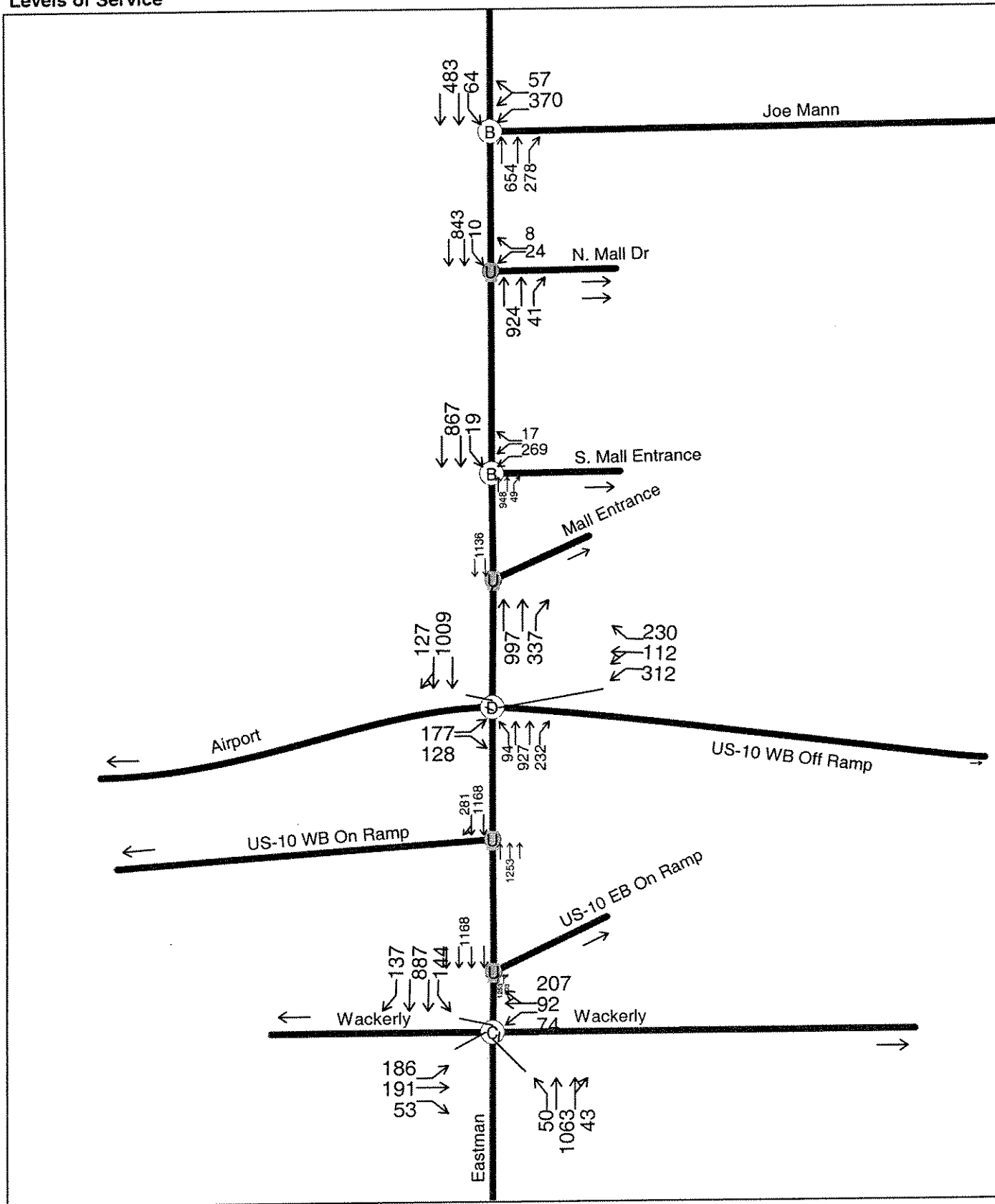
