Appendix A

Micro-Simulation Calibration Assumptions and Results

Table A.1 Major I-680 Links Considered for Traffic Volume Calibration

Corridor	Segment	Direction
I-680 Freeway	North of Stoneridge (257-270)	SB
	Between Route 84 and Andrade (154-250)	SB
	Between Automall Pkwy and Mission (152-58)	SB
	South of Route 237 (132-131)	SB
Arterial Segments	Foothill between Stoneridge and Bernal	SB
	Foothill between Bernal and Sunol	SB
	Foothill between Sunol and Calaveras	SB
	Hopyard between Stoneridge and Bernal	SB
	Hopyard between Bernal and Sunol	SB
I-680 Ramps	Stoneridge loop-on-ramp	SB
	Stoneridge straight-on-ramp	SB
	Bernal off-ramp	SB
	Bernal on-ramp	SB
	Sunol off-ramp	SB
	Sunol on-ramp	SB
	Calaveras off-ramp	SB
	Calaveras on-ramp	SB
	Koopman off-ramp	SB
	SR-84 on-ramp	SB
	Andrade off-ramp	SB
	Andrade on-ramp	SB
	Sheridan on-ramp	SB
	Vargas off-ramp	SB
	Vargas on-ramp	SB
	Rte238 off-ramp	SB
	Rte238 on-ramp	SB
	Washington off-ramp	SB
	Washington on-ramp	SB
	Automall Pkwy off-ramp	SB
	Automall Pkwy on-ramp	SB
	Rte262 straight-off-ramp	SB
	Rte262 loop-off-ramp	SB
	Rte262 loop-on-ramp	SB
	Rte262 straight-on-ramp	SB
	Scott Crk off-ramp	SB
	Scott Crk on-ramp	SB
	Jacklin off-ramp	SB
	Jacklin on-ramp	SB
	Rte237 off-ramp	SB

Table A.2 Major I-680 Segments Considered for Travel Time Calibration

Corridor	Segment	Direction
I-680 Freeway	Between north end and Andrade	SB
	Between north end and south end	SB
	Between Andrade and south end	SB

Table A.3 Major I-405/I-5 Links Considered for Traffic Volume Calibration

Corridor	Segment	Direction
I-405	Irvine Center Dr	NB, SB
	Sand Canyon Av	NB, SB
	Jeffrey Rd	NB
	Culver Dr	NB, SB
I-5	Alton Pkwy	NB, SB
SR-133	Irvine Center Dr	NB, SB
Arterial Segments	Alton Pkwy	EB, WB
	Barranca Pkwy	EB, WB
I-405 Ramps	Irvine Center Dr	NB, SB
	Laguna Fwy	NB, SB
	Sand Canyon Av	NB, SB
	Jeffrey Rd	NB, SB
	Culver Dr	NB, SB
I-5 Ramps	Alton Pkwy	NB

Table A.4 Major I-405/I-5 Segments Considered for Travel Time Calibration

Corridor	Segment	Direction
I-405	Between Culver and Irvine Center Dr	NB, SB

Table A.5 I-680 Peak Hour (8:00 to 9:00 a.m.) Traffic Volume Calibration Results

Corridor	Location	Paramics™ Link	Percent Difference	Nominal Difference*	GEH
I-680 SB Freeway	North of Stoneridge	257-270	0%		0.14
	Between Route 84 and Andrade	154-250	-3%		1.81
	Between Automall Pkwy and Mission	152-58	-1%		0.69
	South of Route 237	132-131	4%		2.94
Arterial Segments	Foothill between Stoneridge and Bernal	291-293	2%	15	0.60
	Foothill between Bernal and Sunol	296-297	17%	44	2.62
	Foothill between Sunol and Calaveras	300-301	-16%	-21	1.92
	Hopyard between Stoneridge and Bernal	317-327	-11%		3.83
	Hopyard between Bernal and Sunol	319-325	12%	82	3.06
I-680 SB Ramps	Stoneridge loop-on-ramp	276-277	17%	27	2.03
	Stoneridge straight-on-ramp	275-273	6%	19	1.04
	Bernal off-ramp	267-268	5%	38	1.36
	Bernal on-ramp	198-200	17%	70	3.28
	Sunol off-ramp	224-225	10%	33	1.75
	Sunol on-ramp	228-231	4%	20	0.84
	Calaveras off-ramp	252-182	1%	3	0.15
	Calaveras on-ramp	159-157	8%	29	1.51
	Koopman off-ramp	172-238	-8%	-29	1.55
	SR-84 on-ramp	165-164	3%	23	0.84
	Andrade off-ramp	535-5	-15%	-80	3.54
	Andrade on-ramp	10-258	50%	37	3.85
	Sheridan on-ramp	19-20	-6%	-40	1.60
	Vargas off-ramp	547-24	-11%	-1	0.34
	Vargas on-ramp	29-30	27%	6	1.20
	Rte238 off-ramp	552-255	-10%	-77	2.84
	Rte238 on-ramp	41-42	1%	8	0.34
	Washington off-ramp	556-48	-14%	-36	2.33
	Washington on-ramp	51-242	-4%	-28	1.01
	Automall Pkwy off-ramp	561-60	0%	2	0.10
	Automall Pkwy on-ramp	149-50	5%		1.98
	Rte262 straight-off-ramp	70-71	-1%		0.20
	Rte262 loop-off-ramp	80-79	10%	16	1.26
	Rte262 loop-on-ramp	76-244	1%		0.43
	Rte262 straight-on-ramp	83-82	-2%	-6	0.30
	Scott Crk off-ramp	574-91	-13%	-73	3.13
	Scott Crk on-ramp	97-260	0%	0	0.00
	Jacklin off-ramp	579-103	-4%	-14	0.75
	Jacklin on-ramp	110-114	22%	69	3.67
	Rte237 off-ramp	143-117	-4%		1.59
Compliance Rate				**100%**	**100%**

*Comparison of nominal difference is used when traffic volume is below 700 vph.

Table A.6 I-680 Peak Period (5:00 to 10:00 a.m.) Traffic Volume Calibration Results

Corridor	Location	Paramics™ Link	Percent Difference	Nominal Difference*	GEH
I-680 SB Freeway	North of Stoneridge	257-270	0%		0.31
	Between Route 84 and Andrade	154-250	0%		0.46
	Between Automall Pkwy and Mission	152-58	-1%		1.49
	South of Route 237	132-131	-2%		3.21
Arterial Segments	Foothill between Stoneridge and Bernal	291-293	-1%		0.78
	Foothill between Bernal and Sunol	296-297	-3%		1.00
	Foothill between Sunol and Calaveras	300-301	-1%		0.36
	Hopyard between Stoneridge and Bernal	317-327	-11%		9.08
	Hopyard between Bernal and Sunol	319-325	-16%	-568	9.80
I-680 SB Ramps	Stoneridge loop-on-ramp	276-277	5%		1.66
	Stoneridge straight-on-ramp	275-273	2%		0.68
	Bernall off-ramp	267-268	3%		1.42
	Bernal on-ramp	198-200	5%		2.52
	Sunol off-ramp	224-225	1%		0.50
	Sunol on-ramp	228-231	6%		3.09
	Calaveras off-ramp	252-182	3%		1.41
	Calaveras on-ramp	159-157	0%		0.22
	Koopman off-ramp	172-238	5%		1.80
	SR-84 on-ramp	165-164	4%		3.26
	Andrade off-ramp	535-5	-1%		0.32
	Andrade on-ramp	10-258	15%	43	2.44
	Sheridan on-ramp	19-20	-5%		2.09
	Vargas off-ramp	547-24	-7%	-3	0.45
	Vargas on-ramp	29-30	12%	18	1.45
	Rte238 off-ramp	552-255	-1%		0.61
	Rte238 on-ramp	41-42	-1%		0.33
	Washington off-ramp	556-48	0%		0.12
	Washington on-ramp	51-242	-3%		1.32
	Automall Pkwy off-ramp	561-60	-2%		0.95
	Automall Pkwy on-ramp	149-50	0%		0.20
	Rte262 straight-off-ramp	70-71	1%		0.45
	Rte262 loop-off-ramp	80-79	15%	78	3.30
	Rte262 loop-on-ramp	76-244	5%		2.66
	Rte262 straight-on-ramp	83-82	-4%		2.14
	Scott Crk off-ramp	574-91	3%		1.43
	Scott Crk on-ramp	97-260	-1%		0.40
	Jacklin off-ramp	579-103	4%		1.50
	Jacklin on-ramp	110-114	-6%		3.04
	Rte237 off-ramp	143-117	-4%		3.26
Compliance Rate				**97%**	**95%**

*Comparison of nominal difference is used when traffic volume is below 700 vph.

Table A.7 I-680 Travel Time Calibration Results

Corridor	Segment	Percent Difference: Peak Hour (8:00-9:00 a.m.)	Percent Difference: Peak Period (5:00-10:00 a.m.)
I-680 SB	Between north end and Andrade Road	7%	12%
	Between north end and south end	0%	3%
	Between Andrade and south end Road	2%	-1%
	Between Andrade and south end Road	2%	-1%
	Between Andrade and south end Road	2%	-1%
Compliance Rate		**100%**	**100%**

Table A.8 I-405/I-5 Peak Hour (7:00 to 8:00 a.m.) Traffic Volume Calibration Results

Corridor	Location	Percent Difference	Nominal Difference*	GEH
I-405 NB	Irvine Center Dr	0%		0.06
	Jeffrey Rd-Sand Canyon Av	-1%		1.27
	Jeffrey Rd	-1%		0.81
	Culver Dr	-2%		1.73
I-405 SB	Culver Dr	2%		1.95
	Jeffrey Rd-Sand Canyon Av	-1%		0.98
	Irvine Center Dr	-1%		0.93
I-5 NB	Alton Pkwy	2%		1.75
I-5 SB	Alton Pkwy	7%		5.79
SR-133 NB	Irvine Center Dr	-8%		1.76
	Irvine Center Dr	2%		0.46
SR-133 SB	Irvine Center Dr	-3%		1.50
	Irvine Center Dr	-6%		2.61
Arterial Segments	Jeffery 405-Alton (SB)	-7%	-156	3.45
	Jeffery 405-Alton (NB)	20%	175	5.62
	Alton E of Jeffery (WB)	-20%	-154	5.90
	Alton E of Jeffery (EB)	2%	7	0.33
	Alton E of Sand (WB)	-29%	-181	7.84
	Alton E of Sand (EB)	7%	48	1.75

Table A.8 I-405/I-5 Peak Hour (7:00 to 8:00 a.m.) Traffic Volume Calibration Results (continued)

Corridor	Location	Percent Difference	Nominal Difference*	GEH
Arterial Segments (continued)	Alton E of Laguna (WB)	-23%	-185	6.94
	Alton E of Laguna (EB)	23%	115	4.91
	Barranca SR133-ICD (WB)	-2%	-8	0.39
	Barranca SR133-ICD (EB)	0%	3	0.10
I-405 NB Ramps	Irvine Center Dr-Santa Ana Fwy	1%	2	0.16
	Irvine Center Dr	-1%	-5	0.22
	Irvine Center Dr	35%	39	3.43
	Laguna Fwy	-4%	-2	0.27
	Laguna Fwy	-3%	-61	1.30
	Sand Canyon Av	19%	31	2.31
	Sand Canyon Av	1%	6	0.29
	Jeffrey Rd	3%	22	0.82
	Jeffrey Rd	4%	13	0.73
	Jeffrey Rd	-1%	-7	0.25
	Culver Dr	-7%	-34	1.62
	Culver Dr	-2%	-12	0.46
	Culver Dr	5%	49	1.51
I-405 SB Ramps	Culver Dr	12%	106	3.52
	Culver Dr	-13%	-40	2.32
	Culver Dr	17%	40	2.48
	Jeffrey Rd	-4%	-17	0.85
	Jeffrey Rd	16%	29	2.06
	Jeffrey Rd	-9%	-57	2.34
	Sand Canyon Av	-5%	-47	1.62
	Sand Canyon Av	5%	7	0.56
	Laguna Fwy	-3%	-19	0.79
	Laguna Fwy	67%	47	4.86
	Irvine Center Dr	-3%	-50	1.28
	Irvine Center Dr	65%	13	2.53
	Irvine Center Dr	22%	2	0.63
I-5 NB Ramps	Alton Pkwy-San Diego Fwy	8%	60	2.16
	Alton Pkwy	12%	10	1.06
	Alton Pkwy	17%	33	2.25
Compliance Rate			**87%**	**96%**

*Comparison of nominal difference is used when traffic volume is below 700 vph.

Table A.9 I-405/I-5 Peak Period (6:00 to 10:00 a.m.) Traffic Volume Calibration Results

Corridor	Location	Percent Difference	Nominal Difference*	GEH
I-405 NB	Irvine Center Dr	0%		0.49
	Jeffrey Rd-Sand Canyon Av	-2%		3.46
	Jeffrey Rd	-2%		4.02
	Culver Dr	-2%		4.36
I-405 SB	Culver Dr	-1%		2.09
	Jeffrey Rd-Sand Canyon Av	-2%		4.21
	Irvine Center Dr	-2%		2.97
I-5 NB	Alton Pkwy	-1%		1.32
I-5 SB	Alton Pkwy	-2%		2.82
SR-133 NB	Irvine Center Dr	0%		0.05
	Irvine Center Dr	3%		1.44
SR-133 SB	Irvine Center Dr	0%		0.00
	Irvine Center Dr	4%		2.68
Arterial Segments	Jeffery 405-Alton (SB)	-4%		3.07
	Jeffery 405-Alton (NB)	0%		0.25
	Alton E of Jeffery (WB)	3%		1.14
	Alton E of Jeffery (EB)	-6%		2.22
	Alton E of Sand (WB)	-12%		4.91
	Alton E of Sand (EB)	1%		0.52
	Alton E of Laguna (WB)	13%		5.91
	Alton E of Laguna (EB)	12%		4.86
	Barranca SR133-ICD (WB)	-4%		1.32
	Barranca SR133-ICD (EB)	-2%		1.31
I-405 NB Ramps	Irvine Center Dr-Santa Ana Fwy	3%		0.76
	Irvine Center Dr	-3%		1.30
	Irvine Center Dr	0%		0.09
	Laguna Fwy	-8%		1.12
	Laguna Fwy	1%		1.20
	Sand Canyon Av	-3%		0.79
	Sand Canyon Av	-4%		1.61
	Jeffrey Rd	-1%		0.63
	Jeffrey Rd	3%		1.04
	Jeffrey Rd	-7%		3.84
	Culver Dr	2%		0.81
	Culver Dr	-1%		0.58
	Culver Dr	0%		0.15

Table A.9 I-405/I-5 Peak Period (6:00 to 10:00 a.m.) Traffic Volume Calibration Results (continued)

Corridor	Location	Percent Difference	Nominal Difference*	GEH
I-405 SB Ramps	Culver Dr	-1%		0.76
	Culver Dr	-6%		2.01
	Culver Dr	-3%		0.85
	Jeffrey Rd	-3%		1.21
	Jeffrey Rd	3%		0.66
	Jeffrey Rd	-10%		4.64
	Sand Canyon Av	-7%		3.64
	Sand Canyon Av	8%		1.68
	Laguna Fwy	4%		1.64
	Laguna Fwy	1%		0.22
	Irvine Center Dr	0%		0.01
	Irvine Center Dr	112%		6.83
	Irvine Center Dr	0%		0.00
I-5 NB Ramps	Alton Pkwy-San Diego Fwy	6%		3.13
	Alton Pkwy	17%		2.82
	Alton Pkwy	-2%		0.62
Compliance Rate			**96%**	**98%**

*Comparison of nominal difference is used when traffic volume is below 700 vph.

Table A.10 I-405/I-5 Travel Time Calibration Results – Peak Period (6:00-10:00 a.m.)

