Technical Memorandum

I-290

Preliminary Engineering and Environmental (Phase I)

Study

West of Mannheim Road to East of Cicero Avenue

Appendix E

Existing Roadway Operations

July 2010

Appendix A-D- (under separate cover)

Appendix E - HCS Analysis Output:

- E-1 Basic Freeway Segment Analysis
- E-2 Ramp Junction Analysis
- E-3 Ramp Weaving Analysis
- **E-4** Interchange Intersection Analysis
 - Existing Intersection Signal Phasing
 - Intersection Traffic Counts 2010-Jan-06
 - Crossroad ADT Volume Adjustment Percentages
 - Ramp Volume Adjustment Percentages
 - Intersection Volume Adjustments
 - Intersection Turn-Lane Storage Analysis
 - Intersection HCS Analysis Output

HCS LOS Methodology for Supersaturated Conditions:

The Highway Capacity Software (HCS) was developed by McTrans as a faithful implementation of the Highway Capacity Manual (HCM) procedures. The HCS uses the information and methodologies from the HCM to determine various degrees of congestion based on roadway and freeway characteristics, such as volume, length of roadways, lane width, and free flow speed. The characteristics are then used to determine levels of service, or degrees of congestion, based on studies that have published and accepted.

The HCM 2000 acknowledges limitations in the ability of the methodology to address oversaturated traffic flow conditions. Oversaturated refers to conditions in which traffic demands exceed the capacity of the facility:

"The freeway facility methodology is limited to the extent that it can accommodate demand in excess of capacity. The procedures address only local oversaturated flow situations, not systemwide oversaturated flow conditions."¹

The methodology for determining the level of service for a basic freeway segment is based on the results of an NCHRP study entitled "Speed-Flow Relationships for Basic Freeway Sections". Traffic counts at each entrance to and exit from the freeway serve as input to the methodology. Whereas entrance counts are considered to represent the current entrance demands for the freeway facility (provided there is NOT a queue), the exit counts may not represent the current exit demands for the freeway due to congestion. Oftentimes, counts taken in congested areas take into account only the demand that is served, not the entire demand. The picture below summarizes the difference between served and unserved demand. The unserved demand usually results in a queue along the freeway. The served demand in oversaturated conditions is when volume equals capacity of the roadway and is considered a LOS E. At any point when volume is over capacity, that is considered a LOS F.



¹ 2000 Highway Capacity Manual, Transportation Research Board, Section 22.1.

The graphic below illustrates the relationship between traffic demand and travel speed. At low flow levels, free flow speeds can generally be maintained. As demand flows near capacity and flow becomes more unstable, speeds begin to drop. The speed at which the facility is at capacity (or at LOS E) is considered Sm. As shown in the figure, once the facility reaches optimum capacity, as demand continues to increase and flow becomes more and more unstable, the actual flow (or "served demand") will begin to decrease, with the remainder ("unserved demand") forming as a queue. The speed-flow relationship is used as the basis for determining level of service for basic freeway segments.



As shown in the illustration below, a traffic count (representing flow rate) that is taken along a freeway will intersect the flow/speed curve twice, unless the traffic count taken is actually the capacity. Without the context of observed flow conditions or speed data, a count taken in oversaturated conditions could be misinterpreted as operating the uncongested flow regime (the top portion of the curve), when the flow is actually representative of breakdown conditions indicative of LOS F. However, without analysis of a broader timeframe and manipulation of the data to represent the full demand conditions, not only the served demand, as outlined in the HCM methodology, HCS analysis, by default, will be based on the upper (uncongested) intersection on the flow/speed curve.



In the case of I-290, observations and speed information indicate that I-290 experiences system wide oversaturated conditions throughout significant portions of the day, including the AM and PM peak periods. As indicated in the Highway Capacity Manual, even the methodology for localized oversaturated conditions is not sufficient to accurately evaluate a facility with system wide congestion. Given this condition, this report considers segments which, based on observations and available volume data, are operating in the congested flow regime (LOS F), contrary to the results of the HCS analysis. The HCS analysis output is annotated to indicate those segments that are oversaturated.

Technical Memorandum

Appendix E-1

Basic Freeway Segment Analysis

I-290 Eastbound

2009 AM I-294 to C-D.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational Analys	i s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Basi	RCT IDOT/PB 12/4/2009 AM I-290 EB I-294 On to C-D Roa 2009 c Freeway Segments	d Off Operation Analys	si s
	Flow Inputs and Ad	justments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE Heavy vehicle adjustment Driver population factor Flow rate, vp	Г Е, ER է, fHV -, fp	1820 0. 95 479 10 0 Level 0. 00 0. 00 1. 5 1. 2 0. 952 1. 00 1006	veh/h V % mi pc/h/l n
	Speed Inputs and A	djustments	
Lane width Right-shoulder lateral of Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, f Lateral clearance adjust Interchange density adju Number of lanes adjustme Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 2 Measured 55.0 0.0 0.0 7.5 4.5 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h
	_LOS and Performanc	e Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of lanes, N Density, D Level of service, LOS	beed, S	1006 55.0 55.0 2 18.3 C	pc/h/l n mi /h mi /h pc/mi /l n

2009 PM I-294 to C-D.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:		
	Operational Analys	i s		
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Basi	RCT IDOT/PB 12/4/2009 PM I-290 EB I-294 On to C-D Roa 2009 c Freeway Segments	d Off Operation Analys	si s	
	Flow Inputs and Ad	justments		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type:		3514 0.95 925 10 0 Level	veh/h v % %	
Grade Segment length Trucks and buses PCE, E Recreational vehicle PCE Heavy vehicle adjustment Driver population factor Flow rate, vp	T E, ER t, fHV r, fp	0.00 0.00 1.5 1.2 0.952 1.00 1295	% mi pc∕h∕l n	
	Speed Inputs and A	djustments		
Lane width Right-shoulder lateral of Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, f Lateral clearance adjust	clearance fLW tment, fLC	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0	ft ft interchange/mi mi/h mi/h mi/h	
Interchange density adju Number of Lanes adjustme Free-flow speed, FFS	ustment, flD ent, fN	7.5 3.0 55.0 Urban Freeway	mi /h mi /h mi /h	
LOS and Performance Measures				
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of Lanes, N Density, D Level of service, LOS	peed, S	1295 55.0 55.0 3 23.5 C	pc/h/ln mi/h mi/h pc/mi/ln	

 $\ensuremath{\mathsf{Overall}}$ results are not computed when free-flow speed is less than 55 mph.

2009 AM C-D Before Lane Drop.txt

HCS+: Basic Freeway Segments Release 5.4

Fax: Phone: E-mail: _Operational Analysis_____ Anal yst: RCT Agency or Company: I DOT/PB 12/4/2009 Date Performed: AM Peak Analysis Time Period: Freeway/Direction: I-290 EB From/To: C-D Road before Lane Drop Jurisdiction: Analysis Year: 2009 Description: I-290 Basic Freeway Segments Operation Analysis Flow Inputs and Adjustments Volume, V 1400 veh/h Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 368 ν Trucks and buses 15 % % Recreational vehicles 0 Terrain type: Level Grade 0.00 % Segment Length 0.00 mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.930 Driver population factor, fp 1.00 792 Flow rate, vp pc/h/ln _Speed Inputs and Adjustments_ 12.0 ft Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of lanes, N 2 Free-flow speed: Measured FFS or BFFS 55.0 mi/h 0.0 Lane width adjustment, fLW mi/h Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD Number of Lanes adjustment, fN Free-flow speed, FFS 7.5 mi/h 4.5 mi/h 55.0 mi /h **Urban Freeway** LOS and Performance Measures 792 Flow rate, vp pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S Number of Lanes, N 55.0 mi/h 2 Density, D Level of service, LOS 14.4 pc/mi/ln В Overall results are not computed when free-flow speed is less than 55 mph. Speed and volume conditions occurring in the field indicate over-saturated conditions

indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual method.

2009 PM C-D Before Lane Drop.txt

HCS+: Basic Freeway Segments Release 5.4

Fax: Phone: E-mail: _Operational Analysis_____ Anal yst: RCT Agency or Company: I DOT/PB 12/4/2009 Date Performed: Analysis Time Period: PM Peak Freeway/Direction: I-290 EB From/To: C-D Road before Lane Drop Jurisdiction: Analysis Year: 2009 Description: I-290 Basic Freeway Segments Operation Analysis Flow Inputs and Adjustments Volume, V 1900 veh/h Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 500 ν Trucks and buses 15 % Recreational vehicles % 0 Terrain type: Level Grade 0.00 % Segment Length 0.00 mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.930 Driver population factor, fp 1.00 Flow rate, vp 1075 pc/h/ln _Speed Inputs and Adjustments_ 12.0 ft Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of lanes, N 2 Free-flow speed: Measured 55.0 mi/h FFS or BFFS Lane width adjustment, fLW mi/h 0.0 Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD Number of Lanes adjustment, fN Free-flow speed, FFS 7.5 mi/h 4.5 mi/h 55.0 mi /h **Urban Freeway** LOS and Performance Measures Flow rate, vp 1075 pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S Number of Lanes, N 55.0 mi/h 2 Density, D Level of service, LOS 19.5 pc/mi/ln С Overall results are not computed when free-flow speed is less than 55 mph. Speed and volume conditions occurring in the field indicate over-saturated conditions

indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual method.

2009 AM C-D Before Merge.txt

HCS+: Basic Freeway Segments Release 5.4

Fax: Phone: E-mail: _Operational Analysis_____ Anal yst: RCT Agency or Company: I DOT/PB 12/4/2009 Date Performed: Analysis Time Period: AM Peak Freeway/Direction: I-290 EB From/To: C-D Road before Merge (1 lane) Jurisdiction: 2009 Analysis Year: Description: I-290 Basic Freeway Segments Operation Analysis ___Flow Inputs and Adjustments_ Volume, V 2800 veh/h Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 737 ν Trucks and buses 15 % % Recreational vehicles 0 Terrain type: Level Grade 0.00 % 0.00 Segment length mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.930 Driver population factor, fp 1.00 Flow rate, vp 1584 pc/h/ln Speed Inputs and Adjustments_ 12.0 ft Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of lanes, N 2 Free-flow speed: Measured 55.0 FFS or BFFS mi/h 0.0 Lane width adjustment, fLW mi/h Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD Number of Lanes adjustment, fN Free-flow speed, FFS 7.5 mi/h 4.5 mi/h 55.0 mi /h **Urban Freeway** LOS and Performance Measures Flow rate, vp 1584 pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S Number of Lanes, N 55.0 mi /h 2 Density, D Level of service, LOS 28.8 pc/mi/ln D Overall results are not computed when free-flow speed is less than 55 mph.

2009 PM C-D Before Merge.txt

HCS+: Basic Freeway Segments Release 5.4

Fax: Phone: E-mail: _Operational Analysis_____ Anal yst: RCT Agency or Company: I DOT/PB 12/4/2009 Date Performed: PM Peak Analysis Time Period: Freeway/Direction: I-290 EB From/To: C-D Road before Merge (1 lane) Jurisdiction: 2009 Analysis Year: Description: I-290 Basic Freeway Segments Operation Analysis ___Flow Inputs and Adjustments_ Volume, V 3800 veh/h Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 1000 ν Trucks and buses 15 % % Recreational vehicles 0 Terrain type: Level Grade 0.00 % 0.00 Segment length mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.930 Driver population factor, fp 1.00 Flow rate, vp 2150 pc/h/ln Speed Inputs and Adjustments_ ft 12.0 Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of Ianes, N 2 Free-flow speed: Measured 55.0 mi/h FFS or BFFS Lane width adjustment, fLW 0.0 mi/h Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD 7.5 mi/h Number of lanes adjustment, fN Free-flow speed, FFS 4.5 mi/h 55.0 mi /h **Urban Freeway** LOS and Performance Measures Flow rate, vp 2150 pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S Number of Lanes, N 52.2 mi/h 2 Density, D Level of service, LOS 41.2 pc/mi/ln F Overall results are not computed when free-flow speed is less than 55 mph. Speed and volume conditions occurring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual

method.

2009 AM C-D Off to I-88 On.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational	Anal ysi s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Basi	RCT IDOT/PB 12/4/2009 AM I-290 EB C-D Road Off 2009 c Freeway Sec	to I-88 On gments Operation Analy	si s
	Flow Inputs	and Adjustments	
Volume, V Dook hour factor DUE		2104	veh/h
Peak four factor, Phr Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade		0.95 554 10 0 Level 0.00	V % %
Trucks and buses PCE, E Recreational vehicle PCI Heavy vehicle adjustmen Driver population factor Flow rate, vp	F E, ER t, fHV ^, fp	0.00 1.5 1.2 0.952 1.00 1163	mi pc∕h∕l n
	Speed Inputs	s and Adjustments	
Lane width Right-shoulder lateral o Interchange density Number of lanes, N Free-flow speed:	cl earance	12.0 6.0 2.00 2 Measured	ft ft interchange/mi
Lane width adjustment, Lateral clearance adjus Interchange density adju Number of Lanes adjustme Free-flow speed, FFS	FLW tment, fLC ustment, fID ent, fN	55.0 0.0 0.0 7.5 4.5 55.0 Urban Freeway	mi /h mi /h mi /h mi /h mi /h mi /h
	_LOS and Pert	formance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of Lanes, N Density, D Level of service, LOS	beed, S	1163 55.0 55.0 2 21.1 C	pc/h/l n mi /h mi /h pc/mi /l n

2009 PM C-D Off to I-88 On.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational	Anal ysi s	
Anal yst: Agency or Company: Date Performed: Anal ysis Time Period: Freeway/Direction: From/To: Jurisdiction: Anal ysis Year: Description: I-290 Basi	RCT I DOT/PB 12/4/2009 PM I-290 EB C-D Road Off 2009 c Freeway Seg	to I-88 On gments Operation Analy	si s
	Flow Inputs	and Adjustments	
Volume, V Deak hour factor DUE		1869	veh/h
Peak-nour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade		0.95 492 10 0 Level 0.00	∨ % %
Segment length Trucks and buses PCE, E Recreational vehicle PC Heavy vehicle adjustmen Driver population factor Flow rate, vp	T E, ER t, fHV ^, fp	0.00 1.5 1.2 0.952 1.00 1033	mi pc∕h∕l n
	Speed Inputs	s and Adjustments	
Lane width Right-shoulder lateral Interchange density Number of lanes, N Free-flow speed:	cl earance	12.0 6.0 2.00 2 Measured	ft ft interchange/mi
FFS or BFFS Lane width adjustment, Lateral clearance adjus Interchange density adju Number of lanes adjustmo Free-flow speed, FFS	FLW tment, fLC ustment, fID ent, fN	55.0 0.0 0.0 7.5 4.5 55.0 Urban Freeway	mi /h mi /h mi /h mi /h mi /h mi /h
	_LOS and Pert	formance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of lanes, N Density, D Level of service, LOS	peed, S	1033 55.0 55.0 2 18.8 C	pc/h/ln mi/h mi/h pc/mi/ln

2009 AM I-88 On to C-D On.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:		
	Operational Analys	i s		
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Basi	RCT IDOT/PB 12/4/2009 AM I-290 EB I-88 On to C-D Road 2009 c Freeway Segments	On Operation Analys	si s	
	Flow Inputs and Ad	justments		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PCI Heavy vehicle adjustmen Driver population factor Flow rate, vp	Г Е, ER t, fHV ^, fp	3940 0.95 1037 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 1452	veh/h v % % mi pc/h/ln	
	Speed Inputs and A	djustments		
Lane width Right-shoulder lateral of Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, t Lateral clearance adjust Interchange density adju Number of lanes adjustme Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h	
LOS and Performance Measures				
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of lanes, N Density, D Level of service, LOS	peed, S	1452 55.0 55.0 3 26.4 D	pc/h/ln mi/h mi/h pc/mi/ln	

2009 PM I-88 On to C-D On.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:		
	Operational Analys	i s		
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Basi	RCT IDOT/PB 12/4/2009 PM I-290 EB I-88 On to C-D Road 2009 c Freeway Segments	On Operation Analys	si s	
	Flow Inputs and Ad	ustments		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PCI Heavy vehicle adjustment Driver population factor Flow rate, vp	Г Е, ER t, fHV ^, fp	3340 0.95 879 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 1231	veh/h v % % mi pc/h/ln	
	Speed Inputs and A	djustments		
Lane width Right-shoulder lateral of Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, f Lateral clearance adjust Interchange density adju Number of lanes adjustme Free-flow speed, FFS	clearance FLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h	
LOS and Performance Measures				
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of lanes, N Density, D Level of service, LOS	beed, S	1231 55.0 55.0 3 22.4 C	pc/h/ln mi/h mi/h pc/mi/ln	

2009 AM 25th Off to 25th SB On.txt

HCS+: Basic Freeway Segments Release 5.4

Fax: Phone: E-mail: _Operational Analysis_____ Anal yst: RCT Agency or Company: I DOT/PB 8/18/2009 Date Performed: Analysis Time Period: AM Freeway/Di recti on: I-290 EB From/To: 25th Off to 25th SB On-ramp Jurisdiction: Analysis Year: 2009 Description: I-290 Basic Freeway Segments Operation Analysis ____Flow Inputs and Adjustments__ Volume, V 5030 veh/h Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 1324 ν Trucks and buses 10 % % Recreational vehicles 0 Terrain type: Level Grade 0.00 % Segment Length 0.00 mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.952 Driver population factor, fp 1.00 Flow rate, vp 1853 pc/h/ln _Speed Inputs and Adjustments_ 12.0 ft Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of lanes, N 3 Free-flow speed: Measured 55.0 FFS or BFFS mi/h 0.0 Lane width adjustment, fLW mi/h Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD Number of Lanes adjustment, fN Free-flow speed, FFS 7.5 mi/h 3.0 mi/h 55.0 mi /h Urban Freeway LOS and Performance Measures Flow rate, vp 1853 pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S Number of Lanes, N 54.9 mi/h 3 Density, D Level of service, LOS 33.7 pc/mi/ln D Overall results are not computed when free-flow speed is less than 55 mph. Speed and volume conditions occurring in the field indicate over-saturated conditions

indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual method.

2009 PM 25th Off to 25th SB On.txt

HCS+: Basic Freeway Segments Release 5.4

Fax: Phone: E-mail: _Operational Analysis_____ Anal yst: RCT Agency or Company: I DOT/PB Date Performed: 8/18/2009 Analysis Time Period: PM Freeway/Direction: I-290 EB From/To: 25th Off to 25th SB On-ramp Juri sdi cti on: 2009 Analysis Year: Description: I-290 Basic Freeway Segments Operation Analysis ___Flow Inputs and Adjustments_ Volume, V 4810 veh/h Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 1266 ν Trucks and buses 9 % 0 % Recreational vehicles Terrain type: Level Grade 0.00 % 0.00 Segment length mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.957 Driver population factor, fp 1.00 Flow rate, vp 1764 pc/h/ln Speed Inputs and Adjustments_ 12.0 ft Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of lanes, N 3 Free-flow speed: Measured FFS or BFFS 55.0 mi/h mi/h Lane width adjustment, fLW 0.0 Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD 7.5 mi/h Number of lanes adjustment, fN Free-flow speed, FFS 3.0 mi/h 55.0 mi /h Urban Freeway LOS and Performance Measures_ Flow rate, vp 1764 pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S Number of Lanes, N 55.0 mi /h 3 Density, D Level of service, LOS 32.1 pc/mi/ln D Overall results are not computed when free-flow speed is less than 55 mph.

2009 AM 25th Off to 25th NB On.txt

HCS+: Basic Freeway Segments Release 5.4

Fax: Phone: E-mail: _Operational Analysis_____ Anal yst: RCT Agency or Company: I DOT/PB Date Performed: 8/18/2009 Analysis Time Period: AM Freeway/Direction: I-290 EB From/To: 25th Off to 25th NB On-ramp Juri sdi cti on: 2009 Analysis Year: Description: I-290 Basic Freeway Segments Operation Analysis __Flow Inputs and Adjustments_ Volume, V veh/h 5200 Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 1368 ν Trucks and buses 10 % % Recreational vehicles 0 Terrain type: Level Grade 0.00 % 0.00 Segment length mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.952 Driver population factor, fp 1.00 Flow rate, vp 1916 pc/h/ln Speed Inputs and Adjustments_ 12.0 ft Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of lanes, N 3 Free-flow speed: Measured FFS or BFFS 55.0 mi/h mi/h Lane width adjustment, fLW 0.0 Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD 7.5 mi/h Number of lanes adjustment, fN Free-flow speed, FFS 3.0 mi/h 55.0 mi /h Urban Freeway LOS and Performance Measures_ 1916 Flow rate, vp pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S Number of Lanes, N 54.7 mi /h 3 Density, D Level of service, LOS 35.0+ pc/mi/ln F Overall results are not computed when free-flow speed is less than 55 mph.

2009 PM 25th Off to 25th NB On.txt

HCS+: Basic Freeway Segments Release 5.4

Fax: Phone: E-mail: _Operational Analysis_____ Anal yst: RCT Agency or Company: I DOT/PB 8/18/2009 Date Performed: Analysis Time Period: PM Freeway/Di recti on: I-290 EB From/To: 25th Off to 25th NB On-ramp Jurisdiction: Analysis Year: 2009 Description: I-290 Basic Freeway Segments Operation Analysis ____Flow Inputs and Adjustments____ Volume, V 5060 veh/h Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 1332 ν Trucks and buses 9 % 0 % Recreational vehicles Terrain type: Level Grade 0.00 % 0.00 Segment length mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.957 Driver population factor, fp 1.00 Flow rate, vp 1855 pc/h/ln _Speed Inputs and Adjustments_ 12.0 ft Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of lanes, N 3 Free-flow speed: Measured 55.0 mi/h FFS or BFFS Lane width adjustment, fLW mi/h 0.0 Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD Number of Lanes adjustment, fN Free-flow speed, FFS 7.5 mi/h 3.0 mi /h 55.0 mi /h Urban Freeway LOS and Performance Measures Flow rate, vp 1855 pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S Number of Lanes, N 54.9 mi /h 3 Density, D Level of service, LOS 33.8 pc/mi/ln D Overall results are not computed when free-flow speed is less than 55 mph. Speed and volume conditions occurring in the field indicate over-saturated conditions

2009 AM 17th Off to 17th On.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax: E-mail: _Operational Analysis_____ Anal yst: RCT Agency or Company: I DOT/PB Date Performed: 8/18/2009 Analysis Time Period: AM Peak Freeway/Direction: I-290 EB From/To: 17th Ave off to 17th Ave On Jurisdiction: Analysis Year: 2009 Description: I-290 Basic Freeway Segments Operation Analysis ____Flow Inputs and Adjustments_ Volume, V 5250 veh/h Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 1382 ν Trucks and buses 10 % % Recreational vehicles 0 Terrain type: Level Grade 0.00 % 0.00 Segment length mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.952 Driver population factor, fp 1.00 Flow rate, vp 1934 pc/h/ln _Speed Inputs and Adjustments_ 12.0 ft Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of lanes, N 3 Free-flow speed: Measured 55.0 FFS or BFFS mi/h Lane width adjustment, fLW mi/h 0.0 Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD Number of Lanes adjustment, fN Free-flow speed, FFS 7.5 mi/h 3.0 mi/h 55.0 mi /h Urban Freeway LOS and Performance Measures Flow rate, vp 1934 pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S Number of Lanes, N 54.6 mi/h 3 Density, D Level of service, LOS 35.4 pc/mi/ln F Overall results are not computed when free-flow speed is less than 55 mph.

2009 PM 17th Off to 17th On.txt

HCS+: Basic Freeway Segments Release 5.4

Fax: Phone: E-mail: _Operational Analysis_____ Anal yst: RCT I DOT/PB Agency or Company: 8/18/2009 Date Performed: Analysis Time Period: PM Freeway/Direction: I-290 EB From/To: 17th Ave Off to 17th Ave On Juri sdi cti on: Analysis Year: 2009 Description: I-290 Basic Freeway Segments Operation Analysis Flow Inputs and Adjustments Volume, V 5070 veh/h Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 1334 ν % Trucks and buses 9 0 % Recreational vehicles Terrain type: Level Grade 0.00 % Segment Length 0.00 mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.957 Driver population factor, fp 1.00 Flow rate, vp 1859 pc/h/ln _Speed Inputs and Adjustments_ 12.0 ft Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of lanes, N 3 Free-flow speed: Measured FFS or BFFS 55.0 mi/h 0.0 Lane width adjustment, fLW mi/h Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD Number of Lanes adjustment, fN Free-flow speed, FFS 7.5 mi/h 3.0 mi/h 55.0 mi /h Urban Freeway LOS and Performance Measures Flow rate, vp 1859 pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S Number of Lanes, N 54.9 mi/h 3 Density, D Level of service, LOS 33.9 pc/mi/ln D Overall results are not computed when free-flow speed is less than 55 mph. Speed and volume conditions occurring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual

method.

2009 AM 17th to 9th.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:		
	Operational	Anal ysi s		
Anal yst: Agency or Company: Date Performed: Anal ysis Time Period: Freeway/Direction: From/To: Jurisdiction: Anal ysis Year: Description: I-290 Basi	RCT IDOT/PB 8/18/2009 AM I-290 EB 17th to 9th 2009 c Freeway Sec	ments Operation Analy	ysi s	
	Flow Inputs	and Adjustments		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCH Heavy vehicle adjustment Driver population factor Flow rate, vp	Г =, ER t, fHV -, fp	5450 0.95 1434 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 2008	veh/h v % % mi	
· •	Speed Inputs	s and Adjustments	•	
Lane width Right-shoulder lateral of Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, f Lateral clearance adjust Interchange density adju Number of lanes adjustme Free-flow speed, FFS	Elearance ELW tment, fLC ustment, flD ent, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi /h mi /h mi /h mi /h mi /h	
LOS and Performance Measures				
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of lanes, N Density, D Level of service, LOS	beed, S	2008 55.0 54.1 3 37.1 E	pc/h/l n mi /h mi /h pc/mi /l n	
Overall results are no	ot computed wh	nen free-flow speed is	s less than 55 mph.	
Speed and volume cond	itions occurring i	n the field indicate over-sat	urated conditions	

2009 PM 17th to 9th.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fax:	
Operationa	al Analysis	
Analyst:RCTAgency or Company:I DOT/PBDate Performed:8/18/2009Analysis Time Period:PMFreeway/Direction:I -290 EBFrom/To:17th to 9thJurisdiction:17th to 9thAnalysis Year:2009Description:I -290 Basic Freeway S	n Gegments Operation Analysis	
Flow Input	s and Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp Flow rate, vp	5370 veh/h 0.95 1413 v 9 % 0 % Level 0.00 % 0.00 mi 1.5 1.2 0.957 1.00 1969 pc/h/l n	
Speed Inpu	its and Adjustments	
Lane width Right-shoulder lateral clearance Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, fLC Interchange density adjustment, flD Number of lanes adjustment, fN	12.0 ft 6.0 ft 2.00 i nterchange/mi 3 Measured 55.0 mi /h 0.0 mi /h 0.0 mi /h 3.0 mi /h 55.0 mi /h	
Free-frow speed, FFS	Urban Freeway	
LOS and Pe	erformance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	1969 pc/h/l n 55.0 mi /h 54.4 mi /h 3 36.2 pc/mi /l n E	
Overall results are not computed	when free-flow speed is less than 55 mph	1.
Speed and volume conditions occurrin	ng in the field indicate over-saturated conditions	٦

indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual method.

2009 AM 9th to 1st.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fax:	
Operational A	Anal ysi s	
Analyst:RCTAgency or Company:I DOT/PBDate Performed:8/18/2009Analysis Time Period:AMFreeway/Direction:I -290 EBFrom/To:9th to 1stJurisdiction:Jurisdiction:Analysis Year:2009Description:I -290 Basic Freeway Segn	nents Operation Analys	si s
Flow Inputs a	and Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp Flow rate, vp	5840 0.95 1537 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 2152	veh/h v % % mi pc/h/l n
Speed Inputs	and Adjustments	
Lane width Right-shoulder lateral clearance Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, fLC Interchange density adjustment, flD Number of lanes adjustment, fN Free-flow speed, FFS	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h
LOS and Perfo	ormance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	2152 55.0 52.2 3 41.3 E	pc/h/ln mi/h mi/h pc/mi/ln
Overall results are not computed whe	en free-flow speed is	less than 55 mph.
Speed and volume conditions occurring in indicative of LOS F, which are not adequate method.	the field indicate over-sature ely evaluated by the Highwa	rated conditions ay Capacity Manual

2009 PM 9th to 1st.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fax:	
Operational	Anal ysi s	
Analyst:RCTAgency or Company:I DOT/PBDate Performed:8/18/2009Analysis Time Period:PMFreeway/Direction:I-290 EBFrom/To:9th to 1stJurisdiction:3009Description:I-290 Basic Freeway Seg	ments Operation Analy	si s
Flow Inputs	and Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp Flow rate, vp	5850 0.95 1539 9 0 Level 0.00 0.00 1.5 1.2 0.957 1.00 2145	veh/h v % % mi pc/h/l n
Speed Inputs	and Adjustments	
Lane width Right-shoulder lateral clearance Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, fLC Interchange density adjustment, flD Number of lanes adjustment, fN Free-flow speed, FFS	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h
LOS and Perf	ormance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	2145 55.0 52.3 3 41.0 E	pc/h/ln mi/h mi/h pc/mi/ln
Overall results are not computed wh	en free-flow speed is	less than 55 mph.
Speed and volume conditions occurring in indicative of LOS F, which are not adequate method.	the field indicate over-satu tely evaluated by the Highw	rated conditions ay Capacity Manual

2009 AM 1st Off to 1st On.txt

HCS+: Basic Freeway Segments Release 5.4

Fax: Phone: E-mail: _Operational Analysis_____ Anal yst: RCT Agency or Company: I DOT/PB Date Performed: 8/18/2009 Analysis Time Period: AM Freeway/Direction: I-290 EB From/To: 1st Off-ramp to 1st On-ramp Juri sdi cti on: 2009 Analysis Year: Description: I-290 Basic Freeway Segments Operation Analysis ___Flow Inputs and Adjustments_ Volume, V 5620 veh/h Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 1479 ν Trucks and buses 10 % % Recreational vehicles 0 Terrain type: Level Grade 0.00 % 0.00 Segment length mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.952 Driver population factor, fp 1.00 Flow rate, vp 2071 pc/h/ln Speed Inputs and Adjustments_ 12.0 ft Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of lanes, N 3 Free-flow speed: Measured FFS or BFFS 55.0 mi/h mi/h Lane width adjustment, fLW 0.0 Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD Number of Lanes adjustment, fN Free-flow speed, FFS 7.5 mi/h 3.0 mi/h 55.0 mi /h **Urban Freeway** LOS and Performance Measures Flow rate, vp 2071 pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S Number of Lanes, N 53.4 mi/h 3 Density, D Level of service, LOS 38.8 pc/mi/ln F Overall results are not computed when free-flow speed is less than 55 mph.

2009 PM 1st Off to 1st On.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax: E-mail: _Operational Analysis_____ Anal yst: RCT Agency or Company: I DOT/PB Date Performed: 8/18/2009 Analysis Time Period: PM Freeway/Direction: I-290 EB From/To: 1st Off-ramp to 1st On-ramp Juri sdi cti on: 2009 Analysis Year: Description: I-290 Basic Freeway Segments Operation Analysis ___Flow Inputs and Adjustments_ Volume, V veh/h 5630 0.95 Peak-hour factor, PHF Peak 15-min volume, v15 1482 ν Trucks and buses 9 % 0 % Recreational vehicles Terrain type: Level Grade 0.00 % 0.00 Segment length mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.957 Driver population factor, fp 1.00 Flow rate, vp 2064 pc/h/ln _Speed Inputs and Adjustments_ 12.0 ft Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of lanes, N 3 Free-flow speed: Measured FFS or BFFS 55.0 mi/h Lane width adjustment, fLW 0.0 mi/h Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD 7.5 mi/h Number of lanes adjustment, fN Free-flow speed, FFS 3.0 mi/h 55.0 mi /h Urban Freeway LOS and Performance Measures 2064 Flow rate, vp pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S 53.5 mi/h Number of lanes, N 3 Density, D Level of service, LOS 38.6 pc/mi/ln F Overall results are not computed when free-flow speed is less than 55 mph.