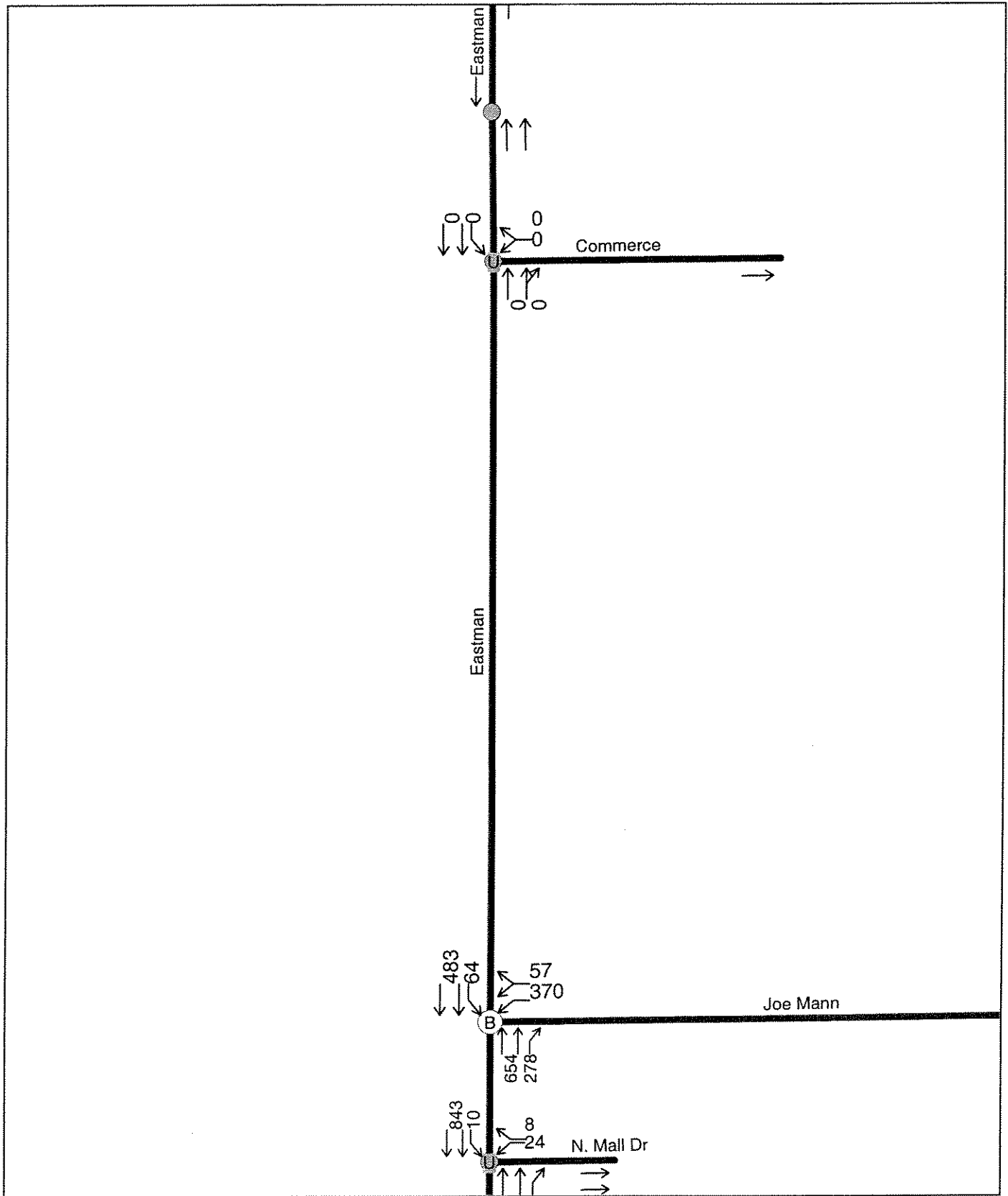