Corridor	Segment	Percent Difference Peak Period (6:00-10:00 a.m.)
I-405 SB	Between Culver and Irvine Center Dr	4%
I-405 NB	Between Irvine Center Dr and Culver	11%
Compliance Rate		**100%**

Appendix B

I-680 Micro-Simulation Results

Table B.1 I-680 Corridor Performance Measures

Baseline 2000

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)															
Peak Hour	6.6	0.3	13.8	na	3.5	0.4	9.7	na	23.5	0.5	na	33.6	0.4	23.5	na
Peak Period	6.7	0.3	11.8	na	3.9	0.4	9.7	na	19.5	0.3	na	30.1	0.3	21.5	na
Avg Speed (mph)															
Peak Hour	63.1	44.7	31.2	50.9	60.5	53.3	33.5	56.5	39.7	46.9	39.9	44.7	47.3	31.5	43.6
Peak Period	62.1	45.2	32.7	53.2	56.4	51.1	33.5	53.4	47.8	52.8	47.9	51.4	50.9	32.9	49.8
Avg Volume (veh)															
Peak Hour	3,195	308	469	5,364	3,421	448	209	4,524	4,846	497	9,818	4,344	444	411	12,677
Peak Period	17,933	1,395	2,187	27,890	19,624	2,491	1,137	25,743	23,425	1,885	42,271	21,871	1,838	1,954	57,141
VHT															
Peak Hour	352	6	215	574	202	6	34	241	1,898	38	1,936	2,452	51	249	2,751
Peak Period	2,001	29	862	2,892	1,270	37	184	1,490	7,636	94	7,730	10,908	159	1,046	12,113
VMT															
Peak Hour	22,225	289	6,690	29,204	12,203	301	1,128	13,632	74,668	1,793	76,461	109,097	2,383	7,817	119,297
Peak Period	124,334	1,305	28,237	153,876	71,321	1,841	6,148	79,310	364,454	4,945	369,399	560,109	8,091	34,385	602,585

Table B.2 I-680 Corridor Performance Measures

Baseline 2010

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)															
Peak Hour	17.6	1.2	16.1	na	15.7	2.7	9.8	na	37.0	1.2	na	70.2	1.7	25.9	na
Peak Period	12.5	0.7	13.3	na	11.8	1.8	9.7	na	28.3	0.7	na	52.5	1.1	23.0	na
Avg Speed (mph)															
Peak Hour	26.3	34.2	29.2	26.9	13.7	25.5	33.3	15.5	25.3	27.5	25.4	23.0	28.0	29.9	23.6
Peak Period	41.5	40.4	31.6	39.0	21.5	31.9	33.4	22.7	35.7	41.2	35.9	33.9	37.8	32.0	33.8
Avg Volume (veh)															
Peak Hour	3,265	331	539	5,665	3,448	518	390	4,874	4,637	550	10,135	4,220	491	506	13,594
Peak Period	18,469	1,559	2,558	29,820	19,913	2,828	1,740	27,310	24,447	2,161	46,053	22,708	2,094	2,377	63,334
VHT															
Peak Hour	951	27	289	1,267	898	47	64	1,008	2,859	107	2,965	4,707	180	353	5,241
Peak Period	3,833	71	1,130	5,033	3,900	174	282	4,356	11,526	251	11,778	19,259	496	1,412	21,167
VMT															
Peak Hour	23,313	930	8,426	32,669	12,265	1,186	2,114	15,565	72,316	2,924	75,240	107,894	5,041	10,540	123,475
Peak Period	155,113	2,837	35,721	193,670	83,683	5,543	9,423	98,649	411,873	10,370	422,244	650,668	18,750	45,144	714,563

Table B.3 I-680 Corridor Performance Measures

Fixed-Time Ramp Metering Without Queue Control

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	**On Ramp**	**Arterial**	**Tot/Avg**	**Fwy**	**On Ramp**	**Arterial**	**Tot/Avg**	**Fwy**	**On Ramp**	**Tot/Avg**	**Fwy**	**On Ramp**	**Arterial**	**Tot/Avg**
Avg Trav Time (min)															
Peak Hour	9.2	0.9	49.7	na	3.6	1.4	85.2	na	13.7	0.9	na	26.5	1.1	134.9	na
Peak Period	8.7	0.8	49.2	na	3.8	1.4	67.9	na	14.5	0.7	na	26.9	1.0	117.2	na
Avg Speed (mph)															
Peak Hour	53.8	22.3	26.1	36.7	59.3	13.2	15.6	40.7	61.4	18.8	59.1	58.4	18.7	24.3	45.2
Peak Period	55.3	24.4	27.4	38.5	57.9	13.7	18.4	42.4	58.8	22.6	57.5	57.6	21.3	26.0	46.2
Avg Volume (veh)															
Peak Hour	3,807	314	510	6,086	4,131	277	120	4,805	4,241	384	8,084	4,141	353	424	11,066
Peak Period	19,110	1,397	2,465	29,630	20,747	1,377	672	24,174	21,701	1,608	37,785	21,068	1,527	2,067	51,697
VHT															
Peak Hour	651	21	933	1,604	277	14	189	480	1,067	62	1,129	1,995	98	1,120	3,213
Peak Period	3,041	86	4,464	7,590	1,433	71	840	2,343	5,791	221	6,012	10,264	377	5,303	15,944
VMT															
Peak Hour	34,072	475	24,296	58,842	16,414	189	2,942	19,547	65,549	1,165	66,715	116,036	1,829	27,238	145,102
Peak Period	167,650	2,094	122,332	292,076	82,933	967	15,444	99,344	340,432	4,991	345,422	591,016	8,051	137,776	736,843

Table B.4 I-680 Corridor Performance Measures

Fixed-Time Ramp Metering with Moderate Queue Control

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	**On Ramp**	**Arterial**	**Tot/Avg**	**Fwy**	**On Ramp**	**Arterial**	**Tot/Avg**	**Fwy**	**On Ramp**	**Tot/Avg**	**Fwy**	**On Ramp**	**Arterial**	**Tot/Avg**
Avg Trav Time (min)															
Peak Hour	6.7	0.8	17.9	na	3.9	1.3	46.9	na	19.1	0.8	na	29.6	1.0	64.8	na
Peak Period	6.7	0.7	14.1	na	4.3	1.3	38.1	na	18.8	0.7	na	29.8	0.9	52.2	na
Avg Speed (mph)															
Peak Hour	62.7	24.5	29.3	47.5	58.0	13.9	19.0	41.1	47.9	18.9	46.8	51.5	18.9	25.7	45.7
Peak Period	61.4	26.4	30.9	50.1	53.0	14.5	21.3	41.8	49.1	22.5	48.4	52.0	21.3	27.4	47.6
Avg Volume (veh)															
Peak Hour	3,474	347	515	5,892	3,841	445	213	4,944	4,911	442	9,335	4,495	419	448	12,542
Peak Period	19,035	1,552	2,497	30,237	21,432	2,194	1,110	26,929	24,099	1,800	42,095	22,766	1,787	2,188	57,923
VHT															
Peak Hour	407	19	324	750	262	21	152	435	1,656	66	1,722	2,325	106	475	2,907
Peak Period	2,267	78	1,243	3,588	1,614	102	688	2,404	7,993	234	8,227	11,875	413	1,932	14,220
VMT															
Peak Hour	25,559	464	9,397	35,420	14,699	291	2,596	17,586	78,095	1,254	79,350	118,353	2,009	11,994	132,356
Peak Period	139,226	2,062	38,373	179,661	84,627	1,472	14,121	100,219	391,832	5,270	397,102	615,685	8,804	52,494	676,982

Table B.5 I-680 Corridor Performance Measures

Fixed-Time Ramp Metering With Aggressive Queue Control

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	**On Ramp**	**Arterial**	**Tot/Avg**	**Fwy**	**On Ramp**	**Arterial**	**Tot/Avg**	**Fwy**	**On Ramp**	**Tot/Avg**	**Fwy**	**On Ramp**	**Arterial**	**Tot/Avg**
Avg Trav Time (min)															
Peak Hour	10.6	0.9	15.7	na	10.2	1.7	9.9	na	27.6	1.1	na	48.3	1.3	25.6	na
Peak Period	8.5	0.8	13.3	na	8.4	1.5	9.9	na	23.6	0.8	na	40.6	1.0	23.2	na
Avg Speed (mph)															
Peak Hour	39.5	24.8	30.6	36.3	22.2	12.6	33.1	22.6	33.1	17.7	32.4	31.9	17.6	31.0	31.4
Peak Period	51.5	27.1	31.8	45.3	31.7	14.4	33.3	31.1	40.2	22.1	39.7	40.5	20.7	32.1	39.3
Avg Volume (veh)															
Peak Hour	3,637	338	527	6,046	4,253	551	335	5,690	5,215	522	10,434	4,784	480	485	13,912
Peak Period	18,999	1,539	2,526	30,208	21,128	2,752	1,502	28,134	25,258	2,003	45,291	23,511	1,981	2,298	62,098
VHT															
Peak Hour	662	22	284	967	735	33	56	825	2,452	98	2,551	3,849	153	340	4,342
Peak Period	2,771	83	1,146	4,000	3,033	144	253	3,430	10,190	280	10,470	15,993	507	1,399	17,900
VMT															
Peak Hour	25,294	539	8,668	34,500	16,268	409	1,867	18,545	80,912	1,735	82,647	122,475	2,683	10,536	135,693
Peak Period	142,043	2,246	36,497	180,786	95,865	2,082	8,449	106,396	409,522	6,173	415,694	647,429	10,501	44,946	702,876

Table B.6 I-680 Corridor Performance Measures

Simple Adaptive Ramp Metering Without Queue Control

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)															
Peak Hour	6.7	0.4	15.7	na	3.6	1.1	21.4	na	25.1	1.1	na	35.4	0.9	37.0	na
Peak Period	6.6	0.4	13.2	na	4.1	1.1	29.5	na	20.8	0.8	na	31.5	0.8	42.7	na
Avg Speed (mph)															
Peak Hour	62.2	34.0	30.8	48.9	59.7	17.7	21.5	41.9	35.6	20.2	35.0	41.2	20.7	27.2	38.0
Peak Period	61.4	34.5	32.3	51.4	52.7	18.3	23.8	42.8	43.2	26.4	42.7	47.4	25.2	29.1	44.6
Avg Volume (veh)															
Peak Hour	3,380	338	516	5,766	3,674	722	442	5,560	5,146	486	10,012	4,616	479	500	13,778
Peak Period	18,549	1,537	2,453	29,603	20,889	2,615	1,294	27,413	24,758	1,934	44,093	23,051	1,920	2,196	60,352
VHT															
Peak Hour	398	11	283	691	230	27	167	425	2,266	94	2,361	2,896	132	450	3,477
Peak Period	2,164	45	1,157	3,453	1,498	104	699	2,361	9,081	257	9,338	12,745	406	1,856	15,570
VMT															
Peak Hour	24,780	345	8,720	33,846	13,752	484	3,587	18,317	80,044	1,879	81,923	118,575	2,708	12,382	136,386
Peak Period	133,120	1,561	37,322	177,430	79,016	1,904	16,527	100,820	391,452	6,745	398,198	603,588	10,211	53,848	693,608

Table B.7 I-680 Corridor Performance Measures

Simple Adaptive Ramp Metering With Moderate Queue Control

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	**On Ramp**	**Arterial**	**Tot/Avg**	**Fwy**	**On Ramp**	**Arterial**	**Tot/Avg**	**Fwy**	**On Ramp**	**Tot/Avg**	**Fwy**	**On Ramp**	**Arterial**	**Tot/Avg**
Avg Trav Time (min)															
Peak Hour	11.7	1.3	21.4	na	12.0	1.9	9.7	na	32.5	1.4	na	56.2	1.5	31.0	na
Peak Period	8.8	0.8	14.9	na	9.4	1.6	9.9	na	26.1	0.9	na	44.3	1.1	24.8	na
Avg Speed (mph)															
Peak Hour	37.8	25.3	27.8	33.7	18.5	11.4	34.2	19.0	28.0	16.9	27.5	27.4	17.2	28.4	27.1
Peak Period	50.5	30.6	31.1	44.1	26.8	13.0	33.3	26.7	37.3	24.0	36.9	37.3	22.0	31.4	36.4
Avg Volume (veh)															
Peak Hour	3,496	345	514	5,903	3,980	477	260	5,193	4,908	541	10,315	4,514	484	458	13,626
Peak Period	19,046	1,573	2,514	30,364	21,171	2,554	1,391	27,669	24,849	2,097	45,821	23,247	2,023	2,265	62,410
VHT															
Peak Hour	692	29	372	1,093	806	31	43	879	2,693	125	2,818	4,190	184	415	4,789
Peak Period	2,835	79	1,266	4,180	3,344	142	233	3,719	10,970	310	11,280	17,149	531	1,499	19,179
VMT															
Peak Hour	24,598	714	10,209	35,521	14,844	345	1,455	16,645	75,211	2,106	77,317	114,653	3,166	11,664	129,482
Peak Period	140,967	2,420	39,276	182,663	88,992	1,853	7,747	98,593	408,581	7,432	416,012	638,540	11,705	47,024	697,269

Table B.8 I-680 Corridor Performance Measures

Simple Adaptive Ramp Metering with Aggressive Queue Control

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)															
Peak Hour	12.3	1.2	16.9	na	13.3	2.2	9.8	na	34.6	1.5	na	60.2	1.6	26.7	na
Peak Period	9.3	0.7	13.5	na	10.5	1.8	9.8	na	27.3	1.0	na	47.1	1.2	23.3	na
Avg Speed (mph)															
Peak Hour	35.3	25.8	29.2	33.1	16.3	10.7	33.4	17.2	26.3	16.1	25.9	25.7	16.3	29.9	25.6
Peak Period	47.8	30.5	31.5	42.9	23.5	12.7	33.6	23.8	36.4	23.8	36.0	35.6	21.5	32.0	34.9
Avg Volume (veh)															
Peak Hour	3,439	334	530	5,835	3,757	518	399	5,192	4,802	547	10,271	4,404	490	501	13,747
Peak Period	18,804	1,546	2,530	30,048	20,503	2,690	1,645	27,528	24,634	2,136	45,994	22,973	2,058	2,333	62,896
VHT															
Peak Hour	708	26	301	1,035	839	38	65	942	2,787	138	2,926	4,333	202	367	4,903
Peak Period	2,940	77	1,145	4,161	3,618	165	270	4,053	11,266	341	11,608	17,824	582	1,414	19,822
VMT															
Peak Hour	24,071	676	8,735	33,482	13,639	406	2,193	16,237	73,397	2,228	75,625	111,108	3,309	10,928	125,345
Peak Period	138,497	2,318	36,101	176,916	84,892	2,091	9,074	96,057	409,514	8,094	417,608	632,903	12,503	45,174	690,580

Table B.9 I-680 Corridor Performance Measures

Corridor Adaptive Ramp Metering Without Queue Control

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	**On Ramp**	**Arterial**	**Tot/Avg**	**Fwy**	**On Ramp**	**Arterial**	**Tot/Avg**	**Fwy**	**On Ramp**	**Tot/Avg**	**Fwy**	**On Ramp**	**Arterial**	**Tot/Avg**
Avg Trav Time (min)															
Peak Hour	6.7	0.4	15.7	na	3.6	0.9	9.5	na	18.4	1.0	na	28.6	0.8	25.3	na
Peak Period	6.7	0.5	13.6	na	3.9	1.1	10.3	na	18.3	0.7	na	29.0	0.8	23.9	na
Avg Speed (mph)															
Peak Hour	62.5	34.4	30.9	49.2	60.3	23.1	35.3	54.1	47.9	22.1	46.5	51.7	23.3	31.5	48.0
Peak Period	61.6	33.4	31.8	51.0	56.0	20.0	33.6	51.0	48.5	26.8	47.8	51.9	26.0	32.1	49.0
Avg Volume (veh)															
Peak Hour	3,449	345	517	5,863	3,729	658	255	5,300	5,161	513	10,294	4,647	489	459	13,852
Peak Period	19,102	1,564	2,499	30,357	21,428	2,650	1,389	28,117	25,294	1,971	45,003	23,592	1,954	2,252	61,615
VHT															
Peak Hour	401	10	283	694	231	21	43	293	1,652	90	1,741	2,283	121	326	2,728
Peak Period	2,240	51	1,187	3,479	1,458	98	248	1,805	8,071	258	8,329	11,769	408	1,435	13,612
VMT															
Peak Hour	25,045	348	8,751	34,144	13,904	482	1,491	15,878	79,016	1,977	80,993	117,966	2,807	10,242	131,014
Peak Period	138,028	1,720	37,734	177,482	81,651	1,964	8,317	91,933	391,024	6,925	397,949	610,705	10,608	46,051	667,364

