway Systems	601
Off-Airport Roadway Systems	603
Parking.....	603
Public Transportation	604

Ports (Marine Terminals)	606
General Location, Access and Modal Connectivity	606
Facilities Requirements	607
Berth and Terminal Design	608
Cargo Handling Systems	609
Container Terminals.....	610
Specialized Marine Terminals	611
“Waterless” Inland Ports	613
Inland River Ports	614
Passenger Distribution Systems.....	618
Walking.....	618
Mechanical Pedestrian-Assist Systems	620
People Movers.....	622
Goods and Freight Distribution Systems	624
Summary	626
References	626
End Notes.....	628
Chapter 15—Recreational Areas	629
Recreational Transportation Systems	629
General Characteristics of Recreational Areas.....	629
Characteristics of Transportation Planning for Recreational Areas.....	631
Considerations in Travelers’ Decisions.....	632
Transportation System Considerations	634
Peak Activity	634
Travel Companions and Vehicle Occupancy	635
Mode of Arrival	636
One-Way Transportation.....	637
Ecological Impact	638
Need for Information and Communication.....	638
Communication with the Visiting Public	638
Communication with the Local Community	639
Communication with the Media	640
Modes.....	640
Nonmotorized Travel	640
Private Motor Vehicles.....	642
Public Modes of Transportation.....	644
Semi-Public Transportation.....	646
Private Tour Services	646
Site-Specific Modes	647
Infrastructure	648
Trails.....	649
Roads.....	649
Parking.....	650
Transit Infrastructure.....	652
Vehicles	654
Private Vehicles.....	654
Public Transit Vehicles.....	655
ITS.....	656
Transportation Planning for Recreational Communities	658
Partnering and Public Participation	658
Goals and Objectives.....	659

Performance Monitoring, Data Analysis and Proxies.....	660
Travel Demand Modeling.....	663
Further Studies	665
Transportation Strategies—Demand Management	665
Evacuation Planning.....	666
Supporting Policies.....	667
Monitoring Movement and Mobility in the Region.....	667
Environmental Benchmarks for Transportation.....	670
Long-Range Needs and Recommendations.....	672
Land Use.....	672
Public Education to Switch to Innovative Transportation Practices.....	672
Funding.....	672
Conclusion	673
References	673
End Notes.....	675
Chapter 16—Transit Planning.....	679
Role of Transit in Cities.....	679
Basic Utility and Impacts on City Form and Character.....	679
Contemporary Transit Trends.....	680
Transit Roles in Cities of Different Sizes.....	680
Statistical Review of Transit Ridership in North America.....	681
Definition and Classification of Transit Modes and their Components	684
Definition of Transportation Systems by Type of Usage	684
Transit System Components.....	684
Transit Modes’ Classifications and Definitions	685
Definition of Transit Modes.....	687
Transit Cost Structure and Funding Sources	688
Regulation Purposes and Types.....	690
Types of Transit Ownership	691
Unregulated Transit.....	693
Bus Transit Modes	694
Bus Systems.....	694
Trolleybuses.....	699
Rail and Other Guided Modes.....	704
Streetcars/Tramways.....	704
LRT	705
RRT (Metro)	710
Regional Rail.....	713
Monorails.....	716
Automated Systems	717
Paratransit and Specialized Services	719
Semipublic Paratransit.....	720
Public Paratransit	720
Characteristics and Roles of Paratransit	723
Terrain-Specialized Systems.....	723
Cable Cars	723
Cog Railways	724
Funicular Railways.....	725
Aerial Tramways.....	725
Water-Borne Transit.....	726

Lines, Networks and Stations.....	727
Types and Characteristics of Lines	728
Line and Network Design.....	733
Stops and Stations: Spacings and Locations	734
The Role of Transfers in Transit Networks	736
TTS.....	736
Transit Operations and Service Scheduling	738
TU Motion and Travel Times	739
Transit Line Scheduling.....	742
Considerations of Fares in Transit Planning	747
System Performance and Quality of Service.....	750
Quality of Service for Passengers.....	751
Measures of Transit System Effectiveness from the Operator’s Perspective.....	753
Transit Impacts on the Communities Served.....	756
Transit Planning Procedures	757
Service or Operations Planning.....	757
Long-Range Transit Planning.....	757
U.S. Federal Procedure for Planning Major Transit Investments.....	760
Tools for Transit Planning.....	762
Mode and Technology Selection	764
Transit-Oriented Development.....	766
Transit as a Stimulant for Land Use Development	769
Transit Agencies as Developers	770
Future Transit issues.....	770
Taxation and Pricing Changes.....	770
Advancements in Technology	770
Transit Financing and the Role of the Private Sector	771
References	771
End Notes.....	773
Chapter 17—Planning for Operations	777
Introduction.....	777
Planning for Operations at a Glance	778
Opportunities, Methods and Techniques that Facilitate Planning for Operations	780
The Transportation Planning Process	780
Seven Opportunities to Coordinate Planning and Operations.....	783
Conclusions and Self-Assessment Tool	801
References	803
End Notes.....	803
Chapter 18—Planning for Parking	805
Introduction.....	805
Parking and Public Policy.....	806
Definitions.....	807
Parking Demand and Needs	810
Setting Parking Demand Formulas.....	811
Putting It All Together: How Much Parking is Enough?	814
Common Uses.....	816
Airports.....	816
Intermodal Parking	822
Industrial Uses	825
Residential Uses	825
Hotels	827