2009 AM 1st to Des Plaines.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:			Fax:	
	_Operational	Anal ysi	S	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Basi	RCT IDOT/PB 8/18/2009 AM I-290 EB 1st to Des PI 2009 c Freeway Sec	laines gments O	peration Analys	si s
	Flow Inputs	and Adj	ustments	
Volume, V Peak-hour factor, PHF			6240 0. 95	veh/h
Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type:			1642 10 0 Level	V % %
Grade Segment length Trucks and buses PCE, E Recreational vehicle PCI Heavy vehicle adjustmen Driver population factor	「 E, ER t, fHV ^, fp		0.00 0.00 1.5 1.2 0.952 1.00	% mi
Flow rate, vp			2299	pc/h/l n
	Speed Inputs	s and Ad	justments	
Lane width Right-shoulder lateral of Interchange density Number of lanes, N	cl earance		12.0 6.0 2.00 3	ft ft interchange/mi
Free-flow speed: FFS or BFFS Lane width adjustment, 1 Lateral clearance adjust Interchange density adju Number of Lanes adjustme Free-flow speed, FFS	fLW tment, fLC ustment, fID ent, fN		Measured 55.0 0.0 7.5 3.0 55.0 Urban Freeway	mi/h mi/h mi/h mi/h mi/h mi/h
	_LOS and Perf	formance	Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of lanes, N Density, D Level of service, LOS	beed, S		2299 55.0 3 F	pc/h/ln mi/h mi/h pc/mi/ln

2009 PM 1st to Des Plaines.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational An	nal ysi s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Basi	RCT IDOT/PB 8/18/2009 PM I-290 EB 1st to Des Plai 2009 c Freeway Segme	ines ents Operation Analy	si s
	Flow Inputs an	nd Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PCI Heavy vehicle adjustment Driver population factor Flow rate, vp	Г =, ER t, fHV -, fp	6510 0.95 1713 9 0 Level 0.00 0.00 1.5 1.2 0.957 1.00 2387	veh/h V % % mi pc/h/l n
	Speed Inputs a	and Adjustments	
Lane width Right-shoulder lateral of Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, t Lateral clearance adjust Interchange density adju Number of lanes adjustme Free-flow speed, FFS	clearance FLW tment, fLC ustment, flD ent, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi /h mi /h mi /h mi /h mi /h
	_LOS and Perfo	rmance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of lanes, N Density, D Level of service, LOS	beed, S	2387 55.0 3 F	pc/h/ln mi/h mi/h pc/mi/ln

2009 AM Des Plaines to Harlem.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:		
	Operational Analys	i s		
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Basi	RCT IDOT/PB 8/4/2009 AM I-290 EB Des Plaines to Harl 2009 c Freeway Segments	em Operation Analys	si s	
	Flow Inputs and Ad	justments		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PCI Heavy vehicle adjustmen Driver population factor Flow rate, vp	T E, ER t, fHV c, fp	6100 0.95 1605 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 2247	veh/h V % mi pc/h/l n	
Speed Inputs and Adjustments				
Lane width Right-shoulder lateral of Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, T Lateral clearance adjust Interchange density adju Number of lanes adjustme Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h	
LOS and Performance Measures				
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of Lanes, N Density, D Level of service, LOS	peed, S	2247 55.0 50.1 3 44.9 E	pc/h/ln mi/h mi/h pc/mi/ln	

2009 PM Des Plaines to Harlem.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:		
	Operational Analys	i s		
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Basi	RCT IDOT/PB 8/18/2009 PM I-290 EB Des Plaines to Harl 2009 c Freeway Segments	em Operation Analy:	si s	
	Flow Inputs and Ad	justments		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCH Heavy vehicle adjustment Driver population factor Flow rate, vp	Г Е, ER t, fHV -, fp	6240 0.95 1642 9 0 Level 0.00 0.00 1.5 1.2 0.957 1.00 2288	veh/h V % mi pc/h/l n	
Speed Inputs and Adjustments				
Lane width Right-shoulder lateral of Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, f Lateral clearance adjust Interchange density adju Number of lanes adjustme Free-flow speed, FFS	clearance FLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h	
LOS and Performance Measures				
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of lanes, N Density, D Level of service, LOS	beed, S	2288 55.0 3 F	pc/h/ln mi/h mi/h pc/mi/ln	

2009 AM Harlem Off to Harlem On.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:		
	Operational Analys	si s		
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Bas	RCT IDOT/PB 8/4/2009 AM I-290 EB Harlem Off-ramp to 2009 ic Freeway Segments	Harlem On Operation Analy	si s	
	Flow Inputs and Ad	ljustments		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PC Heavy vehicle adjustmen Driver population facto Flow rate, vp	T E, ER t, fHV r, fp	5850 0.95 1539 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 2155	veh/h v % % mi pc/h/l n	
Speed Inputs and Adjustments				
Lane width Right-shoulder lateral Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, Lateral clearance adjus Interchange density adj Number of lanes adjustm Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h	
LOS and Performance Measures				
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of Lanes, N Density, D Level of service, LOS	peed, S	2155 55.0 52.1 3 41.4 E	pc/h/l n mi /h mi /h pc/mi /l n	

2009 PM Harlem Off to Harlem On.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:		
	Operational Analys	si s		
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Bas	RCT IDOT/PB 8/18/2009 PM I-290 EB Harlem Off-ramp to 2009 ic Freeway Segments	Harlem On Operation Analy	si s	
	Flow Inputs and Ac	ljustments		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PC Heavy vehicle adjustmen Driver population facto Flow rate, vp	T E, ER t, fHV r, fp	5780 0.95 1521 9 0 Level 0.00 0.00 1.5 1.2 0.957 1.00 2119	veh/h v % % mi pc/h/l n	
	Speed Inputs and A	djustments		
Lane width Right-shoulder lateral Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, Lateral clearance adjus Interchange density adjustme Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h	
LOS and Performance Measures				
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of Lanes, N Density, D Level of service, LOS	peed, S	2119 55.0 52.7 3 40.2 E	pc/h/ln mi/h mi/h pc/mi/ln	

2009 AM Harlem to Austin.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
0pera0	ational Analysi	S	
Analyst:RCTAgency or Company:I DOT/FDate Performed:8/18/2Analysis Time Period:AMFreeway/Direction:I -290From/To:HarlenJurisdiction:Jurisdiction:Analysis Year:2009Description:I -290Basic Free	PB 2009 EB n to Austin eway Segments O	peration Analys	si s
FI ow	Inputs and Adj	ustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, FHV		6670 0.95 1755 10 0 Level 0.00 0.00 1.5 1.2 0.952	veh/h v % % % mi
Flow rate, vp		2457	pc/h/l n
Speed	l Inputs and Ad	justments	
Lane width Right-shoulder lateral clearar Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, Interchange density adjustment Number of lanes adjustment, fN Free-flow speed, FFS	fLC , fID I	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h
LOS and Performance Measures			
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	5	2457 55.0 3 F	pc/h/ln mi/h mi/h pc/mi/ln

2009 PM Harlem to Austin.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:		
	Operational Ar	nal ysi s		
Anal yst: Agency or Company: Date Performed: Anal ysis Time Period: Freeway/Direction: From/To: Jurisdiction: Anal ysis Year: Description: I-290 Basi	RCT IDOT/PB 8/18/2009 PM I-290 EB Harlem to Austi 2009 c Freeway Segme	n ents Operation Analy	si s	
	Flow Inputs ar	nd Adjustments		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PCI Heavy vehicle adjustmen Driver population factor Flow rate, vp	Γ Ξ, ER է, fHV -, fp	6610 0.95 1739 9 0 Level 0.00 0.00 1.5 1.2 0.957 1.00 2424	veh/h V % % mi pc/h/l n	
Speed Inputs and Adjustments				
Lane width Right-shoulder lateral of Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, t Lateral clearance adjust Interchange density adju Number of lanes adjustme Free-flow speed, FFS	clearance FLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h	
LOS and Performance Measures				
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of lanes, N Density, D Level of service, LOS	beed, S	2424 55.0 3 F	pc/h/ln mi/h mi/h pc/mi/ln	
2009 AM Austin Off to Austin On.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational Analys	i s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Bas	RCT IDOT/PB 8/18/2009 AM I-290 EB Austin Off to Austi 2009 ic Freeway Segments	n On Operation Analy	si s
	Flow Inputs and Ad	justments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PC Heavy vehicle adjustmen Driver population facto Flow rate, vp	T E, ER t, fHV r, fp	6490 0.95 1708 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 2391	veh/h V % % mi pc/h/l n
	Speed Inputs and A	djustments	
Lane width Right-shoulder lateral Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, Lateral clearance adjus Interchange density adj Number of lanes adjustm Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h
LOS and Derfermance Measures			
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of lanes, N Density, D Level of service, LOS	peed, S	2391 55.0 3 F	pc/h/ln mi/h mi/h pc/mi/ln

2009 PM Austin Off to Austin On.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational Analys	i s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Bas	RCT IDOT/PB 8/18/2009 PM I-290 EB Austin Off to Austi 2009 ic Freeway Segments	n On Operation Analy	si s
	Flow Inputs and Ad	justments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PC Heavy vehicle adjustmen Driver population facto Flow rate, vp	T E, ER t, fHV r, fp	6150 0.95 1618 9 0 Level 0.00 0.00 1.5 1.2 0.957 1.00 2255	veh/h V % mi pc/h/l n
	Speed Inputs and A	djustments	
Lane width Right-shoulder lateral Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, Lateral clearance adjus Interchange density adjust Number of lanes adjustme Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h
	_LOS and Performanc	e Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of Lanes, N Density, D Level of service, LOS	peed, S	2255 55.0 3 F	pc/h/ln mi/h mi/h pc/mi/ln

2009 AM Austin to Central.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fax:		
Operat	tional Analysis		
Anal yst:RCTAgency or Company:I DOT/PEDate Performed:8/18/20Data ysis Time Period:AMFreeway/Direction:I -290 EFrom/To:AustinJurisdiction:Anal ysis Year:Anal ysis Year:2009Description:I -290 Basic Freeway	3 DO9 EB to Central vay Segments Operation Ana	l ysi s	
Flow I	nputs and Adjustments		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp Flow rate, vp	7670 0.95 2018 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 2119	veh∕h v % % mi pc∕h/l n	
Speed	Inputs and Adjustments		
Lane width Right-shoulder lateral clearand Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, fl Interchange density adjustment, fN Free-flow speed, FFS	12.0 6.0 2.00 4 Measured 55.0 0.0 fLC 6.0 fID 7.5 1.5 55.0 Urban Freewa	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h y	
LOS and Performance Measures			
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	2119 55. 0 52. 7 4 40. 2 E	pc/h/ln mi/h mi/h pc/mi/ln	
Overall results are not compu	uted when free-flow speed	is less than 55 mph.	

Page 1

2009 PM Austin to Central.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	_Operational A	nal ysi s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Basi	RCT IDOT/PB 8/18/2009 PM I-290 EB Austin to Cent 2009 c Freeway Segm	ral ents Operation An	al ysi s
	_Flow Inputs a	nd Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment Length Trucks and buses PCE, ET Recreational vehicle PCE Heavy vehicle adjustment Driver population factor Flow rate, vp	, ER , fHV , fp	7110 0.95 1871 9 0 Level 0.00 0.00 1.5 1.2 0.957 1.00 1955	veh∕h v % % mi pc∕h/l n
	_Speed Inputs	and Adjustments	
Lane width Right-shoulder lateral of Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, f Lateral clearance adjust Interchange density adju Number of lanes adjustme Free-flow speed, FFS	learance LW ment, fLC Istment, fID nt, fN	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freew	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h mi/h
LOS and Performance Measures			
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of lanes, N Density, D Level of service, LOS	eed, S	1955 55.0 54.5 4 35.9 E	pc/h/ln mi/h mi/h pc/mi/ln
Overall results are no	t computed whe	n free-flow speed	is less than 55 mph.

Page 1

2009 AM Central Off to Central On.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational Analys	i s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Basi	RCT IDOT/PB 8/18/2009 AM I-290 EB Central Off-ramp to 2009 c Freeway Segments	Central On Operation Analys	si s
	Flow Inputs and Ad	justments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PCI Heavy vehicle adjustmen Driver population factor Flow rate, vp	Г Е, ER t, fHV ^, fp	7360 0.95 1937 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 2034	veh/h V % mi pc/h/l n
	Speed Inputs and A	djustments	
Lane width Right-shoulder lateral of Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, t Lateral clearance adjust Interchange density adju Number of lanes adjustme Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h
	_LOS and Performanc	e Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of lanes, N Density, D Level of service, LOS	peed, S	2034 55. 0 53. 9 4 37. 8 E	pc/h/ln mi/h mi/h pc/mi/ln

2009 PM Central Off to Central On.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational Analys	i s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Bas	RCT IDOT/PB 8/18/2009 PM I-290 EB Central Off-ramp to 2009 ic Freeway Segments	Central On Operation Analy	si s
	Flow Inputs and Ad	justments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PC Heavy vehicle adjustmen Driver population facto Flow rate, vp	T E, ER t, fHV r, fp	6530 0.95 1718 9 0 Level 0.00 0.00 1.5 1.2 0.957 1.00 1796	veh/h V % % mi pc/h/l n
	Speed Inputs and A	djustments	
Lane width Right-shoulder lateral Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, Lateral clearance adjus Interchange density adj Number of lanes adjustm Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h
		Urban Freeway	
	LUS and Performanc	e measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of Lanes, N Density, D Level of service, LOS	peed, S	1796 55.0 55.0 4 32.7 D	pc/h/In mi /h mi /h pc/mi /In

2009 AM Central to Laramie.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
(Operational Analys	si s	
Analyst:R(Agency or Company:IIDate Performed:8/Analysis Time Period:AMFreeway/Direction:I-From/To:CeJurisdiction:Analysis Year:Analysis Year:20Description:I-290 Basic	CT DOT/PB /18/2009 M -290 EB entral to Laramie DO9 Freeway Segments	Operation Analys	si s
F	Flow Inputs and Ac	ljustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, Heavy vehicle adjustment, Driver population factor, Flow rate, vp	ER fHV fp	7980 0. 95 2100 10 0 Level 0. 00 0. 00 1. 5 1. 2 0. 952 1. 00 2205	veh/h v % mi pc/h/I n
	Speed Inputs and A	djustments	
Lane width Right-shoulder lateral cle Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustme Interchange density adjust Number of lanes adjustment Free-flow speed, FFS	earance N ent, fLC tment, fID t, fN	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h
l	_OS and Performand	e Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car spee Number of lanes, N Density, D Level of service, LOS	ed, S	2205 55.0 51.1 4 43.2 E	pc/h/ln mi/h mi/h pc/mi/ln

2009 PM Central to Laramie.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fax:	
Operational Analys	si s	
Anal yst:RCTAgency or Company:I DOT/PBDate Performed:8/18/2009Anal ysis Time Period:PMFreeway/Direction:I -290 EBFrom/To:Central to LaramieJurisdiction:Jurisdiction:Anal ysis Year:2009Description:I -290 Basic Freeway Segments	Operation Analy	si s
Flow Inputs and Ac	ljustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp	7130 0.95 1876 9 0 Level 0.00 0.00 1.5 1.2 0.957 1.00	veh/h v % % mi
Flow rate, vp	1961	pc/h/l n
Speed Inputs and A	djustments	
Lane width Right-shoulder lateral clearance Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, fLC Interchange density adjustment, flD Number of lanes adjustment, fN Free-flow speed, FFS	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h
LOS and Performanc	e Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	1961 55. 0 54. 5 4 36. 0 E	pc/h/ln mi/h mi/h pc/mi/ln

2009 AM Cicero to Kostner.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	_Operational Analy	vsi s	
Analyst:RAgency or Company:IDate Performed:8Analysis Time Period:AFreeway/Direction:IFrom/To:0Jurisdiction:1Analysis Year:2Description:I-290 Basic	RCT DOT/PB 3/18/2009 M -290 EB Cicero to Kostner 2009 CFreeway Segments	s Operation Analy	si s
	Flow Inputs and A	djustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, Heavy vehicle adjustment, Driver population factor	ER fHV fo	7350 0.95 1934 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00	veh/h v % % mi
Flow rate, vp	. h	2031	pc/h/l n
	Speed Inputs and	Adjustments	
Lane width Right-shoulder lateral cl Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fL Lateral clearance adjustm Interchange density adjus Number of lanes adjustmer Free-flow speed, FFS	earance W hent, fLC stment, fID ht, fN	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h
LOS and Performance Measures			
Flow rate, vp Free-flow speed, FFS Average passenger-car spe Number of Lanes, N Density, D Level of service, LOS	eed, S	2031 55.0 53.9 4 37.7 E	pc/h/ln mi/h mi/h pc/mi/ln

2009 PM Cicero to Kostner.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational Ar	nal ysi s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Basi	RCT IDOT/PB 8/18/2009 PM I-290 EB Cicero to Kostr 2009 c Freeway Segme	ner ents Operation Analy	rsi s
	Flow Inputs ar	nd Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles		6860 0.95 1805 9 0	veh/h v % %
Grade Segment Length Trucks and buses PCE, E Recreational vehicle PC Heavy vehicle adjustmen Driver population factor	T E, ER t, fHV c, fn	Level 0. 00 0. 00 1. 5 1. 2 0. 957 1. 00	% mi
Flow rate, vp	, , , , , , , , , , , , , , , , , , , ,	1887	pc/h/l n
	Speed Inputs a	and Adjustments	
Lane width Right-shoulder lateral Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, Lateral clearance adjus Interchange density adjustment	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5	ft ft i nterchange/mi mi /h mi /h mi /h mi /h
Free-flow speed, FFS	•	55.0 Urban Freeway	mi /h
	_LOS and Perfor	mance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of Lanes, N Density, D Level of service, LOS	peed, S	1887 55. 0 54. 8 4 34. 4 D	pc/h/l n mi /h mi /h pc/mi /l n

2009 AM Kostner to Independence.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational Analy	/si s	
Anal yst: Agency or Company: Date Performed: Anal ysis Time Period: Freeway/Direction: From/To: Jurisdiction: Anal ysis Year: Description: I-290 Basi	RCT IDOT/PB 8/18/2009 AM I-290 EB Kostner to Indeper 2009 c Freeway Segments	ndence s Operation Analy	rsi s
	Flow Inputs and A	Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE Heavy vehicle adjustment Driver population factor Flow rate, vp	- -, ER -, fHV -, fp	7990 0.95 2103 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 2208	veh/h v % % mi pc/h/l n
	Speed Inputs and	Adjustments	
Lane width Right-shoulder lateral of Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, f Lateral clearance adjust Interchange density adju Number of lanes adjustme Free-flow speed, FFS	clearance FLW ment, fLC ustment, flD ent, fN	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h
LOS and Performance Measures			
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of Lanes, N Density, D Level of service, LOS	beed, S	2208 55.0 51.0 4 43.3 E	pc/h/ln mi/h mi/h pc/mi/ln
Overall results are no	ot computed when fr	ree-flow speed is	less than 55 mph.

Page 1

2009 PM Kostner to Independence.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mai I :		Fax:	
	_Operational Analy	si s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Basi	RCT IDOT/PB 8/18/2009 PM I-290 EB Kostner to Indepen 2009 c Freeway Segments	dence Operation Analy	'si s
	_Flow Inputs and A	djustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE Heavy vehicle adjustment Driver population factor Flow rate, vp	, ER , fHV , fp	7590 0.95 1997 9 0 Level 0.00 0.00 1.5 1.2 0.957 1.00 2087	veh/h v % % mi pc/h/l n
	_Speed Inputs and	Adjustments	
Lane width Right-shoulder lateral c Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, f Lateral clearance adjust Interchange density adju Number of lanes adjustme Free-flow speed, FFS	learance LW ment, fLC stment, fID nt, fN	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h
LOS and Performance Measures			
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of lanes, N Density, D Level of service, LOS	eed, S	2087 55.0 53.2 4 39.2 E	pc/h/l n mi /h mi /h pc/mi /l n
Overall results are no	t computed when fr	ee-flow speed is	less than 55 mph.

Page 1

2009 AM Independence to Homan.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational	Anal ysi s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Basi	RCT I DOT/PB 8/18/2009 AM I -290 EB I ndependence 2009 c Freeway Sec	to Homan gments Operation Analy	si s
	Flow Inputs	and Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15		8020 0. 95 2111	veh/h
Trucks and buses Recreational vehicles Terrain type:		10 0 Level 0,00	% %
Segment length Trucks and buses PCE, E Recreational vehicle PCI Heavy vehicle adjustmen Driver population factor Flow rate, vp	T E, ER t, fHV ^, fp	0.00 1.5 1.2 0.952 1.00 2216	mi pc∕h/l n
	Speed Inputs	s and Adjustments	
Lane width Right-shoulder lateral o Interchange density Number of lanes, N Free-flow speed:	cl earance	12.0 6.0 2.00 4 Measured	ft ft interchange/mi
FFS or BFFS Lane width adjustment, Lateral clearance adjus Interchange density adju Number of Lanes adjustme Free-flow speed, FFS	FLW tment, fLC ustment, fID ent, fN	55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	mi /h mi /h mi /h mi /h mi /h mi /h
LOS and Performance Measures			
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of Lanes, N	peed, S	2216 55.0 50.8 4	pc/h/ln mi/h mi/h
Density, D Level of service, LOS		43.6 E	pc/mi/ln

2009 PM Independence to Homan.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:		
	_0perational	Anal ysi s		
Anal yst: Agency or Company: Date Performed: Anal ysis Time Period: Freeway/Direction: From/To: Jurisdiction: Anal ysis Year: Description: I-290 Basi	RCT I DOT/PB 8/18/2009 PM I -290 EB I ndependence 2009 c Freeway Seg	to Homan gments Operation Analy	rsi s	
	_Flow Inputs	and Adjustments		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE Heavy vehicle adjustment Driver population factor Flow rate, vp	- , ER , fHV , fp	7370 0.95 1939 9 0 Level 0.00 0.00 1.5 1.2 0.957 1.00 2027	veh/h v % % mi pc/h/l n	
	Speed Inputs	s and Adjustments		
Lane width Right-shoulder lateral of Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, f Lateral clearance adjust Interchange density adju Number of lanes adjustme Free-flow speed, FFS	Elearance ELW Ement, fLC Istment, fID ent, fN	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h	
LOS and Performance Measures				
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of Lanes, N Density, D Level of service, LOS	beed, S	2027 55.0 53.9 4 37.6 E	pc/h/ln mi/h mi/h pc/mi/ln	
Overall results are no	ot computed wh	nen free-flow speed is	less than 55 mph.	

Page 1

2009 AM Sacramento to Western.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	_Operational Analys	i s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Basi	RCT IDOT/PB 8/18/2009 AM I-290 EB Sacramento to Weste 2009 c Freeway Segments	ern Operation Analys	si s
	_Flow Inputs and Ac	ljustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE Heavy vehicle adjustment Driver population factor Flow rate, vp	, ER , fHV , fp	7750 0.95 2039 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 2141	veh/h V % mi pc/h/I n
	_Speed Inputs and A	djustments	
Lane width Right-shoulder lateral c Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, f Lateral clearance adjust Interchange density adju Number of lanes adjustme Free-flow speed, FFS	learance LW ment, fLC stment, fID nt, fN	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h
LOS and Performance Measures			
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of lanes, N Density, D Level of service, LOS	eed, S	2141 55.0 52.4 40.9 E	pc/h/ln mi/h mi/h pc/mi/ln

2009 PM Sacramento to Western.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
Oper	ational Analysi	s	
Analyst:RCTAgency or Company:IDOT/Date Performed:8/18/Analysis Time Period:PMFreeway/Direction:I-290From/To:SacraJurisdiction:Analysis Year:Analysis Year:2009Description:I-290 Basic Free	PB 2009 EB mento to Wester eway Segments (rn Operation Analys	si s
FI ow	Inputs and Adj	ustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment Length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp		7220 0.95 1900 9 0 Level 0.00 0.00 1.5 1.2 0.957 1.00	veh/h v % % mi
Flow rate, vp		1986	pc/h/l n
Spee	d Inputs and A	djustments	
Lane width Right-shoulder lateral cleara Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, Interchange density adjustmen Number of lanes adjustment, f Free-flow speed, FFS	nce fLC t, fID N	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h
LOS and Performance Measures			
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, Number of lanes, N Density, D Level of service, LOS	S	1986 55.0 54.3 4 36.6 E	pc/h/ln mi/h mi/h pc/mi/ln

I-290 Westbound

2009 AM I-88 to I-294.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
0	perational Analysi	S	
Analyst:RCAgency or Company:ID0Date Performed:12,Analysis Time Period:AMFreeway/Direction:I-2From/To:I-8Jurisdiction:Analysis Year:Analysis Year:200Description:I-290Basic I	T OT/PB /4/2009 290 WB 88 Off to I-294 01 09 Freeway Segments (ff-ramp Operation Analys	si s
FI	low Inputs and Adj	ustments	
Volume, V Peak-hour factor, PHF		3430 0. 95	veh/h
Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade		903 10 0 Level 0.00	V % % %
Trucks and buses PCE, ET Recreational vehicle PCE, Heavy vehicle adjustment, f Driver population factor, f Flow rate, vp	ER fHV fp	0.00 1.5 1.2 0.952 1.00 1896	mi pc/h/l n
Si	peed Inputs and Ad	djustments	
Lane width Right-shoulder lateral clea Interchange density Number of lanes, N Free-flow speed:	arance	12.0 6.0 0.50 2 Measured	ft ft interchange/mi
FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustmen Interchange density adjustr Number of Lanes adjustment, Free-flow speed, FFS	nt, fLC ment, fID , fN	55.0 0.0 0.0 0.0 4.5 55.0 Urban Freeway	mi /h mi /h mi /h mi /h mi /h mi /h
LOS and Performance Measures			
Flow rate, vp Free-flow speed, FFS Average passenger-car speed Number of Lanes, N Density, D	d, S	1896 55.0 54.8 2 34.6	pc/h/ln mi/h mi/h pc/mi/ln
Level of Service, LUS		U	

2009 PM I-88 to I-294.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fax:			
Operati	onal Analysis			
Anal yst:RCTAgency or Company:I DOT/PBDate Performed:12/4/200Anal ysis Time Period:PMFreeway/Direction:I -290 WBFrom/To:I -88 OffJuri sdiction:Juri sdiction:Anal ysis Year:2009Description:I -290 Basic Freeway	9 to I-294 Off-ramp by Segments Operation Analy	ysi s		
Flow In	puts and Adjustments			
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp Flow rate, vp	3524 0.95 927 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 1947	veh/h v % % mi pc/h/l n		
Speed I	nputs and Adjustments			
Lane width Right-shoulder lateral clearance Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, fL Interchange density adjustment, Number of lanes adjustment, fN Free-flow speed, FFS	12.0 6.0 0.50 2 Measured 55.0 0.0 6.0 fID 0.0 4.5 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h		
LOS and Performance Measures				
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	1947 55. 0 54. 6 2 35. 7 E	pc/h/ln mi/h mi/h pc/mi/ln		
Overall results are not comput	ed when free-flow speed is	s less than 55 mph.		

Phone: Fax: E-mail: _____Operational Analysis______ Analyst: RCT Agency or Company: IDOT/PB 12/4/2009 Date Performed: Analysis Time Period: Freeway/Direction: I-290 WB From/To: Wolf Road Off-ramp to I-88 Off Jurisdiction: Analysis Year: 2009 Description: I-290 Basic Freeway Segments Operation Analysis _____Flow Inputs and Adjustments_____ Volume, V 7100 veh/h Peak-hour factor, PHF 0.95 1868 Peak 15-min volume, v15 v Trucks and buses 10 % Recreational vehicles 8 0 Terrain type: Level 0.00 % Grade 0.00 Segment length mi Trucks and buses PCE, ET 1.5 Recreational vehicle PCE, ER 1.2 Heavy vehicle adjustment, fHV 0.952 Driver population factor, fp 1.00 Flow rate, vp 1962 pc/h/ln _____Speed Inputs and Adjustments_____ Lane width 12.0 ft Right-shoulder lateral clearance 6.0 ft 0.50 Interchange density interchange/mi Number of lanes, N 4 Free-flow speed: Measured FFS or BFFS 55.0 mi/h Lane width adjustment, fLW 0.0 mi/h Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, fID 0.0 mi/h Number of lanes adjustment, fN 1.5 mi/h Free-flow speed, FFS 55.0 mi/h Urban Freeway _____LOS and Performance Measures_____LOS and Performance Measures_____ pc/h/ln Flow rate, vp 1962 55.0 Free-flow speed, FFS mi/h 54.5 Average passenger-car speed, S mi/h Number of lanes, N 4 Density, D 36.0 pc/mi/ln

Phone: Fax: E-mail: _____Operational Analysis______ Analyst: RCT Date Performed: 12/4/200 Analysis T 12/4/2009 Analysis Time Period: PM Freeway/Direction: I-290 WB From/To: Wolf Road Off-ramp to I-88 Off Jurisdiction: Analysis Year: 2009 Description: I-290 Basic Freeway Segments Operation Analysis _____Flow Inputs and Adjustments_____ Volume, V 6930 veh/h Peak-hour factor, PHF 0.95 1824 Peak 15-min volume, v15 v Trucks and buses 10 % Recreational vehicles 0 8 Terrain type: Level 0.00 % Grade 0.00 Segment length mi Trucks and buses PCE, ET 1.5 Recreational vehicle PCE, ER 1.2 Heavy vehicle adjustment, fHV 0.952 Driver population factor, fp 1.00 Flow rate, vp 1915 pc/h/ln _____Speed Inputs and Adjustments_____ Lane width 12.0 ft Right-shoulder lateral clearance 6.0 ft 0.50 Interchange density interchange/mi Number of lanes, N 4 Free-flow speed: Measured FFS or BFFS 55.0 mi/h Lane width adjustment, fLW 0.0 mi/h Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, fID 0.0 mi/h Number of lanes adjustment, fN 1.5 mi/h Free-flow speed, FFS 55.0 mi/h Urban Freeway _____LOS and Performance Measures_____LOS and Performance Measures_____ pc/h/ln Flow rate, vp 1915 55.0 Free-flow speed, FFS mi/h 54.7 Average passenger-car speed, S mi/h Number of lanes, N 4 Density, D 35.0pc/mi/ln

Phone: E-mail:		Fax:		
	Operational Analys	i s		
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Mai	RCT IDOT/PB 8/4/2009 AM I-290 WB Mannheim NB On to 2009 nline Operations Ana	Mann. SB On Lysis		
	Flow Inputs and Ad	justments		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PC Heavy vehicle adjustmen Driver population facto Flow rate, vp	T E, ER t, fHV r, fp	7020 0. 95 1847 10 0 Level 0. 00 0. 00 1. 5 1. 2 0. 952 1. 00 1940	veh/h V % mi pc/h/l n	
	Speed Inputs and A	djustments		
Lane width Right-shoulder lateral Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, Lateral clearance adjus Interchange density adj Number of lanes adjustm Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h	
LOS and Performance Measures				
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of Lanes, N Density, D Level of service, LOS	peed, S	1940 55.0 54.6 4 35.5 E	pc/h/l n mi /h mi /h pc/mi /l n	

 $\ensuremath{\mathsf{Overall}}$ results are not computed when free-flow speed is less than 55 mph.

Phone: E-mail:		Fax:		
	Operational Analys	i s		
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Mai	RCT IDOT/PB 8/4/2009 PM Peak I-290 WB Mannheim NB On to 2009 nline Operations Ana	Mann. SB On Iysis		
	Flow Inputs and Ad	justments		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PC Heavy vehicle adjustmen Driver population facto Flow rate, vp	T E, ER t, fHV r, fp	6740 0.95 1774 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 1862	veh/h v % % mi pc/h/l n	
	Speed Inputs and A	djustments		
Lane width Right-shoulder lateral Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, Lateral clearance adjus Interchange density adj Number of lanes adjustm Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h	
LOS and Performance Measures				
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of Lanes, N Density, D Level of service, LOS	peed, S	1862 55. 0 54. 9 4 33. 9 D	pc/h/l n mi /h mi /h pc/mi /l n	

Phone: E-mail:		Fax:		
	Operational Analys	ii s		
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Mai	RCT IDOT/PB 8/4/2009 AM I-290 WB Mannheim Off to Mar 2009 nline Operations Ana	nheim NB On Iysis		
	Flow Inputs and Ac	ljustments		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PC Heavy vehicle adjustmen Driver population facto Flow rate, vp	T E, ER t, fHV r, fp	6380 0.95 1679 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 2351	veh/h v % % mi pc/h/l n	
	Speed Inputs and A	djustments		
Lane width Right-shoulder lateral Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, Lateral clearance adjus Interchange density adj Number of lanes adjustm Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h	
LOS and Performance Measures				
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of lanes, N Density, D Level of service, LOS	peed, S	2351 55.0 3 F	pc/h/ln mi/h mi/h pc/mi/ln	

Phone: E-mail:		Fax:		
<u> </u>	Operational Analys	i s		
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Mai	Rct IDOT/PB 8/4/2009 PM I-290 WB Mannheim Off to Mar 2009 nline Operations Ana	nheim NB On Iysis		
	Flow Inputs and Ac	ljustments		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PC Heavy vehicle adjustmen Driver population facto Flow rate, vp	T E, ER t, fHV r, fp	6210 0.95 1634 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 2288	veh/h V % % mi pc/h/l n	
	Speed Inputs and A	djustments		
Lane width Right-shoulder lateral Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, Lateral clearance adjus Interchange density adj Number of lanes adjustm Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h	
LOS and Performance Measures				
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of Lanes, N Density, D Level of service, LOS	peed, S	2288 55.0 3 F	pc/h/l n mi /h mi /h pc/mi /l n	

2009 AM 25th Off to 25th On.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
<u> </u>	Operational Analys	i s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: 1-290 Basi	RCT IDOT/PB 8/4/2009 AM I-290 WB 25th SB Off to 25th 2009 ic Freeway Segments	On Operation Analy	si s
	Flow Inputs and Ad	justments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PC Heavy vehicle adjustmen Driver population factor Flow rate, vp	T E, ER t, fHV r, fp	6530 0.95 1718 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 2406	veh/h V % mi pc/h/l n
	Speed Inputs and A	djustments	
Lane width Right-shoulder lateral Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, Lateral clearance adjus Interchange density adju Number of lanes adjustme Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 0.50 3 Measured 55.0 0.0 0.0 0.0 3.0 55.0	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h
	LOS and Porformanc		
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of lanes, N Density, D Level of service, LOS	peed, S	2406 55.0 3 F	pc/h/ln mi/h mi/h pc/mi/ln

2009 PM 25th Off to 25th On.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:		
	Operational Analys	i s		
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Main	RCT IDOT/PB 8/4/2009 PM I-290 WB 25th SB Off to 25th Existing 2009 nline Operations Ana	On I ysi s		
	Flow Inputs and Ad	justments		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PC Heavy vehicle adjustmen Driver population facto Flow rate, vp	T E, ER t, fHV r, fp	6300 0.95 1658 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 2321	veh/h V % mi pc/h/l n	
	Speed Inputs and A	djustments		
Lane width Right-shoulder lateral Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, Lateral clearance adjus Interchange density adjustme Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h	
LOS and Performance Measures				
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of Lanes, N Density, D Level of service, LOS	peed, S	2321 55.0 3 F	pc/h/l n mi /h mi /h pc/mi /l n	

2009 AM 25th Off to 25th SB Off.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational Analys	i s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Bas	RCT IDOT/PB 8/4/2009 AM I-290 WB 25th Off to 25th SB 2009 ic Freeway Segments	Off Operation Analy	si s
	Flow Inputs and Ad	justments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PC Heavy vehicle adjustmen Driver population facto Flow rate, vp	T E, ER t, fHV r, fp	6830 0.95 1797 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 2516	veh/h V % % mi pc/h/l n
	Speed Inputs and A	djustments	
Lane width Right-shoulder lateral Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, Lateral clearance adjus Interchange density adj Number of lanes adjustm Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 0.50 3 Measured 55.0 0.0 0.0 0.0 0.0 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h
LOS and Performance Measures			
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of Lanes, N Density, D Level of service, LOS	peed, S	2516 55.0 3 F	pc/h/l n mi /h mi /h pc/mi /l n

2009 PM 25th Off to 25th SB Off.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational Analys	i s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Main	RCT IDOT/PB 8/4/2009 PM I-290 WB 25th Off to 25th SB Existing 2009 nline Operations Ana	Off I ysi s	
	Flow Inputs and Ad	ustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PC Heavy vehicle adjustmen Driver population facto Flow rate, vp	T E, ER t, fHV r, fp	6550 0.95 1724 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 2413	veh/h V % mi pc/h/l n
	Speed Inputs and A	djustments	
Lane width Right-shoulder lateral Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, Lateral clearance adjus Interchange density adj Number of lanes adjustme Free-flow speed, FFS	clearance fLW tment, fLC ustment, flD ent, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h
LOS and Performance Measures			
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of Lanes, N Density, D Level of service, LOS	peed, S	2413 55.0 3 F	pc/h/ln mi/h mi/h pc/mi/ln

2009 AM 25th to Mannheim superseded.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fax:		
Operat	ional Analysis		
Analyst:RJPAgency or Company:I DOT/PEDate Performed:8/4/200Analysis Time Period:AMFreeway/Direction:I -290 MFrom/To:25th toJurisdiction:Jurisdiction:Analysis Year:2009Description:I -290 Mainline Op	3 09 VB o Mannheim perations Analysis		
Flow I	nputs and Adjustments		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp Flow rate, vp	7300 0.95 1921 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 2017	veh/h v % % mi pc/h/l n	
Speed Inputs and Adjustments			
Lane width Right-shoulder lateral clearand Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, f Interchange density adjustment, fN Free-flow speed, FFS	2. 0 6. 0 2. 00 4 Measured 55. 0 0. 0 6 FLC 0. 0 fID 7. 5 1. 5 55. 0 Urban Freewa	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h	
LOS and Performance Measures			
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	2017 55.0 54.0 4 37.3 E	pc/h/l n mi /h mi /h pc/mi /l n	
Overall results are not compu	ited when free-flow speed	is less than 55 mph.	

2009 PM 25th to Mannheim superseded.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fax:		
Operational Ar	nal ysi s		
Analyst:RJPAgency or Company:I DOT/PBDate Performed: $8/4/2009$ Analysis Time Period:PMFreeway/Direction:I -290 WBFrom/To: 25 th to MannheiJurisdiction:Analysis Year:Analysis Year: 2009 Description:I -290 Mainline Operations	m s Analysis		
Flow Inputs an	nd Adjustments		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp Flow rate, vp	6790 0.95 1787 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 1876	veh∕h v % % mi pc∕h∕l n	
Speed Inputs a	and Adjustments		
Lane width Right-shoulder lateral clearance Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, fLC Interchange density adjustment, flD Number of lanes adjustment, fN Free-flow speed, FFS	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freewa	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h	
LOS and Performance Measures			
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	1876 55.0 54.9 4 34.2 D	pc/h/l n mi /h mi /h pc/mi /l n	
Overall results are not computed wher	n free-flow speed	is less than 55 mph.	

Page 1

2009 AM 17th to 25th superseded.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fax:		
Operational An	al ysi s		
Anal yst:RJPAgency or Company:I DOT/PBDate Performed:8/4/2009Anal ysis Time Period:AMFreeway/Direction:I -290 WBFrom/To:17th to 25thJurisdiction:Jurisdiction:Anal ysis Year:2009Description:I -290 Basic Freeway Segment	nts Operation Ana	al ysi s	
Flow Inputs and	d Adjustments		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp Flow rate, vp	6980 0.95 1837 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 1929	veh/h v % % mi pc/h/l n	
Speed Inputs a	nd Adjustments		
Lane width Right-shoulder lateral clearance Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, fLC Interchange density adjustment, flD Number of lanes adjustment, fN Free-flow speed, FFS	12.0 6.0 0.50 4 Measured 55.0 0.0 0.0 0.0 1.5 55.0 Urban Freewa	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h mi/h	
LOS and Performance Measures			
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	1929 55.0 54.7 4 35.3 E	pc/h/l n mi /h mi /h pc/mi /l n	
Overall results are not computed when	free-flow speed	is less than 55 mph.	

Page 1

2009 PM 17th to 25th superseded.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fax:			
Operational Ana	ıl ysi s			
Analyst:RJPAgency or Company:I DOT/PBDate Performed:8/4/2009Analysis Time Period:PMFreeway/Direction:I-290 WBFrom/To:17th to 25thJurisdiction:Analysis Year:Analysis Year:Existing 2009Description:I-290 Mainline Operations	Anal ysi s			
Flow Inputs and	Adjustments			
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp Flow rate, vp	6700 0.95 1763 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 1851	veh/h v % % mi pc/h/l n		
Speed Inputs and Adjustments				
Lane width Right-shoulder lateral clearance Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, fLC Interchange density adjustment, flD Number of lanes adjustment, fN Free-flow speed, FFS	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h		
LOS and Performance Measures				
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	1851 55.0 54.9 4 33.7 D	pc/h/l n mi /h mi /h pc/mi /l n		
Overall results are not computed when free-flow speed is less than 55 mph.				