Table B.10 I-680 Corridor Performance Measures

Corridor Adaptive Ramp Metering Without Queue Control + Adaptive Arterial Signal Control

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	**On Ramp**	**Arterial**	**Tot/Avg**	**Fwy**	**On Ramp**	**Arterial**	**Tot/Avg**	**Fwy**	**On Ramp**	**Tot/Avg**	**Fwy**	**On Ramp**	**Arterial**	**Tot/Avg**
Avg Trav Time (min)															
Peak Hour	6.7	0.4	13.9	na	3.5	0.9	9.5	na	18.5	1.0	na	28.7	0.8	23.5	na
Peak Period	6.7	0.5	12.9	na	3.9	1.1	11.1	na	18.3	0.8	na	29.0	0.8	24.0	na
Avg Speed (mph)															
Peak Hour	62.7	34.4	31.1	50.2	60.5	23.6	35.3	54.1	47.8	21.9	46.4	51.7	23.3	31.7	48.2
Peak Period	61.5	33.1	31.8	51.3	56.1	19.9	32.9	50.7	48.6	26.7	47.9	52.0	25.9	32.0	49.1
Avg Volume (veh)															
Peak Hour	3,467	342	524	5,884	3,746	669	265	5,349	5,176	512	10,296	4,663	489	467	13,890
Peak Period	19,147	1,565	2,521	30,450	21,490	2,648	1,388	28,173	25,278	1,972	44,995	23,597	1,954	2,269	61,678
VHT															
Peak Hour	401	10	254	664	230	21	44	295	1,657	88	1,745	2,288	119	297	2,705
Peak Period	2,243	54	1,126	3,423	1,465	98	267	1,830	8,019	258	8,277	11,727	410	1,394	13,531
VMT															
Peak Hour	25,094	345	7,881	33,320	13,925	495	1,545	15,965	79,106	1,928	81,034	118,125	2,769	9,426	130,319
Peak Period	137,919	1,785	35,816	175,520	82,083	1,952	8,739	92,773	389,366	6,876	396,242	609,367	10,613	44,556	664,535

Table B.11 I-680 Corridor Performance Measures

Corridor Adaptive Metering With Moderate Queue Control

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)															
Peak Hour	9.7	1.1	17.7	na	10.3	1.7	9.6	na	31.5	1.4	na	51.5	1.4	27.3	na
Peak Period	8.0	0.8	13.8	na	8.2	1.6	9.9	na	25.5	0.9	na	41.6	1.1	23.6	na
Avg Speed (mph)															
Peak Hour	45.1	24.8	29.1	38.8	21.6	12.2	34.7	22.0	28.5	16.9	28.0	29.4	17.2	29.8	28.9
Peak Period	54.1	28.5	31.5	46.6	30.9	13.6	33.6	30.3	38.0	24.0	37.6	39.1	21.9	31.9	38.1
Avg Volume (veh)															
Peak Hour	3,558	350	518	5,993	4,148	492	255	5,387	4,983	537	10,357	4,598	485	459	13,734
Peak Period	19,076	1,558	2,511	30,330	21,265	2,606	1,384	27,861	24,986	2,074	45,728	23,357	2,012	2,261	62,325
VHT															
Peak Hour	587	25	311	923	721	29	42	792	2,669	124	2,793	3,976	178	353	4,507
Peak Period	2,582	83	1,173	3,836	2,953	138	232	3,324	10,794	304	11,098	16,329	524	1,405	18,258
VMT															
Peak Hour	25,005	621	9,002	34,627	15,313	345	1,441	17,101	76,049	2,092	78,142	116,367	3,059	10,444	129,869
Peak Period	138,375	2,330	36,956	177,662	89,587	1,870	7,820	99,276	410,193	7,271	417,463	638,155	11,471	44,776	694,401

Table B.12 I-680 Corridor Performance Measures

Corridor Adaptive Ramp Metering With Aggressive Queue Control

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)															
Peak Hour	12.1	1.4	16.5	na	11.7	1.9	9.7	na	32.2	1.4	na	56.0	1.6	26.2	na
Peak Period	8.9	0.9	13.6	na	9.5	1.7	9.7	na	25.9	0.9	na	44.3	1.2	23.3	na
Avg Speed (mph)															
Peak Hour	35.5	22.6	29.0	32.9	18.5	11.4	34.0	19.0	27.9	16.4	27.4	27.2	16.5	29.6	26.9
Peak Period	49.9	27.3	31.4	44.1	25.3	12.8	34.0	25.4	37.4	23.8	37.1	37.1	21.4	31.8	36.2
Avg Volume (veh)															
Peak Hour	3,533	346	517	5,951	4,000	502	263	5,267	4,955	546	10,418	4,556	491	461	13,789
Peak Period	19,103	1,558	2,502	30,341	21,235	2,645	1,383	27,908	24,978	2,113	46,105	23,354	2,041	2,253	62,765
VHT															
Peak Hour	724	32	290	1,045	793	33	44	869	2,700	131	2,831	4,217	195	332	4,745
Peak Period	2,866	92	1,147	4,107	3,414	154	228	3,796	10,971	322	11,293	17,251	569	1,376	19,196
VMT															
Peak Hour	24,340	711	8,378	33,431	14,682	373	1,470	16,525	75,345	2,147	77,493	114,368	3,232	9,848	127,449
Peak Period	141,837	2,535	36,040	180,412	86,301	1,977	7,749	96,027	410,828	7,666	418,493	638,966	12,178	43,790	694,933

Table B.13 I-680 Corridor Performance Measures

Traveler Information

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	**On Ramp**	**Arterial**	**Tot/Avg**	**Fwy**	**On Ramp**	**Arterial**	**Tot/Avg**	**Fwy**	**On Ramp**	**Tot/Avg**	**Fwy**	**On Ramp**	**Arterial**	**Tot/Avg**
Avg Trav Time (min)															
Peak Hour	11.4	0.9	16.0	na	17.9	4.1	13.0	na	37.8	1.2	na	67.1	2.1	29.0	na
Peak Period	9.1	0.5	13.3	na	13.0	2.4	10.7	na	28.7	0.7	na	50.8	1.2	24.0	na
Avg Speed (mph)															
Peak Hour	39.3	37.3	29.9	36.3	11.8	6.8	26.2	13.4	24.8	26.7	24.9	24.0	20.0	28.4	24.2
Peak Period	48.7	42.7	31.9	43.8	20.4	22.9	30.9	21.6	35.5	40.7	35.6	34.1	32.9	31.6	33.8
Avg Volume (veh)															
Peak Hour	3,305	323	537	5,670	3,164	595	763	5,117	4,563	531	9,873	4,144	487	587	13,697
Peak Period	18,504	1,512	2,560	29,669	18,970	3,052	2,932	28,007	24,194	2,124	45,434	22,429	2,087	2,642	63,747
VHT															
Peak Hour	629	20	288	936	948	80	166	1,193	2,881	109	2,990	4,457	210	454	5,120
Peak Period	2,814	50	1,134	3,998	4,123	250	526	4,899	11,619	264	11,883	18,555	564	1,661	20,780
VMT															
Peak Hour	24,381	722	8,599	33,702	11,189	542	4,260	15,991	71,391	2,913	74,304	106,960	4,178	12,859	123,998
Peak Period	136,315	2,115	36,170	174,600	83,752	5,723	16,253	105,727	412,272	10,731	423,002	632,339	18,569	52,422	703,329

Table B.14 I-680 Corridor Performance Measures

Baseline 2000 with Multiple Incidents (Incident Duration of 33 Minutes)

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)															
Peak Hour	82.1	4.5	29.5	na	36.1	7.0	10.0	na	48.7	2.9	na	166.9	4.8	39.5	na
Peak Period	35.2	1.7	16.5	na	18.3	3.3	9.8	na	35.6	1.5	na	89.1	2.2	26.3	na
Avg Speed (mph)															
Peak Hour	11.8	21.5	26.8	14.2	6.7	21.0	32.6	8.2	28.1	27.0	28.0	17.7	24.6	27.4	18.6
Peak Period	36.3	35.6	31.0	35.7	27.5	35.0	33.2	28.0	37.7	40.2	37.8	35.1	37.7	31.3	35.0
Avg Volume (veh)															
Peak Hour	1,963	269	460	3,957	2,017	303	235	2,857	3,376	453	7,904	2,931	388	410	10,368
Peak Period	15,173	1,393	2,198	25,142	16,211	2,233	1,249	21,927	19,357	1,750	36,857	18,143	1,721	1,988	51,643
VHT															
Peak Hour	2,322	75	451	2,847	1,181	69	40	1,290	2,800	218	3,018	6,302	362	491	7,155
Peak Period	8,897	161	1,229	10,288	4,977	249	208	5,433	11,703	440	12,144	25,577	850	1,437	27,864
VMT															
Peak Hour	23,140	1,321	11,571	36,032	7,812	1,347	1,293	10,452	78,342	5,819	84,161	109,294	8,488	12,863	130,645
Peak Period	319,242	5,516	37,741	362,500	136,371	8,597	6,888	151,856	440,962	17,630	458,592	896,576	31,743	44,629	972,947

Table B.15 I-680 Corridor Performance Measures

Year 2000 Existing Incident Management with Multiple Incidents (Incident Duration of 26 Minutes)

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)															
Peak Hour	40.3	2.5	16.8	na	28.6	4.7	9.7	na	48.1	2.3	na	117.0	3.2	26.5	na
Peak Period	24.6	1.1	13.0	na	15.7	2.6	9.7	na	34.2	1.2	na	74.4	1.6	22.7	na
Avg Speed (mph)															
Peak Hour	15.8	27.3	28.0	17.6	8.0	24.8	33.5	9.5	27.3	28.5	27.4	19.7	27.4	28.7	20.5
Peak Period	37.7	38.0	31.5	36.9	28.2	36.0	33.4	28.8	37.9	40.9	38.0	35.9	38.9	31.8	35.7
Avg Volume (veh)															
Peak Hour	2,436	284	462	4,495	2,406	346	228	3,326	3,496	453	8,025	3,153	397	410	10,740
Peak Period	15,946	1,410	2,182	25,952	17,050	2,326	1,215	22,917	20,244	1,811	38,356	19,001	1,775	1,968	53,308
VHT															
Peak Hour	1,612	47	261	1,920	1,140	54	37	1,231	2,822	176	2,998	5,574	277	298	6,149
Peak Period	6,569	107	954	7,630	4,473	202	198	4,873	11,604	373	11,977	22,646	681	1,152	24,480
VMT															
Peak Hour	22,604	1,234	7,269	31,107	9,130	1,336	1,242	11,708	76,897	5,037	81,934	108,631	7,606	8,512	124,749
Peak Period	246,484	4,025	30,034	280,543	126,207	7,248	6,624	140,078	439,294	15,220	454,514	811,985	26,493	36,657	875,136

Table B.16 I-680 Corridor Performance Measures

Baseline 2010 with Multiple Incidents (Incident Duration of 33 min)

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)															
Peak Hour	58.5	2.9	28.6	na	25.2	4.1	9.7	na	44.4	2.0	na	128.2	3.0	38.3	na
Peak Period	30.1	1.4	19.1	na	16.5	2.5	9.7	na	33.4	1.1	na	79.9	1.7	28.9	na
Avg Speed (mph)															
Peak Hour	8.8	24.0	26.5	12.1	9.5	24.6	33.4	11.1	26.4	25.2	26.3	17.2	24.7	27.1	18.2
Peak Period	31.6	34.8	30.1	31.4	18.4	31.9	33.4	19.6	36.1	39.5	36.2	31.3	36.4	30.5	31.3
Avg Volume (veh)															
Peak Hour	2,372	319	511	4,671	2,725	408	270	3,811	3,973	498	8,949	3,503	442	458	11,944
Peak Period	16,140	1,565	2,502	27,406	17,889	2,511	1,418	24,329	22,116	1,998	42,090	20,413	1,954	2,261	58,454
VHT															
Peak Hour	2,291	62	502	2,856	1,141	56	46	1,242	3,038	170	3,209	6,470	288	548	7,307
Peak Period	8,311	148	1,655	10,114	5,061	214	239	5,514	12,706	392	13,098	26,078	754	1,894	28,726
VMT															
Peak Hour	19,753	1,404	13,037	34,194	10,600	1,360	1,519	13,479	80,217	4,283	84,500	110,570	7,047	14,556	132,174
Peak Period	261,937	5,105	49,553	316,595	92,917	6,814	7,966	107,696	458,922	15,430	474,352	813,776	27,349	57,519	898,644

Table B.17 I-680 Corridor Performance Measures

Year 2010 Existing Incident Management with Multiple Incidents (Incident Duration of 26 Minutes)

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)															
Peak Hour	58.1	3.1	27.7	na	26.3	4.5	9.8	na	43.5	1.9	na	127.9	3.2	37.4	na
Peak Period	28.1	1.3	17.9	na	15.6	2.4	9.7	na	32.2	1.1	na	75.9	1.6	27.7	na
Avg Speed (mph)															
Peak Hour	9.3	22.6	26.5	12.4	9.1	24.0	33.3	10.6	25.7	24.6	25.7	16.9	23.9	27.1	17.9
Peak Period	31.8	34.8	30.1	31.5	18.9	31.9	33.4	20.1	36.2	39.5	36.3	31.5	36.4	30.6	31.5
Avg Volume (veh)															
Peak Hour	2,417	317	513	4,709	2,605	395	266	3,662	4,152	504	9,196	3,620	444	458	12,093
Peak Period	16,482	1,583	2,509	27,832	18,275	2,533	1,416	24,757	22,578	2,045	43,031	20,842	1,991	2,266	59,492
VHT															
Peak Hour	2,335	66	486	2,886	1,139	60	44	1,243	3,075	167	3,243	6,548	293	530	7,371
Peak Period	7,892	143	1,542	9,576	4,853	209	236	5,299	12,433	383	12,817	25,179	735	1,777	27,691
VMT															
Peak Hour	20,999	1,401	12,703	35,104	10,188	1,427	1,473	13,089	79,048	4,107	83,155	110,235	6,935	14,177	131,347
Peak Period	249,959	4,931	46,271	301,160	91,665	6,664	7,868	106,197	449,762	15,100	464,862	791,386	26,695	54,140	872,220

Table B.18 I-680 Corridor Performance Measures

Year 2010 Improved Incident Management with Multiple Incidents (Incident Duration of 22 Minutes)

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)															
Peak Hour	54	2	21	na	24	4	10	na	41	2	na	119	3	31	na
Peak Period	27	1	15	na	15	2	10	na	31	1	na	73	2	25	na
Avg Speed (mph)															
Peak Hour	9	25	27	12	10	25	33	11	26	25	26	17	25	28	18
Peak Period	32	35	30	32	19	32	33	21	36	40	36	32	37	31	32
Avg Volume (veh)															
Peak Hour	2,468	334	515	4,832	2,764	415	269	3,863	4,304	511	9,418	3,752	455	461	12,411
Peak Period	16,708	1,615	2,510	28,186	18,603	2,568	1,411	25,150	23,032	2,082	43,849	21,236	2,026	2,266	60,445
VHT															
Peak Hour	2,218	50	367	2,635	1,115	58	44	1,219	2,999	155	3,154	6,333	264	412	7,007
Peak Period	7,645	122	1,291	9,057	4,659	205	233	5,099	12,114	334	12,448	24,419	660	1,524	26,603
VMT															
Peak Hour	20,110	1,220	9,943	31,273	10,685	1,396	1,481	13,562	78,202	3,878	82,082	108,999	6,495	11,424	126,917
Peak Period	241,425	4,264	39,282	284,972	89,894	6,524	7,797	104,214	438,599	13,274	451,874	769,918	24,062	47,079	841,060

Table B.19 I-680 Corridor Performance Measures

Baseline 2010 with Single Incident (Incident Duration of 33 Minutes)