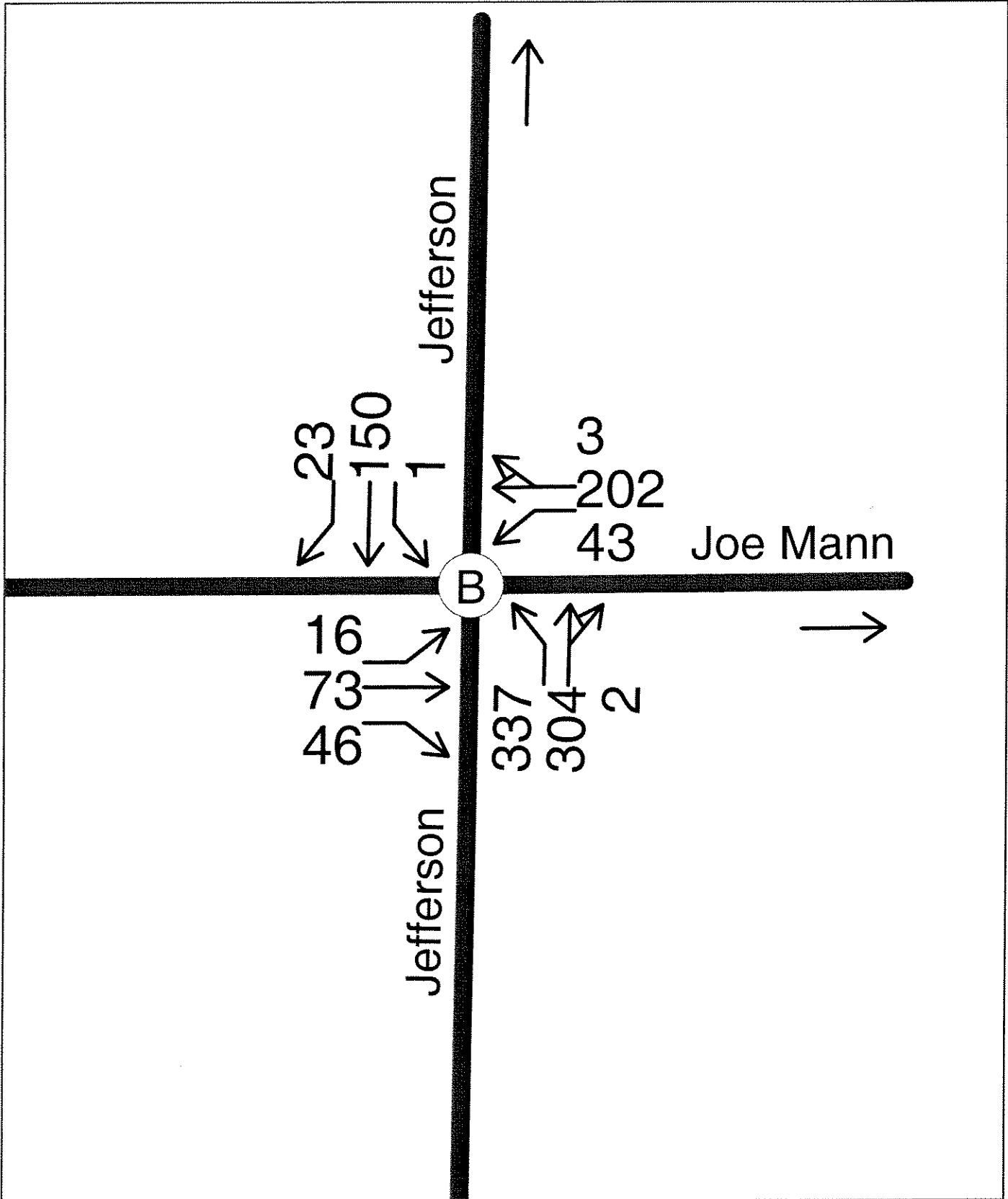
2003 P.M.