2009 AM 17th Off to 17th On.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational Analys	si s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Bas	RCT IDOT/PB 8/4/2009 AM I-290 WB 17th Off-ramp to 17 2009 ic Freeway Segments	'th n-ramp Operation Analy	si s
	Flow Inputs and Ac	ljustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PC Heavy vehicle adjustmen Driver population facto Flow rate, vp	T E, ER t, fHV r, fp	6390 0.95 1682 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 2354	veh/h v % % mi pc/h/l n
	Speed Inputs and A	djustments	
Lane width Right-shoulder lateral Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, Lateral clearance adjus Interchange density adj Number of lanes adjustm Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h
LOS and Performance Measures			
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of lanes, N Density, D Level of service, LOS	peed, S	2354 55.0 3 F	pc/h/ln mi/h mi/h pc/mi/ln
2009 PM 17th Off to 17th On.txt

HCS+: Basic Freeway Segments Release 5.4

Fax: Phone: E-mail: _Operational Analysis_____ Anal yst: RCT Agency or Company: I DOT/PB Date Performed: 8/4/2009 Analysis Time Period: PM Freeway/Direction: I-290 WB From/To: 17th Off-ramp to 17th On-ramp Juri sdi cti on: 2009 Analysis Year: Description: I-290 Basic Freeway Segments Operation Analysis __Flow Inputs and Adjustments_ Volume, V 6220 veh/h Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 1637 ν Trucks and buses 3 % % Recreational vehicles 0 Terrain type: Level Grade 0.00 % 0.00 Segment length mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.985 Driver population factor, fp 1.00 Flow rate, vp 2215 pc/h/ln Speed Inputs and Adjustments_ 12.0 ft Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of lanes, N 3 Free-flow speed: Measured FFS or BFFS 55.0 mi/h mi/h Lane width adjustment, fLW 0.0 Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD 7.5 mi/h Number of lanes adjustment, fN Free-flow speed, FFS 3.0 mi /h 55.0 mi /h Urban Freeway LOS and Performance Measures_ Flow rate, vp 2215 pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S Number of Lanes, N 50.9 mi /h 3 Density, D Level of service, LOS 43.6 pc/mi/ln F Overall results are not computed when free-flow speed is less than 55 mph. Speed and volume conditions occurring in the field indicate over-saturated conditions

indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual

2009 AM 9th to 17th.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational	Anal ysi s	
Anal yst: Agency or Company: Date Performed: Anal ysis Time Period: Freeway/Direction: From/To: Jurisdiction: Anal ysis Year: Description: 1-290 Basi	RJP IDOT/PB 8/4/2009 AM I-290 WB 9th to 17th 2009 C Freeway Sec	uments Operation Analy	sis
	Flow Inputs	and Adjustments	
Volume, V		6470	veh/h
Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PCI Heavy vehicle adjustmen Driver population factor	T E, ER t, fHV r, fp	0.95 1703 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00	V % % mi
Flow rate, vp	Created Langette	2384	pc/h/l n
	Speed Inputs	s and Adjustments	
Lane width Right-shoulder lateral of Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, T Lateral clearance adjust Interchange density adjust Number of lanes adjustmo Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft i nterchange/mi mi /h mi /h mi /h mi /h mi /h
	_LOS and Pert	formance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of Lanes, N Density, D Level of service, LOS	peed, S	2384 55. 0 3 F	pc/h/ln mi/h mi/h pc/mi/ln

2009 PM 9th to 17th.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational	Anal ysi s	
Anal yst: Agency or Company: Date Performed: Anal ysis Time Period: Freeway/Direction: From/To: Jurisdiction: Anal ysis Year: Description: I-290 Basi	RJP IDOT/PB 8/4/2009 PM I-290 WB 9th to 17th 2009 c Freeway Sec	gments Operation Analy	si s
	Flow Inputs	and Adjustments	
Volume, V		6370	veh/h
Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade		0.95 1676 3 0 Level 0.00	V % %
Trucks and buses PCE, E Recreational vehicle PCI Heavy vehicle adjustmen Driver population factor Flow rate, vp	T E, ER t, fHV ^, fp	1.5 1.2 0.985 1.00 2269	pc/h/l n
	Speed Inputs	s and Adjustments	
Lane width Right-shoulder lateral o Interchange density Number of lanes, N Free-flow speed:	cl earance	12.0 6.0 2.00 3 Measured	ft ft interchange/mi
Lane width adjustment, t Lateral clearance adjust Interchange density adju Number of Lanes adjustme Free-flow speed, FFS	FLW tment, fLC ustment, fID ent, fN	55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	mi/h mi/h mi/h mi/h mi/h mi/h
	_LOS and Pert	formance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of lanes, N Density, D Level of service, LOS	peed, S	2269 55.0 3 F	pc/h/ln mi/h mi/h pc/mi/ln

2009 AM 1st to 9th.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational	Anal ysi s	
Anal yst: Agency or Company: Date Performed: Anal ysis Time Period: Freeway/Direction: From/To: Jurisdiction: Anal ysis Year: Description: I-290 Basi	RJP IDOT/PB 8/4/2009 AM I-290 WB 1st to 9th 2009 c Freeway Seg	gments Operation Analy	si s
	Flow Inputs	and Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PCI Heavy vehicle adjustmen Driver population factor Flow rate, vp	Г Е, ER t, fHV ^, fp	6570 0.95 1729 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 2421	veh/h V % mi pc/h/l n
	Speed Inputs	s and Adjustments	
Lane width Right-shoulder lateral of Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, T Lateral clearance adjus Interchange density adju Number of lanes adjustme Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h
	_LOS and Pert	formance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of lanes, N Density, D Level of service, LOS	beed, S	2421 55.0 3 F	pc/h/l n mi /h mi /h pc/mi /l n

2009 PM 1st to 9th.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational	Anal ysi s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Basi	RJP IDOT/PB 8/4/2009 PM I-290 WB 1st to 9th 2009 c Freeway Sec	ments Operation Analy	si s
	Flow Inputs	and Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PCI Heavy vehicle adjustmen Driver population factor Flow rate, vp	Г Е, ER t, fHV ^, fp	6560 0.95 1726 3 0 Level 0.00 0.00 1.5 1.2 0.985 1.00 2336	veh/h V % % mi pc/h/l n
	Speed Inputs	and Adjustments	
Lane width Right-shoulder lateral of Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, T Lateral clearance adjust Interchange density adju Number of lanes adjustmo Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h
	_LOS and Perf	Formance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of lanes, N Density, D Level of service, LOS	beed, S	2336 55.0 3 F	pc/h/l n mi /h mi /h pc/mi /l n

2009 AM 1st Off to 1st On.txt

HCS+: Basic Freeway Segments Release 5.4

Fax: Phone: E-mail: _Operational Analysis_____ Anal yst: RCT I DOT/PB Agency or Company: Date Performed: 8/4/2009 Analysis Time Period: AM Freeway/Direction: I-290 WB From/To: 1st Off-ramp to 1st On-ramp Jurisdiction: 2009 Analysis Year: Description: I-290 Basic Freeway Segments Operation Analysis ___Flow Inputs and Adjustments_ Volume, V veh/h 6500 Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 1711 ν Trucks and buses 10 % % Recreational vehicles 0 Terrain type: Level Grade 0.00 % 0.00 Segment length mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.952 Driver population factor, fp 1.00 Flow rate, vp 2395 pc/h/ln _Speed Inputs and Adjustments_ 12.0 ft Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of lanes, N 3 Free-flow speed: Measured 55.0 FFS or BFFS mi/h Lane width adjustment, fLW mi/h 0.0 Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD 7.5 mi/h Number of lanes adjustment, fN Free-flow speed, FFS 3.0 mi/h 55.0 mi /h Urban Freeway LOS and Performance Measures_ Flow rate, vp 2395 pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S Number of Lanes, N mi/h 3 Density, D Level of service, LOS pc/mi/ln F Overall results are not computed when free-flow speed is less than 55 mph.

Speed and volume conditions occurring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual method.

2009 PM 1st Off to 1st On.txt

HCS+: Basic Freeway Segments Release 5.4

Fax: Phone: E-mail: _Operational Analysis_____ Anal yst: RCT Agency or Company: I DOT/PB Date Performed: 8/4/2009 Analysis Time Period: PM Freeway/Direction: I-290 WB From/To: 1st Off-ramp to 1st On-ramp Jurisdiction: Analysis Year: 2009 Description: I-290 Basic Freeway Segments Operation Analysis ____Flow Inputs and Adjustments___ Volume, V 5990 veh/h Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 1576 ν % Trucks and buses 3 % Recreational vehicles 0 Terrain type: Level Grade 0.00 % Segment length 0.00 mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.985 Driver population factor, fp 1.00 Flow rate, vp 2133 pc/h/ln _Speed Inputs and Adjustments_ 12.0 ft Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of lanes, N 3 Free-flow speed: Measured FFS or BFFS mi/h 55.0 Lane width adjustment, fLW 0.0 mi/h Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD Number of Lanes adjustment, fN Free-flow speed, FFS 7.5 mi/h 3.0 mi /h 55.0 mi/h Urban Freeway LOS and Performance Measures Flow rate, vp 2133 pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S Number of Lanes, N 52.5 mi/h 3 Density, D Level of service, LOS 40.6 pc/mi/ln F

2009 AM Des Plaines to 1st.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational Analys	si s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Basi	RJP IDOT/PB 8/4/2009 AM I-290 WB Des Plaines to 1st 2009 ic Freeway Segments	Operation Analy	si s
	Flow Inputs and Ac	ljustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PCI Heavy vehicle adjustment Driver population factor	T E, ER t, fHV r, fp	6500 0.95 1711 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 2395	veh/h v % % mi
Speed Inputs and Adjustments			
Lane width Right-shoulder lateral of Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, T Lateral clearance adjust Interchange density adju Number of lanes adjustmo Free-flow speed, FFS	fLW fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h
	_LOS and Performanc	e Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of lanes, N Density, D Level of service, LOS	beed, S	2395 55.0 3 F	pc/h/ln mi/h mi/h pc/mi/ln

2009 PM Des Plaines to 1st.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational Analys	si s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Basi	RJP IDOT/PB 8/4/2009 PM I-290 WB Des Plaines to 1st 2009 ic Freeway Segments	Operation Analy	si s
	Flow Inputs and Ac	ljustments	
Volume, V Doak bour factor DUE		6480	veh/h
Peak-nour factor, Phr Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment Length		0.95 1705 3 0 Level 0.00 0.00	V % % mi
Trucks and buses PCE, E Recreational vehicle PCI Heavy vehicle adjustmen Driver population factor Flow rate, vp	T E, ER t, fHV r, fp	1. 5 1. 2 0. 985 1. 00 2308	pc/h/l n
	Speed Inputs and A	djustments	
Lane width Right-shoulder lateral Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment	clearance flw	12.0 6.0 2.00 3 Measured 55.0 0.0	ft ft interchange/mi mi/h mi/h
Lateral clearance adjus Interchange density adju Number of Lanes adjustm Free-flow speed, FFS	ustment, fLC ustment, fID ent, fN	0.0 7.5 3.0 55.0 Urban Freeway	mi /h mi /h mi /h mi /h
LOS and Performance Measures			
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of Lanes, N Density, D Level of service, LOS	peed, S	2308 55.0 3 F	pc/h/ln mi/h mi/h pc/mi/ln

2009 AM Harlem to Des Plaines.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fax:	
Operational A	nal ysi s	
Analyst:RJPAgency or Company:I DOT/PBDate Performed:8/4/2009Analysis Time Period:AMFreeway/Direction:I -290 WBFrom/To:Harlem to DesJurisdiction:Jurisdiction:Analysis Year:2009Description:I -290 Basic Freeway Segm	Plaines ments Operation Analy	si s
Flow Inputs a	nd Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp Flow rate, vp	5800 0.95 1526 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 2137	veh/h v % % mi pc/h/l n
Speed Inputs	and Adjustments	
Lane width Right-shoulder lateral clearance Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, fLC Interchange density adjustment, fID Number of lanes adjustment, fN Free-flow speed, FFS	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h
LOS and Perfo	ormance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	2137 55.0 52.4 3 40.8 E	pc/h/ln mi/h mi/h pc/mi/ln
Overall results are not computed whe	en free-flow speed is	less than 55 mph.

2009 PM Harlem to Des Plaines.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fax:	
Operational Ana	al ysi s	
Analyst:RJPAgency or Company:I DOT/PBDate Performed:8/4/2009Analysis Time Period:PMFreeway/Direction:I -290 WBFrom/To:Harlem to Des PlJurisdiction:Analysis Year:Analysis Year:2009Description:I -290 Basic Freeway Segment	aines nts Operation Analy	si s
Flow Inputs and	d Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp Flow rate, vp	5890 0.95 1550 3 0 Level 0.00 0.00 1.5 1.2 0.985 1.00 2098	veh/h v % % mi pc/h/l n
Speed Inputs an	nd Adjustments	
Lane width Right-shoulder lateral clearance Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, fLC Interchange density adjustment, flD Number of lanes adjustment, fN Free-flow speed, FFS	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h
LOS and Perform	mance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	2098 55. 0 53. 1 3 39. 5 E	pc/h/ln mi/h mi/h pc/mi/ln
Overal I results are not computed when Speed and volume conditions occurring in the indicative of LOS F, which are not adequately of method.	free-flow speed is field indicate over-satura evaluated by the Highwa	less than 55 mph. ated conditions y Capacity Manual

HCS+: Basic Freeway Segments Release 5.4

Fax: Phone: E-mail: _Operational Analysis_____ Anal yst: RCT I DOT/PB Agency or Company: Date Performed: 8/4/2009 Analysis Time Period: AM Freeway/Direction: I-290 WB From/To: Harlem Off to Harlem On Juri sdi cti on: 2009 Analysis Year: Description: I-290 Basic Freeway Segments Operation Analysis ____Flow Inputs and Adjustments__ Volume, V veh/h 5120 Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 1347 ν Trucks and buses 10 % % Recreational vehicles 0 Terrain type: Level Grade 0.00 % 0.00 Segment length mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.952 Driver population factor, fp 1.00 Flow rate, vp 1886 pc/h/ln _Speed Inputs and Adjustments_ 12.0 ft Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of lanes, N 3 Free-flow speed: Measured 55.0 FFS or BFFS mi/h Lane width adjustment, fLW mi/h 0.0 Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD Number of Lanes adjustment, fN Free-flow speed, FFS 7.5 mi/h 3.0 mi /h 55.0 mi /h Urban Freeway LOS and Performance Measures Flow rate, vp 1886 pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S Number of Lanes, N 54.8 mi /h 3 Density, D Level of service, LOS 34.4 pc/mi/ln D Overall results are not computed when free-flow speed is less than 55 mph. Speed and volume conditions occurring in the field indicate over-saturated conditions

indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual method.

HCS+: Basic Freeway Segments Release 5.4

Fax: Phone: E-mail: _Operational Analysis_____ Anal yst: RCT I DOT/PB Agency or Company: Date Performed: 8/4/2009 Analysis Time Period: ΡM Freeway/Direction: I-290 WB From/To: Harlem Off to Harlem On Juri sdi cti on: Analysis Year: 2009 Description: I-290 Basic Freeway Segments Operation Analysis ____Flow Inputs and Adjustments__ Volume, V 5200 veh/h Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 1368 ν Trucks and buses 3 % % Recreational vehicles 0 Terrain type: Level Grade 0.00 % Segment Length 0.00 mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.985 Driver population factor, fp 1.00 Flow rate, vp 1852 pc/h/ln _Speed Inputs and Adjustments_ 12.0 ft Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of lanes, N 3 Free-flow speed: Measured FFS or BFFS 55.0 mi/h 0.0 Lane width adjustment, fLW mi/h Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD Number of Lanes adjustment, fN Free-flow speed, FFS 7.5 mi/h 3.0 mi/h 55.0 mi /h Urban Freeway LOS and Performance Measures Flow rate, vp 1852 pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S Number of Lanes, N 54.9 mi/h 3 Density, D Level of service, LOS 33.7 pc/mi/ln D Overall results are not computed when free-flow speed is less than 55 mph. Speed and volume conditions occurring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual

2009 AM Austin to Harlem.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
(Operational Analys	i s	
Anal yst:R.Agency or Company:IIDate Performed:8/Anal ysis Time Period:AIFreeway/Direction:I-From/To:AuJurisdiction:1Anal ysis Year:20Description:I-290Basic	JP DOT/PB /4/2009 M -290 WB ustin to Harlem DO9 Freeway Segments	Operation Analys	si s
F	Flow Inputs and Ad	justments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, Heavy vehicle adjustment, Driver population factor, Flow rate vp	ER fHV fp	5380 0.95 1416 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 1982	veh/h v % % mi
	Speed Inputs and A	diustments	
Lane width Right-shoulder lateral cle Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment Interchange density adjust Number of lanes adjustment Free-flow speed, FFS	earance N ent, fLC tment, fID t, fN	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h
LOS and Performance Measures			
Flow rate, vp Free-flow speed, FFS Average passenger-car spee Number of Lanes, N Density, D Level of service, LOS	ed, S	1982 55. 0 54. 3 3 36. 5 E	pc/h/ln mi/h mi/h pc/mi/ln
Overall results are not	computed when free	e-flow speed is	less than 55 mph.
Speed and volume condition	ns occurring in the field	indicate over-satura	ted conditions

indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual method.

2009 PM Austin to Harlem.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fax:	
Operational /	Anal ysi s	
Analyst:RJPAgency or Company:I DOT/PBDate Performed:8/4/2009Analysis Time Period:PMFreeway/Direction:I -290 WBFrom/To:Austin to HarlJurisdiction:Analysis Year:Analysis Year:2009Description:I -290 Basic Freeway Segr	em nents Operation Ana	ıl ysi s
Flow Inputs a	and Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp Flow rate, vp	5780 0.95 1521 3 0 Level 0.00 0.00 1.5 1.2 0.985 1.00 2058	veh∕h v % % mi pc∕h/l n
Speed Inputs	and Adjustments	
Lane width Right-shoulder lateral clearance Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, fLC Interchange density adjustment, flD Number of lanes adjustment, fN Free-flow speed, FFS	12.0 6.0 2.00 3 Measured 55.0 0.0 0.0 7.5 3.0 55.0 Urban Freewa	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h
LOS and Perfo	ormance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of lanes, N Density, D Level of service, LOS	2058 55.0 53.6 3 38.4 E	pc/h/l n mi /h mi /h pc/mi /l n
Overall results are not computed whe	en free-flow speed	is less than 55 mph.
Speed and volume conditions occurring in the indicative of LOS F, which are not adequated	he field indicate over-sat ly evaluated by the High	urated conditions way Capacity Manual

2009 AM Austin Off to Austin On.txt

HCS+: Basic Freeway Segments Release 5.4

Fax: Phone: E-mail: _Operational Analysis_____ Anal yst: RCT I DOT/PB Agency or Company: Date Performed: 8/4/2009 Analysis Time Period: AM I-290 WB Freeway/Direction: From/To: Austin Off to Austin On Juri sdi cti on: Analysis Year: 2009 Description: I-290 Basic Freeway Segments Operation Analysis ____Flow Inputs and Adjustments_ Volume, V 4850 veh/h Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 1276 ν Trucks and buses 10 % % Recreational vehicles 0 Terrain type: Level Grade 0.00 % Segment Length 0.00 mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.952 Driver population factor, fp 1.00 Flow rate, vp 1787 pc/h/ln _Speed Inputs and Adjustments_ 12.0 ft Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of lanes, N 3 Free-flow speed: Measured FFS or BFFS 55.0 mi/h 0.0 Lane width adjustment, fLW mi/h Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD Number of Lanes adjustment, fN Free-flow speed, FFS 7.5 mi/h 3.0 mi/h 55.0 mi /h Urban Freeway LOS and Performance Measures 1787 Flow rate, vp pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S Number of Lanes, N 55.0 mi/h 3 Density, D Level of service, LOS 32.5 pc/mi/ln D Overall results are not computed when free-flow speed is less than 55 mph. Speed and volume conditions occurring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual

2009 PM Austin Off to Austin On.txt

HCS+: Basic Freeway Segments Release 5.4

Fax: Phone: E-mail: _Operational Analysis_____ Anal yst: RCT I DOT/PB Agency or Company: Date Performed: 8/4/2009 Analysis Time Period: PM Freeway/Direction: I-290 WB From/To: Austin Off to Austin On Juri sdi cti on: 2009 Analysis Year: Description: I-290 Basic Freeway Segments Operation Analysis ___Flow Inputs and Adjustments_ Volume, V veh/h 5310 Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 1397 ν Trucks and buses 3 % % Recreational vehicles 0 Terrain type: Level Grade 0.00 % 0.00 Segment length mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.985 Driver population factor, fp 1.00 Flow rate, vp 1891 pc/h/ln _Speed Inputs and Adjustments_ 12.0 ft Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of lanes, N 3 Free-flow speed: Measured 55.0 FFS or BFFS mi/h Lane width adjustment, fLW mi/h 0.0 Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD Number of Lanes adjustment, fN Free-flow speed, FFS 7.5 mi/h 3.0 mi/h 55.0 mi /h **Urban Freeway** LOS and Performance Measures Flow rate, vp 1891 pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S Number of Lanes, N 54.8 mi /h 3 Density, D Level of service, LOS 34.5 pc/mi/ln D Overall results are not computed when free-flow speed is less than 55 mph. Speed and volume conditions occurring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual

2009 AM Central to Austin.txt

HCS+: Basic Freeway Segments Release 5.4

Fax:
Anal ysi s
Austin egments Operation Analysis
s and Adjustments
5740 veh/h 0.95 1511 v 10 % 0 % Level 0.00 % 0.00 mi 1.5 1.2 0.952 1.00 1586 pc/h/l n
ts and Adjustments
12.0 ft 6.0 ft 2.00 interchange/mi 4 Measured 55.0 mi/h 0.0 mi/h 7.5 mi/h 1.5 mi/h 55.0 mi/h Urban Freeway
formance Measures
1586 pc/h/l n 55.0 mi /h 55.0 mi /h 4 28.8 pc/mi /l n D
when free-flow speed is less than 55 mph.
onal co / / Se outs flD Per

2009 PM Central to Austin.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fax:
Operation	nal Analysis
Anal yst:RJPAgency or Company:I DOT/PBDate Performed:8/4/2009Anal ysis Time Period:PMFreeway/Direction:I -290 WBFrom/To:Central toJuri sdiction:Juri sdiction:Anal ysis Year:2009Description:I -290 Basic Freeway	o Austin Segments Operation Analysis
Flow Inpu	its and Adjustments
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp Flow rate vp	6410 veh/h 0.95 1687 v 3 % 0 % Level 0.00 % 0.00 mi 1.5 1.2 0.985 1.00 1712 pc/h/l n
Speed Inc	buts and Adjustments
Lane width Right-shoulder lateral clearance Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, fLC Interchange density adjustment, fI Number of lanes adjustment, fN Free-flow speed, FFS	12.0 ft 6.0 ft 2.00 interchange/mi 4 Measured 55.0 mi/h 0.0 mi/h 0.0 mi/h D 7.5 mi/h 1.5 mi/h 55.0 mi/h Urban Freeway
LOS and F	Performance Measures
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	1712 pc/h/l n 55.0 mi /h 55.0 mi /h 4 31.1 pc/mi /l n D
Overall results are not computed	when free-flow speed is less than 55 mph.
Speed and volume conditions occurring	in the field indicate over-saturated conditions

indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual method.

2009 AM Central Off to Central On.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax: E-mail: _Operational Analysis_____ Anal yst: RJP Agency or Company: I DOT/PB Date Performed: 8/4/2009 Analysis Time Period: AM Freeway/Di recti on: I-290 WB From/To: Central Off to Central On Jurisdiction: 2009 Analysis Year: Description: I-290 Basic Freeway Segments Operation Analysis ____Flow Inputs and Adjustments____ Volume, V 5240 veh/h Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 1379 ν Trucks and buses 10 % % Recreational vehicles 0 Terrain type: Level Grade 0.00 % 0.00 Segment length mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.952 Driver population factor, fp 1.00 Flow rate, vp 1448 pc/h/ln _Speed Inputs and Adjustments_ 12.0 ft Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of lanes, N 4 Free-flow speed: Measured 55.0 FFS or BFFS mi/h Lane width adjustment, fLW mi/h 0.0 Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD Number of Lanes adjustment, fN Free-flow speed, FFS 7.5 mi/h 1.5 mi /h 55.0 mi /h Urban Freeway LOS and Performance Measures Flow rate, vp 1448 pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S Number of Lanes, N 55.0 mi /h 4 Density, D Level of service, LOS 26.3 pc/mi/ln D Overall results are not computed when free-flow speed is less than 55 mph. Speed and volume conditions occurring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual

2009 PM Central Off to Central On.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax: E-mail: _Operational Analysis_____ Anal yst: RJP Agency or Company: I DOT/PB Date Performed: 8/4/2009 Analysis Time Period: PM Freeway/Di recti on: I-290 WB From/To: Central Off to Central On Jurisdiction: 2009 Analysis Year: Description: I-290 Basic Freeway Segments Operation Analysis ___Flow Inputs and Adjustments_ Volume, V 5750 veh/h Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 1513 ν Trucks and buses 3 % % Recreational vehicles 0 Terrain type: Level Grade 0.00 % 0.00 Segment length mi Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.985 Driver population factor, fp 1.00 Flow rate, vp 1536 pc/h/ln _Speed Inputs and Adjustments_ 12.0 ft Lane width Right-shoulder lateral clearance 6.0 ft Interchange density 2.00 interchange/mi Number of lanes, N 4 Free-flow speed: Measured 55.0 FFS or BFFS mi/h mi/h Lane width adjustment, fLW 0.0 Lateral clearance adjustment, fLC 0.0 mi/h Interchange density adjustment, flD Number of Lanes adjustment, fN Free-flow speed, FFS 7.5 mi/h 1.5 mi /h 55.0 mi /h Urban Freeway LOS and Performance Measures Flow rate, vp 1536 pc/h/ln Free-flow speed, FFS 55.0 mi∕h Average passenger-car speed, S Number of Lanes, N 55.0 mi /h 4 Density, D Level of service, LOS 27.9 pc/mi/ln D Overall results are not computed when free-flow speed is less than 55 mph. Speed and volume conditions occurring in the field indicate over-saturated conditions

indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual method.

2009 AM Laramie to Central.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fax:	
Operational An	al ysi s	
Anal yst:RJPAgency or Company:I DOT/PBDate Performed: $8/4/2009$ Anal ysis Time Period:AMFreeway/Direction:I -290 WBFrom/To:Laramie to CentJuri sdiction:Anal ysis Year:Anal ysis Year:2009Description:I -290 Basic Freeway Segme	ral nts Operation Ana	l ysi s
Flow Inputs an	d Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp Flow rate, vp	5550 0.95 1461 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 1534	veh∕h v % % mi pc∕h/ln
Speed Inputs a	nd Adjustments	
Lane width Right-shoulder lateral clearance Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, fLC Interchange density adjustment, flD Number of lanes adjustment, fN Free-flow speed, FFS	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freewa	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h y
LOS and Perfor	mance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	1534 55.0 55.0 4 27.9 D	pc/h/ln mi/h mi/h pc/mi/ln
Overall results are not computed when	free-flow speed	is less than 55 mph.
Speed and volume conditions occurring in the	field indicate over-sat	urated conditions

indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual method.

2009 PM Laramie to Central.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational A	Anal ysi s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Basi	RJP IDOT/PB 8/4/2009 PM I-290 WB Laramie to Cer 2009 c Freeway Segn	ntral ments Operation Analy	vsi s
	Flow Inputs a	and Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PCI Heavy vehicle adjustmen Driver population factor	T E, ER t, fHV ^, fp	6040 0.95 1589 3 0 Level 0.00 0.00 1.5 1.2 0.985 1.00	veh/h v % % mi
Flow rate, vp	Cread Impute	1013	pc/n/Th
	Speed Inputs	and Adjustments	
Lane width Right-shoulder lateral Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, Lateral clearance adjust Interchange density adjust Number of lanes adjustme Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h
	LOS and Perfo	prmance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of Lanes, N Density, D Level of service, LOS	beed, S	1613 55.0 55.0 4 29.3 D	pc/h/l n mi /h mi /h pc/mi /l n
Overall results are no	ot computed whe	en free-flow speed is	s less than 55 mph.
Speed and volume condi	tions occurring in t	he field indicate over-satur	ated conditions

speed and volume conditions occurring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual method.

2009 AM Cicero to Laramie superseded.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fax:	
Operational Ana	al ysi s	
Anal yst:RTAgency or Company:I DOT/PBDate Performed:9/24/2009Anal ysis Time Period:AMFreeway/Direction:I -290 WBFrom/To:Cicero to LaramiJurisdiction:Jurisdiction:Anal ysis Year:2009Description:I -290 Basic Freeway Segment	ie nts Operation Analy	/si s
Flow Inputs and	d Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp	6100 0.95 1605 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00	veh/h v % % mi
Flow rate, vp	1080 nd Adiustments	pc/n/in
Lane width Right-shoulder lateral clearance Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, fLC Interchange density adjustment, fLD Number of lanes adjustment, fN Free-flow speed, FFS	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h
LOS and Perfor	mance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	1686 55.0 55.0 4 30.7 D	pc/h/l n mi /h mi /h pc/mi /l n
Overall results are not computed when	free-flow speed is	s less than 55 mph.
Speed and volume conditions occurring in the	e field indicate over-satu	rated conditions

indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual method.

2009 AM Kostner to Cicero.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fax:	
Operational Ana	l ysi s	
Analyst:RTAgency or Company:I DOT/PBDate Performed:12/2/2009Analysis Time Period:AMFreeway/Direction:I -290 WBFrom/To:Kostner to CicerJurisdiction:Analysis Year:Analysis Year:2009Description:I -290 Basic Freeway Segmen	o ts Operation Anal	ysi s
Flow Inputs and	Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp Flow rate, vp	5470 0.95 1439 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 1511	veh/h v % % mi pc/h/l n
Speed Inputs an	d Adjustments	
Lane width Right-shoulder lateral clearance Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, fLC Interchange density adjustment, flD Number of lanes adjustment, fN Free-flow speed, FFS	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	ft ft interchange/mi mi /h mi /h mi /h mi /h mi /h
LOS and Perform	ance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	1511 55.0 55.0 4 27.5 D	pc/h/ln mi/h mi/h pc/mi/ln
Overall results are not computed when	free-flow speed i	s less than 55 mph.

2009 PM Kostner to Cicero.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fa	ax:	
0pera	tional Analysis		
Anal yst:RTAgency or Company:I DOT/PDate Performed:12/2/2Anal ysis Time Period:PMFreeway/Direction:I -290From/To:KostneeJuri sdiction:Juri sdiction:Anal ysis Year:2009Description:I -290Basic Free	B 009 WB r to Cicero way Segments Ope	eration Analys	i s
FI ow	Inputs and Adjus	stments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp Flow rate, vp	6 0. 10 10 0 10 0. 0. 1. 1. 0. 1. 1. 0. 1. 1. 0. 1. 1. 0. 1. 1. 0. 1. 0. 1. 0. 1. 0. 1. 0. 0. 1. 0. 0. 1. 0. 0. 1. 0. 0. 0. 1. 0. 0. 1. 0. 0. 1. 0. 0. 0. 1. 0. 0. 1. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	100 . 95 605 0 evel . 00 . 00 . 5 . 2 . 952 . 00 686	veh/h v % % mi pc/h/l n
Speed	Inputs and Adju	ustments	
Lane width Right-shoulder lateral clearan Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, Interchange density adjustment Number of lanes adjustment, fN Free-flow speed, FFS	12 6 2 2 4 Me 55 0 5 5 0 5 5 0 5 5 0 5 5 0 7 1 5 5 0 0 5 1 1 5 5 0 1 1 5 5 1 0 1 5 5 1 0 1 5 1 1 1 1	2.0 .0 .00 easured 5.0 .0 .0 .5 .5 5.0 rban Freeway	ft ft interchange/mi mi /h mi /h mi /h mi /h mi /h
LOS a	nd Performance M	Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	10 55 57 4 30 D	686 5. 0 5. 0 0. 7	pc/h/ln mi/h mi/h pc/mi/ln
uverall results are not comp	uted when free-1	riow speed is	iess than 55 mph.

2009 AM Independence to Kostner.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	_Operational	Anal ysi s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Basi	RT I DOT/PB 12/2/2009 AM I -290 WB I ndependence 2009 c Freeway Seg	to Kostner gments Operation Analy	si s
	_Flow Inputs	and Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE Heavy vehicle adjustment Driver population factor Flow rate, vp	, ER , fHV , fp	6110 0.95 1608 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 1688	veh/h v % % mi pc/h/l n
	_Speed Inputs	s and Adjustments	
Lane width Right-shoulder lateral c Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, f Lateral clearance adjust Interchange density adju Number of lanes adjustme Free-flow speed, FFS	learance LW ment, fLC stment, fID nt, fN	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h
	_LOS and Pert	formance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of lanes, N Density, D Level of service, LOS	eed, S	1688 55. 0 55. 0 4 30. 7 D	pc/h/ln mi/h mi/h pc/mi/ln
Overall results are no	t computed wh	nen free-flow speed is	less than 55 mph.

2009 PM Independence to Kostner.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	_Operational	Anal ysi s	
Anal yst: Agency or Company: Date Performed: Anal ysis Time Period: Freeway/Direction: From/To: Jurisdiction: Anal ysis Year: Description: I-290 Basi	RT IDOT/PB 12/2/2009 PM I-290 WB Independence 2009 c Freeway Seg	to Kostner gments Operation Anal	ysi s
	_Flow Inputs	and Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE Heavy vehicle adjustment Driver population factor Flow rate, vp	, ER , fHV , fp	6700 0.95 1763 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 1851	veh/h v % % mi pc/h/l n
	_Speed Inputs	s and Adjustments	
Lane width Right-shoulder lateral of Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, f Lateral clearance adjust Interchange density adju Number of lanes adjustme Free-flow speed, FFS	Elearance ELW ment, fLC Istment, fID ent, fN	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h
	_LOS and Pert	formance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car sp Number of lanes, N Density, D Level of service, LOS	eed, S	1851 55.0 54.9 4 33.7 D	pc/h/ln mi/h mi/h pc/mi/ln
Overall results are no	ot computed wh	nen free-flow speed i	s less than 55 mph.

2009 AM Homan to Independence.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fax:	
Operational Analys	i s	
Analyst:RTAgency or Company:I DOT/PBDate Performed:12/2/2009Analysis Time Period:AMFreeway/Direction:I -290 WBFrom/To:Homan to IndependenJurisdiction:Analysis Year:Analysis Year:2009Description:I -290 Basic Freeway Segments	ce Operation Analys	si s
Flow Inputs and Ad	justments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp Flow rate, vp	6110 0.95 1608 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 1688	veh/h V % % mi pc/h/l n
Speed Inputs and A	djustments	
Lane width Right-shoulder lateral clearance Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, fLC Interchange density adjustment, flD Number of lanes adjustment, fN Free-flow speed, FFS	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h
LOS and Performanc	e Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	1688 55. 0 55. 0 4 30. 7 D	pc/h/ln mi/h mi/h pc/mi/ln

2009 PM Homan to Independence.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fax:	
Operational Analys	i s	
Analyst:RTAgency or Company:I DOT/PBDate Performed:12/2/2009Analysis Time Period:PMFreeway/Direction:I -290 WBFrom/To:Homan to IndependenJurisdiction:Analysis Year:Analysis Year:2009Description:I -290 Basic Freeway Segments	ce Operation Analys	si s
Flow Inputs and Ad	justments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp Flow rate, vp	6630 0.95 1745 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 1832	veh/h V % mi pc/h/I n
Speed Inputs and A	djustments	
Lane width Right-shoulder lateral clearance Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, fLC Interchange density adjustment, flD Number of lanes adjustment, fN Free-flow speed, FFS	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h
LOS and Performanc	e Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	1832 55.0 55.0 4 33.3 D	pc/h/l n mi /h mi /h pc/mi /l n

2009 AM Western to Sacramento.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:		Fax:	
	Operational Analys	i s	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Bas	RT IDOT/PB 12/2/2009 AM I-290 WB Western to Sacramen 2009 ic Freeway Segments	to Operation Analy	si s
	Flow Inputs and Ad	justments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PC Heavy vehicle adjustmen Driver population facto Flow rate, vp	T E, ER t, fHV r, fp	5930 0.95 1561 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 1639	veh/h V % % mi pc/h/l n
	Speed Inputs and A	djustments	
Lane width Right-shoulder lateral Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, Lateral clearance adjus Interchange density adjustme Free-flow speed, FFS	clearance fLW tment, fLC ustment, fID ent, fN	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0	ft ft interchange/mi mi/h mi/h mi/h mi/h mi/h mi/h
		Urban Freeway	
	_LOS and Performanc	e Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of lanes, N Density, D Level of service, LOS	peed, S	1639 55.0 55.0 4 29.8 D	pc/h/ln mi/h mi/h pc/mi/ln

2009 PM Western to Sacramento.txt

HCS+: Basic Freeway Segments Release 5.4

Phone: E-mail:	Fax:	
Operational Analy	si s	
Analyst:RTAgency or Company:I DOT/PBDate Performed:12/2/2009Analysis Time Period:PMFreeway/Direction:I -290 WBFrom/To:Western to SacrameJurisdiction:Analysis Year:Analysis Year:2009Description:I -290 Basic Freeway Segments	nto Operation Analy	si s
Flow Inputs and A	djustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fp Flow rate, vp	6570 0.95 1729 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00 1815	veh/h v % % mi pc/h/I n
Speed Inputs and	Adjustments	
Lane width Right-shoulder lateral clearance Interchange density Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, fLC Interchange density adjustment, fLD Number of lanes adjustment, fN Free-flow speed, FFS	12.0 6.0 2.00 4 Measured 55.0 0.0 0.0 7.5 1.5 55.0 Urban Freeway	ft ft interchange/mi mi /h mi /h mi /h mi /h mi /h
LOS and Performan	ce Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of Lanes, N Density, D Level of service, LOS	1815 55.0 55.0 4 33.0 D	pc/h/l n mi /h mi /h pc/mi /l n

Technical Memorandum

Appendix E-2

Ramp Junction Analysis

2009AM 17th Ave. Entrance.txt

HCS+: Ramps and Ramp Junctions Release 5.4

KSpence Parsons Brinckerhoff 47 S. Pennsylvania St. Ste. 600 Indianapolis, IN 46204 317-972-1706 Phone: Fax: E-mail: ____Merge Analysis_____ Anal yst: RCT I DOT/PB Agency/Co.: 8/18/2009 Date performed: Analysis time period: Freeway/Dir of Travel: AM Peak I-290 EB 17th Ave. Entrance Ramp Junction: Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Phase 1 Study _Freeway Data_____ Type of analysis Merge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 5250 vph On Ramp Data Side of freeway Ri ght Number of lanes in ramp 1 Free-flow speed on ramp 35.0 mph Volume on ramp 200 vph Length of first accel/decel lane 793 ft Length of second accel/decel lane ft _Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent Ramp 180 vph Position of adjacent Ramp Upstream Type of adjacent Ramp 0'n Distance to adjacent Ramp 2681 ft __Conversion to pc/h Under Base Conditions_ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 5250 200 180 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1382 53 47 v Trucks and buses 10 10 10 % % Recreational vehicles 0 0 \cap Terrain type: Level Level Level % Grade % % Length mi mi mi 1.5 Trucks and buses PCE, ET 1.5 1.5 1.2 1.2 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.952 0.952 0.952 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 5803 221 199 pcph ____Estimation of V12 Merge Areas_ L = (Equation 25-2 or 25-3) EQ Ρ 0.600 Using Equation 1 = Page 1

	E M	2009AM 17th	Ave. Entrance.tx ⁻	t	
	V = V 12 F	(P_) = 3480 FM	pc/h		
		Capaci ty	Checks		
V FO		Actual 6024	Maximum 6750	LOS F? No	
		2323 pc/h	(Equation 25-4	or 25-5)	
Is v v	> 2700 pc	c/h?	No		
Is v v	> 1.5 v	/2	No		
3 or av34 If yes, v = 34 12A	80	2	(Equation 25-8)		
v R12	Flo Actua 3480 Level of S	ow Entering Me al Max 4600 Service Detern	erge Influence Ar Desirable) nination (if not	rea Violation? No F)	
Density, D = 5.47 R Level of service	5 + 0.0073 for ramp-	34 v + 0.0078 R freeway juncti	3 v - 0.00627 L 12 on areas of infl	A uence D	pc/mi/In
		Speed Estin	nation		
Intermediate spee	d variable	e,	$M_{2} = 0.423$		
Space mean speed	in ramp i	nfluence area,	S = 49.5	mph	
Space mean speed	in outer	lanes,	$S_{0}^{R} = 48.3$	mph	
Space mean speed	for all ve	ehi cl es,	S = 49.0	mph	

Speed and volume conditions occurring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual method.