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)															
Peak Hour	20.6	1.2	16.4	na	15.9	2.9	9.8	na	37.3	1.2	na	73.9	1.8	26.1	na
Peak Period	14.4	0.7	13.4	na	12.1	1.9	9.7	na	28.4	0.7	na	55.0	1.1	23.1	na
Avg Speed (mph)															
Peak Hour	22.1	33.9	29.3	23.8	13.5	25.1	33.2	15.3	24.9	26.9	24.9	22.0	27.4	30.0	22.7
Peak Period	38.0	39.9	31.6	36.6	20.8	31.9	33.3	22.0	35.8	41.3	35.9	33.2	37.7	31.9	33.2
Avg Volume (veh)															
Peak Hour	3,204	332	540	5,612	3,437	517	406	4,878	4,628	545	10,081	4,200	488	510	13,546
Peak Period	18,297	1,564	2,551	29,656	19,786	2,793	1,744	27,115	24,354	2,160	45,950	22,595	2,090	2,372	63,148
VHT															
Peak Hour	1,094	27	294	1,415	913	49	66	1,028	2,879	109	2,988	4,886	185	361	5,431
Peak Period	4,398	70	1,140	5,607	3,992	179	283	4,455	11,550	250	11,800	19,940	498	1,424	21,862
VMT															
Peak Hour	23,450	916	8,632	32,997	12,312	1,236	2,202	15,750	71,510	2,913	74,424	107,271	5,065	10,834	123,171
Peak Period	165,188	2,774	35,994	203,956	82,855	5,704	9,455	98,014	413,711	10,295	424,006	661,754	18,774	45,448	725,977

Table B.20 I-680 Corridor Performance Measures

Existing Incident Management with Single Incident (Incident Duration of 26 Minutes)

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)															
Peak Hour	19.9	1.3	16.3	na	15.7	2.8	9.8	na	37.8	1.2	na	73.4	1.8	26.1	na
Peak Period	13.9	0.7	13.3	na	12.2	1.9	9.7	na	28.5	0.7	na	54.6	1.1	23.1	na
Avg Speed (mph)															
Peak Hour	23.1	34.3	29.1	24.5	13.8	25.7	33.3	15.6	24.9	27.4	25.0	22.3	27.9	29.8	23.0
Peak Period	38.7	40.0	31.5	37.1	20.7	32.1	33.4	21.9	35.8	41.1	35.9	33.2	37.8	31.9	33.2
Avg Volume (veh)															
Peak Hour	3,250	327	539	5,638	3,445	515	397	4,873	4,608	546	10,067	4,197	487	508	13,519
Peak Period	18,293	1,560	2,546	29,626	19,737	2,801	1,733	27,072	24,347	2,156	45,910	22,583	2,088	2,365	63,086
VHT															
Peak Hour	1,070	28	294	1,392	902	48	65	1,015	2,909	112	3,022	4,881	189	359	5,429
Peak Period	4,236	71	1,132	5,440	4,012	178	282	4,471	11,594	260	11,854	19,842	507	1,415	21,765
VMT															
Peak Hour	23,407	940	8,536	32,884	12,391	1,233	2,159	15,781	72,500	3,081	75,581	108,299	5,254	10,695	124,246
Peak Period	160,889	2,836	35,677	199,402	82,948	5,683	9,414	98,045	414,666	10,674	425,340	658,503	19,193	45,091	722,786

Table B.21 I-680 Corridor Performance Measures

Existing Incident Management with Single Incident + Traveler Information

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)															
Peak Hour	12.5	0.8	15.6	na	17.9	4.0	12.1	na	38.7	1.4	na	69.1	2.1	27.6	na
Peak Period	9.8	0.5	12.9	na	13.0	2.5	10.6	na	28.7	0.8	na	51.6	1.3	23.6	na
Avg Speed (mph)															
Peak Hour	38.7	38.4	30.0	35.5	11.8	7.1	27.5	13.5	24.7	26.3	24.7	23.7	20.2	29.1	24.0
Peak Period	47.2	42.5	32.0	42.8	19.9	21.9	31.0	21.2	35.5	40.6	35.6	33.8	32.4	31.6	33.6
Avg Volume (veh)															
Peak Hour	3,253	326	552	5,663	3,147	588	767	5,090	4,533	532	9,855	4,110	488	600	13,715
Peak Period	18,491	1,515	2,577	29,706	19,032	3,046	2,951	28,075	24,230	2,122	45,445	22,459	2,086	2,660	63,807
VHT															
Peak Hour	669	18	287	975	939	78	154	1,171	2,929	120	3,049	4,535	216	442	5,194
Peak Period	3,032	48	1,114	4,194	4,126	254	526	4,905	11,609	267	11,876	18,765	571	1,640	20,975
VMT															
Peak Hour	23,625	670	8,612	32,907	11,097	548	4,171	15,816	72,253	3,149	75,402	106,975	4,367	12,783	124,124
Peak Period	138,949	2,034	35,605	176,588	81,708	5,512	16,224	103,443	411,879	10,867	422,746	632,536	18,413	51,829	702,776

Table B.22 I-680 Corridor Performance Measures

Existing Incident Management with Single Incident + Traveler Information + Adaptive Arterial Signal Control

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)															
Peak Hour	18.9	1.3	14.7	na	14.8	2.8	9.7	na	38.0	1.3	na	71.7	1.8	24.4	na
Peak Period	13.4	0.7	12.7	na	11.4	1.8	9.7	na	28.7	0.7	na	53.4	1.1	22.4	na
Avg Speed (mph)															
Peak Hour	24.6	31.1	29.0	25.5	14.5	26.9	33.4	16.0	24.7	26.7	24.8	22.6	27.4	29.7	23.2
Peak Period	39.9	38.6	31.6	38.1	22.1	33.6	33.4	23.2	35.5	40.8	35.6	33.7	38.1	32.0	33.7
Avg Volume (veh)															
Peak Hour	3,273	383	526	5,857	3,544	476	275	4,771	4,556	542	9,974	4,178	494	470	13,492
Peak Period	18,325	1,708	2,513	30,184	20,095	2,707	1,389	26,897	24,262	2,148	45,739	22,575	2,108	2,263	63,087
VHT															
Peak Hour	1,024	33	257	1,314	874	44	44	964	2,890	117	3,006	4,788	194	301	5,284
Peak Period	4,079	78	1,065	5,222	3,811	164	225	4,201	11,605	270	11,875	19,495	512	1,290	21,298
VMT															
Peak Hour	23,681	1,022	7,473	32,176	12,656	1,194	1,489	15,340	71,288	3,120	74,408	107,626	5,336	8,962	121,923
Peak Period	161,146	3,019	33,694	197,859	84,145	5,494	7,526	97,165	411,871	10,997	422,868	657,163	19,509	41,219	717,892

Table B.23 I-680 Corridor Performance Measures

Existing Incident Management with Single Incident + Traveler Information + Simple Adaptive Ramp Metering with Aggressive Queue Control

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)															
Peak Hour	11.5	1.1	16.2	na	14.6	2.3	15.2	na	35.3	1.5	na	61.5	1.7	31.4	na
Peak Period	8.9	0.7	13.3	na	12.1	2.0	12.0	na	27.3	1.1	na	48.3	1.3	25.4	na
Avg Speed (mph)															
Peak Hour	37.7	26.5	30.1	35.0	14.8	9.7	24.7	15.9	25.9	15.6	25.4	25.3	15.6	28.3	25.1
Peak Period	49.2	30.9	31.9	43.9	21.2	12.0	29.7	21.7	35.8	24.0	35.4	34.5	20.9	31.3	33.8
Avg Volume (veh)															
Peak Hour	3,367	325	536	5,738	3,573	555	570	5,253	4,641	526	9,898	4,258	479	543	13,555
Peak Period	18,676	1,512	2,551	29,825	19,519	2,776	2,290	27,360	22,338	1,890	41,233	21,267	1,906	2,493	59,239
VHT															
Peak Hour	664	25	298	987	895	44	146	1,085	2,807	141	2,948	4,366	210	443	5,021
Peak Period	2,846	72	1,166	4,083	4,049	193	472	4,715	10,457	342	10,797	17,352	607	1,638	19,596
VMT															
Peak Hour	24,408	658	8,963	34,029	13,244	426	3,567	17,237	72,658	2,205	74,863	110,311	3,289	12,530	126,130
Peak Period	138,619	2,202	37,226	178,046	85,564	2,318	13,987	101,868	374,453	8,164	382,618	598,635	12,684	51,212	662,532

Table B.24 I-680 Corridor Performance Measures

Existing Incident Management with Single Incident + Traveler Information + Adaptive Arterial Signal Control + Simple Adaptive Ramp Metering with Aggressive Queue Control

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)															
Peak Hour	11.9	1.1	15.5	na	14.0	2.5	12.7	na	36.0	1.6	na	61.9	1.7	28.1	na
Peak Period	8.9	0.7	13.2	na	12.4	2.1	11.9	na	25.8	1.0	na	47.1	1.3	25.0	na
Avg Speed (mph)															
Peak Hour	35.4	26.2	30.7	33.9	15.0	8.3	26.3	16.1	25.8	15.2	25.3	25.3	15.0	29.4	25.2
Peak Period	48.9	30.6	32.1	43.8	20.2	11.4	29.3	20.7	35.7	24.3	35.4	34.1	20.6	31.3	33.4
Avg Volume (veh)															
Peak Hour	3,449	334	546	5,878	3,528	549	605	5,231	4,590	517	9,760	4,234	475	559	13,516
Peak Period	18,730	1,535	2,571	30,012	19,282	2,724	2,285	27,015	20,691	1,693	37,620	20,130	1,782	2,507	56,168
VHT															
Peak Hour	715	26	293	1,035	857	48	134	1,038	2,876	144	3,020	4,448	217	427	5,093
Peak Period	2,890	78	1,178	4,147	4,153	201	470	4,825	9,295	286	9,581	16,338	565	1,649	18,552
VMT															
Peak Hour	25,317	691	9,027	35,034	12,849	394	3,502	16,745	74,304	2,184	76,489	112,470	3,270	12,529	128,268
Peak Period	141,208	2,392	37,851	181,450	83,817	2,303	13,816	99,936	332,063	6,942	339,006	557,089	11,638	51,666	620,393

Table B.25 I-680 Corridor Performance Measures

Existing Incident Management with Single Incident + Traveler Information + Adaptive Arterial Signal Control + Corridor Adaptive Ramp Metering with Aggressive Queue Control

	North Section (with 2 parallel arterials)				Middle Section (with 1 parallel arterial)				Southern Section (without parallel arterials)			Total/Average I-680			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)															
Peak Hour	9.9	1.1	14.4	na	11.2	1.9	9.7	na	32.2	1.5	na	53.3	1.5	24.0	na
Peak Period	8.1	0.8	12.6	na	8.9	1.7	9.7	na	25.7	1.0	na	42.7	1.1	22.3	na
Avg Speed (mph)															
Peak Hour	43.0	23.3	30.0	38.2	19.5	11.7	34.6	19.9	28.0	15.7	27.4	28.3	16.0	30.7	27.9
Peak Period	53.3	28.0	31.9	46.6	28.2	13.1	34.1	27.8	37.3	23.7	36.9	38.0	21.5	32.3	37.1
Avg Volume (veh)															
Peak Hour	3,558	353	522	6,016	4,079	505	262	5,350	4,910	531	10,223	4,540	483	464	13,668
Peak Period	19,043	1,553	2,503	30,262	21,117	2,616	1,386	27,734	23,760	1,995	43,705	22,500	1,962	2,254	60,652
VHT															
Peak Hour	605	28	256	889	781	32	43	856	2,695	134	2,829	4,081	194	299	4,574
Peak Period	2,633	86	1,076	3,795	3,209	151	230	3,590	10,425	327	10,751	16,267	564	1,306	18,136
VMT															
Peak Hour	24,723	617	7,688	33,028	15,144	374	1,488	17,006	75,318	2,105	77,424	115,186	3,097	9,176	127,458
Peak Period	139,322	2,376	34,306	176,004	89,024	1,972	7,841	98,837	389,019	7,753	396,773	617,366	12,102	42,147	671,615

Appendix C

I-405/I-5 Micro-Simulation Results

Table C.1 I-405/I-5 Corridor Performance Measures

Baseline 2000

	I-405 Section (with 2 Parallel arterials)				I-5 Section (with 1 Parallel Arterial)				Others (Rest of Network)				Network Total/Average			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)																
Peak Hour	6.9	3.3	18.4	na	2.9	1.1	2.6	na	2.3	0.5	7.8	na	4.7	2.0	9.6	na
Peak Period	6.1	2.9	18.1	na	2.8	1.1	2.5	na	2.2	0.5	7.7	na	4.3	1.8	9.3	na
Avg Speed (mph)																
Peak Hour	57.1	38.0	33.7	52.8	58.0	45.7	27.7	55.3	58.8	42.3	23.2	50.5	57.5	39.8	31.9	53.3
Peak Period	61.4	41.0	34.2	56.4	59.7	47.9	29.1	57.2	59.4	42.2	23.6	50.8	60.9	42.7	32.5	56.3
Avg Volume (veh)																
Peak Hour	19,123	552	1,493	21,167	16,911	379	1,800	19,090	4,274	288	372	4,934	40,308	1,219	3,665	45,192
Peak Period	67,116	1,832	4,866	73,814	58,914	1,373	6,102	66,389	13,658	899	1,233	15,790	139,688	4,103	12,202	155,992
Normalized VHT																
Peak Hour	2,190	30	458	2,678	806	7	79	893	161	2	48	212	3,158	40	585	3,782
Peak Period	6,852	88	1,471	8,411	2,768	25	257	3,050	503	8	158	668	10,122	121	1,886	12,129
Normalized VMT																
Peak Hour	124,213	1,121	15,415	140,749	46,654	329	2,197	49,180	9,497	104	1,121	10,722	180,365	1,554	18,733	200,651
Peak Period	420,469	3,575	50,288	474,332	165,133	1,246	7,494	173,872	29,908	326	3,735	33,969	615,509	5,147	61,517	682,173

Table C.2 I-405/I-5 Corridor Performance Measures

Baseline 2010 Without Ramp Metering

	I-405 Section (with 2 parallel arterials)				I-5 Section (with 1 parallel arterial)				Others (rest of network)				Network Total/Average			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)																
Peak Hour	7.9	1.8	19.7	na	3.2	1.0	3.0	na	2.6	0.5	8.4	na	5.2	1.2	10.1	na
Peak Period	7.3	1.8	20.5	na	3.0	1.0	2.8	na	2.4	0.5	8.3	na	5.0	1.2	9.9	na
Avg Speed (mph)																
Peak Hour	55.0	45.9	33.1	51.0	54.9	52.4	26.1	52.0	57.5	42.2	22.9	49.3	55.2	47.5	31.1	51.1
Peak Period	58.5	46.3	34.1	54.3	57.7	52.6	27.4	54.7	58.6	42.2	23.3	49.9	58.3	47.9	32.1	54.1
Avg Volume (veh)																
Peak Hour	19,481	655	1,684	21,820	18,185	458	2,178	20,821	5,190	361	463	6,013	42,856	1,473	4,325	48,655
Peak Period	70,718	2,160	5,206	78,084	64,119	1,608	7,605	73,330	16,766	1,207	1,538	19,512	151,603	4,974	14,349	170,926
VHT																
Peak Hour	2,554	20	551	3,126	964	7	108	1,080	219	3	65	287	3,737	30	725	4,492
Peak Period	8,651	65	1,773	10,489	3,203	26	354	3,583	665	10	211	886	12,519	101	2,338	14,959
VMT																
Peak Hour	139,545	919	18,255	158,719	52,767	406	2,825	55,998	12,594	131	1,498	14,224	204,907	1,457	22,579	228,942
Peak Period	505,782	2,991	60,541	569,314	184,508	1,436	9,712	195,656	39,012	438	4,940	44,390	729,302	4,865	75,193	809,359

