TRAFFIC THEORY

Denos C. Gazis



Kluwer's INTERNATIONAL SERIES

CONTENTS

CHAPTER 1. TRAFFIC FLOW THEORIES	1
Macroscopic Traffic Flow Theory – Kinematic	
Waves in Traffic	1
Shock waves 6	
Flow versus concentration relationships 9	
The Boltzman-like Model of Traffic	17
The two-fluid model of traffic 19	
Microscopic Traffic Flow Theory – Car-Following Models	21
Local stability 22	
Asymptotic stability 26	
Acceleration noise 31	
Non-linear car-following models 33	
Some Questionable Paradoxes	36
The Smeed paradox 36	
The Braess paradox 38	
Additional Flow Theory Work, and Future Challenges	40

CHAPTER 2. QUEUEING AND DELAYS AT ISOLATED INTERSECTIONS	45
Traffic Characteristics	46
The Gap Acceptance Function	49
The Delay to a Single Car	50
Delays to Pedestrians	63
Queueing and Delays of Vehicles	71
The Delay at a Traffic Signal Evaluation of delays 79 Optimization of traffic signal settings 87 The vehicle-actuated traffic signal 89	77
CHAPTER 3. TRAFFIC CONTROL	101
Objectives of Traffic Control	103
Single, Isolated Intersection	105
Synchronization Schemes for Arterial Traffic A mixed integer-linear programming approach The effect of queues on progression 115 The TRANSYT method 118 The Combination method 121 The SIGOP program 124	106
Traffic Responsive Operation of Traffic Lights Single intersection 128 Systems of intersections 132 Additional contributions: The SCOOT program 135 The OPAC, PRODYN, CRONOS, and COP programs	12 8
The Onset of Oversaturation	136

	ix
Oversaturated Systems A single oversaturated intersection Complex oversaturated systems 154	138
Oversaturated Store-and-Forward Networks	165
Freeway Control	171
Systems Affected by Geometric Details	172
CHAPTER 4. TRAFFIC GENERATION, DISTRIBUTION, AND ASSIGNMENT	185
Network Representation of a Transportation System	186
Trip Generation and Distribution Trip generation 190 Trip distribution 198	189
Time-Independent Traffic Assignment Deterministic traffic assignment models 207 Discrete choice, stochastic, models 211 Global Network Optimization Models 219	206
Dynamic Traffic Assignment	225
Traffic Assignment in Congested Systems Delivery of traveller information services 237	229
APPENDIX	
Application of Kalman Filtering for Density Estimation in Traffic Networks	245
Index	257