Recreational and Entertainment Uses	828
Educational Institutions	831
Medical Institutions	833
Convention Centers	834
Office Space	835
Retail Space	838
Eating and Drinking Establishments.....	838
Shared Parking Methodology	839
Captive Market	840
Development Synergy and Multi-Purpose Trips	840
Mode Adjustment.....	840
Central Area Characteristics, Demands and Needs.....	842
Characteristics.....	844
Demands.....	844
Zoning Requirements	884
Definition	844
Minimums or Maximums?	845
Flexibility in Requirements.....	846
Conceptual Parking Supply Options	847
Facility Location and Urban Design	850
Parking Management	851
Pricing Tactics	852
On-Street Supply Tactics	855
Enforcement and Adjudication	858
Off-Street Supply Actions	860
Effectiveness.....	862
Marketing	862
Parking Management Organizations	862
Parking Authority.....	865
Separate Department	865
Non-Profit Organization	866
Parking Management as an Enterprise Fund.....	867
Parking Costs.....	868
Capital Costs	868
Operating Costs	871
Combined Costs	873
Parking Scenario Comparisons	873
Financing Parking Facilities.....	878
Public Financing.....	878
Not-for-Profit Entities.....	881
Private Financing.....	881
Conclusion	882
References	882
End Notes.....	885

Chapter 19—Planning It Safe—Safety Considerations in the Transportation

Planning Process.....	889
Introduction	889
The Importance of Safety	890
Safety Legislative/Regulatory History in the United States	892
The Highway Safety Act (1966).....	892
Highway Safety Act of 1973.....	894
Intermodal Surface Transportation Efficiency Act (ISTEA 1991).....	894

Laying the Groundwork for Incorporating Safety Into Transportation Planning	897
Incorporating Safety into Transportation Planning.....	899
Create Partnerships.....	899
Understand and Articulate the Problem.....	900
Create a Vision.....	902
Develop Goals, Objectives and Performance Measures	902
Analyze Alternative Projects and Strategies	904
Evaluate and Prioritize Projects	911
Monitor Implementation and Assess Outcomes	912
Relationship Between TSP and Strategic Highway Safety Planning.....	914
Lessons from the International Community	915
Conclusions.....	916
Acknowledgments.....	917
References	917
End Notes.....	919
Chapter 20—Integrating Freight Into the Transportation Planning Process.....	923
Introduction.....	923
Overview of Domestic Freight Flows.....	924
Inland Water and Maritime	930
Air Cargo	930
Pipelines.....	930
Intermodal Freight	931
Impact of Freight Flows on the Community and Transportation System.....	931
Community Impacts.....	932
Transportation System Impacts	936
Freight Planning.....	938
Institutional Structure	939
System Designation	941
Data Collection.....	944
Needs Analysis and Models.....	955
Growth Factors	956
Four-Step Model.....	957
Evaluation and Prioritization of Freight Strategies.....	962
Summary	967
References	968
Chapter 21—Pedestrian and Bicycle Planning.....	971
Introduction.....	971
Goals and Benchmarks for Pedestrian and Bicycle Planning.....	972
Increasing Bicycle and Pedestrian Trips as Alternative Modes of Transportation.....	972
Bicycling and Walking for Healthy Lifestyles.....	972
Environmentally Friendly Travel Modes	973
Bicyclist and Pedestrian Safety.....	974
Evolution of Bicycle and Pedestrian Planning.....	974
Beginning of Formal Planning Efforts.....	977
Recent Interest	978
State, Regional and Local Programs.....	978
Important Considerations in Today’s Planning Environment	979
Bicycle and Pedestrian Planning	981
Understanding the Problem	982
Developing a Vision/Goals/Objectives/Performance Measures	982

Analyzing Pedestrian and Bicycling Alternatives	983
Surveys.....	983
Prioritizing Projects/Strategies	990
Producing Planning Products	991
Bicycle and Pedestrian Planning/Design Issues	996
Bicycle Network/Facility Design	996
Pedestrian Network/Facility Design.....	1004
Pedestrian and Bicycle Transportation in Asia and Europe	1013
Summary	1014
Acknowledgments	1014
References	1014
End Notes.....	1018
Index	1023