Table C.3 I-405/I-5 Corridor Performance Measures

Fixed-Time Ramp Metering Without Queue Control

	I-405 Section (with 2 parallel arterials)				I-5 Section (with 1 parallel arterial)				Others (rest of network)				Network Total/Average			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)																
Peak Hour	7.8	4.7	21.5	na	3.1	1.1	3.0	na	2.5	0.5	8.5	na	5.2	2.5	10.6	na
Peak Period	7.3	5.1	25.7	na	3.0	1.1	2.8	na	2.4	0.5	8.4	na	4.9	2.7	11.8	na
Avg Speed (mph)																
Peak Hour	54.9	36.0	32.9	50.4	54.9	45.0	25.8	52.0	57.6	42.2	22.8	49.1	55.1	37.8	31.0	50.7
Peak Period	58.2	37.4	33.1	52.5	57.9	45.5	27.4	54.8	58.7	42.3	23.3	49.7	58.2	38.9	31.6	52.9
Avg Volume (veh)																
Peak Hour	19,340	649	1,638	21,626	18,298	468	2,190	20,956	5,189	365	474	6,027	42,826	1,481	4,301	48,609
Peak Period	70,339	2,200	5,296	77,836	64,027	1,610	7,674	73,310	16,719	1,235	1,572	19,526	151,085	5,045	14,542	170,673
VHT																
Peak Hour	2,532	51	586	3,169	960	8	108	1,076	216	3	67	286	3,707	63	761	4,531
Peak Period	8,550	187	2,273	11,010	3,167	29	356	3,553	653	11	219	883	12,371	227	2,848	15,445
VMT																
Peak Hour	138,037	1,763	19,286	159,087	52,607	393	2,798	55,799	12,419	133	1,541	14,093	203,064	2,288	23,626	228,978
Peak Period	495,870	6,741	75,155	577,766	183,127	1,361	9,750	194,237	38,387	448	5,120	43,956	717,384	8,550	90,025	815,960

Table C.4 I-405/I-5 Corridor Performance Measures

Baseline 2010 (includes Fixed-Time Ramp Metering with Aggressive Queue Control)

	I-405 Section (with 2 parallel arterials)				I-5 Section (with 1 parallel arterial)				Others (rest of network)				Network Total/Average			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)																
Peak Hour	7.9	3.7	19.9	na	3.2	1.1	3.0	na	2.4	0.5	8.5	na	5.2	2.1	10.1	na
Peak Period	7.2	3.3	19.8	na	3.0	1.1	2.8	na	2.3	0.5	8.4	na	4.9	1.9	9.8	na
Avg Speed (mph)																
Peak Hour	54.7	36.5	33.0	50.4	55.0	45.0	25.7	52.0	57.7	42.3	22.9	49.1	55.0	38.5	30.9	50.8
Peak Period	58.2	38.2	33.9	53.7	57.7	45.5	27.3	54.7	58.7	42.3	23.4	49.7	58.2	40.2	31.9	53.7
Avg Volume (veh)																
Peak Hour	19,377	658	1,693	21,728	18,273	463	2,194	20,930	5,174	367	469	6,011	42,825	1,488	4,356	48,669
Peak Period	70,085	2,182	5,442	77,709	64,135	1,617	7,633	73,386	16,706	1,236	1,542	19,484	150,926	5,035	14,618	170,579
VHT																
Peak Hour	2,539	41	562	3,142	965	9	109	1,082	211	3	67	281	3,716	53	738	4,506
Peak Period	8,415	122	1,792	10,329	3,190	29	354	3,573	651	11	217	878	12,255	162	2,364	14,780
VMT																
Peak Hour	137,494	1,459	18,524	157,476	52,888	382	2,819	56,089	12,193	133	1,537	13,864	202,575	1,975	22,879	227,429
Peak Period	487,613	4,571	60,698	552,882	183,728	1,364	9,681	194,773	38,234	449	5,096	43,779	709,575	6,384	75,475	791,434

Table C.5 I-405/I-5 Corridor Performance Measures

Simple Adaptive Ramp Metering Without Queue Control

	I-405 Section (with 2 parallel arterials)				I-5 Section (with 1 parallel arterial)				Others (rest of network)				Network Total/Average			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)																
Peak Hour	7.7	3.6	20.2	na	3.1	1.1	3.0	na	2.5	0.5	8.6	na	5.1	2.0	10.2	na
Peak Period	7.2	3.3	21.1	na	3.0	1.1	2.8	na	2.4	0.5	8.4	na	4.8	1.9	10.0	na
Avg Speed (mph)																
Peak Hour	54.9	36.2	33.2	50.6	55.2	46.1	25.9	52.1	57.5	42.2	22.8	49.1	55.2	38.5	31.1	50.9
Peak Period	58.4	38.5	34.1	53.9	57.9	46.6	27.4	54.9	58.7	42.2	23.3	49.7	58.3	40.4	32.1	53.9
Avg Volume (veh)																
Peak Hour	19,414	654	1,654	21,722	18,291	466	2,198	20,955	5,192	366	472	6,029	42,896	1,485	4,324	48,706
Peak Period	70,302	2,174	5,091	77,568	64,053	1,608	7,614	73,275	16,718	1,239	1,560	19,517	151,073	5,021	14,265	170,359
VHT																
Peak Hour	2,509	39	557	3,106	949	8	109	1,066	218	3	68	289	3,676	51	734	4,461
Peak Period	8,377	120	1,791	10,287	3,153	28	352	3,534	658	11	218	887	12,188	159	2,361	14,708
VMT																
Peak Hour	136,714	1,383	18,500	156,597	52,226	381	2,824	55,430	12,549	133	1,557	14,239	201,489	1,896	22,880	226,265
Peak Period	488,088	4,521	61,151	553,760	182,383	1,341	9,672	193,396	38,650	450	5,110	44,210	709,122	6,312	75,932	791,366

Table C.6 I-405/I-5 Corridor Performance Measures

Simple Adaptive Ramp Metering With Moderate Queue Control

	I-405 Section (with 2 parallel arterials)				I-5 Section (with 1 parallel arterial)				Others (rest of network)				Network Total/Average			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)																
Peak Hour	8.0	4.6	21.3	na	3.1	1.1	2.9	na	2.5	0.5	8.6	na	5.3	2.4	10.6	na
Peak Period	7.5	4.3	22.4	na	3.0	1.1	2.8	na	2.4	0.5	8.4	na	5.0	2.3	10.6	na
Avg Speed (mph)																
Peak Hour	54.4	35.1	32.5	49.9	55.1	45.8	25.9	52.1	57.5	42.2	22.8	49.0	54.8	37.4	30.7	50.4
Peak Period	57.8	37.4	33.3	52.8	57.8	46.5	27.4	54.7	58.6	42.4	23.3	49.7	57.9	39.3	31.6	53.1
Avg Volume (veh)																
Peak Hour	19,293	645	1,673	21,611	18,244	468	2,202	20,913	5,221	387	476	6,084	42,758	1,500	4,349	48,606
Peak Period	69,946	2,189	5,350	77,485	63,981	1,611	7,640	73,231	16,751	1,294	1,556	19,601	150,678	5,093	14,545	170,317
VHT																
Peak Hour	2,596	49	594	3,239	953	8	109	1,070	218	3	68	290	3,766	61	771	4,598
Peak Period	8,797	158	2,000	10,956	3,165	28	354	3,547	661	11	220	892	12,623	198	2,574	15,395
VMT																
Peak Hour	139,795	1,649	19,306	160,750	52,351	380	2,820	55,552	12,536	140	1,567	14,243	204,683	2,169	23,693	230,544
Peak Period	505,587	5,750	66,556	577,893	182,506	1,336	9,713	193,556	38,817	471	5,151	44,439	726,909	7,557	81,420	815,887

Table C.7 I-405/I-5 Corridor Performance Measures

Simple Adaptive Ramp Metering With Aggressive Queue Control

	I-405 Section (with 2 parallel arterials)				I-5 Section (with 1 parallel arterial)				Others (rest of network)				Network Total/Average			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)																
Peak Hour	7.7	3.4	20.4	na	3.1	1.1	3.0	na	2.5	0.5	8.6	na	5.1	1.9	10.3	na
Peak Period	7.1	3.0	20.7	na	3.0	1.1	2.8	na	2.4	0.5	8.5	na	4.8	1.8	9.9	na
Avg Speed (mph)																
Peak Hour	55.0	36.7	33.2	50.7	55.0	46.0	25.9	52.1	57.5	42.4	22.8	49.1	55.2	39.0	31.1	50.9
Peak Period	58.4	38.7	34.1	53.9	57.8	46.6	27.4	54.8	58.6	42.4	23.3	49.7	58.3	40.8	32.1	53.9
Avg Volume (veh)																
Peak Hour	19,404	652	1,657	21,713	18,346	464	2,173	20,983	5,174	374	467	6,014	42,924	1,490	4,296	48,710
Peak Period	70,214	2,171	5,219	77,603	64,004	1,627	7,610	73,240	16,732	1,255	1,542	19,529	150,950	5,052	14,371	170,373
VHT																
Peak Hour	2,495	36	562	3,094	955	8	107	1,071	219	3	67	289	3,668	48	737	4,453
Peak Period	8,308	110	1,793	10,212	3,160	28	352	3,540	663	11	218	891	12,131	150	2,363	14,643
VMT																
Peak Hour	136,202	1,305	18,683	156,189	52,428	380	2,786	55,594	12,572	137	1,539	14,248	201,203	1,821	23,007	226,031
Peak Period	484,182	4,212	61,146	549,541	182,523	1,346	9,665	193,534	38,899	456	5,093	44,448	705,605	6,014	75,904	787,523

Table C.8 I-405/I-5 Corridor Performance Measures

Corridor Adaptive Ramp Metering With Moderate Queue Control

	I-405 Section (with 2 parallel arterials)				I-5 Section (with 1 parallel arterial)				Others (rest of network)				Network Total/Average			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)																
Peak Hour	7.9	7.0	21.6	na	3.2	1.1	3.0	na	2.5	0.5	8.6	na	5.2	3.5	10.8	na
Peak Period	7.3	6.3	23.4	na	3.0	1.1	2.8	na	2.4	0.5	8.3	na	4.9	3.1	11.0	na
Avg Speed (mph)																
Peak Hour	54.7	28.6	32.4	49.6	54.9	46.1	25.8	51.9	57.5	42.2	22.9	49.0	54.9	31.5	30.6	50.1
Peak Period	57.9	33.0	33.3	52.5	57.7	46.7	27.4	54.6	58.6	42.4	23.2	49.7	58.0	35.3	31.7	52.9
Avg Volume (veh)																
Peak Hour	19,340	646	1,673	21,659	18,247	458	2,200	20,906	5,184	388	474	6,045	42,771	1,492	4,347	48,610
Peak Period	70,292	2,177	5,285	77,753	64,092	1,606	7,638	73,336	16,722	1,310	1,581	19,613	151,106	5,093	14,504	170,703
VHT																
Peak Hour	2,569	76	606	3,251	964	8	110	1,082	216	3	68	288	3,750	87	783	4,620
Peak Period	8,651	229	2,071	10,952	3,199	28	356	3,583	661	11	219	892	12,511	269	2,646	15,426
VMT																
Peak Hour	138,681	1,915	19,592	160,189	52,772	380	2,833	55,984	12,438	141	1,561	14,140	203,891	2,436	23,986	230,313
Peak Period	498,115	7,040	68,851	574,006	184,151	1,341	9,765	195,257	38,823	479	5,117	44,418	721,088	8,860	83,733	813,681

Table C.9 I-405/I-5 Corridor Performance Measures

Corridor Adaptive Ramp Metering With Aggressive Queue Control

	I-405 Section (with 2 parallel arterials)				I-5 Section (with 1 parallel arterial)				Others (rest of network)				Network Total/Average			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)																
Peak Hour	7.6	5.6	20.1	na	3.1	1.1	3.0	na	2.5	0.5	8.5	na	5.1	2.9	10.2	na
Peak Period	6.9	4.6	20.4	na	3.0	1.1	2.8	na	2.4	0.5	8.4	na	4.7	2.4	9.9	na
Avg Speed (mph)																
Peak Hour	55.2	30.5	33.1	50.6	55.3	46.2	25.8	52.3	57.5	42.3	22.8	49.2	55.4	33.3	31.0	50.9
Peak Period	58.9	35.2	34.0	54.0	58.0	46.6	27.4	54.9	58.6	42.3	23.4	49.8	58.7	37.5	32.0	54.0
Avg Volume (veh)																
Peak Hour	19,519	644	1,678	21,841	18,297	467	2,175	20,938	5,220	374	470	6,064	43,035	1,485	4,323	48,843
Peak Period	69,963	2,158	5,272	77,393	64,075	1,620	7,618	73,314	16,798	1,266	1,549	19,613	150,836	5,044	14,439	170,319
VHT																
Peak Hour	2,462	60	561	3,083	945	8	107	1,060	220	3	67	290	3,627	72	734	4,434
Peak Period	8,102	166	1,790	10,058	3,152	28	353	3,534	662	11	217	890	11,917	205	2,360	14,482
VMT																
Peak Hour	135,071	1,688	18,552	155,310	52,182	381	2,757	55,320	12,669	136	1,530	14,335	199,922	2,205	22,840	224,966
Peak Period	476,245	5,632	60,836	542,713	182,619	1,340	9,676	193,635	38,864	460	5,087	44,411	697,728	7,432	75,598	780,758

Table C.10 I-405/I-5 Corridor Performance Measures

Traveler Information

	I-405 Section (with 2 parallel arterials)				I-5 Section (with 1 parallel arterial)				Others (rest of network)				Network Total/Average			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)																
Peak Hour	7.7	4.0	20.4	na	3.1	1.1	3.1	na	2.4	0.5	9.0	na	5.1	2.2	10.4	na
Peak Period	6.8	3.6	21.1	na	2.9	1.1	2.9	na	2.3	0.5	8.8	na	4.6	2.0	10.1	na
Avg Speed (mph)																
Peak Hour	55.2	35.7	33.1	50.7	55.1	45.0	24.9	51.9	57.6	42.5	22.7	48.4	55.4	37.8	30.8	50.9
Peak Period	59.4	37.8	34.1	54.4	58.2	45.5	26.9	55.0	58.7	42.6	23.3	48.9	59.1	39.7	31.8	54.2
Avg Volume (veh)																
Peak Hour	19,338	664	1,696	21,698	18,469	454	2,206	21,128	5,208	398	505	6,111	43,015	1,515	4,406	48,937
Peak Period	69,325	2,210	5,182	76,717	64,249	1,609	7,605	73,463	16,666	1,327	1,654	19,648	150,241	5,145	14,442	169,828
VHT																
Peak Hour	2,475	45	576	3,096	954	8	114	1,077	210	3	76	289	3,640	57	766	4,462
Peak Period	7,875	134	1,821	9,830	3,151	29	363	3,543	638	11	244	893	11,664	174	2,428	14,266
VMT																
Peak Hour	135,541	1,535	19,097	156,173	52,499	378	2,853	55,729	12,150	145	1,717	14,012	200,191	2,058	23,666	225,914
Peak Period	466,969	4,915	62,083	533,968	183,188	1,359	9,764	194,312	37,513	483	5,717	43,713	687,671	6,758	77,564	771,993

Table C.11 I-405/I-5 Corridor Performance Measures

Baseline 2000 With Multiple Incidents (Incident Duration of 33 Minutes)