2009PM 17th Ave. Entrance.txt

HCS+: Ramps and Ramp Junctions Release 5.4

KSpence Parsons Brinckerhoff 47 S. Pennsylvania St. Ste. 600 Indianapolis, IN 46204 317-972-1706 Phone: Fax: E-mail: ____Merge Analysis_____ Anal yst: RCT I DOT/PB Agency/Co.: 8/18/2009 Date performed: Analysis time period: Freeway/Dir of Travel: PM Peak I-290 EB 17th Ave. Entrance Ramp Junction: Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Phase 1 Study _Freeway Data_____ Type of analysis Merge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 5070 vph ____On Ramp Data__ Side of freeway Ri ght Number of lanes in ramp 1 Free-flow speed on ramp 35.0 mph Volume on ramp 300 vph Length of first accel/decel lane 793 ft Length of second accel/decel lane ft _Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent Ramp 260 vph Position of adjacent Ramp Upstream Type of adjacent Ramp 0'n Distance to adjacent Ramp 2681 ft __Conversion to pc/h Under Base Conditions_ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 5070 300 260 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1334 79 68 v Trucks and buses 9 5 3 % 0 % Recreational vehicles 0 Ο Level Terrain type: Level Level % Grade % % Length mi mi mi 1.5 Trucks and buses PCE, ET 1.5 1.5 1.2 1.2 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.985 0.957 0.976 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 5577 324 278 pcph ____Estimation of V12 Merge Areas_ L = (Equation 25-2 or 25-3) EQ Ρ 0.600 Using Equation 1 = Page 1
2009PM 17th Ave. Entrance.txt FΜ (P) = 3345 pc/h v = V 12 F FM _Capacity Checks_ LOS F? Actual Maxi mum 5901 6750 V No F0 2232 pc/h (Equation 25-4 or 25-5) v v 3 or av34 > 2700 pc/h? No ls V 3 or av34 ls 1.5 v No /2 v v 12 3 or av34 lf yes, (Equation 25-8) = 3345 v 12A _Flow Entering Merge Influence Area_ ctual Max Desirable Actual Violation? 4600 3345 No v R12 Level of Service Determination (if not F)_ Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = R 12 A 29.0 pc/mi/ln Level of service for ramp-freeway junction areas of influence D _Speed Estimation_ Intermediate speed variable, = 0.418 М S Space mean speed in ramp influence area, S 49.6 mph = R S Space mean speed in outer lanes, = 48.8 mph 0 Space mean speed for all vehicles, S = 49.3 mph

2009AM 9th Ave. Entrance.txt

HCS+: Ramps and Ramp Junctions Release 5.4

KSpence Parsons Brinckerhoff 47 S. Pennsyl vani a St. Ste. 600 Indianapolis, IN 46204 Phone: 317-972-1706 Fax: E-mail: _____Merge Analysis_____ Anal yst: RCT I DOT/PB Agency/Co. : Date performed: 8/18/2009 Analysis time period: AM Peak Freeway/Dir of Travel: I-290 EB 9th Ave. Entrance Ramp Junction: Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Phase 1 Study __Freeway Data_____ Type of analysis Merge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 5450 vph ___On Ramp Data___ Side of freeway Ri ght Number of lanes in ramp 1 Free-flow speed on ramp 35.0 mph Volume on ramp 390 vph Length of first accel/decel lane 325 ft Length of second accel/decel lane ft ___Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent Ramp 220 vph Position of adjacent Ramp Downstream Type of adjacent Ramp 0ff Distance to adjacent Ramp 650 ft __Conversion to pc/h Under Base Conditions_ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 5450 390 220 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1434 103 58 v Trucks and buses 10 10 10 % % Recreational vehicles 0 0 0 Terrain type: Level Level Level Grade % % % Length mi mi mi Trucks and buses PCE, ET 1.5 1.5 1.5 Recreational vehicle PCE, ER 1.2 1.2 1.2 0.952 Heavy vehicle adjustment, fHV 0.952 0.952 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 6024 431 243 pcph ____Estimation of V12 Merge Areas___ = L 1683.12 (Equation 25-2 or 25-3) EQ Ρ 0.647 Using Equation 3 = Page 1

	EM	2009AM 9th	h Ave. Entrance.	txt
	FM V = V (12 F	P) = 3897 FM	pc/h	
		Capacity (Checks	
V FO		Actual 6455	Maximum 6750	LOS F? No
$\sqrt{\sqrt{2}}$		2127 pc/h	(Equation 25-4	or 25-5)
	> 2700 pc	:/h?	No	
Is v v	> 1.5 v	/2	No	
3 or av34 Ifyes, v = 3897 12A	97		(Equation 25-8)	
v R12	Flo Actua 3897 evel of S	w Entering Men I Max I 4600 Gervice Determi	rge Influence Ar Desirable ination (if not	ea Violation? No F)
Density, D = 5.475 R Level of service f	5 + 0.0073 for ramp-f	4 v + 0.0078 R Treeway junctio	v - 0.00627 L 12 on areas of infl	= 37.0 pc/mi/lu A uence E
		Speed Estima	ation	
Intermediate speed	l variable	÷,	M_ = 0.594	
Space mean speed i	n ramp in	fluence area,	S = 47.3	mph
Space mean speed i	n outer I	anes,	R S_ = 49.1	mph
Space mean speed f	for all ve	hi cl es,	S = 47.9	mph

2009PM 9th Ave. Entrance.txt

HCS+: Ramps and Ramp Junctions Release 5.4

KSpence Parsons Brinckerhoff 47 S. Pennsyl vani a St. Ste. 600 Indianapolis, IN 46204 Phone: 317-972-1706 Fax: E-mail: _____Merge Analysis_____ Anal yst: RCT I DOT/PB Agency/Co. : Date performed: 8/18/2009 Analysis time period: PM Peak I-290 EB Freeway/Dir of Travel: Junction: 9th Ave. Entrance Ramp Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Phase 1 Study _Freeway Data_____ Type of analysis Merge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 5370 vph On Ramp Data____ Side of freeway Ri ght Number of lanes in ramp 1 Free-flow speed on ramp 35.0 mph Volume on ramp 480 vph Length of first accel/decel lane ft 325 Length of second accel/decel lane ft ___Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent Ramp 220 vph Position of adjacent Ramp Downstream Type of adjacent Ramp 0ff Distance to adjacent Ramp 650 ft __Conversion to pc/h Under Base Conditions_ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 5370 480 220 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1413 126 58 v Trucks and buses 9 3 9 % 0 % Recreational vehicles 0 0 Terrain type: Level Level Level Grade % % % Length mi mi mi Trucks and buses PCE, ET 1.5 1.5 1.5 Recreational vehicle PCE, ER 1.2 1.2 1.2 Heavy vehicle adjustment, fHV 0.957 0.957 0.985 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 5907 513 242 pcph ____Estimation of V12 Merge Areas___ = L 1676.19 (Equation 25-2 or 25-3) EQ Ρ 0.647 Using Equation 3 = Page 1

	E 14	2009PM 9t	h Ave. Entrance.	txt	
	FM V = V 12 F	(P_) = 3819 FM	pc/h		
		Capaci ty	Checks		
V FO		Actual 6420	Maximum 6750	LOS F? No	
$\sqrt{\frac{10}{2}}$ $\sqrt{\frac{10}{2}}$		2088 pc/h	(Equation 25-4	or 25-5)	
$\begin{array}{cccc} & & & & & \\ & & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & $	> 2700 p	c/h?	No		
Is v v	> 1.5 v	/2	No		
3 or av34 Ifyes, v = 3819 12A	19	2	(Equation 25-8)		
v R12	Fl Actu 3819	ow Entering Me al Max 4600 Service Determ	rge Influence Ar Desirable	rea Violation? No	
Density, D = 5.47	5 + 0.007	34 v + 0.0078	v - 0.00627 L	- = 37.0 A	pc/mi /I n
Level of service	for ramp-	freeway juncti	on areas of infl	uence E	
		Speed Estim	ation		
Intermediate spee	d variabl	e,	M = 0.595		
Space mean speed	in ramp i	nfluence area,	S = 47.3	mph	
Space mean speed	in outer	lanes,	S = 49.3	mph	
Space mean speed	for all v	ehi cl es,	S = 47.9	mph	

2009AM 1st Ave. Exit.txt

HCS+: Ramps and Ramp Junctions Release 5.4

Robert Tan PBQD

Phone: Fax: E-mail: _____Di verge Anal ysi s_____ Anal yst: RCT I DOT/PBQD Agency/Co. : Date performed: 8/18/2009 Analysis time period: AM Peak Freeway/Dir of Travel: I-290 EB 1st Ave. Exit. Ramp Junction: Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Phase 1 Study __Freeway Data_____ Type of analysis Di verge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 5840 vph Off Ramp Data Side of freeway Ri ght Number of lanes in ramp 1 Free-Flow speed on ramp 35.0 mph Volume on ramp 220 vph Length of first accel/decel lane 155 ft Length of second accel/decel lane ft __Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent ramp 390 vph Position of adjacent ramp Upstream Type of adjacent ramp 0'n Distance to adjacent ramp 650 ft __Conversion to pc/h Under Base Conditions_ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 5840 220 390 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1537 58 103 v Trucks and buses 10 10 10 % % Recreational vehicles 0 Ω 0 Level Terrain type: Level Level Grade 0.00 % 0.00 % 0.00 % Length 0.00 mi 0.00 mi 0.00 mi Trucks and buses PCE, ET 1.5 1.5 1.5 Recreational vehicle PCE, ER 1.2 1.2 1.2 0.952 Heavy vehicle adjustment, fHV 0.952 0.952 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 6455 243 431 pcph ____Estimation of V12 Diverge Areas___ = L 2144.31 (Equation 25-8 or 25-9) EQ Ρ 0.866 Using Equation 6 = Page 1

	2009AM 1st Ave. Exit.txt					
v = v + (v - v) P = 5621 pc/h 12 R F R FD						
	Capaci ty	Checks				
V = V	Actual 6455	Maximum 6750	LOS F? No			
	6212	6750	No			
FUFK V R	243	2000	No			
V V V	834 pc/h	(Equation 25-15	or 25-16)			
Is v v > 2700 p	c/h?	No				
1 s v v > 1.5 v	/2	No				
3 or av34 1 If yes, v = 5621 12A	2	(Equation 25-18)				
Flow Actu V 5621	Entering Dive al Max 4400	rge Influence Are Desirable	ea Violation? Yes			
Level of	Service Determ	ination (if not l	-)			
Density, D = R	4. 252 + 0. 008	6 v - 0.009 L 12 D	= 51.2 pc/m	i/ln		
Level of service for ramp-	freeway juncti	on areas of influ	lence E			
Speed Estimation						
Intermediate speed variabl	e,	$D_{s} = 0.450$				
Space mean speed in ramp i	nfluence area,	$S_{p} = 49.2$	mph			
Space mean speed in outer	l anes,	$S_{0} = 60.3$	mph			
Space mean speed for all v	S = 50.4	mph				

Robert Tan PBQD

Phone: Fax: E-mail: _____Di verge Anal ysi s_____ Anal yst: RCT I DOT/PBQD Agency/Co. : Date performed: 8/18/2009 Analysis time period: PM Peak Freeway/Dir of Travel: I-290 EB 1st Ave. Exit. Ramp Junction: Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Phase 1 Study Freeway Data_____ Type of analysis Di verge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 5850 vph Off Ramp Data Side of freeway Ri ght Number of lanes in ramp 1 Free-Flow speed on ramp 35.0 mph Volume on ramp 220 vph Length of first accel/decel lane 155 ft Length of second accel/decel lane ft __Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent ramp 480 vph Position of adjacent ramp Upstream Type of adjacent ramp 0'n Distance to adjacent ramp 650 ft __Conversion to pc/h Under Base Conditions__ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 5850 220 480 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1539 58 126 v Trucks and buses 9 9 3 % 0 % Recreational vehicles 0 0 Level Terrain type: Level Level Grade 0.00 % 0.00 % 0.00 % Length 0.00 mi 0.00 mi 0.00 mi 1.5 1.2 Trucks and buses PCE, ET 1.5 1.5 Recreational vehicle PCE, ER 1.2 1.2 Heavy vehicle adjustment, fHV 0.957 0.957 0.985 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 6435 242 513 pcph ____Estimation of V12 Diverge Areas___ = L 2557.16 (Equation 25-8 or 25-9) EQ Ρ 0.943 Using Equation 6 = Page 1

2009PM 1st Ave. Exit.txt					
v = v + (v - v) P = 6080 pc/h 12 R F R FD					
	Capacity	Checks			
V = V Fi F	Actual 6435	Maximum 6750	LOS F? No		
	6193	6750	No		
	242	2000	No		
	355 pc/h	(Equation 25-15	or 25-16)		
Is v v > 2700 p	oc∕h?	No			
Is v v > 1.5 v	/2	No			
3 or av34 1 If yes, v = 6080 12A	2	(Equation 25-18))		
Flow Actu v 6080	/ Entering Dive al Max 0 4400	rge Influence Are Desirable	ea Violation? Yes		
Level of	Service Determ	ination (if not I	-)		
Density, D=	4.252 + 0.008	6 v - 0.009 L	= 55.1 pc/mi/ln		
Level of service for ramp-	freeway juncti	on areas of influ	uence E		
	Speed Estim	ati on			
Intermediate speed variabl	e,	$D_{s} = 0.450$			
Space mean speed in ramp i	nfluence area,	$S_{\rm p}^{\rm S} = 49.2$	mph		
Space mean speed in outer	l anes,	$S_{0}^{r} = 60.3$	mph		
Space mean speed for all v	vehi cl es,	S = 49.7	mph		

Phone: E-mail:	Fax:		
Merge	Anal ysi s		
Anal yst:RCTAgency/Co.:I DOT/PBQDDate performed:8/18/2009Anal ysis time period:AM PeakFreeway/Dir of Travel:I -290 EBJunction:1st Ave. EntraJuri sdiction:I DOTAnal ysis Year:2009Description:I -290 Phase 1 STUDY	nce Ramp		
+ree	way Data		
Type of analysis Number of lanes in freeway Free-flow speed on freeway Volume on freeway	Merge 3 55.0 5620	mph vph	
On R	amp Data		
Side of freeway Number of Lanes in ramp Free-flow speed on ramp Volume on ramp Length of first accel/decel Lane Length of second accel/decel Lane	Ri ght 1 35.0 620 290	mph vph ft ft	
Adjacent Ramp	Data (if one e	exists)	
Does adjacent ramp exist? Volume on adjacent Ramp Position of adjacent Ramp Type of adjacent Ramp Distance to adjacent Ramp	Yes 140 Downstrea Off 3062	vph am ft	
Conversion to pc/h	Under Base Cor	ndi ti ons	
Junction Components	Freeway Ra	amp	Adj acent
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade	5620 62 0.95 0. 1479 16 10 12 0 0 Level Le	20 95 53 2 evel %	Ramp 140 vph 0.95 37 v 10 % 0 % Level %
Length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fP Flow rate, vp	mi 1.5 1. 1.2 1. 0.952 0. 1.00 1. 6212 69	mi 5 2 943 00 92	mi 1.5 1.2 0.952 1.00 155 pcph
Estimation of	V12 Merge Area	as	
L_= 1102.18 (Equ	ation 25-2 or 2	25-3)	
P = 0.586 Usin	g Equation 1 Page 1		

	ΓM	2009AM 1st	t Ave.	Entrance.txt			
	V = V (12 F	(P_) = 363 FM	38 pc.	/h			
		Capaci t	ty Chec	ks			
V FO		Actual 6904	Max 675	i mum O	LOS Fá Yes	2	
		2574 pc/h	(Eq	uation 25-4	or 25-5	5)	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	> 2700 pc	c/h?	No				
	> 1.5 v	/2	No				
	2	(Eq	uation 25-8)				
v R12	Flo Actua 3638 evel of S	ow Entering al Ma 46 Service Dete	Merge ax Desi 500 erminat	Influence Ar rable ion (if not	rea Vi ol a No F)	ation?	
Density, D = 5.475	+ 0.0073	34 v + 0.00)78 v	- 0.00627 L	=	37.1	pc/mi/ln
Level of service f	or ramp-1	к freeway junc	ction a	reas of infl	A uence	F	
		Speed Est	timatio	n			
Intermediate speed	vari abl e	9,		M_ = 0.597			
Space mean speed i	n ramp ir	nfluence are	ea,	S = 47.2	mph		
Space mean speed i	n outer l	anes,		R = 46.8	mph		
Space mean speed f	or all ve	ehi cl es,		S = 47.1	mph		

Phone: E-mail:	Fax:		
Merge	Anal ysi s		
Anal yst:RCTAgency/Co.:I DOT/PBQDDate performed:8/18/2009Anal ysis time period:PM PeakFreeway/Dir of Travel:I -290 EBJunction:1st Ave. EntraJuri sdiction:I DOTAnal ysis Year:2009Description:I -290 Phase 1 STUDY	nce Ramp		
+ree	way Data		
Type of analysis Number of lanes in freeway Free-flow speed on freeway Volume on freeway	Merge 3 55.0 5630	mph vph	
0n R	amp Data		
Side of freeway Number of Lanes in ramp Free-flow speed on ramp Volume on ramp Length of first accel/decel Lane Length of second accel/decel Lane	Ri ght 1 35. 0 880 290	mph vph ft ft	
Adjacent Ramp	Data (if one exist	s)	
Does adjacent ramp exist? Volume on adjacent Ramp Position of adjacent Ramp Type of adjacent Ramp Distance to adjacent Ramp	Yes 270 Downstream Off 3062	vph ft	
Conversion to pc/h	Under Base Conditi	ons	
Junction Components	Freeway Ramp		Adj acent
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade	5630 880 0.95 0.95 1482 232 9 2 0 0 Level %	%.	Ramp 270 vph 0.95 71 v 2 % 0 % Level
Length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fP Flow rate, vp	mi 1.5 1.5 1.2 1.2 0.957 0.990 1.00 1.00 6193 936	mi	mi 1.5 1.2 0.990 1.00 287 pcph
Estimation of	V12 Merge Areas		
L_= 2040.82 (Equ	ation 25-2 or 25-3)		
P = 0.586 Usin	g Equation 1 Page 1		

	2009PM 1st /	Ave. Entrance.txt		
V	-M = V (P) = 3627 12 F FM	pc/h		
	Capaci ty	Checks		
V FO	Actual 7129	Maximum 6750	LOS F? Yes	
	2566 pc/h	(Equation 25-4	or 25-5)	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2700 pc/h?	No		
	1.5 v /2	No		
	12	(Equation 25-8)		
V R12 Lev	Flow Entering Me Actual Max 3627 4600 vel of Service Deterr	erge Influence Ar Desirable) nination (if not	ea Violation? No F)	
Density, D = 5.475 R	+ 0.00734 v + 0.0078 R r ramp-freeway juncti	3 v - 0.00627 L 12 on areas of infl	= 38.8 A	pc/mi /I n
	Speed Estir	nation		
Intermediate speed	vari abl e,	M_ = 0.675		
Space mean speed in	ramp influence area,	S = 46.2	mph	
Space mean speed in	outer lanes,	R S_ = 46.9	mph	
Space mean speed for	r all vehicles,	S = 46.5	mph	

2009AM DesPlaines Ave. Exit.txt

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: E-mail:	Fax:			
Di ver	ge Anal ysi s			
Anal yst:RCTAgency/Co.:I DOT/PBQDDate performed:8/18/2009Anal ysis time period:AM PeakFreeway/Dir of Travel:I -290 EBJunction:Des Plaines AvJurisdiction:I DOTAnal ysis Year:2009Description:I -290 Phase 1 Study	e. Exit Ramp way Data			
Type of applysis				
Number of lanes in freeway Free-flow speed on freeway Volume on freeway	3 55.0 6240	mph ∨ph		
Off R	amp Data			
Side of freeway Number of lanes in ramp Free-Flow speed on ramp Volume on ramp Length of first accel/decel lane Length of second accel/decel lane	Ri ght 1 35.0 140 167	mph vph ft ft		
Adjacent Ramp	Data (if one exists))		
Does adjacent ramp exist? Volume on adjacent ramp Position of adjacent ramp Type of adjacent ramp Distance to adjacent ramp	Yes 620 Upstream On 3062	vph ft		
Conversion to pc/h	Under Base Condition	าร		
Junction Components	Freeway Ramp		Adi acent	
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fP Flow rate, vp		% mi	Ramp 620 vpt 0.95 163 v 12 % 0 % Level 0.00 % 0.00 mi 1.5 1.2 0.943 1.00 692 pct	n
Estimation of	V12 Diverge Areas			
L_= 3176.48 (Equ	ation 25-8 or 25-9)			
P = 0.585 Usin	g Equation 6 Page 1			

		2009AM DesPlai	nes Ave. Exit.tx	t				
v = v + (v - v) P = 4096 pc/h 12 R F R FD								
	Capacity Checks							
V = V		Actual 6897	Maximum 6750	LOS F? Yes				
		6742	6750	No				
		155	2000	No				
		2801 pc/h	(Equation 25-15 or 25-16)					
Is v v	> 2700 pc	c/h?	Yes					
Is v v	> 1.5 v	/2	No					
3 or av34 If yes, v = 41 12A	12 97	2	(Equation 25-18)					
v 12A	Flow Actua 4197	Entering Dive al Max I 4400	rge Influence Are Desirable	ea Violation? No				
	Level of Service Determination (if not F)							
Density,	D =	4.252 + 0.008	6 v - 0.009 L	= 38.8 pc/mi/ln				
Level of service	for ramp-1	freeway junctio	on areas of influ	uence F				
		Speed Estima	ation					
Intermediate spee	d variable	Э,	D = 0.442					
Space mean speed	in ramp in	nfluence area,	$S_{p}^{3} = 49.3$	mph				
Space mean speed	in outer l	anes,	$S_{0}^{K} = 53.7$	mph				
Space mean speed for all vehicles, $\begin{array}{c} 0\\ S\\ = 50.9 \end{array}$ mph								

2009PM DesPlaines Ave. Exit.txt

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: E-mail:	Fax:				
Di ver	ge Anal ysi s				
Analyst: RCT Agency/Co.: IDOT/PBQD Date performed: 8/18/2009 Analysis time period: PM Peak Freeway/Dir of Travel: I-290 EB Junction: Des Plaines Ave. Exit Ramp Jurisdiction: IDOT Analysis Year: 2009 Description: I-290 Phase 1 Study					
Type of analysis	Di verge				
Number of lanes in freeway Free-flow speed on freeway Volume on freeway	3 55. 0 6510	mph ∨ph			
Off R	amp Data				
Side of freeway Number of lanes in ramp Free-Flow speed on ramp Volume on ramp Length of first accel/decel lane Length of second accel/decel lane	Ri ght 1 35.0 270 167	mph vph ft ft			
Adjacent Ramp	Data (if one exists)				
Does adjacent ramp exist? Volume on adjacent ramp Position of adjacent ramp Type of adjacent ramp Distance to adjacent ramp	Yes 880 Upstream On 3062	vph ft			
Conversion to pc/h	Under Base Conditior	າട			
lunction Components	Freeway Ramp		Adiacent		
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fP Flow rate, vp	6510 270 0.95 0.95 1713 71 9 2 0 0 Level Level 0.00 % 0.00 % 0.00 mi 1.5 1.5 1.2 1.2 0.957 0.990 1.00 1.00 7161 287	% mi	Ramp 880 vph 0.95 232 232 v 2 % 0 % Level % 0.00 % 0.00 mi 1.5 1.2 0.990 1.00 936 pcph		
Estimation of	V12 Di verge Areas				
L = 4376.06 (Equ	ation 25-8 or 25-9)				
EQ P = 0.622 Usin	g Equation 6 Page 1				

		2009PM DesPlai	nes Ave. Exit.tx	t	
v' = v + (v - v) P = 4565 pc/h 12 R F R FD					
		Capacity (Checks		
V = V_		Actual 7161	Maximum 6750	LOS F? Yes	
V = V - V		6874	6750	Yes	
		287	2000	No	
		2596 pc/h	(Equation 25-15	or 25-16)	
Is v v	> 2700 pc	c/h?	No		
Is v v	> 1.5 v	/2	No		
3 or av34 If yes, v = 456 12A	65	2	(Equation 25-18)		
v 12	Flow Actua 4565	Entering Dive al Max I 4400	rge Influence Are Desirable	ea Violation? Yes	
l	_evel of S	Service Determi	ination (if not l	-)	
Densi ty,	D = R	4.252 + 0.0080	6 v - 0.009 L 12 D	= 42.0 pc/mi/ln	
Level of service 1	for ramp-1	freeway junctio	on areas of influ	uence F	
		Speed Estima	ation		
Intermediate speed	d variable	э,	$D_{s} = 0.454$		
Space mean speed i	in ramp in	nfluence area,	$S_{\rm p}^{\rm 3} = 49.1$	mph	
Space mean speed i	in outer I	anes,	$S_{0}^{\kappa} = 54.1$	mph	
Space mean speed 1	Space mean speed for all vehicles, $S = 50.8$ mph				

Phone: E-mail:	Fax:						
Di ver	ge Anal ysi s						
Analyst:RCTAgency/Co.:IDOT/PBQDDate performed:8/18/2009Analysis time period:AM PeakFreeway/Dir of Travel:I-290 EBJunction:Harlem Ave. Exit RampJurisdiction:IDOTAnalysis Year:2009Description:I-290 Phase 1 Study							
Free	way Data						
Number of lanes in freeway Free-flow speed on freeway Volume on freeway	DI verge 3 55. 0 6100	mph vph					
Off R	amp Data						
Side of freeway Number of lanes in ramp Free-Flow speed on ramp Volume on ramp Length of first accel/decel lane Length of second accel/decel lane	Left 1 35.0 250 260	mph vph ft ft					
Adjacent Ramp	Data (if one exists))					
Does adjacent ramp exist? Volume on adjacent ramp Position of adjacent ramp Type of adjacent ramp Distance to adjacent ramp	Yes 820 Downstream On 2010	vph ft					
Conversion to pc/h	Under Base Condition	าร					
Junction Components	Freeway Ramp		Adj acent				
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fP		% mi	Ramp 820 0.95 216 10 0 Level 0.00 0.00 1.5 1.2 0.952 1.00	vph v % mi			
Flow rate, vp	6742 276		906	pcph			
Estimation of	viz Diverge Areas						
L = (Equide Control	a Equation E						
P = 0.579 USIN	Page 1						

	FD	2009AM Harle	m Ave. Exit.txt	
	FD V = V + 12 R	- (v - v) P = F R FD	= 4018 pc/h	
		Capacity (Checks	
		Actual 6742	Maximum 6750	LOS F? No
		6466	6750	No
		276	2000	No
		2724 pc/h	(Equation 25-15	or 25-16)
3 or av34 Is v v	> 2700 pc	:/h? Yes		
3 or av34 Is v v	> 1.5 v	/2	No	
3 or av34 12 If yes, v = 4042 (Equation 25-18) 12A)
V 12A	Flow Actua 4042	Entering Diver al Max [4400	rge Influence Are Desirable	ea Violation? No
L	_evel of S	Service Determi	nation (if not H	-)
Density,	D=	4.252 + 0.0086	5 v - 0.009 L	= 38.4 pc/mi/ln
Level of service f	For ramp-1	reeway junctio	on areas of influ	uence E
		Speed Estima	ation	
Intermediate speed	d variable	2,	$D_{c} = 0.453$	
Space mean speed i	n ramp ir	nfluence area,	S S = 49.1	mph
Space mean speed i	n outer I	anes,	S = 54.5	mph
Space mean speed f	for all ve	ehi cl es,	S = 51.0	mph

Robert Tan PBQD

Phone: Fax: E-mail: ____Diverge Analysis_____ Anal yst: RCT I DOT/PBQD Agency/Co.: Date performed: 8/18/2009 Analysis time period: Freeway/Dir of Travel: PM Peak I-290 EB Junction: Harlem Ave. Exit Ramp Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Phase 1 Study _Freeway Data_____ Type of analysis Di verge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 6240 vph ____Off Ramp Data___ Side of freeway Left Number of lanes in ramp 1 Free-Flow speed on ramp 35.0 mph Volume on ramp 460 vph Length of first accel/decel lane 260 ft Length of second accel/decel lane ft _Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent ramp 830 vph Position of adjacent ramp Downstream Type of adjacent ramp 0n Distance to adjacent ramp 2010 ft __Conversion to pc/h Under Base Conditions_ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 6240 460 830 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1642 121 218 v Trucks and buses 9 9 2 % % Recreational vehicles 0 0 0 Terrain type: Level Level Level Grade 0.00 % 0.00 % 0.00 % Length 0.00 mi 0.00 mi 0.00 mi 1.5 1.2 1.5 1.2 Trucks and buses PCE, ET 1.5 Recreational vehicle PCE, ER 1.2 0.990 Heavy vehicle adjustment, fHV 0.957 0.957 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 6864 506 882 pcph ____Estimation of V12 Diverge Areas__ L = (Equation 25-8 or 25-9) EQ Ρ 0.565 Using Equation 5 = Page 1

	FD	2009PM Harle	m Ave. Exit.txt		
	V = V + 12 R	+ (v - v) P = F R FD	= 4099 pc/h		
		Capacity (Checks		
		Actual 6864	Maximum 6750	LOS F? Yes	
		6358	6750	No	
		506	2000	No	
		2765 pc/h	(Equation 25-15	or 25-16)	
Is v v	> 2700 pc	c/h?	Yes		
Is v v	> 1.5 v	/2	No		
3 or av34 If yes, v = 416	54	2	(Equation 25-18)		
V	Flow Actua 4164	Entering Diver al Max I 4400	rge Influence Are Desirable	ea Violation? No	
L	_evel of S	Service Determi	nation (if not I	F)	
Density,	D =	4.252 + 0.0086	6 v - 0.009 L	= 39.5 pc/mi/ln	
Level of service f	For ramp-1	Freeway junctio	on areas of influ	uence F	
		Speed Estima	ati on		
Intermediate speed	d variable	2,	D = 0.474		
Space mean speed i	n ramp ir	nfluence area,	S = 48.8	mph	
Space mean speed i	n outer l	anes,	$S_{0}^{R} = 54.5$	mph	
Space mean speed f	for all ve	ehi cl es,	S = 50.8	mph	

2009AM Harlem Ave. Entrance.txt

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: E-mail:	Fax:				
	Merge Analysis_				
Analyst:RCTAgency/Co.:I DOT/PBQDDate performed:8/18/2009Analysis time period:AM PeakFreeway/Dir of Travel:I -290 EBJunction:Harlem AvJurisdiction:I DOTAnalysis Year:2009Description:I -290 Phase 1 Study	e. Entrance Ran	ıp			
	_Freeway Data				
Type of analysis Number of lanes in freeway Free-flow speed on freeway Volume on freeway	Mer <u>c</u> 3 55.(585(je)	mph vph		
	_On Ramp Data				
Side of freeway Number of Lanes in ramp Free-flow speed on ramp Volume on ramp Length of first accel/decel Lane Length of second accel/decel Lane	Left 1 35.0 820 900	-)	mph vph ft ft		
Adj acent	Ramp Data (if	one exists)		
Does adjacent ramp exist? Volume on adjacent Ramp Position of adjacent Ramp Type of adjacent Ramp Distance to adjacent Ramp	Yes 250 Upst 0ff 2010	ream)	vph ft		
Conversion to	pc/h Under Bas	se Conditio	ns		
Junction Components	Freeway	Ramp		Adi acent	
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade	5850 0.95 1539 10 0 Level 9	820 0.95 216 3 0 Level	%_	Ramp 250 0. 95 66 10 0 Level	vph v % %
Length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fP Flow rate, vp	n 1.5 1.2 0.952 1.00 6466	ni 1.5 1.2 0.985 1.00 876	mi	1.5 1.2 0.952 1.00 276	mi pcph
Estimati	on of V12 Merge	e Areas			
L = 1398.99	(Equation 25-2	2 or 25-3)			
P = 0.603	Using Equatior Page 1	า 1			

	2009AM	Harlem Ave.	Entrance. t	xt	
	v = v (P) = 12 F FM	3897 pc/l	١		
	Ca	pacity Checks	S		
V FO	Actual 7342	Maxiı 6750	num	LOS F? Yes	
	2569 p	c/h (Equ	ation 25-4	or 25-5)	
Is v v	> 2700 pc/h?	No			
s or avsa Is v v	> 1.5 v /2	No			
3 or av34 If yes, v = 389 12A	12 7	(Equation 25-8)			
v R12 L	Flow Ente Actual 3897 evel of Service	ring Merge I Max Desira 4600 Determinatio	าfluence Ar able on (if not	rea Violation Yes F)	?
Density, D = 5.475 R Level of service f	+ 0.00734 v + R for ramp-freeway	0.0078 v 12 junction are	- 0.00627 L eas of infl	_ = 40.3 A uence F	pc∕mi∕In
	Spee	d Estimation			
Intermediate speed	vari abl e,	I	M = 0.994		
Space mean speed i	n ramp influenc	e area,	S = 42.1	mph	
Space mean speed i	n outer lanes,	:	S = 49.2	mph	
Space mean speed f	or all vehicles	,	S = 43.9	mph	

2009PM Harlem Ave. Entrance.txt

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: E-mail:	Fax:						
Merge	e Anal ysi s						
Analyst:RCTAgency/Co.:I DOT/PBQDDate performed:8/18/2009Analysis time period:PM PeakFreeway/Dir of Travel:I -290 EBJunction:Harlem Ave. Entrance RampJurisdiction:I DOTAnalysis Year:2009Description:I -290 Phase 1 Study							
	way bata						
Type of analysis Number of Lanes in freeway Free-flow speed on freeway Volume on freeway	Merge 3 55. 0 5780	mph ∨ph					
On F	Ramp Data						
Side of freeway Number of lanes in ramp Free-flow speed on ramp Volume on ramp Length of first accel/decel lane Length of second accel/decel lane	Left 1 35.0 830 900	mph vph ft ft					
Adjacent Ramp) Data (if one exists)						
Does adjacent ramp exist? Volume on adjacent Ramp Position of adjacent Ramp Type of adjacent Ramp Distance to adjacent Ramp	Yes 460 Upstream Off 2010	vph ft					
Conversion to pc/h	n Under Base Conditior	าร					
Junction Components	Freeway Ramp		Adi acent				
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade	5780 830 0.95 0.95 1521 218 9 2 0 0 Level Level %	%	Ramp 460 vph 0.95 121 v 9 % 0 % Level %				
Length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fP Flow rate, vp	mi 1. 5 1. 5 1. 2 1. 2 0. 957 0. 990 1. 00 1. 00 6358 882	mi	mi 1.5 1.2 0.957 1.00 506 pcph				
Estimation of	F V12 Merge Areas						
L= 1377.16 (Equ	uation 25-2 or 25-3)						
EQ P = 0.603 Usir	ng Equation 1 Page 1						

	EM	2009PM Harlem	Ave. Entrance. to	кt	
	V = V 12 F	(P) = 3832 FM	pc/h		
		Capaci ty	Checks		
V FO		Actual 7240	Maximum 6750	LOS F? Yes	
		2526 pc/h	(Equation 25-4	or 25-5)	
Is v v	> 2700 p	c/h?	No		
3 or av34 Is v v > 1.	> 1.5 v	/2	No		
3 or av34 Ifyes, v = 3832 12A		(Equation 25-8)			
v R12	FI Actu 3832 Level of	ow Entering Me al Max 4600 Service Determ	erge Influence Ar Desirable) hination (if not	ea Violation? Yes F)	
Density, D = 5.47 R Level of service	5 + 0.007 for ramp-	34 v + 0.0078 R freeway juncti	v - 0.00627 L 12 on areas of infl	= 39.8 A uence F	pc/mi /l n
		Speed Estim	nation		
Intermediate spee	d variabl	e,	M = 0.946		
Space mean speed	in ramp i	nfluence area,	S S_ = 42.7	mph	
Space mean speed	in outer	lanes,	R S_= 49.4	mph	
Space mean speed	for all v	ehi cl es,	S = 44.4	mph	