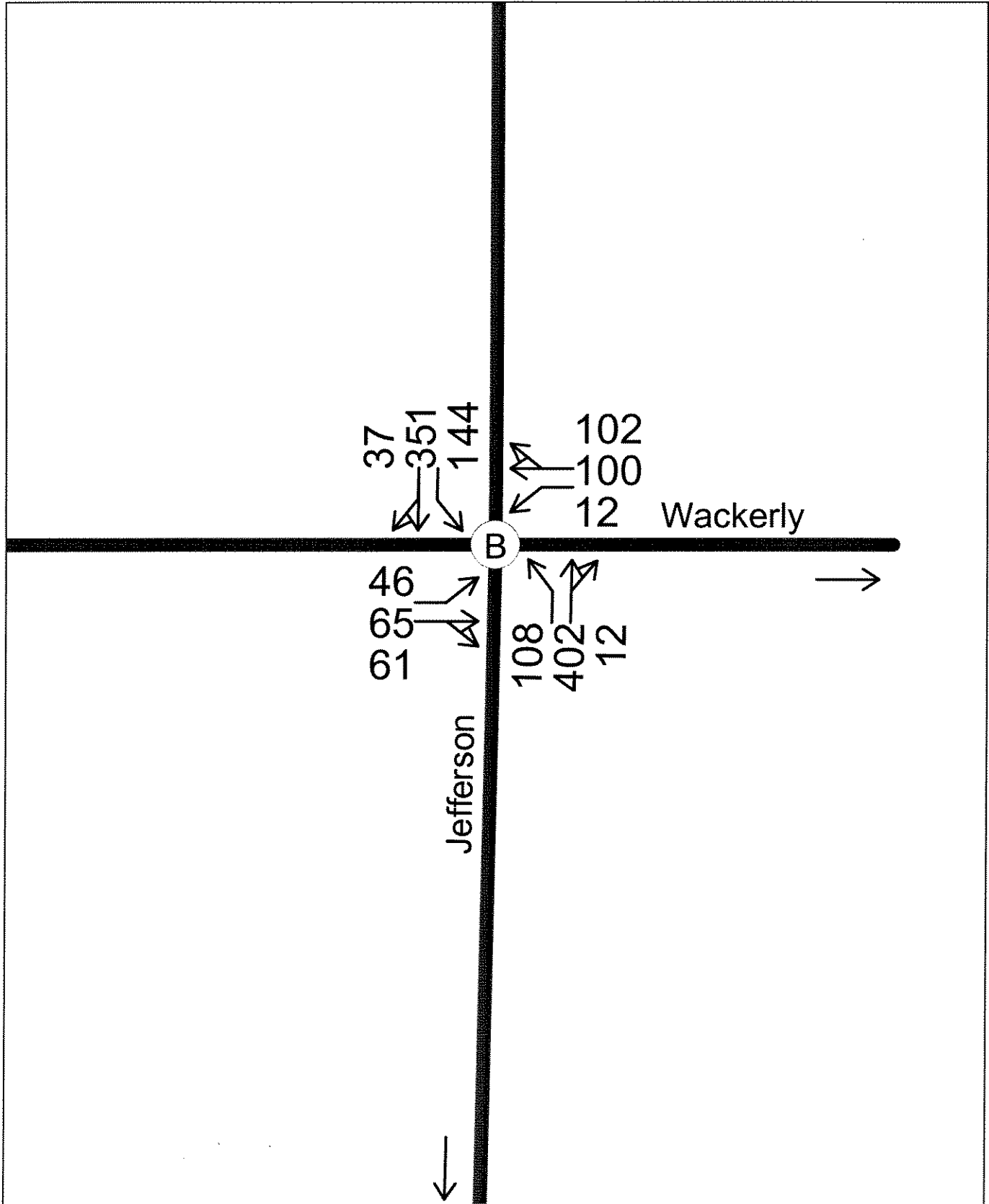


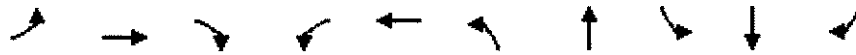
M:\PROJ\0541\5965\00\Traffic\Syncro\EX2003-PM.sy7