	I-405 Section (with 2 parallel arterials)				I-5 Section (with 1 parallel arterial)				Others (rest of network)				Network Total/Average			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)																
Peak Hour	8.2	3.4	19.1	na	3.3	1.1	2.7	na	2.3	0.5	8.0	na	5.5	2.0	9.8	na
Peak Period	7.7	2.9	20.4	na	3.1	1.1	2.5	na	2.2	0.5	8.0	na	5.2	1.8	9.9	na
Avg Speed (mph)																
Peak Hour	55.2	38.0	33.7	51.6	55.0	45.5	27.6	52.8	58.7	42.2	23.4	50.5	55.3	39.7	32.0	51.8
Peak Period	58.1	41.1	34.7	54.4	57.7	47.9	29.1	55.5	59.4	42.3	23.9	50.8	58.1	42.7	32.9	54.5
Avg Volume (veh)																
Peak Hour	18,144	563	1,455	20,161	16,847	400	1,800	19,046	4,288	272	370	4,930	39,278	1,235	3,625	44,138
Peak Period	66,623	1,851	4,368	72,842	58,886	1,378	6,198	66,462	13,734	933	1,198	15,865	139,244	4,162	11,764	155,169
Normalized VHT																
Peak Hour	2,557	33	479	3,069	965	8	83	1,056	168	3	51	221	3,690	43	613	4,346
Peak Period	8,859	94	1,538	10,491	3,163	27	271	3,460	523	8	165	696	12,544	128	1,975	14,647
Normalized VMT																
Peak Hour	139,948	1,236	16,153	157,336	53,088	357	2,293	55,738	9,885	102	1,193	11,180	202,920	1,695	19,639	224,255
Peak Period	512,116	3,810	53,334	569,260	182,310	1,289	7,883	191,482	31,101	352	3,967	35,419	725,526	5,451	65,184	796,161

Table C.12 I-405/I-5 Corridor Performance Measures

Year 2000 Existing Incident Management with Multiple Incidents (Incident Duration of 26 Minutes)

	I-405 Section (with 2 parallel arterials)				I-5 Section (with 1 parallel arterial)				Others (rest of network)				Network Total/Average			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)																
Peak Hour	9.0	3.5	19.2	na	3.6	1.2	2.7	na	2.2	0.5	8.0	na	5.9	2.1	9.8	na
Peak Period	8.2	3.0	20.6	na	3.3	1.1	2.6	na	2.2	0.5	7.9	na	5.5	1.8	9.8	na
Avg Speed (mph)																
Peak Hour	53.4	37.9	33.8	50.3	53.1	45.7	27.7	51.2	58.9	42.4	23.3	50.5	53.6	39.6	32.0	50.5
Peak Period	56.7	40.8	34.8	53.3	56.6	48.0	29.1	54.5	59.5	42.4	23.8	51.0	56.9	42.6	33.0	53.6
Avg Volume (veh)																
Peak Hour	17,598	558	1,415	19,571	16,635	386	1,773	18,794	4,246	275	362	4,883	38,479	1,218	3,550	43,247
Peak Period	62,497	1,793	4,155	68,445	57,278	1,350	5,984	64,612	13,543	912	1,183	15,638	133,318	4,055	11,321	148,695
Normalized VHT																
Peak Hour	2,619	32	453	3,104	1,002	7	78	1,088	159	3	48	210	3,781	42	579	4,402
Peak Period	8,599	89	1,428	10,115	3,178	25	254	3,456	497	8	156	661	12,274	121	1,837	14,232
Normalized VMT																
Peak Hour	138,383	1,190	15,290	154,864	53,181	343	2,169	55,693	9,366	100	1,133	10,599	200,931	1,634	18,591	221,156
Peak Period	484,490	3,567	49,638	537,696	179,183	1,217	7,366	187,767	29,643	333	3,719	33,695	693,317	5,118	60,722	759,157

Table C.13 I-405/I-5 Corridor Performance Measures

Baseline 2010 With Incident (Incident Duration of 33 Minutes)

	I-405 Section (with 2 parallel arterials)				I-5 Section (with 1 parallel arterial)				Others (rest of network)				Network Total/Average			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)																
Peak Hour	7.9	3.8	19.9	na	3.2	1.1	3.0	na	2.5	0.5	8.4	na	5.2	2.2	10.1	na
Peak Period	7.7	3.5	21.4	na	3.1	1.1	2.8	na	2.4	0.5	8.4	na	5.1	2.0	10.1	na
Avg Speed (mph)																
Peak Hour	54.7	36.3	33.1	50.5	54.9	45.1	25.9	51.9	57.4	42.4	22.8	49.1	55.0	38.4	31.1	50.8
Peak Period	57.2	38.2	34.3	53.0	56.8	45.5	27.3	53.9	58.5	42.4	23.3	49.6	57.2	40.0	32.2	53.1
Avg Volume (veh)																
Peak Hour	19,312	662	1,675	21,648	18,242	469	2,182	20,893	5,194	378	475	6,047	42,748	1,508	4,331	48,588
Peak Period	69,805	2,188	5,050	77,043	64,116	1,622	7,658	73,395	16,700	1,266	1,561	19,527	150,621	5,076	14,269	169,966
VHT																
Peak Hour	2,548	42	557	3,146	964	9	108	1,080	220	3	67	290	3,732	54	731	4,517
Peak Period	8,966	127	1,804	10,897	3,275	29	356	3,660	668	11	220	898	12,909	167	2,380	15,456
VMT																
Peak Hour	138,220	1,488	18,448	158,155	52,785	391	2,788	55,965	12,641	138	1,535	14,313	203,646	2,017	22,771	228,433
Peak Period	509,299	4,737	61,893	575,929	185,460	1,372	9,722	196,555	39,130	461	5,152	44,743	733,890	6,571	76,767	817,228

Table C.14 I-405/I-5 Corridor Performance Measures

Year 2010 Existing Incident Management (Incident Duration of 26 Minutes)

	I-405 Section (with 2 parallel arterials)				I-5 Section (with 1 parallel arterial)				Others (rest of network)				Network Total/Average			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)																
Peak Hour	7.9	3.9	20.2	na	3.1	1.1	3.0	na	2.4	0.5	8.6	na	5.2	2.2	10.2	na
Peak Period	7.5	3.5	20.8	na	3.0	1.1	2.8	na	2.3	0.5	8.4	na	5.0	2.0	10.0	na
Avg Speed (mph)																
Peak Hour	54.7	36.2	33.1	50.4	55.0	45.1	25.9	52.0	57.8	42.2	22.8	49.1	55.0	38.2	31.1	50.7
Peak Period	57.4	38.1	34.1	53.1	57.1	45.5	27.3	54.1	58.7	42.3	23.3	49.6	57.4	40.0	32.0	53.2
Avg Volume (veh)																
Peak Hour	19,348	660	1,677	21,686	18,329	466	2,184	20,979	5,189	376	474	6,039	42,866	1,502	4,335	48,704
Peak Period	70,293	2,189	5,230	77,711	64,262	1,628	7,610	73,499	16,715	1,260	1,573	19,548	151,270	5,076	14,413	170,759
VHT																
Peak Hour	2,546	43	564	3,154	956	8	108	1,072	209	3	67	280	3,711	55	739	4,506
Peak Period	8,794	126	1,806	10,726	3,250	30	353	3,633	649	11	221	880	12,693	166	2,379	15,239
VMT																
Peak Hour	137,877	1,520	18,669	158,065	52,441	389	2,797	55,627	12,110	136	1,552	13,798	202,427	2,045	23,018	227,490
Peak Period	501,386	4,703	61,526	567,615	184,910	1,374	9,656	195,939	38,115	457	5,162	43,734	724,411	6,534	76,343	807,289

Table C.15 I-405/I-5 Corridor Performance Measures

Year 2010 Improved Incident Management (Incident Duration of 22 Minutes)

	I-405 Section (with 2 parallel arterials)				I-5 Section (with 1 parallel arterial)				Others (rest of network)				Network Total/Average			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)																
Peak Hour	7.9	3.7	20.1	na	3.1	1.1	2.9	na	2.4	0.5	8.6	na	5.2	2.1	10.2	na
Peak Period	7.5	3.4	20.2	na	3.0	1.1	2.8	na	2.3	0.5	8.3	na	5.0	1.9	9.8	na
Avg Speed (mph)																
Peak Hour	54.8	36.5	33.0	50.5	55.1	44.7	25.9	52.1	57.7	42.3	22.8	49.0	55.1	38.6	31.0	50.8
Peak Period	57.6	38.1	33.9	53.3	57.1	45.4	27.4	54.2	58.7	42.3	23.2	49.6	57.6	40.1	31.9	53.3
Avg Volume (veh)																
Peak Hour	19,306	654	1,683	21,643	18,259	472	2,199	20,931	5,179	373	472	6,024	42,744	1,499	4,355	48,598
Peak Period	69,741	2,184	5,362	77,287	64,072	1,615	7,647	73,334	16,668	1,266	1,577	19,510	150,480	5,065	14,586	170,131
VHT																
Peak Hour	2,537	40	565	3,142	952	8	108	1,068	212	3	68	282	3,700	53	741	4,493
Peak Period	8,793	124	1,803	10,721	3,232	30	354	3,616	648	11	220	878	12,673	164	2,377	15,215
VMT																
Peak Hour	137,747	1,438	18,641	157,826	52,284	394	2,799	55,476	12,193	136	1,553	13,883	202,224	1,968	22,993	227,185
Peak Period	503,075	4,641	61,180	568,895	184,024	1,373	9,709	195,105	38,064	460	5,123	43,649	725,164	6,474	76,011	807,649

Table C.16 I-405/I-5 Corridor Performance Measures

Existing Incident Management with Single Incident + Traveler Information

	I-405 Section (with 2 parallel arterials)				I-5 Section (with 1 parallel arterial)				Others (rest of network)				Network Total/Average			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)																
Peak Hour	7.8	4.1	21.1	na	3.1	1.1	3.0	na	2.5	0.5	9.2	na	5.2	2.3	10.6	na
Peak Period	7.1	3.9	21.0	na	2.9	1.1	2.9	na	2.4	0.5	9.2	na	4.8	2.1	10.2	na
Avg Speed (mph)																
Peak Hour	54.7	35.7	33.2	50.3	54.8	44.8	25.1	51.7	57.3	42.4	22.6	48.0	54.9	37.9	30.9	50.5
Peak Period	58.5	37.4	34.0	53.7	57.6	45.4	26.5	54.3	58.5	42.5	23.2	48.4	58.4	39.4	31.6	53.5
Avg Volume (veh)																
Peak Hour	19,369	667	1,665	21,700	18,438	469	2,225	21,131	5,193	403	514	6,109	42,999	1,538	4,404	48,941
Peak Period	69,105	2,227	5,345	76,678	64,385	1,624	7,759	73,767	16,708	1,482	1,709	19,899	150,198	5,333	14,812	170,344
VHT																
Peak Hour	2,518	46	585	3,149	957	8	112	1,078	218	4	78	299	3,692	58	775	4,526
Peak Period	8,241	144	1,870	10,254	3,165	30	378	3,572	656	13	262	930	12,061	186	2,509	14,756
VMT																
Peak Hour	136,253	1,577	19,420	157,251	52,385	388	2,816	55,588	12,485	146	1,777	14,407	201,123	2,110	24,013	227,246
Peak Period	479,969	5,219	63,487	548,676	182,207	1,365	9,990	193,562	38,414	537	6,104	45,056	700,591	7,122	79,581	787,294

Table C.17 I-405/I-5 Corridor Performance Measures

Existing Incident Management with Single Incident + Traveler Information + Adaptive Arterial Signal Control

	I-405 Section (with 2 parallel arterials)				I-5 Section (with 1 parallel arterial)				Others (rest of network)				Network Total/Average			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)																
Peak Hour	7.6	4.2	18.7	na	3.2	1.0	3.3	na	2.5	0.5	8.7	na	5.1	2.3	9.9	na
Peak Period	7.0	3.9	18.9	na	3.0	1.0	2.9	na	2.3	0.5	8.7	na	4.8	2.1	9.5	na
Avg Speed (mph)																
Peak Hour	55.0	35.6	33.4	50.6	54.6	46.5	24.5	51.4	57.4	42.3	23.3	48.5	55.0	37.9	30.8	50.7
Peak Period	58.5	37.6	34.4	53.9	57.5	46.9	26.7	54.4	58.5	42.4	24.1	49.1	58.3	39.6	32.0	53.7
Avg Volume (veh)																
Peak Hour	19,500	674	1,732	21,905	18,524	458	2,197	21,179	5,237	399	516	6,152	43,260	1,531	4,445	49,236
Peak Period	69,791	2,241	5,473	77,505	64,668	1,603	7,658	73,929	16,737	1,419	1,686	19,843	151,197	5,264	14,817	171,277
VHT																
Peak Hour	2,476	47	540	3,063	974	8	120	1,101	217	4	75	295	3,666	58	734	4,459
Peak Period	8,171	146	1,721	10,037	3,197	28	373	3,598	651	12	245	908	12,019	186	2,338	14,543
VMT																
Peak Hour	134,374	1,597	18,050	154,021	53,022	378	2,905	56,304	12,459	144	1,759	14,362	199,854	2,119	22,714	224,686
Peak Period	474,948	5,320	59,170	539,439	183,516	1,337	9,912	194,764	38,135	515	5,942	44,592	696,598	7,171	75,025	778,794

Table C.18 I-405/I-5 Corridor Performance Measures

Existing Incident Management with Single Incident + Traveler Information + Simple Adaptive Ramp Metering with Aggressive Queue Control

	I-405 Section (with 2 parallel arterials)				I-5 Section (with 1 parallel arterial)				Others (rest of network)				Network Total/Average			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)																
Peak Hour	7.4	3.5	20.5	na	3.1	1.1	3.1	na	2.5	0.5	9.1	na	5.0	2.0	10.5	na
Peak Period	6.9	3.2	20.5	na	2.9	1.1	2.9	na	2.3	0.5	8.9	na	4.7	1.8	10.1	na
Avg Speed (mph)																
Peak Hour	55.4	36.8	33.0	50.8	55.1	46.1	24.9	51.9	57.4	42.5	22.6	48.2	55.5	38.9	30.7	50.9
Peak Period	59.1	38.6	34.0	54.1	58.0	46.7	26.6	54.7	58.5	42.5	23.2	48.6	58.8	40.6	31.7	53.9
Avg Volume (veh)																
Peak Hour	19,521	661	1,699	21,881	18,475	450	2,195	21,119	5,239	402	509	6,149	43,234	1,513	4,403	49,150
Peak Period	69,191	2,212	5,428	76,831	64,338	1,580	7,660	73,577	16,766	1,389	1,706	19,861	150,294	5,181	14,794	170,269
VHT																
Peak Hour	2,418	39	580	3,037	947	8	115	1,069	217	4	78	298	3,582	50	772	4,404
Peak Period	7,953	117	1,854	9,924	3,142	28	370	3,539	651	12	254	917	11,746	157	2,478	14,380
VMT																
Peak Hour	133,049	1,391	19,177	153,616	52,125	371	2,852	55,349	12,493	147	1,761	14,401	197,667	1,909	23,789	223,366
Peak Period	468,264	4,430	62,944	535,638	182,006	1,319	9,856	193,181	38,162	504	5,913	44,580	688,431	6,254	78,713	773,398

Table C.19 I-405/I-5 Corridor Performance Measures

Existing Incident Management with Single Incident + Traveler Information + Adaptive Arterial Signal Control + Simple Adaptive Ramp Metering with Aggressive Queue Control

	I-405 Section (with 2 parallel arterials)				I-5 Section (with 1 parallel arterial)				Others (rest of network)				Network Total/Average			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)																
Peak Hour	7.4	3.4	19.0	na	3.1	1.0	3.1	na	2.4	0.5	8.5	na	4.9	2.0	9.8	na
Peak Period	6.9	3.2	18.7	na	2.9	1.0	2.9	na	2.3	0.5	8.3	na	4.7	1.8	9.4	na
Avg Speed (mph)																
Peak Hour	55.5	37.1	33.7	51.2	55.3	47.3	25.0	52.2	57.6	42.4	23.4	48.7	55.6	39.3	31.1	51.3
Peak Period	58.9	38.8	34.4	54.3	57.9	48.0	26.7	54.7	58.7	42.4	24.0	49.2	58.7	40.8	32.0	54.1
Avg Volume (veh)																
Peak Hour	19,570	664	1,672	21,906	18,432	448	2,179	21,058	5,225	391	516	6,133	43,227	1,504	4,366	49,097
Peak Period	69,335	2,225	5,476	77,036	64,459	1,573	7,635	73,667	16,742	1,380	1,725	19,846	150,536	5,178	14,835	170,550
VHT																
Peak Hour	2,407	38	531	2,976	948	7	112	1,068	211	3	73	287	3,566	49	715	4,330
Peak Period	7,985	119	1,707	9,810	3,155	27	365	3,547	641	12	238	891	11,779	157	2,311	14,248
VMT																
Peak Hour	132,399	1,368	17,863	151,629	52,410	371	2,782	55,563	12,148	141	1,715	14,004	196,957	1,881	22,359	221,197
Peak Period	468,281	4,501	58,723	531,505	182,447	1,319	9,746	193,512	37,643	499	5,756	43,898	688,370	6,319	74,225	768,915