2009AM Austin Blvd. Exit.txt

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: E-mail:	Fax:						
Diverge Analysis Analyst: RCT Agency/Co.: IDOT/PBQD Date performed: 8/18/2009 Analysis time period: AM Peak Freeway/Dir of Travel: I-290 EB Junction: Austin Ave. Exit Ramp Jurisdiction: IDOT Analysis Year: 2009 Description: I-290 Phase 1 Study							
Type of analysis Number of lanes in freeway Free-flow speed on freeway Volume on freeway Off R	Diverge 3 55.0 6670 amp Data	mph vph					
Side of freeway Number of Lanes in ramp Free-Flow speed on ramp Volume on ramp Length of first accel/decel Lane Length of second accel/decel Lane	Left 1 35.0 180 301	mph vph ft ft					
Adjacent Ramp Does adjacent ramp exist? Volume on adjacent ramp Position of adjacent ramp Type of adjacent ramp Distance to adjacent ramp	No) vph ft					
Conversion to pc/h Junction Components Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fP Flow rate, vp	Under Base Condition Freeway Ramp 6670 180 0.95 0.95 1755 47 10 10 0 0 Level Level 0.00 % 0.00 % 0.00 % 0.00 % 0.00 % 0.00 % 0.00 % 0.00 % 0.00 % 0.00 % 0.00 % 0.00 % 0.00 % 0.00 % 0.00 % 0.00 % 0.952 0.952 1.00 1.00 7372 199	ns mi	Adjacent Ramp vph v % % mi pcph				
L = (Equ EQ P = 0.567 Usin	ation 25-8 or 25-9) g Equation 5 Page 1						

2009AM Austin Blvd. Exit.txt					
v = v + (v - v) P = 4263 pc/h 12 R F R FD					
		Capacity (Checks		
		Actual 7372	Maximum 6750	LOS F? Yes	
	-	7173	6750	Yes	
		199	2000	No	
		3109 pc/h	(Equation 25-15	or 25-16)	
3 or av34 Is v v	> 2700 pc/	/h?	Yes		
3 or av34 Is v v	> 1.5 v	/2	No		
3 or av34 If yes, v = 467	12 72		(Equation 25-18)		
12A					
V	Actual 4672	ntering Diver_ Max E 4400	rge Influence Are Desirable	ea Violation? No	
12A	_evel of Se	ervice Determi	nation (if not F	-)	
Density,	D_= 4	4. 252 + 0. 0086	5 v - 0.009 L	= 43.7 pc/mi/ln	
Level of service f	R For ramp-fi	reeway junctio	ב 12 א areas of influ	lence F	
		Speed Estima	ation		
Intermediate speed	d variable,		D = 0.446		
Space mean speed i	n ramp int	fluence area,	S S = 49.2	mph	
Space mean speed i	n outer la	anes,	R S = 54.6	mph	
Space mean speed f	for all ve	ni cl es,	S = 50.9	mph	

2009PM Austin Blvd. Exit.txt

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: E-mail:	Fax:		
Di ve	rge Anal ysi s		
Anal yst:RCTAgency/Co.:I DOT/PBQDDate performed:8/18/2009Anal ysis time period:PM PeakFreeway/Dir of Travel:I-290 EBJunction:Austin Ave. EJurisdiction:I DOTAnal ysis Year:2009Description:I-290 Phase 1 Study	xit Ramp eway Data		
Type of analysis Number of lanes in freeway Free-flow speed on freeway Volume on freeway	Di verge 3 55. 0 6610	mph vph	
Off	Ramp Data		
Side of freeway Number of lanes in ramp Free-Flow speed on ramp Volume on ramp Length of first accel/decel lane Length of second accel/decel lane	Left 1 35.0 460 301	mph vph ft ft	
Adjacent Ram	p Data (if one exists)	
Does adjacent ramp exist? Volume on adjacent ramp Position of adjacent ramp Type of adjacent ramp Distance to adjacent ramp	No	vph ft	
Conversion to pc/	h Under Base Conditio	ns	
Juncti on Components Vol ume, V (vph) Peak-hour factor, PHF Peak 15-min vol ume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fP Flow rate, vp	Freeway Ramp 6610 460 0.95 0.95 1739 121 9 9 0 0 Level Level 0.00 % 0.00 % 0.00 % 1.5 1.5 1.2 1.2 0.957 0.957 1.00 7271 506	% mi	Adjacent Ramp vph v % % mi pcph
Estimation o	f V12 Diverge Areas		
L = (Eq EQ P = 0.555 Usi	uation 25-8 or 25-9) ng Equation 5 Page 1		

		2009PM Austir	n Blvd. Exit.txt		
	V = V + 12 R	(v - v) P = F R FD	= 4260 pc/h		
		Capacity C	Checks		
		Actual 7271	Maximum 6750	LOS F? Yes	
	(6765	6750	Yes	
	Į	506	2000	No	
		3011 pc/h	(Equation 25-15	or 25-16)	
	> 2700 pc/	/h?	Yes		
s or avsa Is v v	> 1.5 v	/2 No			
3 or av34 If yes, v = 457	12		(Equation 25-18)		
12A					
V	FLOW E Actual 4571	Entering Diver Max E 4400	esi rabl e	ea Violation? No	
12A L	evel of Se	ervice Determi	nation (if not F	-)	
Density,	D_= 4	4.252 + 0.0086	5 v - 0.009 L	= 42.8 pc/mi/ln	
Level of service f	R or ramp-fi	reeway junctio	ט 12 n areas of influ	Jence F	
		Speed Estima	ation		
Intermediate speed	vari abl e,		$D_{-} = 0.474$		
Space mean speed i	n ramp int	fluence area,	S S_ = 48.8	mph	
Space mean speed i	n outer la	anes,	R S_= 54.6	mph	
Space mean speed f	or all vel	hi cl es,	0 S = 50.7	mph	

2009AM Austin Ave. Entrance.txt

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: E-mail:	Fax:						
	Merge Analysis						
Analyst:RCTAgency/Co.:IDOT/PBQDDate performed:8/18/2009Analysis time period:AM PeakFreeway/Dir of Travel:I-290 EBJunction:Austin Ave. Entrance RampJurisdiction:IDOTAnalysis Year:2009Description:I-290 Phase 1 Study							
	_FIEEway Data						
Type of analysis Number of Lanes in freeway Free-flow speed on freeway Volume on freeway	Merge 3 55.0 6490	mph vph					
	_On Ramp Data						
Side of freeway Number of lanes in ramp Free-flow speed on ramp Volume on ramp Length of first accel/decel lane Length of second accel/decel lane	Left 1 35.0 1180 1500	mph vph ft ft					
Adj acent	Ramp Data (if one	exists)					
Does adjacent ramp exist? Volume on adjacent Ramp Position of adjacent Ramp Type of adjacent Ramp Distance to adjacent Ramp	No	vph ft					
Conversion to	pc/h Under Base Co	ndi ti ons					
Junction Components	Freeway R	amp Adjacen	t				
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade	6490 1 0.95 0 1708 3 10 0 0 0 Level L	капр 180 . 95 11 evel	vph v %				
Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fP Flow rate, vp	1.5 1 1.2 1 0.952 1 1.00 1 7173 1	. 5 . 2 . 000 . 00 242	pcph				
Estimati	on of V12 Merge Are	as					
L = FO	(Equation 25-2 or	25-3)					
P ⁻ = 0.619	Using Equation 1 Page 1						

2009AM Austin Ave. Entrance.txt FΜ (P) = 4444pc/h V = V 12 F FM _Capacity Checks_ LOS F? Actual Maxi mum 8415 6750 V Yes F0 2729 pc/h (Equation 25-4 or 25-5) v v 3 or av34 > 2700 pc/h? Yes ls v 3 or av34 ls 1.5 v /2 12 No v ν 3 or av34 (Equation 25-8) If yes, v = 4473 12A _Flow Entering Merge Influence Area_ ctual Max Desirable Actual Violation? 4600 Yes v 4473 12A Level of Service Determination (if not F)_ Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = R 12 A 44.3 pc/mi/ln Level of service for ramp-freeway junction areas of influence F _Speed Estimation_ Intermediate speed variable, = 2.238 М S Space mean speed in ramp influence area, S = 25.9 mph R S Space mean speed in outer lanes, = 49.0 mph 0 Space mean speed for all vehicles, S = 29.5 mph

2009PM Austin Ave. Entrance.txt

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: E-mail:	Fax:						
	Merge Analysis						
Analyst:RCTAgency/Co.:I DOT/PBQDDate performed:8/18/2009Analysis time period:PM PeakFreeway/Dir of Travel:I -290 EBJunction:Austin Ave. Entrance RampJurisdiction:I DOTAnalysis Year:2009Description:I -290 Phase 1 Study							
	_Freeway Data						
Type of analysis Number of lanes in freeway Free-flow speed on freeway Volume on freeway	Merge 3 55.0 6150	mph vph					
	_On Ramp Data						
Side of freeway Number of lanes in ramp Free-flow speed on ramp Volume on ramp Length of first accel/decel lane Length of second accel/decel lane	Left 1 35.0 960 1500	mph ∨ph ft ft					
Adj acent	Ramp Data (if one	e exists)					
Does adjacent ramp exist? Volume on adjacent Ramp Position of adjacent Ramp Type of adjacent Ramp Distance to adjacent Ramp	No	vph ft					
Conversion to pc/h Under Base Conditions							
Junction Components	Freeway	Ramp	Adj acent				
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Length	6150 0.95 1618 9 0 Level % mi	960 0.95 253 0 0 Level % mi	vph v % % mi				
Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fP Flow rate, vp	1.5 1.2 0.957 1.00 6765	1.5 1.2 1.000 1.00 1011	pcph				
Estimation of V12 Merge Areas							
L =	(Equation 25-2 or	~ 25-3)					
P = 0.619	Using Equation ´ Page 1	1					

2009PM Austin Ave. Entrance.txt FΜ (P) = 4191pc/h V = V12 F FM _Capacity Checks_ LOS F? Actual Maxi mum 7776 6750 V Yes F0 2574 pc/h (Equation 25-4 or 25-5) v v 3 or av34 > 2700 pc/h? No ls v 3 or av34 ls > 1.5 v /2 12 No v v 3 or av34 lf yes, v (Equation 25-8) = 4191 12A _Flow Entering Merge Influence Area_____ ctual Max Desirable Violation? Actual 4191 4600 Yes v R12 Level of Service Determination (if not F)_ Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = R 12 A pc/mi/ln 40.1 Level of service for ramp-freeway junction areas of influence F _Speed Estimation_ Intermediate speed variable, = 1.386 М S Space mean speed in ramp influence area, S = 37.0 mph R S Space mean speed in outer lanes, = 49.3 mph 0 Space mean speed for all vehicles, S = 39.6 mph

Robert Tan PBQD

Phone: Fax: E-mail: ____Diverge Analysis_____ Anal yst: RCT I DOT/PBQD Agency/Co.: Date performed: 8/18/2009 Analysis time period: Freeway/Dir of Travel: AM Peak I-290 EB Junction: Central Ave. Exit. Ramp Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Phase 1 Study _Freeway Data_____ Type of analysis Di verge Number of lanes in freeway 4 Free-flow speed on freeway 55.0 mph Volume on freeway 7670 vph Off Ramp Data____ Side of freeway Ri ght Number of lanes in ramp 1 Free-Flow speed on ramp 35.0 mph Volume on ramp 310 vph Length of first accel/decel lane 270 ft Length of second accel/decel lane ft _Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent ramp 620 vph Position of adjacent ramp Downstream Type of adjacent ramp 0n Distance to adjacent ramp 2270 ft __Conversion to pc/h Under Base Conditions_ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 7670 310 620 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 2018 82 163 v Trucks and buses 10 10 2 % % Recreational vehicles 0 0 0 Terrain type: Level Level Level Grade 0.00 % 0.00 % 0.00 % Length 0.00 mi 0.00 mi 0.00 mi 1.5 1.2 1.5 1.2 Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER 0.990 Heavy vehicle adjustment, fHV 0.952 0.952 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 8477 343 659 pcph ____Estimation of V12 Diverge Areas__ L = (Equation 25-8 or 25-9) EQ Ρ 0.436 Using Equation 8 = Page 1

2009AM Central Ave. Exit.txt							
v = v + (v - v) P = 3889 pc/h 12 R F R FD							
Capacity Checks							
V = V Fi F $V = V - V$ F0 F R V R V 3 or av34 Is V V 2700		Actual 8477	Maximum 9000	LOS F? No			
	1	8134	9000	No			
	:	343	2000	No			
		2294 pc/h (Equation 25-15		or 25-16)			
	> 2700 pc	/h?	No				
3 or av34 Is v v > 1.5 v / 3 or av34 12 If yes, v = 3889		/2	No				
			(Equation 25-18))			
v 12	FI ow Actua 3889 Level of S	Entering Diver I Max E 4400 ervice Determi	rge Influence Are Desirable nation (if not P	ea Violation? No -)			
Density,	D = -	4.252 + 0.0086	5 v - 0.009 L	= 35.3 pc/mi/ln			
R 12 D Level of service for ramp-freeway junction areas of influence E							
Speed Estimation							
Intermediate speed variable,			D = 0.459				
Space mean speed in ramp influence area,			S = 49.0	mph			
Space mean speed in outer lanes,			$s_{0}^{\kappa} = 55.3$	mph			
Space mean speed for all vehicles,			S = 52.2	mph			

Robert Tan PBQD

Phone: Fax: E-mail: ____Diverge Analysis_____ Anal yst: RCT I DOT/PBQD Agency/Co.: Date performed: 8/18/2009 Analysis time period: Freeway/Dir of Travel: PM Peak I-290 EB Junction: Central Ave. Exit. Ramp Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Phase 1 Study _Freeway Data_____ Type of analysis Di verge Number of lanes in freeway 4 Free-flow speed on freeway 55.0 mph Volume on freeway 7110 vph Off Ramp Data____ Side of freeway Ri ght Number of lanes in ramp 1 Free-Flow speed on ramp 35.0 mph Volume on ramp 580 vph Length of first accel/decel lane 270 ft Length of second accel/decel lane ft _Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent ramp 600 vph Position of adjacent ramp Downstream Type of adjacent ramp 0n Distance to adjacent ramp 2270 ft __Conversion to pc/h Under Base Conditions_ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 7110 580 600 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1871 153 158 v Trucks and buses 9 9 3 % 0 % Recreational vehicles 0 0 Terrain type: Level Level Level Grade 0.00 % 0.00 % 0.00 % Length 0.00 mi 0.00 mi 0.00 mi 1.5 1.2 1.5 1.2 Trucks and buses PCE, ET 1.5 Recreational vehicle PCE, ER 1.2 Heavy vehicle adjustment, fHV 0.985 0.957 0.957 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 7821 638 641 pcph ____Estimation of V12 Diverge Areas__ L = (Equation 25-8 or 25-9) EQ Ρ 0.436 Using Equation 8 = Page 1
	ED	2009PM Centra	al Ave. Exit.txt	
	V = V + 12 R	F (V - V) P = F R FD	= 3770 pc/h	
		Capacity (Checks	
V = V		Actual 7821	Maximum 9000	LOS F? No
		7183	9000	No
		638	2000	No
		2025 pc/h	(Equation 25-15	or 25-16)
3 or av34 Is v v	> 2700 pc	c/h?	No	
3 or av34 Is v v	> 1.5 v	/2	No	
3 or av34 1 If yes, v = 3770		2	(Equation 25-18)	
v 12	FlowFlow Actua 3770 Level of S	Entering Diver al Max 1 4400 Service Determi	rge Influence Are Desirable ination (if not P	ea Violation? No F)
Density,	D =	4.252 + 0.0086	6 v - 0.009 L	= 34.2 pc/mi/ln
Level of service	R for ramp-f	reeway junctio	12 D Don areas of influ	uence D
	·	Speed Estima	ation	
Intermediate spee	ed variable	<u>,</u>	D = 0.485	
Space mean speed	in ramp ir	nfluence area,	S S_ = 48.7	mph
Space mean speed	in outer l	anes,	R S_ = 56.3	mph
Space mean speed	for all ve	ehi cl es,	S = 52.4	mph

2009AM Central Ave. Entrance.txt

HCS+: Ramps and Ramp Junctions Release 5.4

Robert Tan PBQD

Phone: E-mail:	Fax:				
Merg	e Anal ysi s				
Anal yst:RCTAgency/Co.:I DOT/PBQDDate performed:8/18/2009Anal ysis time period:AM PeakFreeway/Dir of Travel:I -290 EBJunction:Central Ave.Juri sdiction:I DOTAnal ysis Year:2009Description:I -290 Phase 1 Study	Entrance Ramp)			
	cway bata				
Type of analysis Number of lanes in freeway Free-flow speed on freeway Volume on freeway	Merge 4 55.0 7360		mph vph		
0n	Ramp Data				
Side of freeway Number of lanes in ramp Free-flow speed on ramp Volume on ramp Length of first accel/decel lane Length of second accel/decel lane	Ri ght 1 35.0 620 552		mph vph ft ft		
Adjacent Ram	p Data (if on	ne exists)			
Does adjacent ramp exist? Volume on adjacent Ramp Position of adjacent Ramp Type of adjacent Ramp Distance to adjacent Ramp	Yes 310 Upstre Off 2270	am	vph ft		
Conversion to pc/	h Under Base	Condi ti or	าร		
Junction Components	Freeway	Ramp		Adi acent	
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade	7360 0.95 1937 10 0 Level	620 0.95 163 2 0 Level	%.	Ramp 310 0.95 82 10 0 Level	vph v % %
Length Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fP Flow rate, vp	mi 1.5 1.2 0.952 1.00 8135	1.5 1.2 0.990 1.00 659	mi	n 1. 5 1. 2 0. 952 1. 00 343	ni pcph
Estimation o	f V12 Merge A	reas			
L= (Eq	uation 25-2 c	or 25-3)			
EU P = 0.135 Usi	ng Equation Page 1	4			

	E 1.4	2009AM Central	Ave. Entrance.t	xt	
	v = v 12 F	(P) = 1102 FM	pc/h		
		Capaci ty	Checks		
V FO		Actual 8794	Maximum 9000	LOS F? No	
		3516 pc/h	(Equation 25-4	or 25-5)	
	> 2700 p	⊳c∕h?	Yes		
3 or av34 Is v v > 1.5 v 3 or av34 If yes, v = 3254 12A	> 1.5 v	/2	Yes		
	2	(Equation 25-8))		
V 12A	FI Actu 3254 Level of	ow Entering Me al Max 4600 Service Detern	erge Influence Ar Desirable) nination (if not	rea Violation? No F)	
Density, $D = 5.47$	5 + 0.007	34 v + 0.0078	šv - 0.00627 L	_ = 32.2	pc/mi/ln
K Level of service	for ramp-	R freeway juncti	on areas of infl	A uence D	
		Speed Estin	nation		
Intermediate spee	d variabl	e,	M_ = 0.478		
Space mean speed	in ramp i	nfluence area,	S = 48.8	mph	
Space mean speed	in outer	l anes,	R S = 47.6	mph	
Space mean speed	for all v	ehi cl es,	0 S = 48.1	mph	

2009PM Central Ave. Entrance.txt

HCS+: Ramps and Ramp Junctions Release 5.4

Robert Tan PBQD

Phone: E-mail:	Fax:				
	Merge Analysis_				
Analyst:RCTAgency/Co.:I DOT/PBQDDate performed:8/18/2009Analysis time period:PM PeakFreeway/Dir of Travel:I-290 EBJunction:Central ArJurisdiction:I DOTAnalysis Year:2009Description:I-290 Phase 1 Study	ve. Entrance Ran Ereeway Data	np			
	_rrccway bata				
Type of analysis Number of lanes in freeway Free-flow speed on freeway Volume on freeway	Merge 4 55.0 6530	2	mph vph		
	_On Ramp Data				
Side of freeway Number of lanes in ramp Free-flow speed on ramp Volume on ramp Length of first accel/decel lane Length of second accel/decel lane	Ri gh1 1 35. 0 600 552	t	mph vph ft ft		
Adj acent	Ramp Data (if o	one exists))		
Does adjacent ramp exist? Volume on adjacent Ramp Position of adjacent Ramp Type of adjacent Ramp Distance to adjacent Ramp	Yes 580 Upstr Off 2270	ream	vph ft		
Conversion to	pc/h Under Base	e Conditior	าร		
Junction Components	Freeway	Ramp		Adi acent	
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade	6530 0.95 1718 9 0 Level	600 0.95 158 3 0 Level	%	Ramp 580 0. 95 153 9 0 Level	vph v % %
Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population factor, fP Flow rate, vp	1.5 1.2 0.957 1.00 7183	1.5 1.2 0.985 1.00 641	m	1.5 1.2 0.957 1.00 638	pcph
Estimatio	on of V12 Merge	Areas			
L_=	(Equation 25-2	or 25-3)			
P = 0.138	Using Equation Page 1	4			

	ΓM	2009PM Central	Ave. Entrance.t	xt	
	v = v 12 F	(P) = 989 FM	pc/h		
		Capaci ty	Checks		
V FO		Actual 7824	Maximum 9000	LOS F? No	
		3097 pc/h	(Equation 25-4	or 25-5)	
Is v v	> 2700 p	c/h?	Yes		
3 or av34 Is v v > 1.5 v 3 or av34 If yes, v = 2873 12A	> 1.5 v	/2	Yes		
	2	(Equation 25-8)			
v 12A	FI Actu 2873 Level of	ow Entering Me al Max 4600 Service Determ	erge Influence Ar Desirable) hination (if not	rea Violation? No F)	
Density, D = 5.47 R Level of service	5 + 0.007 for ramp-	34 v + 0.0078 R freeway juncti	v - 0.00627 L 12 on areas of infl	_ = 29.1 A uence D	pc/mi /I n
		Speed Estim	nation		
Intermediate spee	d variabl	e,	$M_{2} = 0.413$		
Space mean speed	in ramp i	nfluence area,	S = 49.6	mph	
Space mean speed	in outer	l anes,	R S_= 49.0	mph	
Space mean speed	for all v	ehi cl es,	S = 49.3	mph	

2009AM WB 25th Exit to SB 25th.txt

HCS+: Ramps and Ramp Junctions Release 5.4

Parsons Brinckerhoff 230 W. Monroe St Suite 900 Chicago, IL 60606 Phone: (312) 782-8150 Fax: (312) 782-1684 E-mail: _____Di verge Anal ysi s______ Anal yst: I DOT/PB Agency/Co. : Date performed: 4/1/2009 Analysis time period: Freeway/Dir of Travel: AM Peak I-290 WB Junction: 25th Ave. Exit to SB Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junction Analysis _Freeway Data_____ Type of analysis Di verge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 6830 vph Off Ramp Data Side of freeway Ri ght Number of lanes in ramp 1 20.0 Free-Flow speed on ramp mph Volume on ramp 300 vph Length of first accel/decel lane 125 ft Length of second accel/decel lane ft __Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? No Volume on adjacent ramp vph Position of adjacent ramp Type of adjacent ramp Distance to adjacent ramp ft Conversion to pc/h Under Base Conditions Adj acent Junction Components Freeway Ramp Ramp Volume, V (vph) 6830 300 vph Peak-hour factor, PHF 0.95 0.95 Peak 15-min volume, v15 1797 79 v Trucks and buses 10 10 % % Recreational vehicles 0 0 Terrain type: Level Level Grade 0.00 % 0.00 % % Length 0.00 mi 0.00 mi mi Trucks and buses PCE, ET 1.5 1.5 1. 2 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.952 0.952 Driver population factor, fP 1.00 1.00 Flow rate, vp 7549 332 pcph ____Estimation of V12 Diverge Areas___ L = (Equation 25-8 or 25-9) EQ P = 0.556 Using Equation 5 Page 1

	2009AM V	VB 25th Exi	t to SB 25th.	txt				
	v = v + (v - 12 R F	v)P= RFD	4345 pc/h					
	Capacity Checks							
	Actual 7549	Ma 67	ximum 50	LOS F? Yes				
	7217	67	50	Yes				
	332	19	00	No				
	3204 p	oc/h (E	quation 25-15	5 or 25-16)				
Is v v	> 2700 pc/h?	Ye	S					
Is v v	> 1.5 v /2	No						
3 or av34 If yes, v = 484	12 19	(E	(Equation 25-18)					
	Flow Enteri Actual	ng Diverge Max Des	Influence An irable	rea Violation?				
۷ 12۵	4849	4400		No				
L	evel of Service	e Determina	tion (if not	F)				
Density,	D = 4.252	+ 0.0086 v	- 0.009 L	= 44.8	pc/mi/ln			
Level of service f	for ramp-freeway	/junction	areas of infl	uence F				
	Spee	ed Estimati	on					
Intermediate speed	l vari abl e,		D = 0.653					
Space mean speed i	n ramp influend	ce area,	S = 46.5	mph				
Space mean speed i	n outer lanes,		$s_{0}^{k} = 53.7$	mph				
Space mean speed f	for all vehicles	5,	S = 48.9	mph				

2009PM WB 25th Exit to SB 25th.txt

HCS+: Ramps and Ramp Junctions Release 5.4

Parsons Brinckerhoff 230 W. Monroe St Suite 900 Chicago, IL 60606 Phone: (312) 782-8150 Fax: (312) 782-1684 E-mail: _____Di verge Anal ysi s______ Anal yst: I DOT/PB Agency/Co. : Date performed: 4/1/2009 Analysis time period: Freeway/Dir of Travel: PM Peak I-290 WB Junction: 25th Ave. Exit to SB Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junction Analysis _Freeway Data_____ Type of analysis Di verge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 6550 vph Off Ramp Data Side of freeway Ri ght Number of lanes in ramp 1 20.0 Free-Flow speed on ramp mph Volume on ramp 250 vph Length of first accel/decel lane 125 ft Length of second accel/decel lane ft __Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? No Volume on adjacent ramp vph Position of adjacent ramp Type of adjacent ramp Distance to adjacent ramp ft Conversion to pc/h Under Base Conditions Adj acent Junction Components Freeway Ramp Ramp Volume, V (vph) 6550 250 vph Peak-hour factor, PHF 0.95 0.95 Peak 15-min volume, v15 1724 66 v Trucks and buses 3 3 % % Recreational vehicles 0 0 Terrain type: Level Level Grade 0.00 % 0.00 % % Length 0.00 mi 0.00 mi mi 1.5 1.2 Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.985 0.985 Driver population factor, fP 1.00 1.00 Flow rate, vp 6998 267 pcph ____Estimation of V12 Diverge Areas___ L = (Equation 25-8 or 25-9) EQ P = 0.573 Using Equation 5 Page 1

	2009PM WB 25th	Exit to SB 25th.	txt					
V = V 12 R	+ (v - v) P F R FI	= 4122 pc/h)						
	Capacity Checks							
	Actual 6998	Maximum 6750	LOS F? Yes					
	6731	6750	No					
	267	1900	No					
	2876 pc/h	(Equation 25-15	or 25-16)					
3 of av34 Is v v > 2700	pc/h?	Yes						
3 or av34 Is v v > 1.5 v	/2	No						
3 or av34 If yes, v = 4298	12	(Equation 25-18)					
FL o Act v 429 12A Level of	w Entering Dive ual Max 8 4400 Service Deterr	erge Influence Ar Desirable D nination (if not	ea Violation? No F)					
Density, D	= 4.252 + 0.008	86 v - 0.009 L	= 40.1 pc/mi/ln					
R Level of service for ramp	-freeway juncti	12 D ion areas of infl	uence F					
	Speed Estir	mation						
Intermediate speed variab	le,	$D_{0} = 0.647$						
Space mean speed in ramp	influence area,	S = 46.6	mph					
Space mean speed in outer	lanes,	$S_{0}^{R} = 53.7$	mph					
Space mean speed for all	vehi cl es,	S = 49.1	mph					

2009AM WB 17th Ave. Exit.txt HCS+: Ramps and Ramp Junctions Release 5.4 Parsons Brinckerhoff 230 W. Monroe St Suite 900 Chi cago, IL 60606 Phone: (312) 782-8150 Fax: (312) 782-1684 E-mail: _____Di verge Anal ysi s______Di verge Anal ysi s_____ Anal yst: I DOT/PB Agency/Co. : Date performed: 4/1/2009 Analysis time period: AM Peak Freeway/Dir of Travel: I-290 WB Junction: 17th Ave. Exit Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junction Analysis Freeway Data_____ Type of analysis Di verge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 6470 vph Off Ramp Data Side of freeway Ri ght Number of lanes in ramp 1 Free-Flow speed on ramp 35.0 mph Volume on ramp 80 vph Length of first accel/decel lane 311 ft Length of second accel/decel lane ft __Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent ramp 100 vph Position of adjacent ramp Upstream Type of adjacent ramp 0ff Distance to adjacent ramp 2474 ft __Conversion to pc/h Under Base Conditions__ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 6470 80 100 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1703 21 26 v Trucks and buses 10 10 10 % % Recreational vehicles 0 0 0 Terrain type: Level Level Level Grade 0.00 % 0.00 % 0.00 % Length 0.00 mi 0.00 mi 0.00 mi 1.5 1.2 Trucks and buses PCE, ET 1.5 1.5 1. 2 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.952 0.952 0.952 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 7151 88 111 pcph ____Estimation of V12 Diverge Areas___ L = (Equation 25-8 or 25-9) EQ P = 0.577 Using Equation 5

Page 1

C	2009AM WB 1	7th Ave. Exit.txt	
v 1	= v + (v - v) P 2 R F R FI	= 4165 pc/h)	
	Capaci ty	Checks	
	Actual 7151	Maximum 6750	LOS F? Yes
	7063	6750	Yes
	88	2000	No
	2986 pc/h	(Equation 25-15	or 25-16)
3 or av34 Is v v >	2700 pc/h?	Yes	
s or av34	1.5 v /2	No	
3 or av34 If yes, v = 4451	12	(Equation 25-18)
12A			
V	Actual Max 4451 4400	erge Influence Ar Desirable D	ea Violation? No
12A Lev	el of Service Deter	mination (if not	F)
Density,	$D_{=} 4.252 + 0.008$	86 v - 0.009 L	= 39.7 pc/mi/ln
Level of service for	R ramp-freeway juncti	12 D ion areas of infl	uence F
	Speed Estin	mation	
Intermediate speed v	ari abl e,	D_ = 0.436	
Space mean speed in	ramp influence area,	S S_ = 49.3	mph
Space mean speed in	outer lanes,	R S_ = 53.7	mph
Space mean speed for	all vehicles,	S = 50.9	mph

2009PM WB 17th Ave. Exit.txt HCS+: Ramps and Ramp Junctions Release 5.4 Parsons Brinckerhoff 230 W. Monroe St Suite 900 Chi cago, IL 60606 Phone: (312) 782-8150 Fax: (312) 782-1684 E-mail: _____Di verge Anal ysi s______ Anal yst: I DOT/PB Agency/Co. : Date performed: 4/1/2009 Analysis time period: Freeway/Dir of Travel: PM Peak I-290 WB Junction: 17th Ave. Exit Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junction Analysis Freeway Data_____ Type of analysis Di verge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 6370 vph ____Off Ramp Data___ Side of freeway Ri ght Number of lanes in ramp 1 35.0 Free-Flow speed on ramp mph Volume on ramp 150 vph Length of first accel/decel lane 311 ft Length of second accel/decel lane ft __Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent ramp 190 vph Position of adjacent ramp Upstream Type of adjacent ramp 0ff Distance to adjacent ramp 2474 ft __Conversion to pc/h Under Base Conditions__ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 6370 150 190 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1676 39 50 v Trucks and buses 3 3 3 % 0 % Recreational vehicles 0 0 Terrain type: Level Level Level Grade 0.00 % 0.00 % 0.00 % Length 0.00 mi 0.00 mi 0.00 mi 1.5 1.2 1.5 1.2 Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.985 0.985 0.985 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 6806 160 203 pcph ____Estimation of V12 Diverge Areas___ L = (Equation 25-8 or 25-9) EQ P = 0. 582 Using Equation 5 Page 1

	2009PM WB 1	17th Ave. Exit.tx	t	
v 12	= v + (v - v) P R F R F	= 4031 pc/h D		
	Capaci ty	/ Checks		
	Actual 6806	Maximum 6750	LOS F? Yes	
	6646	6750	No	
	160	2000	No	
	2775 pc/h	(Equation 25-1	5 or 25-16)	
3 or av34 Is v v > 2	700 pc/h?	Yes		
3 or av34 Is v v > 1	.5 v /2	No		
3 or av34 If yes, v = 4106 12A	12	(Equation 25-18)		
v 12A Leve	_Flow Entering Div Actual Max 4106 440 I of Service Deter	verge Influence A < Desirable DO rmination (if not	rea Violation? No F)	
Density,	D = 4.252 + 0.00)86 v - 0.009 L	= 36.8	pc/mi/ln
Level of service for	R ramp-freeway iunct	12 tion areas of inf	D Luence F	
	Speed Esti	mation		
Intermediate speed va	ri abl e,	D = 0.442		
Space mean speed in r	amp influence area	S = 49.2	mph	
Space mean speed in o	uter lanes,	R S = 53.7	mph	
Space mean speed for	all vehicles,	S = 50.9	mph	

2009AM WB 9th Ave. Exit.txt

HCS+: Ramps and Ramp Junctions Release 5.4

Parsons Brinckerhoff 230 W. Monroe St Sui te 900 Chi cago, IL 60606 Phone: (312) 782-8150 E-mail: Fax: (312) 782-1684 _____Di verge Anal ysi s______ Anal yst: I DOT/PB Agency/Co.: 4/1/2009 Date performed: Analysis time period: AM Peak Freeway/Dir of Travel: I-290 WB Junction: 9th Ave. Exit Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junction Analysis Freeway Data_____ Type of analysis Di verge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 6570 vph ____Off Ramp Data____ Side of freeway Right Number of lanes in ramp 1 35.0 Free-Flow speed on ramp mph Volume on ramp 100 vph Length of first accel/decel lane 184 ft Length of second accel/decel lane ft ___Adjacent Ramp Data (if one exists)___ Does adjacent ramp exist? Yes Volume on adjacent ramp 550 vph Position of adjacent ramp Upstream Type of adjacent ramp 0'n Distance to adjacent ramp 800 ft ___Conversion to pc/h Under Base Conditions__ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 6570 100 550 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1729 26 145 v Trucks and buses 10 10 16 % Recreational vehicles % 0 0 0 Level Terrain type: Level Level Grade 0.00 % 0.00 % 0.00 % Length 0.00 mi 0.00 mi 0.00 mi Trucks and buses PCE, ET 1.5 1.5 1.5 Recreational vehicle PCE, ER 1.2 1.2 1.2 0.952 0.926 Heavy vehicle adjustment, fHV 0.952 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 7262 111 625 pcph ____Estimation of V12 Diverge Areas___ L = 2722.24 (Equation 25-8 or 25-9) EQ P = 0.906 Using Equation 6 Page 1

2009AM WB 9th Ave. Exit.txt				
	v = v + (v - v) P 12 R F R F	= 6587 pc/h D		
	Capaci ty	/ Checks		
V = V	Actual 7262	Maximum 6750	LOS F? Yes	
	7151	6750	Yes	
	111	2000	No	
	675 pc/h	(Equation 25-15	or 25-16)	
	> 2700 pc/h?	No		
Is v v	> 1.5 v /2	No		
3 or av34 If yes, v = 65 12A	12 87	(Equation 25-18)		
V 12	Flow Entering Div Actual Max 6587 440	verge Influence Ar « Desirable)0	ea Violation? Yes	
	Level of Service Deter	mination (if not	F)	
Density, Level of service	D = 4.252 + 0.00 R for ramp-freeway junct	086 v - 0.009 L 12 D tion areas of infl	= 59.2 pc/mi/ln uence F	
	Speed Esti	mation		
Intermediate spee	d variable,	$D_{c} = 0.438$		
Space mean speed	in ramp influence area	s_{1} , s_{2} = 49.3	mph	
Space mean speed	in outer lanes,	$S_{0}^{K} = 60.3$	mph	
Space mean speed	for all vehicles,	S = 50.2	mph	

2009PM WB 9th Ave. Exit.txt

HCS+: Ramps and Ramp Junctions Release 5.4

Parsons Brinckerhoff 230 W. Monroe St Sui te 900 Chi cago, IL 60606 Phone: (312) 782-8150 E-mail: Fax: (312) 782-1684 _____Di verge Anal ysi s______ Anal yst: I DOT/PB Agency/Co. : 4/1/2009 Date performed: Analysis time period: PM Peak Freeway/Dir of Travel: I-290 WB Junction: 9th Ave. Exit Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junction Analysis Freeway Data_____ Type of analysis Di verge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 6560 vph ____Off Ramp Data____ Side of freeway Right Number of lanes in ramp 1 35.0 Free-Flow speed on ramp mph 190 Volume on ramp vph Length of first accel/decel lane 184 ft Length of second accel/decel lane ft ___Adjacent Ramp Data (if one exists)___ Does adjacent ramp exist? Yes Volume on adjacent ramp 570 vph Position of adjacent ramp Upstream Type of adjacent ramp 0'n Distance to adjacent ramp 800 ft ___Conversion to pc/h Under Base Conditions__ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 6560 190 570 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1726 50 150 v Trucks and buses 3 3 7 % Recreational vehicles 0 % 0 0 Level Terrain type: Level Level Grade 0.00 % 0.00 % 0.00 % Length 0.00 mi 0.00 mi 0.00 mi Trucks and buses PCE, ET 1.5 1.5 1.5 Recreational vehicle PCE, ER 1.2 1.2 1.2 0.966 Heavy vehicle adjustment, fHV 0.985 0.985 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 7009 203 621 pcph ____Estimation of V12 Diverge Areas___ L = 2864.67 (Equation 25-8 or 25-9) EQ P = 0.913 Using Equation 6 Page 1