M:\PROJ\0541\5965\00\Traffic\Syncro\EX2003-PM.sy7







Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	186	191	53	74	92	50	1063	144	887	137
Turn Type	pm+pt		Perm	pm+pt		pm+pt		pm+pt		pm+ov
Protected Phases	7	4		3	8	5	2	1	6	7
Permitted Phases	4		4	8		2		6		6
Detector Phases	7	4	4	3	8	5	2	1	6	7
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	5.0	10.0	5.0	10.0	5.0
Minimum Split (s)	11.1	22.1	22.1	11.1	22.1	11.3	22.3	11.3	22.3	11.1
Total Split (s)	13.0	31.0	31.0	13.0	31.0	13.0	43.0	13.0	43.0	13.0
Total Split (%)	13.0%	31.0%	31.0%	13.0%	31.0%	13.0%	43.0%	13.0%	43.0%	13.0%
Yellow Time (s)	3.6	3.6	3.6	3.6	3.6	4.3	4.3	4.3	4.3	3.6
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5	2.0	2.0	2.0	2.0	2.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	Max	None	Max	None	C-Max	None	C-Max	None
Act Effct Green (s)	36.8	29.6	29.6	35.8	27.0	47.7	39.0	48.9	41.7	54.7
Actuated g/C Ratio	0.37	0.30	0.30	0.36	0.27	0.48	0.39	0.49	0.42	0.55
v/c Ratio	0.63	0.38	0.11	0.20	0.61	0.21	0.97	0.67	0.65	0.16
Control Delay	30.9	31.6	8.3	20.3	26.2	13.9	49.1	28.3	24.8	1.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.9	31.6	8.3	20.3	26.2	13.9	49.1	28.3	24.8	1.6
LOS	C	C	A	C	C	B	D	C	C	A
Approach Delay		28.4			25.1		47.6		22.5	
Approach LOS		C			C		D		C	

**Intersection Summary**

Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 24 (24%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green  
 Natural Cycle: 90  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.97  
 Intersection Signal Delay: 32.9  
 Intersection Capacity Utilization 79.9%  
 Analysis Period (min) 15  
 Intersection LOS: C  
 ICU Level of Service D

**Splits and Phases: 3: Wackerly & Eastman**

13 s	43 s	13 s	31 s
13 s	43 s	13 s	31 s



Lane Group	EBL	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBT
Lane Configurations									
Volume (vph)	177	128	312	112	230	94	927	232	1009
Turn Type	Protcustom		Split		Prot pm+pt		Free		
Protected Phases	3	3	4	4	4	1	1 2		2
Permitted Phases		1				1 2		Free	
Detector Phases	3	3	4	4	4	1	1 2		2
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0			10.0
Minimum Split (s)	11.0	11.0	17.0	17.0	17.0	11.3			35.3
Total Split (s)	21.0	21.0	18.0	18.0	18.0	13.0	61.0	0.0	48.0
Total Split (%)	21.0%	21.0%	18.0%	18.0%	18.0%	13.0%	61.0%	0.0%	48.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	4.3			4.3
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5	2.0			2.0
Lead/Lag	Lead	Lead	Lag	Lag	Lag	Lead			Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes			Yes
Recall Mode	None	None	None	None	None	None			C-Max
Act Effct Green (s)	15.7	24.7	15.3	15.3	15.3	53.0	57.0	100.0	44.0
Actuated g/C Ratio	0.16	0.25	0.15	0.15	0.15	0.53	0.57	1.00	0.44
v/c Ratio	0.69	0.33	0.87	0.89	0.69	0.44	0.50	0.16	1.03
Control Delay	49.9	14.5	74.6	77.9	29.7	23.9	20.2	0.1	59.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.9	14.5	74.6	77.9	29.7	23.9	20.2	0.1	59.9
LOS	D	B	E	E	C	C	C	A	E
Approach Delay				59.9			16.7		59.9
Approach LOS				E			B		E