Table C.20 I-405/I-5Corridor Performance Measures

Existing Incident Management with Single Incident + Traveler Information + Adaptive Arterial Signal Control + Corridor Adaptive Ramp Metering with Aggressive Queue Control

	I-405 Section (with 2 parallel arterials)				I-5 Section (with 1 parallel arterial)				Others (rest of network)				Network Total/Average			
	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg	Fwy	On Ramp	Arterial	Tot/Avg
Avg Trav Time (min)																
Peak Hour	7.5	5.2	20.2	na	3.1	1.0	3.0	na	2.4	0.5	9.1	na	5.0	2.7	10.4	na
Peak Period	6.9	4.3	21.2	na	2.9	1.0	2.9	na	2.3	0.5	9.1	na	4.7	2.3	10.3	na
Avg Speed (mph)																
Peak Hour	55.5	31.1	33.1	50.7	55.5	46.1	25.3	52.4	57.6	42.4	22.8	48.3	55.6	34.0	30.9	50.9
Peak Period	59.0	35.5	34.1	53.9	57.8	46.7	26.7	54.6	58.6	42.6	23.3	48.6	58.7	37.9	31.8	53.8
Avg Volume (veh)																
Peak Hour	19,513	640	1,711	21,865	18,457	462	2,210	21,129	5,226	411	501	6,138	43,195	1,513	4,422	49,132
Peak Period	66,793	2,122	5,106	74,020	62,067	1,560	7,346	70,974	16,225	1,392	1,629	19,246	145,086	5,074	14,080	164,240
VHT																
Peak Hour	2,485	57	591	3,134	966	8	114	1,088	217	4	78	298	3,668	69	783	4,520
Peak Period	7,909	156	1,845	9,910	3,126	28	361	3,514	640	12	252	903	11,674	196	2,458	14,327
VMT																
Peak Hour	136,897	1,626	19,581	158,104	53,533	382	2,884	56,799	12,481	153	1,782	14,416	202,910	2,162	24,247	229,319
Peak Period	465,223	5,258	62,971	533,452	180,746	1,318	9,647	191,712	37,532	519	5,881	43,932	683,501	7,096	78,500	769,096

Appendix D

Secondary Research Results

Table D.1 Incident Management-Field Evaluation Results (1 of 4)

Type of IM	Location	Facility Type	Area Type	# lanes	Vol	Speed	Safety	Response Time/Incident Duration	Incident Delay	Total Delay	Travel Time Variation	Market Penetration	Fiscal Benefits	Source	Other info
Improved	San Antonio	Freeway	Urban				41%	20% - 5 min. (21%) for major incidents, 6 min. (19%) for minor incidents	700 fewer hours; 2,600 gallons of fuel saved per incident				$1.65 million	"Before and After Analysis of the San Antonio TransGuide System," TTI, July 1996 and "ITS Benefits: Review of Evalution Methods and Reported Benefits," U.S. DOT, TTI, Oct 1998	DMS, lane control signals, loops, CCTV
Improved	San Antonio	Freeway	Urban						16.2% reduction					"ITS Benefits and Unit Costs Database," Mitretek for FHWA	
	California								40-50 veh-hr reduction					"Advanced Transportation Systems Program Plan: 1996 Update," Caltrans	
FSP	California							5-10 min. reduction in response time (30-50%)						"Advanced Transportation Systems Program Plan: 1996 Update," Caltrans	
Improved	Seattle				0.10%		0.6% total crashes, 0.4% fatal			1.5% reduction	2.5% reduction	6%		"ITS Benefits and Unit Costs Database," Mitretek for FHWA	Modeled / Simulation
Improved	Toronto	Freeway	Urban	Varies 2-4+		7-19%		65% reduction						"ITS Benefits and Unit Costs Database," Mitretek for FHWA	
FSP	Hayward, CA	Freeway	Urban	4+				38% for incidents, 57% for breakdowns	3% reduction for all accidents, 41% for all breakdowns					"Advanced Traffic Management Systems and High-Occupancy Vehicle Systems," TRR No. 1554, 1996 and "Freeway Service Patrol Evaluation," and "I-880 Field Experiment, Analysis of Incident Data," Skabardonis, Noeimi, Petty, Rydzewski, Varaiya, Al-Deek, February 1995	Emissions reductions: CO 77.2 tons, Nox 19.1 tons, HC 7.6 tons

Table D.1 Incident Management-Field Evaluation Results (2 of 4)

Type of IM	Location	Facility Type	Area Type	# lanes	Vol	Speed	Safety	Response Time/Incident Duration	Incident Delay	Total Delay	Travel Time Variation	Market Penetration	Fiscal Benefits	Source	Other info
FSP	Chicago	Freeway	Urban				18% reduction in secondary accidents			60% reduction in congestion				"Learning from the Evaluation and Analysis of Performance," PATH, 1998	Emergency Traffic Patrol
CHART Program	Maryland	Freeway	Urban?						5%, 2 million vehicle-hours per year					"CHART Incident Response Evaluation Final Report," COMSIS Corporation, May 1996 and "ITS Benefits: Review of Evalution Methods and Reported Benefits," U.S. DOT, TTI, Oct 1998	Using roving tow trucks and lane sensors on I-95; reported benefit cost = 5:1
	Minneapolis-St. Paul, Minnesota	Freeway	Urban					Incident duration: 8 min. decrease for breakdowns (84% of incidents)					$800,000 annually	"Highway Helper Summary Report - Twin Cities Metro Area," MinnDOT, Report # TMC 07450-0394, Jul 1994	
Incident mgmt component of multi-function traffic mgmt system	Houston, TX	Freeway	Urban					Duration reduced 30 min. on average		570,000 vehicle-hours of delay annually			$8.4 million annually by reduced delay	"Estimation of Benefits of Houston Transtar," Parsons Transp. Group with TTI, 7 Feb 1997 and "ITS Benefits: Review of Evalation Methods and Reported Benefits," U.S. DOT, TTI, Oct 1998	
	Atlanta, GA		Urban					Now automated	Report / dispatch delay reduced by 50%, clearance 38% faster					"1996 Olympic and Paralympic Even Study," Booz-Allen & Hamilton, May 1997	
										10 to 45%				"ITS Benefits," Shank, Dwight, Mitretek Systems, 27 Aug 1996	

Table D.1 Incident Management-Field Evaluation Results (3 of 4)

Type of IM	Location	Facility Type	Area Type	# lanes	Vol	Speed	Safety	Response Time/Incident Duration	Incident Delay	Total Delay	Travel Time Variation	Market Penetration	Fiscal Benefits	Source	Other info
ATMS/ATIS	City of Irvine, Orange County, CA							Response time average = 15.3 sec.			Savings average across all scenarios = 7.4%			"An Evaluation of Potential System Performance under Full ATMS/ATIS Deployment," Filipo Logi, Craig Rindt, Will Recker, and Michael McNally, Nov 1999	Simulation model
TransVision: Incident mgmt system	Ft. Worth, TX		Urban						0.72 hours of lane-blockage, projected annually to 500,000 veh-hours				$7.3 million	ITS Benefits: Review of Evalution Methods and Reported Benefits, U.S. DOT, TTI, Oct 1998	
Automated incident detection and verification system	Brooklyn, NY	Gowanus Express-way	Urban					66% reduction (90 min.-30 min., breakdowns to 19 min.)						ITS Benefits: Review of Evalution Methods and Reported Benefits, U.S. DOT, TTI, Oct 1998	
Early Deployment Study: Simulation for Proposed Freeway Mgmt Center	Detroit, MI		Urban							40%			Fuel reduction: $41.3 million	ITS Benefits: Review of Evalution Methods and Reported Benefits, U.S. DOT, TTI, Oct 1998	Simulation Model: fuel reduction = 42%, reduced CO = 122,000 tons, reduced Nox = 1200 tons
Freeway Electronic Surveillance project on 42-mile network	Los Angeles, CA	Freeway	Urban							65%				ITS Benefits: Review of Evalution Methods and Reported Benefits, U.S. DOT, TTI, Oct 1998	
Combination of detectors, CCTV, IM teams	Los Angeles, CA		Urban						50%					ITS Benefits: Review of Evalution Methods and Reported Benefits, U.S. DOT, TTI, Oct 1998	Estimated benefit cost = 5:1, 6:1.
Surveillance to video link provided to towing company	Richardson, TX							Incident clearance: 5-7 mins.						ITS Benefits: Review of Evalution Methods and Reported Benefits, U.S. DOT, TTI, Oct 1998	

Table D.1 Incident Management-Field Evaluation Results (4 of 4)

Type of IM	Location	Facility Type	Area Type	# lanes	Vol	Speed	Safety	Response Time/Incident Duration	Incident Delay	Total Delay	Travel Time Variation	Market Penetration	Fiscal Benefits	Source	Other info
	Northern VA (I-95 at National Capital)	Freeway	Urban						35% in annual delay already, 64% estimated	Additional 21-46% estimated			$14.5 million annually already, with additional $6 million-$12.5 million possible	"Incident Management and ITS Technology: Estimating Benefits for Northern Virginia," Gerard Maas, Mark Maggio, Hadi Shafie, and Roger Stough, March 11, 1998 and "Estimating Benefits of ITS Technology in IM: The Case of Northern Virginia," for 77th TRB, Jan 1998.	Using IMPACT model, expert opinion, and field research to estimate benefits
Improved	National					10-42%								"Intelligent Transportation Infrastructure Benefits: Expected and Experienced," 1996, Mitre Corp	
FSP	California	Freeway	Urban				10%							"Intelligent Transportation Infrastructure Benefits: Expected and Experienced," 1996, Mitre Corp	
Improved	San Antonio, TX	Freeway	Urban				35%							ITS Benefits Database, Feb 2001, Mitretek	
Improved	Los Angeles, CA	Freeway	Urban			11-15%								"Intelligent Vehicle Highway Systems Operational Benefits - Mobility 2000, Mar 1990	

Table D.2 Traveler Information-Field Evaluation Results (1 of 5)

Type of Trav Info	Location	# lanes	Area Type	Parallel Arterial	Market Penetration	Vol	Speed	Safety	Divergence	Time Savings	Delay	Source	Other info
Pre-Trip	California						5-10% for those with service					Caltrans, Advanced Transportation Systems Program Plan: 1996 Update	
Standalone	Osaka-Kobe, Japan	na	Urban	y					4%	9.8 min during congested periods, up to 38 min for incidents		"ITS Benefits and Unit Costs Database," Mitretek for FHWA	
Standalone	Los Angeles	na	Urban	y					10.60%			"Quantifying the Diversionary Benefits of the Fixed Changeable Message Signs (CMS)"	
Traveler Info with IM	United Kingdom	4	Urban	y				18% reduction in injury accidents				"Working Paper: Estimating the Potential Safety Benefits of Intelligent Transportation Systems," Mitretek, 1998	M1 motorway, AID system
Pre-Trip				y	5%					7-20%	15% reduction	"Intelligent Transportation Infrastructure Benefits: Expected and Experienced," The Mitre Corp, 1996	Simulations
Standalone	United Kingdom	na						28%				"ITS Benefits: 1999 Update," Mitretek, 1999	M25, variable speed limits
Standalone	Strasbourg, France					5%						"ITS Benefits: 1999 Update," Mitretek, 2000	A4, variable speed limits
Traveler Information with ramp metering, arterial management	Long Island, NY		Suburban				35% decrease in rush hour speeds		5-10% with passive CMS, more with recommended alternate route			"Evaluation of INFORM - Lessons Learned and Applications to Other Systems," Smith, S. and C. Perez, 71st TRB, Jan 1992	
INFORM - Integrated corridor mgmt system	Long Island, NY					5%	13%		5-10% with passive messages, 10-20% with action messages (recommending route)		1,900 veh-hours per incident and 300,000 veh-hours annually	ITS Benefits: Review of Evaluation Methods and Reported Benefits, USDOT, TTI, Oct 1998	

Table D.2 Traveler Information-Field Evaluation Results (2 of 5)

Type of Trav Info	Location	# lanes	Area Type	Parallel Arterial	Market Penetration	Vol	Speed	Safety	Divergence	Time Savings	Delay	Source	Other info
Via pager - operational test (Genesis Project)	Minneapolis-St. Paul, MN		Urban		Of users (# unknown), 65% used daily, 88% used weekly				42% when incident known			"System Effectiveness Test," Wetherby, B., 10 Jun 1997 and ITS Benefits: Review of Evaluation Methods and Reported Benefits, U.S. DOT, TTI, Oct 1998	Discovered 50% incidents via pager vs. 15% other media; only 2% of survey sample dropped out bc of dissatisfaction with service
Genesis - Route Guidance System	Minneapolis-St. Paul, MN (I-35)	3	Urban		20%					Up to 15%; generally increase as congestion increases		"Genesis Modeling Report," Mesham Rakha and Michael von Aerde and "Genesis Field Operational Test: Final Report Evaluation," BoozAllen & Hamilton, Sept 1997	Modeling study; reduction in vehicle stops, fuel consumption, and HC emissions by up to 5%, increase in NOx emissions by 5%
TransGuide System: Traveler information with incident management (and ramp metering) - field operational test	San Antonio, TX		Urban					Injury-related crashes: 15%; total crashes: 35%; secondary crashes: 30%; in inclement weather: 40%; overall accident rate: 41%	% likely to use alt routes increased from 58-71%		Annual savings: delay and fuel = $1.65 million, crash reduction = $4.3 million	"Before and After Analysis of the San Antonio TransGuide System," Henk, R. H. Jul 1996 and "ITS Benefits: Review of Evaluation Methods and Reported Benefits," U.S. DOT, TTI, Oct 1998	
In-Vehicle navigation systems test	Orlando, Fl		Urban					Perceived benefit; users no more likely to be involved in accidents.		20% travel time; 80% travel planning time		"TravTek Evaluation: Rental and Local User Study," U.S. DOT, FHWA-RD-96-028, FHWA, Mar 1996; and "Travtek Evaluation Safety Study," FHWA-RD-95-188, Feb 1996 and "ITS Benefits: Review of Evaluation Methods and Reported Benefits," U.S. DOT, TTI, Oct 1998	Drivers felt safer, less confused, more confident and attentive to road conditions; assuming 100% penetration, emission reduction estimations = HC 16%, CO 7%, Nox 5%

Table D.2 Traveler Information-Field Evaluation Results (3 of 5)

Type of Trav Info	Location	# lanes	Area Type	Parallel Arterial	Market Penetration	Vol	Speed	Safety	Divergence	Time Savings	Delay	Source	Other info
TravTek: In-Vehicle ATIS	Orlando, FL		Urban		From 1 to 50%			0%	30-40% and of those: 45% change route, 45% change time, and 10% change mode	12%		"ITS Benefits," Shank, D., Mitretek Systems, 27 Aug 1996; "TravTek Modeling Report," M. van Aerde and H. Rakha; and "Intelligent Transportation Systems FOT Cross-Cutting Study ATIS," BoozAllen, Hwy and Veh Tech Group, Sept 1998	Simulation; travel distance: 4%; stops: 32%: wrong turns: 37%; fuel consumption: 12%; emissions: 6%
Route Guidance Systems	Tokyo, Japan		Urban					40%		6%		"An Evaluation of the Benefits of User and System Optimized Route Guidance Strategies," M. Rakha	Dynamic simulation model; fuel savings = 3-7%
Autoguide - Route Guidance System	London, England		Urban	Yes, access to entire network	10-30%					5% equipped, 24% unequipped		"An Evaluation of the Benefits of User and System Optimized Route Guidance Strategies," M. Rakha	Simulation
Route Guidance Systems	Sudbury network in MA			Yes, access to entire network						3.8-4.6%		"An Evaluation of the Benefits of User and System Optimized Route Guidance Strategies," M. Rakha	Macroscopic simulation model
Route Guidance Systems	Los Angeles, CA		Urban	3						33% on 30-min. trip		"An Evaluation of the Benefits of User and System Optimized Route Guidance Strategies," M. Rakha	Simulation
Route Guidance Systems: Comprehensive Auto Traffic Control System (CATC)	Tokyo, Japan		Urban							9-15%		"An Evaluation of the Benefits of User and System Optimized Route Guidance Strategies," M. Rakha	Pilot study
Route Guidance Systems	Tokyo, Japan		Urban	2	10%					11%		"An Evaluation of the Benefits of User and System Optimized Route Guidance Strategies," M. Rakha	Mathematical model