2009PM WB 9th Ave. Exit.txt					
FD V = V 12 R	+ (v - v) P F R FD	= 6414 pc/h			
	Capaci ty	Checks			
	Actual 7009	Maximum 6750	LOS F? Yes		
	6806	6750	Yes		
	203	2000	No		
	595 pc/h	(Equation 25-15	or 25-16)		
Is v v > 2700 p	⊳c∕h?	No			
Is v v > 1.5 v	/2	No			
3 or av34 1 If yes, v = 6414 12A	2	(Equation 25-18)			
FI ow Actu V 6414	e Entering Dive Max Max 4400	rge Influence Aro Desirable	ea Violation? Yes		
Level of	Service Determ	ination (if not	F)		
Density, D_=	4.252 + 0.008	6 v - 0.009 L	= 57.8 pc/mi/ln		
Level of service for ramp-	freeway juncti	on areas of infl	uence F		
	Speed Estim	ation			
Intermediate speed variabl	e,	$D_{0} = 0.446$			
Space mean speed in ramp i	nfluence area,	S = 49.2	mph		
Space mean speed in outer	lanes,	$S_{0}^{R} = 60.3$	mph		
Space mean speed for all v	ehi cl es,	S = 50.0	mph		

2009AM WB 1st Ave. Enter Ramp.txt

HCS+: Ramps and Ramp Junctions Release 5.4

Parsons Brinckerhoff 230 W. Monroe St Sui te 900 Chi cago, IL 60606 Phone: (312) 782-8150 E-mail: Fax: (312) 782-1684 _____Merge Analysis_____ Anal yst: I DOT/PB Agency/Co. : 4/1/2009 Date performed: Analysis time period: AM Peak Freeway/Dir of Travel: I-290 WB Junction: 1st Ave. Entrance Ramp Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junction Analysis _____Freeway Data_____ Type of analysis Merge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 6020 vph On Ramp Data____ Side of freeway Right Number of lanes in ramp 1 35.0 Free-flow speed on ramp mph Volume on ramp 550 vph Length of first accel/decel lane 197 ft Length of second accel/decel lane ft ___Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent Ramp 100 vph Position of adjacent Ramp Downstream Type of adjacent Ramp 0ff Distance to adjacent Ramp 800 ft __Conversion to pc/h Under Base Conditions_ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 6020 550 100 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1584 145 26 v Trucks and buses 10 16 10 % % Recreational vehicles 0 0 0 Terrain type: Level Level Level Grade % % % Length mi mi mi Trucks and buses PCE, ET 1.5 1.5 1.5 Recreational vehicle PCE, ER 1.2 1.2 1.2 0.952 Heavy vehicle adjustment, fHV 0.926 0.952 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 6654 625 111 pcph ____Estimation of V12 Merge Areas___ L = 849.41 (Equation 25-2 or 25-3) EQ Ρ 0.585 Using Equation 3 = Page 1

	ΓM	2009AM WB 1s	st Ave. Enter Ram	p. txt	
	V = V 12 F	(P_) = 3894 FM	pc/h		
		Capaci ty	Checks		
V F0		Actual 7279	Maximum 6750	LOS F? Yes	
V V		2760 pc/h	(Equation 25-4 d	or 25-5)	
Is v v	> 2700 pc	c/h?	Yes		
s or avsa Is v v	> 1.5 v	/2	No		
3 or av34 If yes, v = 3954 12A	54 54	2	(Equation 25-8)		
v 12A L	Flo Actua 3954 Level of S	ow Entering Me al Max 4600 Service Determ	rge Influence Are Desirable ination (if not I	ea Violation? No F)	
Density, $D = 5.475$ R	5 + 0.0073	$R = \frac{1}{2}$	v - 0.00627 L	= 39.7	pc/mi /I n
Level of service i	or ramp-i			Lence F	
		Speed Estim	ati on		
Intermediate speed	l variable	Э,	$M_{s} = 0.687$		
Space mean speed i	n ramp ir	nfluence area,	$S_{p}^{3} = 46.1$	mph	
Space mean speed i	n outer l	anes,	$S_{0}^{R} = 46.1$	mph	
Space mean speed f	for all ve	ehi cl es,	S = 46.1	mph	

2009PM WB 1st Ave. Enter Ramp.txt

HCS+: Ramps and Ramp Junctions Release 5.4

Parsons Brinckerhoff 230 W. Monroe St Sui te 900 Chi cago, IL 60606 Phone: (312) 782-8150 E-mail: Fax: (312) 782-1684 _____Merge Anal ysi s_____ Anal yst: I DOT/PB Agency/Co. : 4/1/2009 Date performed: Analysis time period: PM Peak Freeway/Dir of Travel: I-290 WB Junction: 1st Ave. Entrance Ramp Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junction Analysis __Freeway Data_____ Type of analysis Merge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 5990 vph On Ramp Data____ Side of freeway Ri ght Number of lanes in ramp 1 35.0 Free-flow speed on ramp mph Volume on ramp 570 vph Length of first accel/decel lane 197 ft Length of second accel/decel lane ft ___Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent Ramp 190 vph Position of adjacent Ramp Downstream Type of adjacent Ramp 0ff Distance to adjacent Ramp 800 ft __Conversion to pc/h Under Base Conditions_ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 5990 570 190 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1576 150 50 v Trucks and buses 3 7 3 % % Recreational vehicles 0 0 0 Terrain type: Level Level Level Grade % % % Length mi mi mi Trucks and buses PCE, ET 1.5 1.5 1.5 Recreational vehicle PCE, ER 1.2 1.2 1.2 0.985 Heavy vehicle adjustment, fHV 0.985 0.966 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 6400 621 203 pcph ____Estimation of V12 Merge Areas___ = L 1553.42 (Equation 25-2 or 25-3) EQ Ρ 0.615 Using Equation 3 = Page 1

	2009PM WB	lst Ave. Enter Ra	mp.txt	
V = X 12	/ (P) = 3938 F FM	pc/h		
	Capaci ty	Checks		
V FO	Actual 7021	Maximum 6750	LOS F? Yes	
V V 3 or av34 Is V V > 2700 p 3 or av34 Is V V > 1.5 V 3 or av34 1 If yes, V = 3938 12A	2462 pc/h	(Equation 25-4	or 25-5)	
) pc/h?	No		
	v_/2	No		
	12	(Equation 25-8))	
Ac v 39 R12 Level c	Flow Entering M ctual Max 238 460 of Service Deter	erge Influence A Desirable O mination (if not	rea Violation? No F)	
Density, D = 5.475 + 0.0 R Level of service for ran	00734 v + 0.007 R np-freewaviunct	8 v - 0.00627 12 ion areas of inf	L = 39.5 A Luence F	pc/mi/ln
	Speed Esti	mation		
Intermediate speed varia	able,	M = 0.680		
Space mean speed in ramp influence area,		$S_{-} = 46.2$	mph	
Space mean speed in oute	er Lanes,	R S_ = 47.5	mph	
Space mean speed for all	vehi cl es,	S = 46.6	mph	

2009AM WB 1st Ave. Exit.txt

HCS+: Ramps and Ramp Junctions Release 5.4

Parsons Brinckerhoff 230 W. Monroe St Suite 900 Chi cago, IL 60606 Phone: (312) 782-8150 Fax: (312) 782-1684 E-mail: _____Di verge Anal ysi s______ Anal yst: I DOT/PB Agency/Co. : Date performed: 4/1/2009 Analysis time period: AM Peak Freeway/Dir of Travel: I-290 WB 1st Ave. Exit Ramp Junction: Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junction Analysis _Freeway Data_____ Type of analysis Di verge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 6500 vph Off Ramp Data Side of freeway Ri ght Number of lanes in ramp 1 35.0 Free-Flow speed on ramp mph Volume on ramp 480 vph Length of first accel/decel lane 204 ft Length of second accel/decel lane ft __Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent ramp 550 vph Position of adjacent ramp Downstream Type of adjacent ramp 0n 1900 Distance to adjacent ramp ft ___Conversion to pc/h Under Base Conditions__ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 6500 480 550 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1711 126 145 v Trucks and buses 10 10 16 % % Recreational vehicles 0 0 0 Terrain type: Level Level Level Grade 0.00 % 0.00 % 0.00 % Length 0.00 mi 0.00 mi 0.00 mi 1.5 1.2 Trucks and buses PCE, ET 1.5 1.5 1. 2 1.2 Recreational vehicle PCE, ER 0.926 Heavy vehicle adjustment, fHV 0.952 0.952 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 7184 531 625 pcph ____Estimation of V12 Diverge Areas___ L = (Equation 25-8 or 25-9) EQ P = 0.556 Using Equation 5 Page 1

	ED	2009AM WB 1s	st Ave. Exit.txt	
	rd V = V 12 R	+ (v - v) P F R FD	= 4230 pc/h	
		Capacity (Checks	
V = V Fi F $V = V - V$ F0 F R V R V 3 or av34 Is V V > 2700 p		Actual 7184	Maximum 6750	LOS F? Yes
		6653	6750	No
		531	2000	No
		2954 pc/h	(Equation 25-15 or 25-16)	
	> 2700 pc	c/h?	Yes	
$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$		/2	No	
		2	(Equation 25-18)	
v 12A	Flow Actua 4484 Level of S	Entering Diver al Max I 4400 Service Determi	rge Influence Ard Desirable ination (if not 1	ea Violation? No -)
Densi ty,	D =	4. 252 + 0. 0080	6 v - 0.009 L	= 41.0 pc/mi/ln
Level of service	R for ramp-i	freeway junctio	12 D on areas of influ	uence F
		Speed Estima	ati on	
Intermediate spee	d variable	э,	D_ = 0.476	
Space mean speed in ramp influence area,		S S = 48.8	mph	
Space mean speed in outer lanes,		anes,	$S_{2}^{R} = 53.7$	mph
Space mean speed	for all ve	ehi cl es,	S = 50.5	mph

2009PM WB 1st Ave. Exit.txt

HCS+: Ramps and Ramp Junctions Release 5.4

Parsons Brinckerhoff 230 W. Monroe St Suite 900 Chi cago, IL 60606 Phone: (312) 782-8150 Fax: (312) 782-1684 E-mail: _____Di verge Anal ysi s_____ Anal yst: I DOT/PB Agency/Co. : Date performed: 4/1/2009 Analysis time period: PM Peak Freeway/Dir of Travel: I-290 WB 1st Ave. Exit Ramp Junction: Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junction Analysis _Freeway Data_____ Type of analysis Di verge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 6480 vph Off Ramp Data Side of freeway Ri ght Number of lanes in ramp 1 35.0 Free-Flow speed on ramp mph 490 Volume on ramp vph Length of first accel/decel lane 204 ft Length of second accel/decel lane ft __Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent ramp 570 vph Position of adjacent ramp Downstream Type of adjacent ramp 0n Distance to adjacent ramp 1900 ft __Conversion to pc/h Under Base Conditions__ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 6480 490 570 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1705 129 150 v Trucks and buses 3 3 7 % % Recreational vehicles 0 0 0 Terrain type: Level Level Level Grade 0.00 % 0.00 % 0.00 % Length 0.00 mi 0.00 mi 0.00 mi 1.5 1.2 1.5 1.2 Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.966 0.985 0.985 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 6923 524 621 pcph ____Estimation of V12 Diverge Areas___ L = (Equation 25-8 or 25-9) EQ P = 0.563 Using Equation 5 Page 1

בר	2009PM WB 1	st Ave. Exit.txt		
v 12	= v + (v - v) P R F R F	= 4125 pc/h D		
Capacity Checks				
V = V Fi F $V = V - V$ F0 F R V R V 3 or av34 Is V V > 2700 p	Actual 6923	Maximum 6750	LOS F? Yes	
	6399	6750	No	
	524	2000	No	
	2798 pc/h	(Equation 25-15 or 25-16)		
	700 pc/h?	Yes		
3 or av34 Is v v > 1	.5 v /2	No		
3 or av34 If yes, v = 4223	12	(Equation 25-18)		
IZA				
V	Actual Max 4223 440	erge influence Ar Desirable 0	violation? No	
12A Leve	l of Service Deter	mination (if not	F)	
Density,	$D_{p} = 4.252 + 0.00$	86 v - 0.009 L	= 38.7	pc/mi/ln
Level of service for	R ramp-freeway junct	ion areas of infl	uence F	
	Speed Esti	mation		
Intermediate speed va	ri abl e,	D = 0.475		
Space mean speed in ramp influence area,		, S = 48.8	mph	
Space mean speed in outer lanes,		$S_{2}^{R} = 53.7$	mph	
Space mean speed for	all vehicles,	S = 50.6	mph	

2009AM WB Des Plaines Enter Ramp.txt HCS+: Ramps and Ramp Junctions Release 5.4 Parsons Brinckerhoff 230 W. Monroe St Suite 900 Chicago, IL 60606 Phone: (312) 782-8150 Fax: (312) 782-1684 E-mail: _____Merge Analysis_____ Anal yst: I DOT/PB Agency/Co. : Date performed: 4/1/2009 Analysis time period: Freeway/Dir of Travel: AM Peak I-290 WB Junction: Des Plaines Ave. Entrance Ramp Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junction Analysis _Freeway Data_____ Type of analysis Merge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 5800 vph ____On Ramp Data___ Side of freeway Ri ght Number of lanes in ramp 1 35.0 Free-flow speed on ramp mph Volume on ramp 700 vph Length of first accel/decel lane 548 ft Length of second accel/decel lane ft __Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? No Volume on adjacent Ramp vph Position of adjacent Ramp Type of adjacent Ramp Distance to adjacent Ramp ft __Conversion to pc/h Under Base Conditions_ Adj acent Junction Components Freeway Ramp Ramp Volume, V (vph) 5800 700 vph Peak-hour factor, PHF 0.95 0.95 Peak 15-min volume, v15 1526 184 v Trucks and buses 10 6 % % Recreational vehicles 0 Ω Terrain type: Level Level Grade % % % Length mi mi mi 1.5 Trucks and buses PCE, ET 1.5 1.2 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.952 0.971 Driver population factor, fP 1.00 1.00 Flow rate, vp 6411 759 pcph ____Estimation of V12 Merge Areas__ L = (Equation 25-2 or 25-3) EQ P = 0.593 Using Equation 1 Page 1

F	2009AM WB Des P	laines Enter Ramp). txt	
r V 1	[™] = v (P) = 3801 2 F FM	pc/h		
	Capaci ty	Checks		
V FO	Actual 7170	Maximum 6750	LOS F? Yes	
	2610 pc/h	(Equation 25-4	or 25-5)	
$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	2700 pc/h?	No		
	1.5 v /2	No		
	12	(Equation 25-8)	1	
V R12 Lev	Flow Entering M Actual Max 3801 460 el of Service Deter	erge Influence Ar Desirable O mination (if not	ea Violation? No F)	
Density, D = 5.475 + R	0.00734 v + 0.007 R	8 v - 0.00627 L 12	- = 37.3 A	pc/mi/In
	Sneed Esti	mation	uchec 1	
Intermediate speed v	ari abl e,	M_ = 0.655		
Space mean speed in ramp influence area,		S = 46.5	mph	
Space mean speed in outer lanes,		R S_= 46.6	mph	
Space mean speed for	all vehicles,	S = 46.5	mph	

2009PM WB Des Plaines Enter Ramp.txt HCS+: Ramps and Ramp Junctions Release 5.4 Parsons Brinckerhoff 230 W. Monroe St Suite 900 Chicago, IL 60606 Phone: (312) 782-8150 Fax: (312) 782-1684 E-mail: _____Merge Analysis_____ Anal yst: I DOT/PB Agency/Co. : Date performed: 4/1/2009 Analysis time period: Freeway/Dir of Travel: PM Peak I-290 WB Junction: Des Plaines Ave. Entrance Ramp Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junction Analysis _Freeway Data_____ Type of analysis Merge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 5890 vph ____On Ramp Data___ Side of freeway Ri ght Number of lanes in ramp 1 35.0 Free-flow speed on ramp mph 590 Volume on ramp vph Length of first accel/decel lane 548 ft Length of second accel/decel lane ft __Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? No Volume on adjacent Ramp vph Position of adjacent Ramp Type of adjacent Ramp Distance to adjacent Ramp ft __Conversion to pc/h Under Base Conditions_ Adj acent Junction Components Freeway Ramp Ramp Volume, V (vph) 5890 590 vph Peak-hour factor, PHF 0.95 0.95 Peak 15-min volume, v15 1550 155 v Trucks and buses 3 5 % % Recreational vehicles 0 Ω Terrain type: Level Level Grade % % % Length mi mi mi 1.5 Trucks and buses PCE, ET 1.5 1.2 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.985 0.976 Driver population factor, fP 1.00 1.00 Flow rate, vp 6293 637 pcph ____Estimation of V12 Merge Areas__ L = (Equation 25-2 or 25-3) EQ P = 0.593 Using Equation 1 Page 1

	2009PM WB Des P	laines Enter Ramp	o. txt	
r™ ∨ 12	= v (P) = 3731 : F FM	pc/h		
	Capaci ty	Checks		
V FO	Actual 6930	Maximum 6750	LOS F? Yes	
	2562 pc/h	(Equation 25-4	or 25-5)	
3 or av34 Is v v > 2700 p 3 or av34 Is v v > 1.5 v 3 or av34 1 If yes, v = 3731 12A	:700 pc/h?	No		
	.5 v /2	No		
	12	(Equation 25-8))	
V R12 Leve	Flow Entering M Actual Max 3731 460	erge Influence An Desirable O mination (if not	rea Violation? No F)	
Density, D = 5.475 +	0.00734 v + 0.007	8 v 0.00627 l	_ = 35.8	pc/mi/ln
R Level of service for	R ramp-freeway junct	12 ion areas of infl	A uence F	
	Speed Esti	mation		
Intermediate speed va	ri abl e,	M = 0.590		
Space mean speed in r	amp influence area	, S = 47.3	mph	
Space mean speed in c	outer Lanes,	R S = 46.9	mph	
Space mean speed for	all vehicles,	S = 47.2	mph	

2009AM WB Harlem Ave. Enter Ramp.txt HCS+: Ramps and Ramp Junctions Release 5.4 Parsons Brinckerhoff 230 W. Monroe St Suite 900 Chicago, IL 60606 Phone: (312) 782-8150 Fax: (312) 782-1684 E-mail: _____Merge Anal ysi s______ Anal yst: I DOT/PB Agency/Co. : Date performed: 4/1/2009 Analysis time period: Freeway/Dir of Travel: AM Peak I-290 WB Junction: Harlem Ave. Entrance Ramp Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junction Analysis _Freeway Data_____ Type of analysis Merge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 5120 vph ____On Ramp Data___ Side of freeway Left Number of lanes in ramp 1 Free-flow speed on ramp 35.0 mph Volume on ramp 680 vph Length of first accel/decel lane ft 487 Length of second accel/decel lane ft __Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent Ramp 260 vph Position of adjacent Ramp Upstream Type of adjacent Ramp 0ff 2320 Distance to adjacent Ramp ft __Conversion to pc/h Under Base Conditions_ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 5120 680 260 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1347 179 68 v Trucks and buses 10 3 10 % % Recreational vehicles 0 0 Ω Level Terrain type: Level Level % Grade % % Length mi mi mi 1.5 Trucks and buses PCE, ET 1.5 1.5 1.2 1.2 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.952 0.985 0.952 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 5659 727 287 pcph ____Estimation of V12 Merge Areas__ L = 1011.03 (Equation 25-2 or 25-3) EQ Ρ 0. 591 Using Equation 1 = Page 1

2009AM WB Harlem Ave. Enter Ramp.txt FΜ = V (P) = 3345 pc/h V 12 F FM _Capacity Checks_ LOS F? Actual Maxi mum 6386 6750 V No F0 2314 pc/h (Equation 25-4 or 25-5) v 3 or av34 > 2700 pc/h? No ls V 3 or av34 ls 1.5 v /2 12 No v v 3 or av34 (Equation 25-8) If yes, v = 3345 12A _Flow Entering Merge Influence Area Max Dĕsi rabl e Actual Violation? 4600 No v 3345 R12 Level of Service Determination (if not F)_ Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = R 12 A 37.0 pc/mi/ln Level of service for ramp-freeway junction areas of influence Е _Speed Estimation_ Intermediate speed variable, = 0.629 М S Space mean speed in ramp influence area, S = 46.8 mph R S Space mean speed in outer lanes, = 49.9 mph 0 Space mean speed for all vehicles, S = 47.7 mph

Speed and volume conditions occurring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual method.

2009PM WB Harlem Ave. Enter Ramp.txt HCS+: Ramps and Ramp Junctions Release 5.4 Parsons Brinckerhoff 230 W. Monroe St Suite 900 Chicago, IL 60606 Phone: (312) 782-8150 Fax: (312) 782-1684 E-mail: _____Merge Anal ysi s______ Anal yst: I DOT/PB Agency/Co. : Date performed: 4/1/2009 Analysis time period: Freeway/Dir of Travel: PM Peak I-290 WB Junction: Harlem Ave. Entrance Ramp Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junction Analysis _Freeway Data_____ Type of analysis Merge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 5200 vph ____On Ramp Data___ Side of freeway Left Number of lanes in ramp 1 35.0 Free-flow speed on ramp mph Volume on ramp 690 vph Length of first accel/decel lane 487 ft Length of second accel/decel lane ft __Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent Ramp 580 vph Position of adjacent Ramp Upstream Type of adjacent Ramp 0ff 2320 Distance to adjacent Ramp ft __Conversion to pc/h Under Base Conditions_ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 5200 690 580 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1368 182 153 v Trucks and buses 3 3 3 % % Recreational vehicles 0 0 Ω Level Terrain type: Level Level % Grade % % Length mi mi mi 1.5 Trucks and buses PCE, ET 1.5 1.5 1.2 1.2 Recreational vehicle PCE, ER 1.2 0.985 Heavy vehicle adjustment, fHV 0.985 0.985 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 5556 737 620 pcph ____Estimation of V12 Merge Areas___ L = 991.13 (Equation 25-2 or 25-3) EQ Ρ 0. 591 Using Equation 1 = Page 1

2009PM WB Harlem Ave. Enter Ramp.txt FΜ = V (P) = 3284 pc/h V 12 F FM _Capacity Checks_ LOS F? Actual Maxi mum 6293 6750 V No F0 2272 pc/h (Equation 25-4 or 25-5) v v 3 or av34 > 2700 pc/h? No ls V 3 or av34 ls 1.5 v /2 No v v 12 3 or av34 lf yes, = 3284 (Equation 25-8) v 12A _Flow Entering Merge Influence Area Actual Max Desirable Violation? 4600 No v 3284 R12 Level of Service Determination (if not F)_ Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = R 12 A pc/mi/ln 36.5 Level of service for ramp-freeway junction areas of influence E _Speed Estimation_ Intermediate speed variable, = 0.609 М S S Space mean speed in ramp influence area, = 47.1 mph R S Space mean speed in outer lanes, = 50.0 mph 0 Space mean speed for all vehicles, S = 47.9 mph

Speed and volume conditions occurring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual method.

2009AM WB Harlem Ave. Exit Ramp.txt HCS+: Ramps and Ramp Junctions Release 5.4 Parsons Brinckerhoff 230 W. Monroe St Suite 900 Chi cago, IL 60606 Phone: (312) 782-8150 Fax: (312) 782-1684 E-mail: _____Di verge Anal ysi s_____ Anal yst: I DOT/PB Agency/Co. : Date performed: 4/1/2009 Analysis time period: AM Peak Freeway/Dir of Travel: I-290 WB Junction: Harlem Ave. Exit Ramp Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junction Analysis _____Freeway Data_____ Type of analysis Di verge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 5380 vph ____Off Ramp Data___ Side of freeway Left Number of lanes in ramp 1 Free-Flow speed on ramp 35.0 mph Volume on ramp 260 vph Length of first accel/decel lane ft 343 Length of second accel/decel lane ft __Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent ramp 680 vph Position of adjacent ramp Downstream Type of adjacent ramp 0n Distance to adjacent ramp 2320 ft ___Conversion to pc/h Under Base Conditions__ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 5380 260 680 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1416 68 179 v Trucks and buses 10 10 3 % 0 % Recreational vehicles 0 0 Terrain type: Level Level Level Grade 0.00 % 0.00 % 0.00 % Length 0.00 mi 0.00 mi 0.00 mi 1.5 1.2 1.5 1.2 Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER 0.985 Heavy vehicle adjustment, fHV 0.952 0.952 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 5946 287 727 pcph ____Estimation of V12 Diverge Areas___ L = (Equation 25-8 or 25-9) EQ P = 0. 598 Using Equation 5 Page 1

2009AM WB Harlem Ave. Exit Ramp.txt FD + (v - v) P = 3672F R FD V = V pc/h 12 R _Capacity Checks_ LOS F? Actual Maxi mum 5946 6750 No v = V Fi F 5659 6750 No = V F0 R 287 2000 V No R v 2274 pc/h (Equation 25-15 or 25-16) 3 or av34 ls > 2700 pc/h? No v v 3 or av34 No 1.5 v /2 ls > V v 3 or av34 12 If yes, v = 3672 (Equation 25-18) 12A Flow Entering Diverge Influence Area______ May Desirable Violation? 4400 v 3672 No 12 Level of Service Determination (if not F)_ D = 4.252 + 0.0086 v - 0.009 LDensity, = 34.3 pc/mi/ln 12 R D Level of service for ramp-freeway junction areas of influence D ____Speed Estimation_ Intermediate speed variable, D = 0.454 S Space mean speed in ramp influence area, S = 49.1 mph R S Space mean speed in outer lanes, = 56.1 mph 0 Space mean speed for all vehicles, S = 51.3 mph

Speed and volume conditions occurring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual method.

2009PM WB Harlem Ave. Exit Ramp.txt HCS+: Ramps and Ramp Junctions Release 5.4 Parsons Brinckerhoff 230 W. Monroe St Suite 900 Chi cago, IL 60606 Phone: (312) 782-8150 Fax: (312) 782-1684 E-mail: _____Di verge Anal ysi s______ Anal yst: I DOT/PB Agency/Co. : Date performed: 4/1/2009 Analysis time period: Freeway/Dir of Travel: PM Peak I-290 WB Junction: Harlem Ave. Exit Ramp Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junction Analysis _____Freeway Data_____ Type of analysis Di verge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 5780 vph ____Off Ramp Data___ Side of freeway Left Number of lanes in ramp 1 Free-Flow speed on ramp 35.0 mph Volume on ramp 580 vph Length of first accel/decel lane ft 343 Length of second accel/decel lane ft __Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent ramp 690 vph Position of adjacent ramp Downstream Type of adjacent ramp 0n Distance to adjacent ramp 2320 ft ___Conversion to pc/h Under Base Conditions__ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 5780 580 690 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1521 153 182 v Trucks and buses 3 3 3 % % Recreational vehicles 0 0 0 Terrain type: Level Level Level Grade 0.00 % 0.00 % 0.00 % Length 0.00 mi 0.00 mi 0.00 mi 1.5 1.2 1.5 1.2 Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.985 0.985 0.985 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 6175 620 737 pcph ____Estimation of V12 Diverge Areas___ L = (Equation 25-8 or 25-9) EQ P = 0.577 Using Equation 5 Page 1
2009PM WB Harlem Ave. Exit Ramp.txt FD + (v - v) P = 3826F R FD pc/h V = V12 R __Capacity Checks_ LOS F? Actual Maxi mum 6175 6750 No V = V Fi F 5555 6750 No = V F0 R 620 2000 No v R 2349 pc/h (Equation 25-15 or 25-16) v 3 or av34 ls > 2700 pc/h? No V V 3 or av34 No > 1.5 v /2 ls V v 3 or av34 12 lf yes, v (Equation 25-18) = 3826 12A Flow Entering Diverge Influence Area______ May Desirable Violation? 4400 3826 v No 12 Level of Service Determination (if not F)_ D = 4.252 + 0.0086 v - 0.009 LDensity, = 35.7 pc/mi/ln R 12 D Level of service for ramp-freeway junction areas of influence E ____Speed Estimation_ Intermediate speed variable, D = 0.484 S Space mean speed in ramp influence area, S = 48.7 mph R Space mean speed in outer lanes, S = 55.8 mph 0 Space mean speed for all vehicles, S = 51.0 mph

2009AM WB Austin Blvd. Enter Ramp.txt HCS+: Ramps and Ramp Junctions Release 5.4 Parsons Brinckerhoff 230 W. Monroe St Suite 900 Chicago, IL 60606 Phone: (312) 782-8150 Fax: (312) 782-1684 E-mail: _____Merge Analysis_____ Anal yst: I DOT/PB Agency/Co. : Date performed: 4/1/2009 Analysis time period: Freeway/Dir of Travel: AM Peak I-290 WB Junction: Austin Blvd. Entrance Ramp Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junction Analysis _Freeway Data_____ Type of analysis Merge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 4850 vph On Ramp Data____ Side of freeway Left Number of lanes in ramp 1 35.0 Free-flow speed on ramp mph Volume on ramp 530 vph Length of first accel/decel lane 774 ft Length of second accel/decel lane ft __Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? No Volume on adjacent Ramp vph Position of adjacent Ramp Type of adjacent Ramp Distance to adjacent Ramp ft __Conversion to pc/h Under Base Conditions_ Adj acent Junction Components Freeway Ramp Ramp 530 Volume, V (vph) 4850 vph Peak-hour factor, PHF 0.95 0.95 Peak 15-min volume, v15 1276 139 v Trucks and buses 10 2 % % Recreational vehicles 0 Ω Terrain type: Level Level Grade % % % Length mi mi mi 1.5 Trucks and buses PCE, ET 1.5 1.2 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.990 0.952 Driver population factor, fP 1.00 1.00 Flow rate, vp 5361 563 pcph ____Estimation of V12 Merge Areas_ L = (Equation 25-2 or 25-3) EQ P = 0.599 Using Equation 1 Page 1

2009AM WB Austin Blvd. Enter Ramp.txt FΜ = v (P) = 3212pc/h V 12 F FM _Capacity Checks_ LOS F? Actual Maxi mum 5924 6750 V No F0 2149 pc/h (Equation 25-4 or 25-5) v 3 or av34 > 2700 pc/h? No ls V 3 or av34 ls > 1.5 v /2 12 No v v 3 or av34 If yes, v = 3212 (Equation 25-8) 12A _Flow Entering Merge Influence Area Max Dĕsi rabl e Actual Violation? 4600 No v 3212 R12 Level of Service Determination (if not F)_ Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = R 12 A 32.8 pc/mi/ln Level of service for ramp-freeway junction areas of influence D _Speed Estimation_ Intermediate speed variable, = 0.517 М S Space mean speed in ramp influence area, S = 48.3 mph R S Space mean speed in outer lanes, = 50.4 mph 0 Space mean speed for all vehicles, S = 48.9 mph

2009PM WB Austin Blvd. Enter Ramp.txt HCS+: Ramps and Ramp Junctions Release 5.4 Parsons Brinckerhoff 230 W. Monroe St Suite 900 Chicago, IL 60606 Phone: (312) 782-8150 Fax: (312) 782-1684 E-mail: _____Merge Analysis_____ Anal yst: RT I DOT/PB Agency/Co. : Date performed: 4/8/2010 Analysis time period: Freeway/Dir of Travel: PM Peak I-290 WB Junction: Austin Blvd. Entrance Ramp Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junction Analysis _Freeway Data_____ Type of analysis Merge Number of lanes in freeway 3 Free-flow speed on freeway 55.0 mph Volume on freeway 7300 vph On Ramp Data____ Side of freeway Left Number of lanes in ramp 1 35.0 Free-flow speed on ramp mph Volume on ramp 470 vph Length of first accel/decel lane 774 ft Length of second accel/decel lane ft __Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? No Volume on adjacent Ramp vph Position of adjacent Ramp Type of adjacent Ramp Distance to adjacent Ramp ft __Conversion to pc/h Under Base Conditions_ Adj acent Junction Components Freeway Ramp Ramp Volume, V (vph) 7300 470 vph Peak-hour factor, PHF 0.95 0.95 Peak 15-min volume, v15 1921 124 v Trucks and buses 3 1 % % Recreational vehicles 0 0 Terrain type: Level Level Grade % % % Length mi mi mi 1.5 Trucks and buses PCE, ET 1.5 1.2 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.995 0.985 Driver population factor, fP 1.00 1.00 Flow rate, vp 7799 497 pcph ____Estimation of V12 Merge Areas__ L = (Equation 25-2 or 25-3) EQ Ρ 0.599 Using Equation 1 = Page 1

	2009	9PM WB Austin	Blvd. Enter Ramp	o. txt	
	v = v (12 F	(P) = 4673 FM	pc/h		
		Capaci ty	Checks		
V FO		Actual 8296	Maximum 6750	LOS F? Yes	
		3126 pc/h	(Equation 25-4	or 25-5)	
Is v v	> 2700 pc	:/h?	Yes		
	> 1.5 v	/2	No		
3 or av34 1 If yes, v = 5099 12A			(Equation 25-8)		
 V 12A L	Flo Actua 5099 evel of S	w Entering Me Il Max 4600 Gervice Determ	rge Influence Ar Desirable ination (if not	ea Violation? Yes F)	
Density, $D = 5.475$ R	5 + 0.0073	$R = \frac{1}{R}$	v - 0.00627 L	= 48.8 A	pc/mi/In
Level of service i	or ramp-r	Snood Fatim		uence r	
		Speed ESTIM			
Intermediate speed	i vari abi e		M = 2.202 S		
Space mean speed i	n ramp in	ifluence area,	$S_{R} = 26.4$	mph	
Space mean speed i	n outer I	anes,	$S_{0} = 49.3$	mph	
Space mean speed f	for all ve	ehi cl es,	S = 29.9	mph	

2009AM WB Central Ave. Enter Ramp.txt HCS+: Ramps and Ramp Junctions Release 5.4 Parsons Brinckerhoff 230 W. Monroe St Suite 900 Chicago, IL 60606 Phone: (312) 782-8150 Fax: (312) 782-1684 E-mail: _____Merge Analysis_____ Anal yst: I DOT/PB Agency/Co. : Date performed: 4/1/2009 Analysis time period: Freeway/Dir of Travel: AM Peak I-290 WB Junction: Central Ave. Entrance Ramp Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junction Analysis _Freeway Data_____ Type of analysis Merge Number of lanes in freeway 4 Free-flow speed on freeway 55.0 mph Volume on freeway 5240 vph On Ramp Data____ Side of freeway Ri ght Number of lanes in ramp 1 35.0 Free-flow speed on ramp mph Volume on ramp 500 vph Length of first accel/decel lane 606 ft Length of second accel/decel lane ft __Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent Ramp vph 310 Position of adjacent Ramp Upstream Type of adjacent Ramp 0ff Distance to adjacent Ramp 2110 ft __Conversion to pc/h Under Base Conditions_ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 5240 500 310 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1379 132 82 v Trucks and buses 10 2 10 % % Recreational vehicles 0 0 Ω Level Terrain type: Level Level % Grade % % Length mi mi mi 1.5 Trucks and buses PCE, ET 1.5 1.5 1.2 1.2 1.2 Recreational vehicle PCE, ER 0.990 Heavy vehicle adjustment, fHV 0.952 0.952 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 5792 532 343 pcph ____Estimation of V12 Merge Areas__ L = (Equation 25-2 or 25-3) EQ P = 0. 151 Using Equation 4 Page 1

2009AM WB Central Ave. Enter Ramp.txt FΜ = v (P) = 876 pc/h V 12 F FM _Capacity Checks_ LOS F? Actual Maxi mum 6324 9000 V No F0 2458 pc/h (Equation 25-4 or 25-5) v 3 or av34 > 2700 pc/h? No ls V 3 or av34 ls > 1.5 v /2 12 Yes v v 3 or av34 If yes, v (Equation 25-8) = 2316 12A _Flow Entering Merge Influence Area Max Dĕsi rabl e Violation? Actual 4600 No v 2316 12A Level of Service Determination (if not F)_ Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = R 12 A 23.6 pc/mi/ln Level of service for ramp-freeway junction areas of influence С _Speed Estimation_ Intermediate speed variable, = 0.346 М S Space mean speed in ramp influence area, S = 50.5 mph R S Space mean speed in outer lanes, = 50.5 mph 0 Space mean speed for all vehicles, S = 50.5 mph