**Intersection Summary**

Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 18 (18%), Referenced to phase 2:NBSB, Start of Green  
 Natural Cycle: 90  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 1.03  
 Intersection Signal Delay: 41.5  
 Intersection Capacity Utilization 65.4%  
 Analysis Period (min) 15  
 Intersection LOS: D  
 ICU Level of Service C

Splits and Phases: 8: Airport & Eastman





Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖↗	↗	↑↑	↗	↖	↑↑
Volume (vph)	269	17	948	49	19	867
Turn Type	custom			Perm	Perm	
Protected Phases	4	4	2			6
Permitted Phases		4		2	6	
Detector Phases	4	4	2	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	23.0	23.0	22.1	22.1	22.1	22.1
Total Split (s)	31.4	31.4	68.6	68.6	68.6	68.6
Total Split (%)	31.4%	31.4%	68.6%	68.6%	68.6%	68.6%
Yellow Time (s)	3.5	3.5	4.3	4.3	4.3	4.3
All-Red Time (s)	2.5	2.5	1.8	1.8	1.8	1.8
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	Max	Max	Max	Max	Max	Max
Act Effect Green (s)	27.4	27.4	64.6	64.6	64.6	64.6
Actuated g/C Ratio	0.27	0.27	0.65	0.65	0.65	0.65
v/c Ratio	0.31	0.04	0.45	0.05	0.08	0.41
Control Delay	29.9	11.9	9.3	1.8	4.8	7.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.9	11.9	9.3	1.8	4.8	7.4
LOS	C	B	A	A	A	A
Approach Delay	28.9		8.9			7.3
Approach LOS	C		A			A

Intersection Summary

Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 33 (33%), Referenced to phase 2:NBT, Start of Green  
 Natural Cycle: 50  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.45  
 Intersection Signal Delay: 10.9  
 Intersection Capacity Utilization 40.5%  
 Analysis Period (min) 15  
 Intersection LOS: B  
 ICU Level of Service A