Table D.2 Traveler Information-Field Evaluation Results (4 of 5)

Type of Trav Info	Location	# lanes	Area Type	Parallel Arterial	Market Penetration	Vol	Speed	Safety	Divergence	Time Savings	Delay	Source	Other info
VMS	Amsterdam, Netherlands		Urban						66%			"Evaluating Network Wide Effects of VMS's in the Netherlands," Mariette Kraan, Nanne van der Zijpp, Bas Tutert, Tanja Vonk, and Dorry van Megen, 78th TRB, Nov 1998	Reduces uncertainty by up to 87%
Joint Architecture Team: In-Vehicle Benefits Simulation					30%	10%				8 - 20% in congestion, else 7-12%	21%	ITS Benefits: Review of Evaluation Methods and Reported Benefits, U.S. DOT, TTI, Oct 1998	Simulation
ADVANCE Project: Dynamic Route Guidance Systems	Chicago, IL									4%		ITS Benefits: Review of Evaluation Methods and Reported Benefits, U.S. DOT, TTI, Oct 1998 and "Intelligent Transportation Systems FOT Cross-Cutting Study ATIS," BoozAllen, Hwy and Veh Tech Group, Sept 1998	Small sample size and high deviations
Pre-Trip Route Selection Simulation	Detroit, MI											ITS Benefits: Review of Evaluation Methods and Reported Benefits, U.S. DOT, TTI, Oct 1998	Simulation: Under incident conditions, 90% of en-route benefits can be achieved pre-trip
SmarTraveler: Commercially provided pre-trip info	Seattle, WA; and Boston, MA								45% route and 45% time and 5-10% modes			ITS Benefits: Review of Evaluation Methods and Reported Benefits, U.S. DOT, TTI, Oct 1998 and "ITS Benefits: Continuing Successes and Operational Test Results," Oct 1997	Diversions based on survey behavior; emission data based on survey: reductions VOC 25%, Nox 1.5%, CO 33%
Pre-Trip Survey	Marin County, Ca								69% say they would divert, saving estimated 17 min.			ITS Benefits: Review of Evaluation Methods and Reported Benefits, U.S. DOT, TTI, Oct 1998	Assumption that driver presented with alt route and expected time savings.

Table D.2 Traveler Information-Field Evaluation Results (5 of 5)

Type of Trav Info	Location	# lanes	Area Type	Parallel Arterial	Market Penetration	Vol	Speed	Safety	Divergence	Time Savings	Delay	Source	Other info
Radio and television	Bay Area, CA				Radio: 25% commuters; TV: (times / wk, % commuter, % non-commuter): (5+,57,26), (3-4,26,34), (1-2,10,8), (<1,7,29)							"Evaluation of Television Traffic Information in the San Francisco Bay Area," Robert Tam, Youngbin Yim, UCB ITS PATH, Oct 1997	
Pre-Trip Incident Info	Bay Area, CA (US-101 Corridor)	4?	Urban	Yes	Radio: 35% southbound, 45% northbound; TV: 9% southbound, 17% northbound				12.5% time; 28.6% route; 39.3% no change; 7.1% mode			"Traveler Response to Traffic Information on an Incident: A Case Study of the U.S. 101 Corridor in the SF Bay Area," Ronald Koo, Youngbim Yim.	
Full traveler information (In-Vehicle, CMS…) w / ramp metering, incident management… - all ITS			Urban		Assume 100%	Freeways: 16%; arterials: 14%; total: 15%		Injury accidents: 30%; fatal: 26%			Freeways: 20%; arterials: 17%; total = 18%	"Working Paper: Estimating Target values for ITS Goal Measures, Status Report," Mitretek Systems, Oct 1998	These are estimated with varying degrees of certainty (and assuming 100% market penetration)
	Pittsburgh, PA (I-279 from I-79 to I-376, I-376 from I-279 to U.S. 30)		Urban				15%			13%	10%	"ITS Services Benefits Evaluation I-376 Freeway - PennLincoln Pkwy East Pittsburgh, Pennsylvania," COMSIS Corporation, 14 Nov 1996	
Pre-trip when incident occurs			Urban	Yes	100%						21% systemwide	"ITS Benefits: Continuing Successes and Operational Test Results," Oct 1997	
Combined incident management	Austin, TX					7-12%						"PATH's Learning from the Evaluation and Analysis of Performance Web Site," 1998, California PATH and Caltrans	
Combine incident management	Salt Lake Valley						15%					"ITS Benefits Database," Feb 2001, Mitretek	

Table D.3 Arterial Management-Field Evaluation Results (1 of 2)

Type of Signal	Location	# lanes	Volume	Speed	Safety	Traffic Delays	Incident Related Delay	Travel Time	Source	Other info
	Orange County, CA			10-27%					"LEAP - Learning from the Evaluation and Analysis of Performance," PATH-Berkeley, 1998	1991
Adaptive	Detroit, MI						60-70% reduction		"ITS Benefits and Unit Costs Database," Mitretek for FHWA	Simulation
Adaptive	Detroit, MI			19% peak direction	6% reduction injuries (27% injuries, 100% serious injuries), 21% increase PDO, 89% left-turn accidents	30%			"Intelligent Transportation Infrastructure Benefits: Expected and Experienced," The Mitre Corp, 1996 and "ITS Benefits: Review of Evaluation Methods and Reported Benefits," U.S. DOT, TTI, Oct 1998	FAST-TRAC
Actuated	Detroit, MI							25-41% reduction	"ITS Benefits and Unit Costs Database," Mitretek for FHWA	Simulation
Adaptive	Duncan, BC					25% reduction			"ITS Benefits and Unit Costs Database," Mitretek for FHWA	
Adaptive	Oviedo, Spain			14%		14.4% reduction			"ITS Benefits and Unit Costs Database," Mitretek for FHWA	
Adaptive	Madrid, Spain			-4%		19% reduction			"ITS Benefits and Unit Costs Database," Mitretek for FHWA	
Adaptive	Simulations					20% reduction			"ITS Benefits and Unit Costs Database," Mitretek for FHWA	Simulation
Adaptive	Toronto, Canada			3-16%		17% reduction, 6-26% reduction		8%	"ITS Benefits and Unit Costs Database," Mitretek for FHWA and "ITS Benefits: Review of Evaluation Methods and Reported Benefits," U.S. DOT, TTI, Oct 1998	6% reduction in fuel consumption
Adaptive	Oakland County, MI							7.26-8.64%	"ITS Benefits and Unit Costs Database," Mitretek for FHWA	
Automated	Los Angeles, CA			16% (14%)		44%		18% (13%)	"ITS Benefits: Continuing Success and Operational Test Results," and "Automated Traffic Surveillance and Control Evaluation Study," City of LA DOT, Jun 1994; and "ITS Benefits: Review of Evaluation Methods and Reported Benefits," U.S. DOT, TTI, Oct 1998	Fuel consumption decrease 13%, air emission decrease 14%, vehicle stops reduced 41%, 20% reduction in intersection delay
	Paris, France							20%	"ITS Benefits: 1999 Update," Mitretek, 1999	SURF-2000

Table D.3 Arterial Management-Field Evaluation Results (2 of 2)

Type of Signal	Location	# lanes	Volume	Speed	Safety	Traffic Delays	Incident Related Delay	Travel Time	Source	Other info
Automated	Abilene, TX			22%		37%		14%	"ITS Benefits: Continuing Success and Operational Test Results" and "Other Resources Measured ITS Technology Benefits (2/27/95)" and "ITS Benefits: Review of Evaluation Methods and Reported Benefits," U.S. DOT, TTI, Oct 1998	67% fuel consumption reduction
				14-22%	6-10%	20-38%		12-20%	"ITS Benefits," Shank, D., Mitretek Systems, 27 Aug 1996	Vehicle stops: 2-35%; fuel consumption: 6-12%; emissions 6-38%

Table D.4 Ramp Metering-Field Evaluation Results (1 of 4)

Type of Meter	Queue Control	Location	# lanes	Parallel Arterial	Volume	Speed	Safety	Source	Other info
Fixed	n	Portland, WA	3	Yes	25%	7.5-154%	43%	"Ramp Metering Status in North America 1995 Update," FHWA and "Twin Cities Ramp Meter Evaluation - Final Report," Cambridge Systematics, 2001 and "ITS Benefits: Review of Evaluation Methods and Reported Benefits," U.S. DOT, TTI, Oct 1998	I-5 in 1981
		Seattle, WA	3?	Yes	62-86%	20-25% (48% travel time)	39% (38%)	"Ramp Metering Status in North America 1995 Update," FHWA and "6 Year FLOW Evaluation," Henry K. and O. Meyhan, WashDOT, Jan 1989; and "ITS Benefits: Review of Evaluation Methods and Reported Benefits," U.S. DOT, TTI, Oct 1998)	I-5 north of CBD between 1981 and 1987
	n	Seattle, WA	2?	n	6.50%			"Ramp Metering Status in North America 1995 Update," FHWA	SR-520 near Lake Washington in 1986
Upstream adaptive	n	Seattle, WA	3	n	5-6%		67% sideswipe and rear-end	"Ramp Metering: A Review of the Literature," E. D. Arnold	I-405 SB in 1997
		Seattle, WA			10-100%	unquantified increase	62%	"6-Year FLOW Evaluation," Henry, K. and O. Meyhan, Jan 1989	Along I-5 in District 1
Traffic responsive	n	Denver, CO	3	Yes		57%	5%	"Ramp Metering Status in North America 1995 Update," FHWA	I-25 NB south of the city in 1981
Corridor adaptive	n	Denver, CO	3	Yes	19%	35.5-58%	5-50%	"Ramp Metering Status in North America 1995 Update," FHWA and "Twin Cities Ramp Meter Evaluation - Final Report," Cambridge Systematics, 2001	
Corridor adaptive	n	Detroit, MI	3	Yes	14.30%	8%	50% total, 71% injury	"Ramp Metering Status in North America 1995 Update," FHWA	SCANDI, I-94 eastbound in 1982
Corridor adaptive	y	Austin, TX	2	Yes	7.90%	60%		"Ramp Metering Status in North America 1995 Update," FHWA and "Ramp Metering: A Review of the Literature," E. D. Arnold, Jr.	I-35 NB

Table D.4 Ramp Metering-Field Evaluation Results (2 of 4)

Type of Meter	Queue Control	Location	# lanes	Parallel Arterial	Volume	Speed	Safety	Source	Other info
Corridor adaptive	n	Long Island, NY	2	Yes	16%	20%		"Ramp Metering Status in North America 1995 Update," FHWA and "Assessing the Benefits and Costs of Intelligent Transportation Systems: Ramp Meters," California PATH, 1999	
Corridor Adaptive	y	Long Island, NY	2	Yes	2%	9%-40%	15%	"Ramp Metering Status in North America 1995 Update," FHWA and "ITS Benefits: Review of Evaluation Methods and Reported Benefits," U.S. DOT, TTI, Oct 1998	
		California			50-80%	Up to 50%	20-50%	"Ramp Metering Status in North America 1995 Update," FHWA	
Upstream adaptive	n	Milwaukee, WI			22%	3-35%	15%	"Ramp Metering in Minnesota," TTI, May 2000	
Upstream adaptive	n	Sacramento, CA	3	Yes	3-5%		50%	"Ramp Metering in Minnesota," TTI, May 2000	
Upstream adaptive	n	Los Angeles, CA	4	Yes			20%	"Ramp Metering in Minnesota," TTI, May 2000	
Traffic responsive - corridor adaptive	n	Minneapolis, MN	2	Yes	10%	20%		Minneapolis, "Ramp Metering in Minnesota," TTI, May 2000	TH 169 in 1996, conversion from fixed time to traffic responsive
		Minneapolis-St. Paul, MN			25-32% (with FMS)	14-27%	27%	"ITS Benefits: Review of Evaluation Methods and Reported Benefits," U.S. DOT, TTI, October 1998 and "ITS Benefits: Continuing Successes and Operational Test Results," Oct 1997	Along single corridor (I-35)
Fixed	n	Phoenix, AZ	4	Yes	15%	5-10%	16%	"Ramp Metering in Minnesota," TTI, May 2000 and "Twin Cities Ramp Meter Evaluation - Final Report," Cambridge Systematics, 2001	Superstition Highway (US 60) between Country Club and Mill in Tempe and Mesa in 1995
Fixed	y	Great Britain	3	No	3.20%			"Assessing the Benefits and Costs of Intelligent Transportation Systems: Ramp Meters," California PATH, 1999	M6 motorway

Table D.4 Ramp Metering-Field Evaluation Results (3 of 4)

Type of Meter	Queue Control	Location	# lanes	Parallel Arterial	Volume	Speed	Safety	Source	Other info
		Zoetemeer, Netherlands			3%	15%		"Assessing the Benefits and Costs of Intelligent Transportation Systems: Ramp Meters," California PATH, 2000	
	y	Abilene, TX				22%		"Twin Cities Ramp Meter Evaluation - Final Report," Cambridge Systematics, 2001	
Fixed	y	Houston, TX	3	Yes		29%		"Twin Cities Ramp Meter Evaluation - Final Report," Cambridge Systematics, 2002 and "ITS Benefits: Review of Evaluation Methods and Reported Benefits," U.S. DOT, TTI, Oct 1998	Travel time savings = 393,000 vehicle-hours and fiscal benefit = $5.73 million
					17-25%	16-62%	15-50%	"Ramp Metering: A Review of the Literature," E. D. Arnold	Traffic responsive metering often produces results 5% to 10% better than pre-timed
Upstream adaptive	n	Los Angeles, CA	4+	Yes	-2% to 6%	6%-21%		"Preliminary SWARM Study Report on W/B Foothill Freeway (W/B LA-210," Caltrans District 7, 2000	I-210 WB from Vernon to lake in 2001, SWARM1 and 1/2b
Upstream adaptive	y	Los Angeles, CA	4+	Yes	8%	39%		"Preliminary SWARM Study Report on W/B Foothill Freeway (W/B LA-210," Caltrans District 7, 2001	I-210 WB from Vernon to lake in 2001, SWARM2b
	y	Dallas, TX				7.6-55%	4-30%	"An Overview of the Ramp Metering Subsystem for the Phoenix Freeway Management System," ITE 1990 Compendium of Technical Papers	
		Minneapolis-St. Paul, MN					27%	"ITS Real World Benefits" Jan 1998 with source: Minnesota DOT, Freeway Operations Minutes, Jan 1994	On I-35
					19 to 25%	18 to 62%	15 to 50%	"ITS Benefits," Shank, Dwight, Mitretek Systems, 27 August 1996	Time savings: 5-20%

Table D.4 Ramp Metering-Field Evaluation Results (4 of 4)

Type of Meter	Queue Control	Location	# lanes	Parallel Arterial	Volume	Speed	Safety	Source	Other info
		Detroit, MI			12.5% (with FMS)	7%	50% crashes, 71% injuries	ITS Benefits: Review of Evaluation Methods and Reported Benefits, U.S. DOT, TTI, Oct 1998; and "ITS Benefits: Continuing Successes and Operational Test Results," Oct 1997	
	y	Austin, TX	3?	yes?	8%	38%		"ITS Benefits: Continuing Successes and Operational Test Results," Oct 1997	
						16-62%		"ITS Benefits: Continuing Successes and Operational Test Results," Oct 1997	While demand increased 17-25%, by survey of TMC's
Corridor adaptive	y	Minneapolis, MN	3	y	25%	16%	24%	Minneapolis, "Ramp Metering: A Review of the Literature," E. D. Arnold, Jr.	