2009PM WB Central Ave. Enter Ramp.txt HCS+: Ramps and Ramp Junctions Release 5.4 Parsons Brinckerhoff 230 W. Monroe St Suite 900 Chi cago, IL 60606 Phone: (312) 782-8150 Fax: (312) 782-1684 E-mail: _____Merge Analysis_____ Anal yst: I DOT/PB Agency/Co. : Date performed: 4/1/2009 Analysis time period: Freeway/Dir of Travel: PM Peak I-290 WB Junction: Central Ave. Entrance Ramp Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junction Analysis _Freeway Data_____ Type of analysis Merge Number of lanes in freeway 4 Free-flow speed on freeway 55.0 mph Volume on freeway 5750 vph ___On Ramp Data___ Side of freeway Ri ght Number of lanes in ramp 1 35.0 Free-flow speed on ramp mph Volume on ramp 660 vph Length of first accel/decel lane 606 ft Length of second accel/decel lane ft __Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent Ramp 290 vph Position of adjacent Ramp Upstream Type of adjacent Ramp 0ff 2110 Distance to adjacent Ramp ft __Conversion to pc/h Under Base Conditions_ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 5750 660 290 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1513 174 76 v Trucks and buses 3 3 3 % 0 % Recreational vehicles 0 Ω Level Terrain type: Level Level % Grade % % Length mi mi mi 1.5 Trucks and buses PCE, ET 1.5 1.5 1.2 1.2 Recreational vehicle PCE, ER 1.2 0.985 Heavy vehicle adjustment, fHV 0.985 0.985 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 6143 705 310 pcph ____Estimation of V12 Merge Areas__ L = (Equation 25-2 or 25-3) EQ P = 0.130 Using Equation 4 Page 1

2009PM WB Central Ave. Enter Ramp.txt FΜ = V (P) = v 797 pc/h 12 F FM _Capacity Checks_ LOS F? Actual Maxi mum 6848 9000 V No F0 2673 pc/h (Equation 25-4 or 25-5) v 3 or av34 > 2700 pc/h? No ls V 3 or av34 ls > 1.5 v /2 12 Yes v v 3 or av34 (Equation 25-8) If yes, v = 2457 12A _Flow Entering Merge Influence Area Actual Max Děsi rabl e Violation? 4600 No v 2457 12A Level of Service Determination (if not F)_ Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = R 12 A 26.0 pc/mi/ln Level of service for ramp-freeway junction areas of influence С _Speed Estimation_ Intermediate speed variable, = 0.371 М S Space mean speed in ramp influence area, S = 50.2 mph R S Space mean speed in outer lanes, = 50.2 mph 0 Space mean speed for all vehicles, S = 50.2 mph

2009AM WB Central Ave. Exit Ramp.txt HCS+: Ramps and Ramp Junctions Release 5.4 Parsons Brinckerhoff 230 W. Monroe St Suite 900 Chi cago, IL 60606 Phone: (312) 782-8150 Fax: (312) 782-1684 E-mail: _____Di verge Anal ysi s______ Anal yst: I DOT/PB Agency/Co. : Date performed: 4/1/2009 Analysis time period: AM Peak Freeway/Dir of Travel: I-290 WB Junction: Central Ave. Exit Ramp Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junctions Analysis _____Freeway Data_____ Type of analysis Di verge Number of lanes in freeway 4 Free-flow speed on freeway 55.0 mph Volume on freeway 5550 vph Off Ramp Data Side of freeway Ri ght Number of lanes in ramp 1 35.0 Free-Flow speed on ramp mph Volume on ramp 310 vph Length of first accel/decel lane ft 346 Length of second accel/decel lane ft __Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent ramp 500 vph Position of adjacent ramp Downstream Type of adjacent ramp 0n Distance to adjacent ramp 2110 ft ___Conversion to pc/h Under Base Conditions__ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 5550 310 500 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1461 82 132 v Trucks and buses 10 10 2 % % Recreational vehicles 0 0 0 Terrain type: Level Level Level Grade 0.00 % 0.00 % 0.00 % Length 0.00 mi 0.00 mi 0.00 mi 1.5 1.2 1.5 1.2 Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER 0.990 Heavy vehicle adjustment, fHV 0.952 0.952 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 6134 343 532 pcph ____Estimation of V12 Diverge Areas___ L = (Equation 25-8 or 25-9) EQ P = 0. 436 Using Equation 8 Page 1

2009AM WB Central Ave. Exit Ramp.txt FD + (v - v) P = 2868F R FD V = V pc/h 12 R _Capacity Checks_ LOS F? Actual Maxi mum 6134 9000 No v = V Fi F 5791 9000 No = V F0 R 2000 V 343 No R v 1633 pc/h (Equation 25-15 or 25-16) 3 or av34 ls > 2700 pc/h? No v v 3 or av34 No ls 1.5 v /2 V > v 3 or av34 12 lf yes, v = 2868 (Equation 25-18) 12A Flow Entering Diverge Influence Area_____ Actual Max Desirable Violation? 4400 2868 v No 12 Level of Service Determination (if not F)_ D = 4.252 + 0.0086 v - 0.009 LDensity, = 25.8 pc/mi/ln R 12 D Level of service for ramp-freeway junction areas of influence C ____Speed Estimation_ Intermediate speed variable, D = 0.459 S Space mean speed in ramp influence area, S = 49.0 mph R S Space mean speed in outer lanes, = 57.9 mph 0 Space mean speed for all vehicles, S = 53.4mph

2009PM WB Central Ave. Exit Ramp.txt HCS+: Ramps and Ramp Junctions Release 5.4 Parsons Brinckerhoff 230 W. Monroe St Suite 900 Chi cago, IL 60606 Phone: (312) 782-8150 Fax: (312) 782-1684 E-mail: _____Di verge Anal ysi s______ Anal yst: I DOT/PB Agency/Co. : Date performed: 4/1/2009 Analysis time period: PM Peak Freeway/Dir of Travel: I-290 WB Junction: Central Ave. Exit Ramp Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Ramp Junctions Analysis _____Freeway Data_____ Type of analysis Di verge Number of lanes in freeway 4 Free-flow speed on freeway 55.0 mph Volume on freeway 6040 vph Off Ramp Data____ Side of freeway Ri ght Number of lanes in ramp 1 35.0 Free-Flow speed on ramp mph 290 Volume on ramp vph Length of first accel/decel lane 346 ft Length of second accel/decel lane ft __Adjacent Ramp Data (if one exists)__ Does adjacent ramp exist? Yes Volume on adjacent ramp 660 vph Position of adjacent ramp Downstream Type of adjacent ramp 0n Distance to adjacent ramp 2110 ft __Conversion to pc/h Under Base Conditions_ Junction Components Freeway Ramp Adj acent Ramp Volume, V (vph) 6040 290 660 vph Peak-hour factor, PHF 0.95 0.95 0.95 Peak 15-min volume, v15 1589 174 76 v Trucks and buses 3 3 3 % % Recreational vehicles 0 0 0 Terrain type: Level Level Level Grade 0.00 % 0.00 % 0.00 % Length 0.00 mi 0.00 mi 0.00 mi 1.5 1.2 1.5 1.2 Trucks and buses PCE, ET 1.5 1.2 Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV 0.985 0.985 0.985 Driver population factor, fP 1.00 1.00 1.00 Flow rate, vp 6453 310 705 pcph ____Estimation of V12 Diverge Areas___ L = (Equation 25-8 or 25-9) EQ P = 0. 436 Using Equation 8 Page 1

2009PM WB Central Ave. Exit Ramp.txt FD + (v - v) P = 2988F R FD V = V pc/h 12 R _Capacity Checks_ LOS F? Actual Maxi mum 6453 9000 No v = V Fi F 6143 9000 No = V F0 F R 2000 V 310 No R v 1732 pc/h (Equation 25-15 or 25-16) 3 or av34 ls > 2700 pc/h? No V v 3 or av34 No ls > 1.5 v /2 V v 3 or av34 12 lf yes, v = 2988 (Equation 25-18) 12A Flow Entering Diverge Influence Area______ May Desirable Violation? 2988 4400 v No 12 Level of Service Determination (if not F)_ D = 4.252 + 0.0086 v - 0.009 LDensity, = 26.8 pc/mi/ln R 12 D Level of service for ramp-freeway junction areas of influence C ____Speed Estimation_ Intermediate speed variable, D = 0.456 S Space mean speed in ramp influence area, S = 49.1 mph R Space mean speed in outer lanes, S = 57.5 mph 0 Space mean speed for all vehicles, S = 53.3 mph

Technical Memorandum

Appendix E-3

Weaving Section Analysis

HCS+: Freeway Weaving Release 5.4

Robert Tan PBQD

Phone: E-mail: Fax:

Operatic	onal Anal	ysi s			
Anal yst:RCTAgency/Co.:I DOT/PBDate Performed:4/8/2010Anal ysis Time Period:AM PeakFreeway/Dir of Travel:I -290 EB C-D FWeaving Location:Harrison Ent.Jurisdiction:I DOTAnal ysis Year:2009Description:I -290 Phase 1 Study	Rd. to Mannh	eim Ex.			
l nr	outs				
Freeway free-flow speed, SFF Weaving number of lanes, N Weaving segment length, L Terrain type Grade Length Weaving type Volume ratio, VR Weaving ratio, R	45 3 15 Le 0. 0.	39 20	mph ft % mi	1	
Conversion to pc/h	Under Ba	ise Cond	itions		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, fP Flow rate, v 	Non-Wea V 01 1450 0.95 382 20 0 1.5 1.2 0.909 1.00 1678	vi ng V 02 0 10 0 1. 5 1. 2 0. 952 1. 00 0 Speeds	Weaving V w1 750 0.95 197 20 0 1.5 1.2 0.909 1.00 868	V W2 200 0.95 53 10 0 1.5 1.2 0.952 1.00 221	veh/h v % % pc/h
a (Exhibit 24-6) b (Exhibit 24-6) c (Exhibit 24-6) d (Exhibit 24-6) Weaving intensity factor, Wi Weaving and non-weaving speeds, Si Number of lanes required for unconstrained operation, Nw (Exhibit 2 Maximum number of lanes, Nw (max) (Exh Type of operation is 	Weaving 0.35 2.20 0.97 0.80 1.57 28.61 24-7) hibit 24-	N 0 4 1 0 4 7) 1 C 0 6 5 8 6 7	on-Weavir .0020 .00 .30 .75 .22 3.60 .50 .40 onstraine vice and	ng ed Capacity	/
Weaving segment speed, S Weaving segment density, D Level of service, LOS	36. 15 25. 52 C Page	mph pc/mi/I	n		

Limitations on Weaving Segments___

		If Max Exce	eded See Note
	Anal yzed	Maximum	Note
Weaving flow rate, Vw	1089	2800	а
Average flow rate (pcphpl)	922		b
Volume ratio, VR	0. 39	0.45	С
Weaving ratio, R	0. 20	N/A	d
Weaving length (ft)	1500	2500	е

Notes: a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).

g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.

- h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS+: Freeway Weaving Release 5.4

Robert Tan PBQD

Phone: E-mail: Fax:

Operati	onal Anal	l ysi s_			
Anal yst:RCTAgency/Co.:I DOT/PBDate Performed:4/8/2010Anal ysis Time Period:PM PeakFreeway/Dir of Travel:I -290 EB C-DWeaving Location:Harrision EntJurisdiction:I DOTAnal ysis Year:2009Description:I -290 Phase 1 Study	Rd. ∵ to Manı	nheim I	Ex.		
Ir	puts				
Freeway free-flow speed, SFF Weaving number of lanes, N Weaving segment length, L Terrain type Grade Length Weaving type Volume ratio, VR Weaving ratio, R	4! 3 1! Le A 0. 0.	5 500 evel . 33 . 46	mph ft % mi	ı	
Conversion to pc/h	Under Ba	ase Coi	ndi ti ons		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, fP Flow rate, v	Non-Wea V 01 1850 0.95 487 20 0 1.5 1.2 0.909 1.00 2142	avi ng V 0.95 0 10 1.5 1.2 0.95 1.00 0	Weaving V 500 0.95 132 20 0 1.5 1.2 20.909 1.00 578	V W2 450 0.95 118 10 0 1.5 1.2 0.952 1.00 497	veh/h v % % pc/h
Weaving and No	on-Weavi ng	g Speed	ds		
a (Exhibit 24-6) b (Exhibit 24-6) c (Exhibit 24-6) d (Exhibit 24-6) Weaving intensity factor, Wi Weaving and non-weaving speeds, Si Number of Lanes required for	Weaving 0.15 2.20 0.97 0.80 0.71 35.49 24-7)	g	Non-Weavir 0.0035 4.00 1.30 0.75 0.40 40.00	ng	
Maximum number of lanes, Nw (max) (Ex Type of operation is	z4-7) shibit 24-	-7)	1.40 Unconstrai	ned	
Weaving Segment Speed, Densi	ty, Level	l of Se	ervice and	Capaci t	y
Weaving segment speed, S Weaving segment density, D Level of service, LOS	38. 37 27. 95 C Page	mph pc/mi, e 1	/l n		

Limitations on Weaving Segments

		If Max Exce	eded See Note
	Anal yzed	Maximum	Note
Weaving flow rate, Vw	1075	2800	а
Average flow rate (pcphpl)	1072		b
Volume ratio, VR	0.33	0.45	С
Weaving ratio, R	0.46	N/A	d
Weaving length (ft)	1500	2500	е

Notes:

- Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp а. Junctions".
- Capacity constrained by basic freeway capacity. b.
- Capacity occurs under constrained operating conditions. С.
- d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
- Four-lane Type A segments do not operate well at volume ratios greater e. than 0.35. Poor operations and some local queuing are expected in such cases.
- Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h f. (Type A), 4,000 (Type B), 3,500 (Type C).
- Five-lane Type A segments do not operate well at volume ratios greater g. than 0.20. Poor operations and some local queuing are expected in such cases.
- Type B weaving segments do not operate well at volume ratios greater h. than 0.80. Poor operations and some local queuing are expected in such cases.
- Type C weaving segments do not operate well at volume ratios greater ί. than 0.50. Poor operations and some local queuing are expected in such cases.

HCS+: Freeway Weaving Release 5.4

Phone: E-mail:	Fax	:			
Operatio	nal Anal	ysi s			
Anal yst:RCTAgency/Co.:I DOT/PBDate Performed:8/18/2009Anal ysis Time Period:AM PeakFreeway/Dir of Travel:I -290 EBWeaving Location:Mannheim C-D EJurisdiction:I DOTAnal ysis Year:2009Description:I -290 Phase 1 Study	nt. to 2	5th Ex.			
inp	uts				
Freeway free-flow speed, SFF Weaving number of lanes, N	55 4		mph		
Weaving segment length, L Terrain type	11! Le	55 vel	ft		
Grade Length			% mi		
Weaving type Volume ratio VR	A	32			
Weaving ratio, R	0.	18			
Conversion to pc/h	Under Ba	se Conc	ditions		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, fP Flow rate, v	Non-Wear V 01 3630 0. 95 955 10 0 1. 5 1. 2 0. 952 1. 00 4012	vi ng V 02 0.95 0 10 0 1.5 1.2 0.952 1.00 0	Weaving V w1 1400 0.95 368 10 0 1.5 1.2 0.952 1.00 1547	V w2 310 0.95 82 10 0 1.5 1.2 0.952 1.00 342	veh/h v % % pc/h
Weaving and Non	-Weavi ng	Speeds	6		
a (Exhibit 24-6) b (Exhibit 24-6) c (Exhibit 24-6) d (Exhibit 24-6) Weaving intensity factor, Wi Weaving and non-weaving speeds, Si Number of Lanes required for unconstrained operation, Nw (Exhibit 2 Maximum number of Lanes, Nw (max) (Exh	Weaving 0.35 2.20 0.97 0.80 2.71 27.13 4-7) i bit 24-	7)	Non-Weaving). 0020 4. 00 1. 30 0. 75 0. 40 47. 06 1. 68 1. 40	9	
Type of operation is		(Constrai ne	b	
Weaving Segment Speed, Densit	y, Level	of Ser	rvice and	Capaci ty	/
Weaving segment speed, S Weaving segment density, D Level of service, LOS	38.10 38.72 E Page 1	mph pc∕mi∕I	n		

Capacity of	base condition, cb	6387	pc/h
Capacity as	a 15-minute flow rate, c	: 6083	pc/h
Capacity as	a full-hour volume, ch	5779	pc/h

Limitations on Weaving Segments___

		If Max Exce	eded See Note
	Anal yzed	Maximum	Note
Weaving flow rate, Vw	1889	2800	а
Average flow rate (pcphpl)	1475	2250	b
Volume ratio, VR	0. 32	0.35	С
Weaving ratio, R	0. 18	N/A	d
Weaving length (ft)	1155	2500	е
Notes:			

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

- f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
 g. Five-lane Type A segments do not operate well at volume ratios greater
- g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

2009PM Mannheim to 25th.txt

HCS+: Freeway Weaving Release 5.4

Phone: E-mail:	Fax	(:			
Operatio	nal Anal	ysi s			
Anal yst:RCTAgency/Co.:I DOT/PBDate Performed:8/18/2009Anal ysis Time Period:PM PeakFreeway/Dir of Travel:I -290 EBWeaving Location:Mannheim C-D EJurisdiction:I DOTAnal ysis Year:2009Description:I -290 Phase 1 Study	nt. to 2	25th Ex			
IIIp	uts				
Freeway free-flow speed, SFF Weaving number of lanes, N Weaving segment length, L Terrain type Grade Length	55 4 11 Le	55 evel	mph ft % mi		
Weaving type Volume ratio, VR Weaving ratio, R	A 0. 0.	44 19			
Conversion to pc/h	Under Ba	ise Con	di ti ons		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, fP Flow rate, v	Non-Wea V 01 2910 0.95 766 9 0 1.5 1.2 0.957 1.00 3201	ivi ng V 02 0.95 0 10 0 1.5 1.2 0.952 1.00 0	Weaving V 1900 0.95 500 8 0 1.5 1.2 0.962 1.00 2080	V w2 430 0.95 113 9 0 1.5 1.2 0.957 1.00 473	veh∕h v % % pc∕h
Weaving and Non	-Weaving	Speed	S		
a (Exhibit 24-6) b (Exhibit 24-6) c (Exhibit 24-6) d (Exhibit 24-6) Weaving intensity factor, Wi Weaving and non-weaving speeds, Si Number of Lanes required for unconstrained operation, Nw (Exhibit 2	Weavi ng 0. 35 2. 20 0. 97 0. 80 3. 22 25. 66 4-7)]	Non-Weavin 0.0020 4.00 1.30 0.75 0.56 43.87 2.07	g	
Maximum number of lanes, Nw (max) (Exh Type of operation is	ibit 24-	•7)	1. 40 Constrai ne	d	
Weaving Segment Speed, Densit	y, Level	of Se	rvice and (Capaci ty	/
Weaving segment speed, S Weaving segment density, D Level of service, LOS	33.36 43.12 F Page 1	mph pc/mi/	ln		

	20071		
Capacity of	base condition, cb	6214	pc/h
Capacity as	a 15-minute flow rate,	c 5946	pc/h
Capacity as	a full-hour volume, ch	5649	pc/h

Limitations on Weaving Segments___

		If Max Exce	eded See Note
	Anal yzed	Maximum	Note
Weaving flow rate, Vw	2553	2800	а
Average flow rate (pcphpl)	1438	2250	b
Volume ratio, VR	0.44	0.35	С
Weaving ratio, R	0. 19	N/A	d
Weaving length (ft)	1155	2500	е
Notes:			

 Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater

g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.

h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.

i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

2009AM 25th to 25th.txt

HCS+: Freeway Weaving Release 5.4

Phone: E-mail:	Fax:				
0peratio	nal Analy	/si s			
Analyst:RCTAgency/Co.:I DOT/PBDate Performed:8/18/2009Analysis Time Period:AM PeakFreeway/Dir of Travel:I-290 EBWeaving Location:25th Ent. to 2Jurisdiction:I DOTAnalysis Year:2009Description:I-290 Phase 1 Study	5th Ex. uts				
Freeway free-flow speed, SFF Weaving number of lanes, N Weaving segment length, L Terrain type Grade Length Weaving type Volume ratio, VR Weaving ratio, R	55 4 500 Lev A 0.0 0.2) vel 20	mph ft % mi		
Conversion to pc/h	Under Bas	se Condi	tions		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, fP Flow rate, v	Non-Weav V 01 4970 0.95 1308 10 0 1.5 1.2 0.952 1.00 5493	vi ng V 02 0.95 0 10 0 1.5 1.2 0.952 1.00 0	Weaving V w1 230 0.95 61 13 0 1.5 1.2 0.939 1.00 257	V w2 60 0.95 16 10 0 1.5 1.2 0.952 1.00 66	veh/h v % % pc/h
Weaving and Non	-Weaving	Speeds_			
a (Exhibit 24-6) b (Exhibit 24-6) c (Exhibit 24-6) d (Exhibit 24-6) Weaving intensity factor, Wi Weaving and non-weaving speeds, Si Number of Lanes required for unconstrained operation, Nw (Exhibit 2- Maximum number of Lanes, Nw (max) (Exh	Weaving 0.15 2.20 0.97 0.80 1.37 34.00 4-7) ibit 24-7	No 0. 1. 0. 0. 44 0. 2) 1.	n-Weaving 0035 00 30 75 53 . 39 52 40	9	
Type of operation is		Un	constraiı	ned	
Weaving segment speed, Density Weaving segment density, D Level of service, LOS	y, Level 43.65 m 33.31 p D Page 1	от serv nph oc/mi/ln	ice and (Japacı ty <u>.</u>	

Capacity	of	ba	ase condition, cb		6780	pc/h
Capaci ty	as	а	15-minute flow rate,	С	6457	pc/h
Capaci ty	as	а	full-hour volume, ch		6134	pc/h

Limitations on Weaving Segments_

		If Max Exce	eded See Note
	Anal yzed	Maximum	Note
Weaving flow rate, Vw	323	2800	а
Average flow rate (pcphpl)	1454	2250	b
Volume ratio, VR	0.06	0.35	С
Weaving ratio, R	0. 20	N/A	d
Weaving length (ft)	500	2500	е
Notes:			

 Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

- f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
 g. Five-lane Type A segments do not operate well at volume ratios greater
- g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

2009PM 25th to 25th.txt

HCS+: Freeway Weaving Release 5.4

Phone: E-mail:	Fax:				
Operatio	nal Analy	ysi s			
Anal yst:RCTAgency/Co.:I DOT/PBDate Performed:8/18/2009Anal ysis Time Period:PM PeakFreeway/Dir of Travel:I -290 EBWeaving Location:25th Ent. to 2Jurisdiction:I DOTAnal ysis Year:2009Description:I -290 Phase 1 Study	5th Ex. uts				
Ereeway free_flow speed SEE	55		mph		
Weaving number of lanes, N Weaving segment length, L Terrain type Grade	55 4 500 Lev) vel	ft %		
Length Weaving type Volume ratio, VR Weaving ratio, R	A 0. (0. 2)9 22	mi		
Conversion to pc/h	Under Bas	se Condi	tions		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, fP Flow rate, v	Non-Weav V 01 4710 0.95 1239 9 0 1.5 1.2 0.957 1.00 5181	vi ng V 02 0.95 0 10 0 1.5 1.2 0.952 1.00 0	Weaving V w1 350 0.95 92 10 0 1.5 1.2 0.952 1.00 386	V w2 100 0.95 26 9 0 1.5 1.2 0.957 1.00 110	veh/h v % % pc/h
Weaving and Non	-Weaving	Speeds_			
a (Exhibit 24-6) b (Exhibit 24-6) c (Exhibit 24-6) d (Exhibit 24-6) Weaving intensity factor, Wi Weaving and non-weaving speeds, Si Number of Lanes required for unconstrained operation, Nw (Exhibit 2 Maximum number of Lanes, Nw (max) (Exh	Weaving 0.15 2.20 0.97 0.80 1.43 33.54 4-7) ibit 24-7	No 0. 1. 0. 43 0. 7) 1.	n-Weaving 0035 00 30 75 58 . 49 68 40	9	
lype of operation is		Un	constraiı	ned	
Weaving Segment Speed, Densit	y, Level	of Serv	ice and (Capaci ty <u></u>	
Weaving segment speed, S Weaving segment density, D Level of service, LOS	42.39 r 33.48 µ D Page 1	nph oc∕mi∕In			

Capacity of	base condition, cb	6780	pc/h
Capacity as	a 15-minute flow rate, c	6488	pc/h
Capacity as	a full-hour volume, ch	6164	pc/h

Limitations on Weaving Segments_

		If Max Exce	eded See Note
	Anal yzed	Maximum	Note
Weaving flow rate, Vw	496	2800	а
Average flow rate (pcphpl)	1419	2250	b
Volumĕ ratio, VR	0.09	0.35	С
Weaving ratio, R	0. 22	N/A	d
Weaving length (ft)	500	2500	е
Notes:			

 Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

- f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
 g. Five-lane Type A segments do not operate well at volume ratios greater
- g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

2009AM 25th to 17th.txt

HCS+: Freeway Weaving Release 5.4

Phone: E-mail:	Fax:		
Operati	onal Analysis	6	
Anal yst: Agency/Co.: Date Performed: Date Performed: Anal ysis Time Period: Freeway/Dir of Travel: Freeway/Dir of Travel: I-290 EB Weaving Location: Juri sdi ction: Anal ysis Year: Description: I-290 Phase 1 Study	17th Ex. puts		
Erroway from flow croad SEE	ь — — — — — — — — — — — — — — — — — — —	mnh	
Weaving number of lanes, N Weaving segment length, L Terrain type Grade Length	55 4 1215 Level	mpn ft % mi	
Weaving type Volume ratio, VR Weaving ratio, R	A 0. 07 0. 44		
Conversion to pc/h	Under Base (Condi ti ons	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, fP Flow rate, v	$\begin{array}{cccc} \text{Non-Weaving} \\ \text{V} & \text{V} \\ \text{o1} & \text{o2} \\ 5020 & \text{O} \\ 0.95 & \text{O} \\ 1321 & \text{O} \\ 10 & 10 \\ \text{O} & \text{O} \\ 1.5 & 1.1 \\ 1.2 & 1.2 \\ 0.952 & \text{O} \\ 1.00 & 1.0 \\ 5548 & \text{O} \end{array}$	g Weaving V V 2 w1 230 95 0.95 61 7 0 5 1.5 2 1.2 952 0.966 00 1.00 250	V w2 180 veh/h 0.95 47 V 10 % 0 % 1.5 1.2 0.952 1.00 198 pc/h
Weaving and No	n-Weaving Spe	eeds	
a (Exhibit 24-6) b (Exhibit 24-6) c (Exhibit 24-6) d (Exhibit 24-6) Weaving intensity factor, Wi Weaving and non-weaving speeds, Si Number of Lanes required for unconstrained operation, Nw (Exhibit Maximum number of Lanes, Nw (max) (Ex Type of operation is	Weaving 0.15 2.20 0.97 0.80 0.72 41.15 24-7) hibit 24-7)	Non-Weaving 0.0035 4.00 1.30 0.75 0.31 49.48 0.70 1.40 Unconstrair	J
Weaving Segment Speed Densi	tv. Level of	Service and (Capaci tv
Weaving segment speed, S Weaving segment density, D Level of service, LOS	48.74 mph 30.75 pc/r D Page 1	ni /I n	, , , , , , , , , , , , , , , , , , ,

Capaci ty	of	ba	ise condition, cb		7681	pc/h
Capaci ty	as	а	15-minute flow rate,	С	7315	pc/h
Capaci ty	as	а	full-hour volume, ch		6949	pc/h

Limitations on Weaving Segments_

		If Max Exce	eded See Note
	Anal yzed	Maximum	Note
Weaving flow rate, Vw	448	2800	а
Average flow rate (pcphpl)	1499	2250	b
Volume ratio, VR	0.07	0.35	С
Weaving ratio, R	0.44	N/A	d
Weaving length (ft)	1215	2500	е
Notes:			

 Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

- f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
 g. Five-lane Type A segments do not operate well at volume ratios greater
- g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

2009PM 25th to 17th.txt

HCS+: Freeway Weaving Release 5.4

Phone: E-mail:	Fax				
0peratio	nal Anal	ysi s			
Analyst:RCTAgency/Co.:I DOT/PBDate Performed:8/18/2009Analysis Time Period:PM PeakFreeway/Dir of Travel:I-290 EBWeaving Location:25th Ent. to 1'Jurisdiction:I DOTAnalysis Year:2009Description:I-290 Phase 1 Study	7th Ex. uts				
Freeway free-flow speed, SFF Weaving number of lanes, N Weaving segment length, L Terrain type Grade Length Weaving type Volume ratio, VR Weaving ratio, R	55 4 12 Le 0. 0.	15 vel 10 50	mph ft % mi		
Conversion to pc/h	Under Ba	ise Conc	li ti ons		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, fP Flow rate, v	Non-Wea V 01 4800 0.95 1263 9 0 1.5 1.2 0.957 1.00 5280	vi ng V 0.95 0 10 0 1.5 1.2 0.952 1.00 0	Weaving V w1 270 0.95 71 5 0 1.5 1.2 0.976 1.00 291	V w2 260 0.95 68 9 0 1.5 1.2 0.957 1.00 286	veh∕h v % % pc∕h
Weaving and Non	-Weavi ng	Speeds	5		
a (Exhibit 24-6) b (Exhibit 24-6) c (Exhibit 24-6) d (Exhibit 24-6) Weaving intensity factor, Wi Weaving and non-weaving speeds, Si Number of Lanes required for unconstrained operation, Nw (Exhibit 2- Maximum number of Lanes, Nw (max) (Exh Type of operation is	Weaving 0.15 2.20 0.97 0.80 0.74 40.87 4-7) ibit 24-	1 N 4 1 0 0 4 0 7) 1 1 0	lon-Weaving . 0035 . 00 . 30 . 75 . 32 .9. 01 . 82 . 40 Inconstrai	g ned	
Weaving Segment Speed, Densit	y, Level	of Ser	vice and (Capaci ty	/
Weaving segment speed, S Weaving segment density, D Level of service, LOS	48.07 30.46 D Page 1	mph pc∕mi∕I	n		

Capacity of	base condition, cb	7681	pc/h
Capacity as	a 15-minute flow rate, c	7350	pc∕h
Capacity as	a full-hour volume, ch	6982	pc/h

Limitations on Weaving Segments_

		If Max Exce	eded See Note
	Anal yzed	Maximum	Note
Weaving flow rate, Vw	577	2800	а
Average flow rate (pcphpl)	1464	2250	b
Volume ratio, VR	0. 10	0.35	С
Weaving ratio, R	0. 50	N/A	d
Weaving length (ft)	1215	2500	е
Notes:			

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

- f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
 g. Five-lane Type A segments do not operate well at volume ratios greater
- g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

2009AM Laramie to Cicero.txt

HCS+: Freeway Weaving Release 5.4

Phone: E-mail:	Fax	:			
Operatio	nal Anal	ysi s			
Anal yst:RCTAgency/Co.:I DOT/PBDate Performed:8/18/2009Anal ysis Time Period:AM PeakFreeway/Dir of Travel:I -290 EBWeaving Location:Laramie Ent. toJuri sdiction:I DOTAnal ysis Year:2009Description:I -290 Phase 1 Study	o Cicero	Ex.			
IIIÞ	uts				
Freeway free-flow speed, SFF Weaving number of lanes, N Weaving segment length, L Terrain type Grade Length	55 5 88 Le	2 vel	mph ft % mi		
Weaving type Volume ratio, VR Weaving ratio, R	A 0. 0.	18 29			
Conversion to pc/h	Under Ba	se Condi	tions		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, fP Flow rate, v	Non-Wea V 01 6900 0.95 1816 10 0 1.5 1.2 0.952 1.00 7626	vi ng V 02 0.95 0 10 0 1.5 1.2 0.952 1.00 0	Weaving V w1 1080 0.95 284 10 0 1.5 1.2 0.952 1.00 1193	V w2 450 0.95 118 5 0 1.5 1.2 0.976 1.00 485	veh/h v % % pc/h
Weaving and Non	-Weaving	Speeds_			
a (Exhibit 24-6) b (Exhibit 24-6) c (Exhibit 24-6) d (Exhibit 24-6) Weaving intensity factor, Wi Weaving and non-weaving speeds, Si Number of Lanes required for unconstrained operation, Nw (Exhibit 2- Maximum number of Lanes, Nw (max) (Exh Type of operation is	Weaving 0.35 2.20 0.97 0.80 3.29 25.48 4-7) ibit 24-	No 0. 4. 1. 0. 46 7) 1. Co	n-Weaving 0020 30 75 43 . 53 46 40 nstraine	g d	
Weaving Segment Speed Density	v level	of Serv	ice and o	Capaci ty	
Weaving segment speed, S Weaving segment density, D Level of service, LOS	40.50 45.95 F Page 1	mph pc/mi /I n			

				0.00.0.
Capacity of b	ase condition,	cb	8713	pc/h
Capacity as a	15-minute flow	rate, c	8298	pc/h
Capacity as a	full-hour volu	ıme, ch	7883	pc/h

_Limitations on Weaving Segments___

		If Max Exce	If Max Exceeded See Note		
	Anal yzed	Maximum	Note		
Weaving flow rate, Vw	1678	2800	а		
Average flow rate (pcphpl)	1860	2250	b		
Volume ratio, VR	0. 18	0. 20	С		
Weaving ratio, R	0.29	N/A	d		
Weaving length (ft)	882	2500	е		
Notes:					

 Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater

g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.

h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.

i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

2009PM Laramie to Cicero.txt

HCS+: Freeway Weaving Release 5.4

Phone: E-mail:	Fax	(:			
Operatio	nal Anal	ysi s			
Anal yst:RCTAgency/Co.:I DOT/PBDate Performed:8/18/2009Anal ysis Time Period:PM PeakFreeway/Dir of Travel:I -290 EBWeaving Location:Laramie Ent. toJuri sdiction:I DOTAnal ysis Year:2009Description:I -290 Phase 1 Study	o Cicero	o Ex.			
IIIÞ	uts				
Freeway free-flow speed, SFF Weaving number of lanes, N Weaving segment length, L Terrain type Grade Length	55 5 88 Le	5 82 evel	mph ft % mi		
Weaving type Volume ratio, VR Weaving ratio, R	A 0. 0.	17 40			
Conversion to pc/h	Under Ba	ise Cond	itions		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, fP Flow rate, v	Non-Wea V 01 6320 0.95 1663 9 0 1.5 1.2 0.957 1.00 6952	ovi ng V 0.95 0 10 1.5 1.2 0.952 1.00 0	Weaving V w1 810 0.95 213 9 0 1.5 1.2 0.957 1.00 891	V w2 540 0.95 142 5 0 1.5 1.2 0.976 1.00 582	veh/h v % % pc/h
Weaving and Non-Weaving Speeds					
a (Exhibit 24-6) b (Exhibit 24-6) c (Exhibit 24-6) d (Exhibit 24-6) Weaving intensity factor, Wi Weaving and non-weaving speeds, Si Number of Lanes required for unconstrained operation, Nw (Exhibit 2- Maximum number of Lanes, Nw (max) (Exh Type of operation is	Weaving 0.35 2.20 0.97 0.80 2.96 26.36 4-7) ibit 24-	y N 0 4 1 0 0 4 7) 1 C	on-Weavin . 0020 . 00 . 30 . 75 . 37 7. 88 . 41 . 40 onstraine	g d	
Weaving Segment Speed Densit	v level	of Ser	vice and	Capacity	
Weaving segment speed, S Weaving segment density, D Level of service, LOS	41.90 40.21 E Page 1	mph pc/mi /I	n	sapaor ty.	