Splits and Phases: 13: S. Mall Entrance & Eastman

↑ ø2	↖ ø4
68.6 s	31.4 s
↓ ø6	
68.6 s	

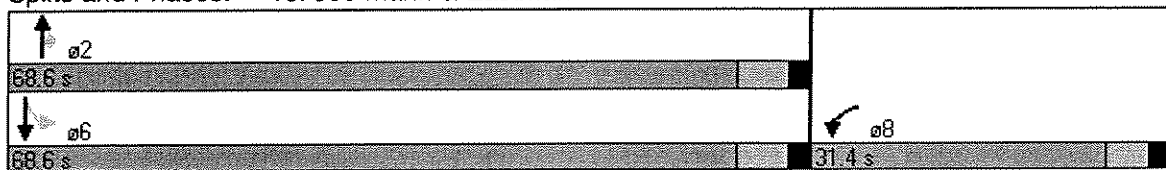


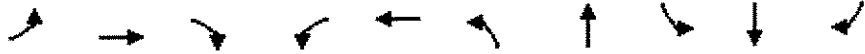
Lane Group	WBL	NBT	NBR	SBL	SBT
Lane Configurations	↙↘	↑↑	↗	↘	↑↑
Volume (vph)	370	654	278	64	483
Turn Type			Perm	Perm	
Protected Phases	8	2			6
Permitted Phases			2	6	
Detector Phases	8	2	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.2	22.2	22.2	22.2
Total Split (s)	31.4	68.6	68.6	68.6	68.6
Total Split (%)	31.4%	68.6%	68.6%	68.6%	68.6%
Yellow Time (s)	3.5	4.3	4.3	4.3	4.3
All-Red Time (s)	2.5	1.9	1.9	1.9	1.9
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	Max	Max	Max	Max	Max
Act Effct Green (s)	27.4	64.6	64.6	64.6	64.6
Actuated g/C Ratio	0.27	0.65	0.65	0.65	0.65
v/c Ratio	0.49	0.31	0.27	0.17	0.23
Control Delay	31.4	4.7	0.8	8.2	7.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	31.4	4.7	0.8	8.2	7.7
LOS	C	A	A	A	A
Approach Delay	31.4	3.5			7.7
Approach LOS	C	A			A

**Intersection Summary**

Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 37 (37%), Referenced to phase 2:NBT and 6:SBTL, Start of Green  
 Natural Cycle: 45  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.49  
 Intersection Signal Delay: 11.0  
 Intersection Capacity Utilization 44.0%  
 Analysis Period (min) 15  
 Intersection LOS: B  
 ICU Level of Service A

Splits and Phases: 16: Joe Mann & Eastman





Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↗	↖	↗	↖	↑	↗
Volume (vph)	16	73	46	43	202	337	304	1	150	23
Turn Type	Perm		Perm	Perm		Perm		Perm		Perm
Protected Phases		4			8		2		6	
Permitted Phases	4		4	8		2		6		6
Detector Phases	4	4	4	8	8	2	2	6	6	6
Minimum Initial (s)	3.0	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	20.1	20.1	20.1	20.1	20.1
Total Split (s)	36.1	36.1	36.1	36.1	36.1	53.9	53.9	53.9	53.9	53.9
Total Split (%)	40.1%	40.1%	40.1%	40.1%	40.1%	59.9%	59.9%	59.9%	59.9%	59.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.6	3.6	3.6	3.6	3.6
All-Red Time (s)	2.4	2.4	2.4	2.4	2.4	0.0	0.0	0.0	0.0	0.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effect Green (s)	32.1	32.1	32.1	32.1	32.1	49.9	49.9	49.9	49.9	49.9
Actuated g/C Ratio	0.36	0.36	0.36	0.36	0.36	0.55	0.55	0.55	0.55	0.55
v/c Ratio	0.05	0.12	0.08	0.10	0.34	0.54	0.32	0.00	0.16	0.03
Control Delay	19.6	20.2	6.3	20.2	22.9	16.5	11.9	9.0	10.3	3.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.6	20.2	6.3	20.2	22.9	16.5	11.9	9.0	10.3	3.8
LOS	B	C	A	C	C	B	B	A	B	A
Approach Delay		15.3			22.4		14.3		9.4	
Approach LOS		B			C		B		A	

**Intersection Summary**  
 Cycle Length: 90  
 Actuated Cycle Length: 90  
 Offset: 58 (64%), Referenced to phase 2:NBT and 6:SBT, Start of Green  
 Natural Cycle: 50  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.54  
 Intersection Signal Delay: 15.4  
 Intersection Capacity Utilization 49.9%  
 Analysis Period (min) 15  
 Intersection LOS: B  
 ICU Level of Service A

Splits and Phases: 18: Joe Mann & Jefferson

↑ ø2 53.9 s	→ ø4 36.1 s
↓ ø6 53.9 s	← ø8 36.1 s



PM-2003

HCS2000: Two-Lane Highways Release 4.1c

DLZ

Phone: Fax:  
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst Agency/Co. DLZ  
Date Performed 10/06/05  
Analysis Time Period PM Peak  
Highway Joe Mann  
From/To Eastman / Jefferson  
Jurisdiction City of Midland  
Analysis Year 2003  
Description

