

Table of Contents

1.0.	INTRODUCTION	1
1.1.	Purpose	1
1.2.	Background	1
2.0.	PREREQUISITES FOR HOV AND MANAGED LANES	3
2.1.	Program and Policy Understanding.....	3
2.1.1.	Background on HOV Lanes.....	3
2.1.2.	Background on Managed Lanes.....	4
2.1.3.	Prerequisite Conditions	5
2.2.	Goals and Objectives	6
2.2.1.	Goals	6
2.2.2.	Objectives.....	8
2.3.	Management Tools.....	9
2.3.1.	Eligibility.....	9
2.3.2.	Pricing	9
2.3.3.	Access.....	11
2.4.	Organizational Support	11
2.5.	Resource Needs	13
2.5.1.	Functional Needs by Facility Type	14
2.5.2.	Funding	14
2.5.3.	Phasing	15
3.0.	PREREQUISITES FOR RAMP METERING	17
3.1.	Program and Policy Understanding.....	17
3.2.	Organizational Support and Buy-in.....	18
3.3.	Resource Needs	19
3.3.1.	Funding	19
3.3.2.	Staffing	19
3.3.3.	Training.....	21
3.3.4.	Public Information and Outreach.....	22
3.3.5.	Maintenance and Equipment.....	22
3.3.6.	Software.....	24
4.0.	RAMP METERING COORIDOR EVALUATION ISSUES	25
4.1.	Problem Analysis.....	25
4.1.1.	Safety	25
4.1.2.	Congestion.....	26
4.2.	Location Analysis.....	27
4.2.1.	Problem Extent	27
4.2.2.	Site Characteristics	28
4.3.	Impact Analysis	31
4.3.1.	Diversion	33
4.3.2.	Equity.....	33
4.3.3.	Public Perception.....	34
4.4.	Geometric Improvements.....	34
5.0.	INTRA- AND INTER-AGENCY COORDINATION AND OUTREACH	36
5.1.	Intra-agency Coordination and Outreach – Internal Activities.....	36

5.1.1.	Upper Management	36
5.1.2.	Managers and Operators.....	36
5.2.	Inter-agency Information and Public Outreach	37
5.2.1.	The Public and Local Businesses.....	37
5.2.2.	Local and County Traffic Operations.....	38
5.2.3.	Enforcement	38
5.2.4.	Transit.....	39
5.2.5.	Local Leaders	39
5.2.6.	Media	39
5.3.	Outreach Tools and Techniques	39
6.0.	SELECTING A HOV AND MANAGED LANE APPROACH.....	42
6.1.	Planning.....	43
6.1.1.	Regional Level Planning	43
6.1.2.	Corridor and Project Level Planning.....	47
6.1.3.	Design Plan	54
6.1.4.	Operation Plan	54
6.1.5.	Performance Monitoring	59
6.1.6.	Priority Pricing.....	62
6.2.	Types of Managed Lane Designs.....	63
6.2.1.	Concurrent Flow Lanes	63
6.2.2.	Reversible Flow Lanes.....	65
6.2.3.	Contraflow Lanes.....	66
6.2.4.	Queue Bypass Lanes	67
6.2.5.	Direct Access Ramps	68
7.0.	SELECTING A RAMP METERING APPROACH.....	70
7.1.	Geographic Extent	70
7.1.1.	Isolated	70
7.1.2.	Linked.....	70
7.2.	Local versus System-wide Metering.....	70
7.2.1.	Isolated	70
7.2.2.	Coordinated	71
7.3.	Pre-timed versus Traffic Responsive	71
7.3.1.	Pre-timed	71
7.3.2.	Traffic Responsive.....	72
7.3.3.	Operator Control	72
7.4.	Flow Control	72
7.4.1.	One Vehicle per Green	73
7.4.2.	Multiple Vehicles per Green Metering	73
7.4.3.	Dual Lane Metering.....	73
7.5.	Ramp Storage and Queues.....	73
7.6.	Special Use Bypass.....	74
8.0.	Ramp Metering Testing and Start-up.....	75
9.0.	RAMP METERING PERFORMANCE MONITORING, EVALUATION AND REPORTING ..	76
References	77

List of Tables

Table 2-1: Agencies and Groups Involved in Planning HOV Lane Facilities	12
Table 2-2: Resource Needs for Different HOV Facilities	14
Table 3-1: Ramp Metering Performance Measures.....	18
Table 3-2: Elements of Ramp Metering.....	23
Table 4-1: Types and Characteristics of Ramp Metering Flow Chart	29
Table 5-1: Sample Ramp Metering Coordination and Outreach Schedule.....	41
Table 6-1: Regional Screening Criteria	45
Table 6-2: Vehicle Volume Operating Thresholds for Freeway Managed Lanes.....	46
Table 6-3: Components for a Benefit-Cost Analysis.....	50
Table 6-4: Candidate Corridor Evaluation Criteria	52
Table 6-5: Sample Objectives and Corresponding Measures for HOV Facilities.....	59
Table 6-6: Recommended Objectives and Related Measures of Effectiveness	61

List of Figures

Figure 2-1: I-405 HOV Lanes in Southern California.....	3
Figure 2-2: Managed Lanes on State Route 91 in California	4
Figure 2-3: Typical Eligibility Restriction on an HOV Lane	10
Figure 2-4: Pricing Sign on I-15 Express Lanes in San Diego	10
Figure 5: Ramp Gating Applied to I-5 in Seattle	11
Figure 4-1: Minimum Acceleration Lengths for Entrance Terminals with Flat Grades of 2 Percent or Less.....	32
Figure 6-1: Planning and Implementation Process	42
Figure 6-2: ETC Installations on Managed Lanes.....	62
Figure 6-3: Concurrent Flow HOV Lanes.....	64
Figure 6-4: Reversible Flow HOV Lane.....	65
Figure 6-5: Contraflow Lane using Moveable Barrier	67
Figure 6-6: Freeway Ramp Meter Bypass	68
Figure 6-7: Examples of HOV/Managed Lane Direct Access Ramps	69