Input Data

Highway class	Class 1	Peak-hour factor, PHF	0.92
Shoulder width	2.0 ft	% Trucks and buses	2 %
Lane width	12.0 ft	% Trucks crawling	0.0 %
Segment length	1.0 mi	Truck crawl speed	0.0 mi/hr
Terrain type	Level	% Recreational vehicles	0 %
Grade: Length	mi	% No-passing zones	100 %
Up/down	%	Access points/mi	10 /mi

Analysis direction volume, Vd 1032 veh/h  
Opposing direction volume, Vo 981 veh/h

Average Travel Speed

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.5*	1.5*
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adj. factor,(note-5) fHV	0.990	0.990
Grade adj. factor,(note-1) fG	1.00	1.00
Directional flow rate,(note-2) vi	1133 pc/h	1077 pc/h

$V_p = 1133 + 1077 = 2210 \text{ pc/h}$

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM - mi/h  
Observed volume,(note-3) Vf - veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS ~~45.0~~ mi/h = 37 mph  
Adj. for lane and shoulder width,(note-3) fLS 2.6 mi/h  
Adj. for access points,(note-3) fA 2.5 mi/h

Free-flow speed, FFSd  $38.9 \text{ mi/h} = 37 - 2.6 - 2.5 = 31.9 \text{ mph}$

Adjustment for no-passing zones, fnp 1.1 mi/h  
Average travel speed, ATSD  $24.7 \text{ mi/h} = 31.9 - 0.00776(2210) - 1.1 = 13.6 \text{ mph}$

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.5*	1.5*
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.990	0.990
Grade adjustment factor,(note-1) fG	1.00	1.00
Directional flow rate,(note-2) vi	1133 pc/h	1077 pc/h
Base percent time-spent-following,(note-4) BPTSFd	90.0 %	

PM-2003

Adjustment for no-passing zones, fnp 5.7  
 Percent time-spent-following, PTSFd 95.7 %

Level of Service and Other Performance Measures

Level of service, LOS E ✓  
 Volume to capacity ratio, v/c 0.67  
 Peak 15-min vehicle-miles of travel, VMT15 280 veh-mi  
 Peak-hour vehicle-miles of travel, VMT60 1032 veh-mi  
 Peak 15-min total travel time, TT15 12.9 veh-h

- Notes:
1. If the highway is extended segment (level) or rolling terrain, fG = 1.0
  2. If  $v_i (v_d \text{ or } v_o) \geq 1,700$  pc/h, terminate analysis-the LOS is F.
  3. For the analysis direction only.
  4. Exhibit 20-21 provides factors a and b.
  5. Use alternative Equation 20-14 if some trucks operate at crawl speeds on a specific downgrade.

Passing Lane Analysis

Total length of analysis segment, Lt 1.0 mi  
 Length of two-lane highway upstream of the passing lane, Lu mi  
 Length of passing lane including tapers, Lpl mi  
 Average travel speed, ATSD (from above) 21.7 mi/h  
 Percent time-spent-following, PTSFd (from above) 95.7  
 Level of service,(note-1) LOSd (from above) E

Average Travel Speed

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde 1.70 mi  
 Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld mi  
 Adj. factor for the effect of passing lane on average speed, fpl 1.11  
 Average travel speed including passing lane,(note-2) ATSpI

Percent Time-Spent-Following

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde 3.60 mi  
 Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld mi  
 Adj. factor for the effect of passing lane on percent time-spent-following, fpl 0.62  
 Percent time-spent-following including passing lane,(note-3) PTSFpl %

Level of Service and Other Performance Measures (note-4)

Level of service including passing lane, LOSpl  
 Peak 15-min total travel time, TT15 veh-h

- Notes:
1. If LOSd = F, passing lane analysis cannot be performed.
  2. If  $L_d < 0$ , use alternative Equation 20-22.
  3. If  $L_d < 0$ , use alternative Equation 20-20.
  4. v/c, VMT15, and VMT60 are calculated on Directional Two-Lane Highway Segment Worksheet.