	200711		01 001 0.
Capacity of base condition,	cb	8744	pc/h
Capacity as a 15-minute flow	w rate,	c 8367	pc/h
Capacity as a full-hour volu	ume, ch	7949	pc/h

Limitations on Weaving Segments___

		If Max Exce	If Max Exceeded See Note		
	Anal yzed	Maximum	Note		
Weaving flow rate, Vw	1473	2800	а		
Average flow rate (pcphpl)	1685	2250	b		
Volumĕ ratio, VR	0. 17	0. 20	С		
Weaving ratio, R	0.40	N/A	d		
Weaving length (ft)	882	2500	е		
Notes:					

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater

g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.

h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.

i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax: E-mail: _____Operational Analysis_____Operational Analysis_____ RCT Analyst: Agency/Co.: IDOT/PB Date Performed: 4/8/2010 Analysis Time Period: AM Peak Freeway/Dir of Travel: Westbound Weaving Location: Mannheim Ent. to Wolf Exit Jurisdiction: IDOT Analysis Year: 2009 Description: I-290 Weaving Analysis _____Inputs_____ Freeway free-flow speed, SFF 55 mph Weaving number of lanes, N 5 1230 Weaving segment length, L ft Terrain type Level Ŷ Grade Length mi А Weaving type Multilane or C-D 0.10 Volume ratio, VR 0.44 Weaving ratio, R _____Conversion to pc/h Under Base Conditions_____ Non-Weaving Weaving V V V V о2 w1 w2 01 Volume, V 0 400 6700 320 veh/h 0.95 0.95 0.95 Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 0 1763 105 84 v 10 Trucks and buses 10 10 10 % Recreational vehicles 0 0 0 0 % Trucks and buses PCE, ET 1.5 1.5 1.5 1.5 1.2 1.2 Recreational vehicle PCE, ER 1.2 1.2 Heavy vehicle adjustment, fHV 0.952 0.952 0.952 0.952 Driver population adjustment, fP 1.00 1.00 1.00 1.00 Flow rate, v 7405 0 442 353 pc/h _____Weaving and Non-Weaving Speeds____ Weaving Non-Weaving a (Exhibit 24-6) 0.15 0.0035 2.20 4.00 b (Exhibit 24-6) c (Exhibit 24-6) 0.97 1.30 d (Exhibit 24-6) 0.80 0.75 Weaving intensity factor, Wi 0.81 0.37 Weaving and non-weaving speeds, Si 39.80 47.88 Number of lanes required for

unconstrained operation, Nw (Exhibit 24-7) 1.03 Maximum number of lanes, Nw (max) (Exhibit 24-7) 1.40 Type of operation is Unconstrained __Weaving Segment Speed, Density, Level of Service and Capacity_____ Weaving segment speed, S 46.95 mph Weaving segment density, D 34.93 pc/mi/ln Level of service, LOS D Capacity of base condition, cb 9619 pc/h Capacity as a 15-minute flow rate, c 9161 pc/h Capacity as a full-hour volume, ch 8703 pc/h _____Limitations on Weaving Segments_____ If Max Exceeded See Note Analyzed Maximum Note Weaving flow rate, Vw 795 2800 а Average flow rate (pcphpl) 1640 2250 b Volume ratio, VR 0.10 0.20 С Weaving ratio, R 0.44 N/A d 2500 Weaving length (ft) 1230 е Notes: Weaving segments longer than 2500 ft. are treated as isolated merge and a. diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions". b. Capacity constrained by basic freeway capacity. c. Capacity occurs under constrained operating conditions. Three-lane Type A segments do not operate well at volume ratios greater d. than 0.45. Poor operations and some local queuing are expected in such cases. e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases. f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C). g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases. Type B weaving segments do not operate well at volume ratios greater h. than 0.80. Poor operations and some local queuing are expected in such cases. Type C weaving segments do not operate well at volume ratios greater i. than 0.50. Poor operations and some local queuing are expected in such cases.
Phone: Fax: E-mail: _____Operational Analysis_____ RCT Analyst: Agency/Co.: IDOT/PB Date Performed: 4/8/2010 Analysis Time Period: PM Peak Freeway/Dir of Travel: Westbound Weaving Location: Mannheim Ent. to Wolf Exit Jurisdiction: IDOT Analysis Year: 2009 Description: I-290 Weaving Analysis _____Inputs_____ Freeway free-flow speed, SFF 55 mph Weaving number of lanes, N 5 1230 Weaving segment length, L ft Terrain type Level ° Grade Length mi Weaving type A Multilane or C-D 0.13 Volume ratio, VR Weaving ratio, R 0.39 _____Conversion to pc/h Under Base Conditions_____ Non-Weaving Weaving V V V V о2 w1 w2 о1 Volume, V 0 6370 560 370 veh/h 0.95 0.95 0.95 Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 1676 0 147 97 v 10 7 0 Trucks and buses 3 3 % Recreational vehicles 0 0 0 % Trucks and buses PCE, ET 1.5 1.5 1.5 1.5 1.2 1.2 Recreational vehicle PCE, ER 1.2 1.2 Heavy vehicle adjustment, fHV 0.985 0.952 0.966 0.985 Driver population adjustment, fP 1.00 1.00 1.00 1.00 Flow rate, v 6805 0 610 395 pc/h _____Weaving and Non-Weaving Speeds_____ Weaving Non-Weaving a (Exhibit 24-6) 0.15 0.0035 2.20 4.00 b (Exhibit 24-6) c (Exhibit 24-6) 0.97 1.30 d (Exhibit 24-6) 0.80 0.75 Weaving intensity factor, Wi 0.83 0.39 Weaving and non-weaving speeds, Si 39.63 47.42 Number of lanes required for

unconstrained operation, Nw (Exhibit 24-7) 1.21 Maximum number of lanes, Nw (max) (Exhibit 24-7) 1.40 Type of operation is Unconstrained __Weaving Segment Speed, Density, Level of Service and Capacity_____ Weaving segment speed, S 46.25 mph Weaving segment density, D 33.77 pc/mi/ln Level of service, LOS D Capacity of base condition, cb 9453 pc/h Capacity as a 15-minute flow rate, c 9313 pc/h Capacity as a full-hour volume, ch 8847 pc/h _____Limitations on Weaving Segments_____ If Max Exceeded See Note Analyzed Maximum Note Weaving flow rate, Vw 1005 2800 а Average flow rate (pcphpl) 1562 2250 b Volume ratio, VR 0.13 0.20 С Weaving ratio, R 0.39 N/A d 2500 Weaving length (ft) 1230 е Notes: Weaving segments longer than 2500 ft. are treated as isolated merge and a. diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions". b. Capacity constrained by basic freeway capacity. c. Capacity occurs under constrained operating conditions. Three-lane Type A segments do not operate well at volume ratios greater d. than 0.45. Poor operations and some local queuing are expected in such cases. e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases. f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C). g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases. Type B weaving segments do not operate well at volume ratios greater h. than 0.80. Poor operations and some local queuing are expected in such cases. Type C weaving segments do not operate well at volume ratios greater i. than 0.50. Poor operations and some local queuing are expected in such cases.

2009AM 25th to Mannheim.txt

HCS+: Freeway Weaving Release 5.4

Phone: E-mail:	Fax	k :			
Operatio	nal Anal	ysi s			
Analyst:RCTAgency/Co.:I DOT/PBDate Performed:7/6/2009Analysis Time Period:AM PeakFreeway/Dir of Travel:WestboundWeaving Location:25th Ent. to MJurisdiction:I DOTAnalysis Year:2009Description:I -290 Weaving Analysis	annheim uts	Exi .			
Freeway free-flow speed, SFF Weaving number of lanes, N Weaving segment length, L Terrain type Grade Length Weaving type Volume ratio, VR Weaving ratio, R	55 4 20 Le A 0.	5 025 evel 19 44	mph ft Mi Mul	tilane c	or C-D
Conversion to pc/h	Under Ba	ase Con	ditions		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, fP Flow rate, v	Non-Wea V 01 5780 0.95 1521 10 0 1.5 1.2 0.952 1.00 6388	avi ng V 02 0.95 0 10 0 1.5 1.2 0.952 1.00 0	Weaving V w1 750 0.95 197 10 0 1.5 1.2 0.952 1.00 828	V w2 600 0.95 158 10 0 1.5 1.2 0.952 1.00 663	veh/h v % % pc/h
Weaving and Non	-Weavi ng	g Speeds	S		
a (Exhibit 24-6) b (Exhibit 24-6) c (Exhibit 24-6) d (Exhibit 24-6) Weaving intensity factor, Wi Weaving and non-weaving speeds, Si Number of Lanes required for unconstrained operation, Nw (Exhibit 2 Maximum number of Lanes, Nw (max) (Exh Type of operation is	Weaving 0.15 2.20 0.97 0.80 0.78 40.28 4-7) ibit 24-	-7)	Non-Weavin 0.0035 4.00 1.30 0.75 0.44 46.15 1.35 1.40 Jnconstrai	g ned	
Weaving Segment Speed, Densit	y, Level	of Se	rvice and	Capaci ty	/
Weaving segment speed, S Weaving segment density, D Level of service, LOS	44.91 43.86 F Page 1	mph pc/mi/1	l n		

		2007741	2011 10	marin nor ini
Capacity of	base condition,	cb	7756	pc/h
Capacity as	a 15-minute flo	w rate,	c 7387	pc/h
Capacity as	a full-hour vol	ume, ch	7018	pc/h

Limitations on Weaving Segments___

		If Max Exce	eded See Note
	Anal yzed	Maximum	Note
Weaving flow rate, Vw	1491	2800	а
Average flow rate (pcphpl)	1969	2250	b
Volume ratio, VR	0. 19	0.35	С
Weaving ratio, R	0.44	N/A	d
Weaving length (ft)	2025	2500	е
Notes:			

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater

g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.

h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.

i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

2009PM 25th to Mannheim.txt

HCS+: Freeway Weaving Release 5.4

Phone: E-mail:	Fax	x :			
Operatio	nal Anal	ysi s			
Anal yst:RCTAgency/Co.:I DOT/PBDate Performed:7/6/2009Anal ysis Time Period:PM PeakFreeway/Dir of Travel:WestboundWeaving Location:25th EntranceJuri sdiction:I DOTAnal ysis Year:2009Description:I-290 Weaving Anal ysis	to Manni	neim Ex	it		
	uto	_			
Weaving number of Lanes, N	53	C	mpn		
Weaving segment length, L Terrain type Grade	20 Le	025 evel	ft %		
Length Weaving type	۸		mi Mul	tilano (or C D
Volume ratio, VR	0.	16	war		51 C-D
weaving ratio, R	0.	46			
Conversion to pc/h	Under Ba	ase Con	di ti ons		
	Non-Wea V o1	avi ng V o2	Weaving V w1	V w2	
Volume, V Peak-hour factor, PHF	5720 0.95	0 0. 95	580 0. 95	490 0. 95	veh/h
Peak 15-min volume, v15 Trucks and buses	1505 3	0 10	153 3	129 7	V %
Recreational vehicles	0	0	0	0	%
Recreational vehicle PCE, ER	1.5	1.5	1.5	1.5	
Heavy vehicle adjustment, fHV Driver population adjustment, fP	0. 985 1. 00	0.952 1.00	0. 985 1. 00	0.966 1.00	
Flow rate, v	6111	0	619	533	pc/h
Weaving and Non	-Weavi ng	g Speed	S		
	Weavi ng	9	Non-Weaving	g	
a (Exhibit 24-6) b (Exhibit 24-6)	0. 15 2. 20		0.0035 4.00		
c (Exhibit 24-6) d (Exhibit 24-6)	0.97		1.30		
Weaving intensity factor, Wi	0.68		0.36		
Number of Lanes required for	41.78		48.08		
unconstrained operation, Nw (Exhibit 2 Maximum number of lanes, Nw (max) (Exh Type of operation is	4-7) ibit 24:	-7)	1.20 1.40 Unconstrai	ned	
Weaving Segment Speed, Densit	y, Level	of Se	rvice and	Capaci ty	y
Weaving segment speed, S Weaving segment density, D Level of service, LOS	46.96 38.67 E Page 1	mph pc/mi/	Ίn		

	200711	2011 10	marin nor mi
Capacity of base condit	ion, cb	7909	pc/h
Capacity as a 15-minute	flow rate,	c 7792	pc/h
Capacity as a full-hour	volume, ch	7402	pc/h

_Limitations on Weaving Segments__

		If Max Exce	eded See Note
	Anal yzed	Maximum	Note
Weaving flow rate, Vw	1152	2800	а
Average flow rate (pcphpl)	1815	2250	b
Volume ratio, VR	0. 16	0.35	С
Weaving ratio, R	0.46	N/A	d
Weaving length (ft)	2025	2500	е
Notes:			

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater

g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.

h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.

i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

2009AM 17th to 25th.txt

HCS+: Freeway Weaving Release 5.4

Wiedelman Parsons Brinckerhoff

Phone: E-mail:	Fax:	:			
Operati	onal Analy	ysi s			
Anal yst:RCTAgency/Co.:I DOT/PBDate Performed:7/6/2009Anal ysis Time Period:AM PeakFreeway/Dir of Travel:I -290 WBWeaving Location:17th Ave. EntJuri sdiction:I DOTAnal ysis Year:2009Description:I -290 Phase 1 Study	. to 25th puts	Ave.	Ex		
Erroway from flow spood SEE	 ۲۵		mph		
Weaving number of lanes, N	4	-	inpri	I	
Terrain type	88 Lev	/ vel	ττ		
Grade Length			% mi		
Weaving type Volume ratio VP	A	11			
Weaving ratio, R	0.2	20			
Conversion to pc/h	Under Bas	se Con	di ti ons		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, fP Flow rate, v	Non-Weav V 01 6240 0.95 1642 10 0 1.5 1.2 0.952 1.00 6896	vi ng V 0.95 0 10 0 1.5 1.2 0.952 1.00 0	Weaving V w1 590 0.95 155 10 0 1.5 1.2 0.952 1.00 652	V w2 150 0.95 39 10 0 1.5 1.2 0.952 1.00 165	veh/h v % % pc/h
Weaving and No	n-Weavi ng	Speed	S		
a (Exhibit 24-6) b (Exhibit 24-6) c (Exhibit 24-6) d (Exhibit 24-6) Weaving intensity factor, Wi Weaving and non-weaving speeds, Si Number of Lanes required for unconstrained operation, Nw (Exhibit 1	Weaving 0.15 2.20 0.97 0.80 1.26 34.91 24-7)		Non-Weavin 0.0035 4.00 1.30 0.75 0.60 43.11 0.85	g	
Maximum number of lanes, Nw (max) (Ex Type of operation is	hibit 24-7	7)	1.40 Unconstrai	ned	
Weaving Segment Speed, Densi	ty, Level	of Se	rvice and	Capaci ty	У
Weaving segment speed, S Weaving segment density, D Level of service, LOS	42.06 r 45.84 r F Page	mph oc/mi/ 1	ln		

Capacity o	of b	ase condition, cb	7304	pc/h
Capacity a	is a	15-minute flow rate,	c 6956	pc/h
Capacity a	is a	full-hour volume, cl	n 6608	pc/h

Limitations on Weaving Segments

		If Max Exce	eded See Note
	Anal yzed	Maximum	Note
Weaving flow rate, Vw	817	2800	а
Average flow rate (pcphpl)	1928	2250	b
Volume ratio, VR	0. 11	0.35	С
Weaving ratio, R	0. 20	N/A	d
Weaving length (ft)	887	2500	е
No. Los Transformed States and St			

Notes:

- Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp а. Junctions".
- Capacity constrained by basic freeway capacity. b.
- Capacity occurs under constrained operating conditions. С.
- Three-lane Type A segments do not operate well at volume ratios greater d. than 0.45. Poor operations and some local queuing are expected in such cases.
- Four-lane Type A segments do not operate well at volume ratios greater e. than 0.35. Poor operations and some local queuing are expected in such cases.
- Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h f. (Type A), 4,000 (Type B), 3,500 (Type C).
- Five-lane Type A segments do not operate well at volume ratios greater g. than 0.20. Poor operations and some local queuing are expected in such cases.
- Type B weaving segments do not operate well at volume ratios greater h. than 0.80. Poor operations and some local queuing are expected in such cases.
- Type C weaving segments do not operate well at volume ratios greater ί. than 0.50. Poor operations and some local queuing are expected in such cases.

2009PM 17th to 25th.txt

HCS+: Freeway Weaving Release 5.4

Wiedelman Parsons Brinckerhoff

Phone: E-mail:	Fax	K :			
Operatio	nal Anal	ysi s			
Analyst:RCTAgency/Co.:I DOT/PBDate Performed:7/6/2009Analysis Time Period:PM PeakFreeway/Dir of Travel:I -290 WBWeaving Location:17th Ave. Ent.Jurisdiction:I DOTAnalysis Year:2009Description:I -290 Phase 1 Study	to 25th	ו Ave. E	<		
l np	uts				
Freeway free-flow speed, SFF Weaving number of lanes, N Weaving segment length, L Terrain type Grade Length Weaving type Volume ratio, VR Weaving ratio, R	55 4 88 Le 0. 0.	5 37 evel 10 23	mph ft % mi		
Conversion to pc/h	Under Ba	ase Condi	tions		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, fP Flow rate, v	Non-Wea V 01 6070 0.95 1597 3 0 1.5 1.2 0.985 1.00 6485	avi ng V 02 0 0.95 0 10 0 1.5 1.2 0.952 1.00 0	Weaving V w1 480 0.95 126 7 0 1.5 1.2 0.966 1.00 522	V w2 150 0.95 39 3 0 1.5 1.2 0.985 1.00 160	veh/h v % % pc/h
Weaving and Non	-Weavi ng	g Speeds_			
a (Exhibit 24-6) b (Exhibit 24-6) c (Exhibit 24-6) d (Exhibit 24-6) Weaving intensity factor, Wi Weaving and non-weaving speeds, Si Number of Lanes required for unconstrained operation, Nw (Exhibit 2 Maximum number of Lanes Nw (max) (Exh	Weaving 0.15 2.20 0.97 0.80 1.15 35.94 4-7)	9 No 0. 4. 1. 0. 0. 44 0. 0.	on-Weavin 0035 00 30 75 53 4.51 79	g	
Type of operation is	. √ 1 € 1 ⁻	Ur	nconstrai	ned	
Weaving Segment Speed, Densit	y, Level	of Serv	i ce and	Capaci ty	
Weaving segment speed, S Weaving segment density, D Level of service, LOS	43.52 41.17 E Page 1	mph pc/mi/lr	ו		

Capacity of	base condition, cb	7337 pc/h
Capacity as	a 15-minute flow rate, c	7229 pc/h
Capacity as	a full-hour volume, ch	6868 pc/h

Limitations on Weaving Segments_

		If Max Exce	eded See Note
	Anal yzed	Maximum	Note
Weaving flow rate, Vw	682	2800	а
Average flow rate (pcphpl)	1791	2250	b
Volume ratio, VR	0. 10	0.35	С
Weaving ratio, R	0. 23	N/A	d
Weaving length (ft)	887	2500	е
Notes:			

 Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater

g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.

h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.

i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

2009AM Austin Central Off Ramp.txt

HCS+: Freeway Weaving Release 5.4

Wiedelman Parsons Brinckerhoff

Phone: E-mail: Fax:

Operatio	nal Anal	ysi s			
Analyst:RCTAgency/Co.:I DOT/PBDate Performed:3/25/2010Analysis Time Period:AM PeakFreeway/Dir of Travel:I -290 WBWeaving Location:Austin Off-RamJurisdiction:I DOTAnalysis Year:2009Description:I -290 Phase 1 Study	р				
I np	uts				
Freeway free-flow speed, SFF Weaving number of lanes, N Weaving segment length, L Terrain type Grade Length Weaving type Volume ratio, VR Weaving ratio, R	55 4 22 Le 0. 0.	200 evel 05 27	mph ft Mi		
Conversion to pc/h	Under Ba	ise Con	ditions		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, fP Flow rate, v	Non-Wea V 01 4630 0.95 1218 10 0 1.5 1.2 0.952 1.00 5117	V ng V 02 810 0.95 213 10 0 1.5 1.2 0.952 1.00 895	Weaving V w1 220 0.95 58 10 0 1.5 1.2 0.952 1.00 243	V w2 80 0.95 21 10 0 1.5 1.2 0.952 1.00 88	veh/h v % % pc/h
Weaving and Non	-Weaving	Speed	S		
a (Exhibit 24-6) b (Exhibit 24-6) c (Exhibit 24-6) d (Exhibit 24-6) Weaving intensity factor, Wi Weaving and non-weaving speeds, Si Number of Lanes required for	Weaving 0.15 2.20 0.97 0.80 0.45 46.00	I	Non-Weavi n 0. 0035 4. 00 1. 30 0. 75 0. 19 52. 71	g	
Maximum number of lanes, Nw (Exhibit 2 Maximum number of lanes, Nw (max) (Exh Type of operation is	4- <i>1)</i> ibit 24-	7)	U. 62 1. 40 Unconstrai	ned	
Weaving Segment Speed, Densit	y, Level	of Se	ervice and	Capaci ty	
Weaving segment speed, S Weaving segment density, D Level of service, LOS	52. 32 30. 31 D Page	mph pc/mi/ e 1	'l n		

Capacity of base condition	n, cb 8274 pc/h	
Capacity as a 15-minute fl	ow rate, c 7880 pc/h	
Capacity as a full-hour vo	olume, ch 7486 pc/h	

Limitations on Weaving Segments___

		If Max Exce	eded See Note
	Anal yzed	Maximum	Note
Weaving flow rate, Vw	331	2800	а
Average flow rate (pcphpl)	1585	2250	b
Volume ratio, VR	0.05	0.35	С
Weaving ratio, R	0. 27	N/A	d
Weaving length (ft)	2200	2500	е

Notes: a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).

g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.

h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.

i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Speed and volume conditions occurring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual method.

HCS+: Freeway Weaving Release 5.4

Wiedel man Parsons Brinckerhoff

Phone: E-mail: Fax:

Operational Analysis							
Analyst:RCTAgency/Co.:I DOT/PBDate Performed:3/25/2010Analysis Time Period:PM PeakFreeway/Dir of Travel:I -290 WBWeaving Location:Austin Off-RampJurisdiction:I DOTAnalysis Year:2009Description:I -290 Phase 1 Study							
I np	uts						
Freeway free-flow speed, SFF Weaving number of lanes, N Weaving segment length, L Terrain type Grade Length Weaving type Volume ratio, VR Weaving ratio, R	55 4 22 Le A 0. 0.	5 200 evel 06 27	mph ft % mi	1			
Conversion to pc/h	Under Ba	ase Cond	ditions				
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, fP Flow rate, v	Non-Wea V 01 5035 0.95 1325 3 0 1.5 1.2 0.985 1.00 5379	avi ng V 02 1000 0.95 263 3 0 1.5 1.2 0.985 1.00 1068	Weaving V 275 0.95 72 3 0 1.5 1.2 0.985 1.00 293	V w2 100 0.95 26 3 0 1.5 1.2 0.985 1.00 106	veh/h v % % pc/h		
Weaving and Non	-Weavi ng	g Speeds	8				
a (Exhibit 24-6) b (Exhibit 24-6) c (Exhibit 24-6) d (Exhibit 24-6) Weaving intensity factor, Wi Weaving and non-weaving speeds, Si Number of lanes required for unconstrained operation, Nw (Exhibit 2 Maximum number of lanes, Nw (max) (Exh Type of operation is	Weaving 0.15 2.20 0.97 0.80 0.49 45.15 4-7) ibit 24-	-7)	Non-Weavin D. 0035 4. 00 1. 30 D. 75 D. 22 51. 94 D. 67 1. 40 Jnconstrai	ned			
Weaving Segment Speed, Densit	v, Level	of Ser	rvice and	Capaci tv	,		
Weaving segment speed, S Weaving segment density, D Level of service, LOS	51. 49 33. 24 D Page	mph pc/mi/I e 1	n	, J			

	2007111 001101		Augurn orr
Capacity of	base condition, cb	8274	pc/h
Capacity as	a 15-minute flow rate, c	8152	pc/h
Capacity as	a full-hour volume, ch	7744	pc/h

Limitations on Weaving Segments___

		If Max Exce	eded See Note
	Anal yzed	Maximum	Note
Weaving flow rate, Vw	399	2800	а
Average flow rate (pcphpl)	1711	2250	b
Volume ratio, VR	0.06	0.35	С
Weaving ratio, R	0. 27	N/A	d
Weaving length (ft)	2200	2500	е
Notes:			

 Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).

g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.

h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.

i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Speed and volume conditions occurring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual method.

2009AM Cicero to Laramie.txt

HCS+: Freeway Weaving Release 5.4

Wiedelman Parsons Brinckerhoff

Phone: Fax: E-mail: _____Operational Analysis_____ Anal yst: RCT Agency/Co.: Date Performed: I DOT/PB 7/6/2009 Analysis Time Period: Freeway/Dir of Travel: AM Peak I-290 WB Weaving Location: Cicero Ent. to Laramie Ex. Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Phase 1 Study Inputs____ Freeway free-flow speed, SFF 55 mph Weaving number of lanes, N 5 Weaving segment length, L 718 ft Terrain type Level % Grade Length mi Weaving type А Volume ratio, VR Weaving ratio, R 0.19 0.47 ____Conversion to pc/h Under Base Conditions_ Non-Weaving Weavi ng v V V V o2 w2 01 w1 Volume, V 4920 0 630 550 veh/h Peak-hour factor, PHF 0.95 0.95 0.95 0.95 Peak 15-min volume, v15 1295 166 145 0 V Trucks and buses 10 % 10 10 10 Recreational vehicles % 0 0 0 0 Trucks and buses PCE, ET 1.5 1.5 1.5 1.5 Recreational vehicle PCE, ER 1.2 1.2 1.2 1.2 Heavy vehicle adjustment, fHV 0.952 0.952 0.952 0.952 1.00 Driver population adjustment, fP 1.00 1.00 1.00 Flow rate, v 5437 696 607 0 pc/h _____Weaving and Non-Weaving Speeds_ Non-Weaving Weaving a (Exhibit 24-6) b (Exhibit 24-6) 0.35 0.0020 4.00 2.20 c (Exhibit 24-6) d (Exhibit 24-6) 1.30 0.75 0.97 0.80 Weaving intensity factor, Wi 2.91 0.34 Weaving and non-weaving speeds, Si Number of Lanes required for 48.52 26.51 unconstrained operation, Nw (Exhibit 24-7) 1.42 1.40 Maximum number of lanes, Nw (max) (Exhibit 24-7) Type of operation is Constrai ned ___Weaving Segment Speed, Density, Level of Service and Capacity_____ Weaving segment speed, S Weaving segment density, D 41.81 mph 32.24 pc/mi/ln Level of service, LOS D Page 1

Capacity of base condition,	cb	8363	pc/h
Capacity as a 15-minute flow	w rate,	c 7965	pc/h
Capacity as a full-hour volu	ume, ch	7567	pc/h

Limitations on Weaving Segments_

		If Max Exce	eded See Note
	Anal yzed	Maximum	Note
Weaving flow rate, Vw	1303	2800	а
Average flow rate (pcphpl)	1348	2250	b
Volume ratio, VR	0. 19	0.20	С
Weaving ratio, R	0. 47	N/A	d
Weaving length (ft)	718	2500	е
Notes:			

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

- f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
 g. Five-lane Type A segments do not operate well at volume ratios greater
- g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Speed and volume conditions occurring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual method.

2009PM Cicero to Laramie.txt

HCS+: Freeway Weaving Release 5.4

Wiedelman Parsons Brinckerhoff

Phone: Fax: E-mail: _____Operational Analysis_____ Anal yst: RCT Agency/Co.: Date Performed: I DOT/PB 7/6/2009 Analysis Time Period: Freeway/Dir of Travel: PM Peak I-290 WB Weaving Location: Cicero Ent. to Laramie Ex. Jurisdiction: I DOT Analysis Year: 2009 Description: I-290 Phase 1 Study Inputs____ Freeway free-flow speed, SFF 55 mph Weaving number of lanes, N 5 Weaving segment length, L 718 ft Terrain type Level % Grade Length mi Weaving type А Volume ratio, VR Weaving ratio, R 0.17 0.48 ____Conversion to pc/h Under Base Conditions_ Non-Weaving Weavi ng v V V V o2 w1 w2 01 Volume, V 5490 0 610 550 veh/h Peak-hour factor, PHF 0.95 0.95 0.95 0.95 Peak 15-min volume, v15 1445 161 145 0 V Trucks and buses 3 % 10 3 5 Recreational vehicles 0 0 % 0 0 1.5 1.5 Trucks and buses PCE, ET 1.5 1.5 Recreational vehicle PCE, ER 1.2 1.2 1.2 1.2 0.985 Heavy vehicle adjustment, fHV 0.952 0.985 0.976 1.00 Driver population adjustment, fP 1.00 1.00 1.00 Flow rate, v 5865 651 593 0 pc/h _____Weaving and Non-Weaving Speeds_ Non-Weaving Weaving a (Exhibit 24-6) b (Exhibit 24-6) 0.15 0.0035 4.00 2.20 c (Exhibit 24-6) d (Exhibit 24-6) 1.30 0.75 0.97 0.80 Weaving intensity factor, Wi 1.27 0.60 Weaving and non-weaving speeds, Si Number of Lanes required for 34.83 43.06 1.35 unconstrained operation, Nw (Exhibit 24-7) 1.40 Maximum number of lanes, Nw (max) (Exhibit 24-7) Type of operation is Unconstrai ned ___Weaving Segment Speed, Density, Level of Service and Capacity_____ Weaving segment speed, S Weaving segment density, D 41.35 34.38 mph pc/mi/ln Level of service, LOS D Page 1

Capacity of base	condition, cb	8463	pc/h
Capacity as a 15	-minute flow rate,	c 8338	pc/h
Capacity as a fu	II-hour volume, ch	7921	pc/h

Limitations on Weaving Segments_

		If Max Exce	eded See Note
	Anal yzed	Maximum	Note
Weaving flow rate, Vw	1244	2800	а
Average flow rate (pcphpl)	1421	2250	b
Volume ratio, VR	0. 17	0.20	С
Weaving ratio, R	0. 48	N/A	d
Weaving length (ft)	718	2500	е
Notes:			

 Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

- f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
 g. Five-lane Type A segments do not operate well at volume ratios greater
- g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Speed and volume conditions occurring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual method.

Technical Memorandum

Appendix E-4

Interchange Intersection Analysis

- Existing Intersection Signal Phasing
- Intersection Traffic Counts 2010-Jan-06
- Crossroad ADT Volume Adjustment Percentages
- Ramp Volume Adjustment Percentages
- Intersection Volume Adjustments
- Intersection Turn-Lane Storage Analysis
- Intersection HCS Analysis Output











		Des Pla	aines Ave. & H	larrison St.	
		PHASE 1	PHASE 2	PHASE 3	PHASE 4
					4
	G	6	55	15	16
AM	Y	3	4	4	4
	AR	0	1	1	1
	G	10	51	20	16
PM	Y	3	4	4	4
	AR	0	1	1	1

















SUMMARY OF TRAFFIC SURVEY

INTERSECTION OF 1ST AVENUE & HARRISON STREET



LEGEND XXX - AM TRAFFIC (XXX)- PM TRAFFIC

SUMMARY OF TRAFFIC SURVEY

INTERSECTION OF 1ST AVENUE & BATAAN DRIVE



LEGEND XXX - AM TRAFFIC (XXX)- PM TRAFFIC

SUMMARY OF TRAFFIC SURVEY

INTERSECTION OF HARLEM AVENUE & I-290 RAMPS



LEGEND XXX - AM TRAFFIC (XXX)- PM TRAFFIC

Intersection	2001	2006	2009	% Change
25th Avenue				
Congress Street	22,631	24,000		6%
Lexington Street	20,425	21,100		3%
17th Ave				
Harrison Street	9,738	9,500		-2%
Bataan Drive	12,596	9,500		-25%
9th Ave				
Harrison Street	13,493	10,800		-20%
Bataan Drive	10,667	10,800		1%
1st Avene				
Harrison Street	22,636		29,000	28%
Bataan Drive	27,284		31,200	14%
Des Plains Avenue				
I-290 WB on Ramp	23,270	14,900		-36%
Harrison Street	19,550	14,900		-24%
Harlem Avenue				
I-290 Ramps	36,966		39,500	7%
Harrison/Garrield Street	33,545		35,200	5%
Austin Boulevard				
I-290 Ramps	16,671	21,700		30%
Railroad Avenue	17,375	21,700		25%
Central Avenue				
Flournoy Street	17,425	19,600		12%
EB I-290 Ramps	18,524	11,300		-39%
Laramie Avenue				
Flournoy Street	12,895	15,500		20%
Lexington Street	10,167	10,600		4%
Cicero Avenue				
Flournoy Street	28,921		29,100	1%
Lexington Street	27,500		33,000	20%
Overall	402,279	215,900	197,000	3%

Cross Road Intersection ADT % Changes

	A	M Peak Ho	ur	P	M Peak Ho	ur
Intersection	2001	2009	% Change	2001	2009	% Change
25th Avenue						
EB Exit Ramp EB Entrance Ramp EB Exit Ramp EB Entrance Ramp	107 236 102 285	310 230 60 230	190% -3% -41% -19%	135 268 64 276	430 350 100 270	219% 31% 56% -2%
WB Entrance Ramp WB Exit Ramp WB Exit Ramp	480 81 270	600 300 150	25% 270% -44%	410 215 217	490 250 150	20% 16% -31%
17th Ave						
EB Exit Ramp EB Entrance Ramp	187 232	180 200	-4% -14%	246 272	260 300	6% 10%
WB Entrance Ramp WB Exit Ramp	477 99	590 80	24% -19%	413 170	480 150	16% -12%
9th Ave						
EB Entrance Ramp	289	390	35%	350	480	37%
WB Exit Ramp	150	100	-33%	244	190	-22%
1st Avene						
EB Exit Ramp EB Entrance Ramp	241 592	220 620	-9% 5%	205 440	220 880	7% 100%
WB Entrance Ramp WB Exit Ramp	398 478	550 480	38% 0%	369 461	570 490	54% 6%
Des Plains Avenue						
EB Exit Ramp	214	140	-35%	333	270	-19%
WB Entrance Ramp	669	700	5%	532	590	11%
Harlem Avenue						
EB Exit Ramp EB Entrance Ramp	402 851	400 820	0% -4%	420 715	460 830	10% 16%
WB Entrance Ramp WB Exit Ramp	509 412	680 360	34% -13%	542 604	690 580	27% -4%
Austin Boulevard						
EB Exit Ramp EB Entrance Ramp	160 1,281	180 1,180	13% -8%	350 801	460 960	31% 20%
WB Entrance Ramp WB Exit Ramp	374 1,032	530 890	42% -14%	290 1,047	470 1,100	62% 5%
Central Avenue						
EB Exit Ramp EB Entrance Ramp	313 592	310 620	-1% 5%	455 389	580 600	27% 54%
WB Entrance Ramp WB Exit Ramp	520 312	500 310	-4% -1%	424 320	660 290	56% -9%
Laramie Avenue						
EB Entrance Ramp	607	450	-26%	380	540	42%
WB Exit Ramp	404	550	36%	578	610	6%
Cicero Avenue						
EB Exit Ramp	596	1,080	81%	752	810	8%
WB Entrance Ramp	627	630	0%	506	550	9%
Overall	14,579	15,620	7.1%	14,193	17,110	20.6%

Cross Road Ramp Volume % Changes

Cross Street Intersection Turning Volume Adjustment Summary

									25th	Avenu	e Inter	sectio	ns							
					С	ongres	ss Stre	et						L	exingto	on Stre	et			
	rection			AN	1			PN					AM					PM		
		2001	%Δ	di	2009	Bal-	2001	% Adi	2009	Bal-	2001	% Δα	4i	2009	Bal-	2001	% Δ(41	2009	Bal-
		Vol	/0 A	uj.	Vol	anced	Vol	76 Auj.	Vol	anced	Vol	70 AU	<i>и</i> ј.	Vol	anced	Vol	70 AU	<i>л</i> ј.	Vol	anced
	Left	4	6%	Α	5		11	6% A	12		147	3%	Α	152		108	3%	Α	112	
Ш	Thru			\square							4	0%	-	4		6	0%	R	6	
	Right	75	6%	Α	80		85	6% A	91	$\langle \rangle \rangle$	100	3%	Α	103		157	3%	Α	162	
	Left		///			$\langle / / \rangle$		V///	///.	$\langle \rangle \rangle$	2	0%	-	2	\sim	9	0%	R	9	
NB	Thru			\sim				V////			0	0%	-	0		5	0%	R	5	
-	Right			\mathbb{Z}	\bigcirc					\bigcirc	40	3%	Α	42		27	4%	R	29	
	Left	331	25%	R	414		202	20% R	243		18	6%	R	20	$\langle \rangle$	35	3%	Α	37	
B	Thru	982	6%	R	1041	948	607	6% A	644	618	1150	3%	Α	1185	111	669	3%	Α	690	741
	Right			//			\langle / \rangle				8	13%	R	10		13	8%	R	15	
	Left			\square							10	10%	R	11		34	3%	Α	36	
SB	Thru	496	6%	Α	526		1274	6% A	1351	11	358	3%	Α	369	616	1219	3%	Α	1256	1243
	Right	250	25%	R	313		221	20% R	266		48	4%	R	50		63	3%	Α	65	

									17th	Avenu	e Inter	sectio	ns							
_					ŀ	larriso	n Stre	et							Bataar	n Drive	•			
D	irection			AM	1			PN	Λ				AM					PM		
		2001	% Ad	6	2009	Bal-	2001	% Adi	2009	Bal-	2001	% Δα	41	2009	Bal-	2001	% Δα	41	2009	Bal-
		Vol	70 Au	<i>4</i> ј.	Vol	anced	Vol	78 Auj.	Vol	anced	Vol	70 AU	J.	Vol	anced	Vol	70 AU	J.	Vol	anced
	Left			\square							68	-4%	R	65		69	6%	R	73	
B	Thru			23							69	-4%	R	66		78	6%	R	83	
	Right			\mathbb{Z}	\square			V //			136	-4%	R	131	\vee	139	6%	R	147	
	Left	95	19%	R	114	111	174	-12% R	153	11		///	//		V//			\sim		
NB	Thru	263	24%	R	326		271	16% R	314						V / /	())				
-	Right	130	19%	R	155		147	-12% R	129			///	//		V / /			1	\square	
	Left	185	24%	R	230		165	16% R	191				\sim		11/1			11		
B	Thru	187	0%	-	187		300	0% -	300		304	0%	-	304	351	396	0%	-	396	418
	Right			1		V / / /				\mathcal{V}	181	-14%	R	156		97	10%	R	107	
	Left	///		\mathbb{Z}						V = 1	86	-14%	R	74		102	10%	R	112	
SB	Thru	168	0%	-	168	174	304	0% R	304	335	177	0%	-	177		376	0%	-	376	
	Right	85	24%	R	106		90	16% -	105				\mathbb{Z}					<u>//</u>		

									9th /	Avenue	e Inters	ection	s							
					F	larriso	n Stree	ət							Bataar	n Drive	9			
Di	rection			AN	1			PN					AM					PM		
		2001	% Δ	Hi	2009	Bal-	2001	% Adi	2009	Bal-	2001	% Adi		2009	Bal-	2001	% Δα	41	2009	Bal-
		Vol	70 A	J.	Vol	anced	Vol	76 Auj.	Vol	anced	Vol	78 Auj	•	Vol	anced	Vol	70 AU	J.	Vol	anced
	Left			//						\sim	33	3%	Α	34		30	3%	Α	31	
E	Thru			\square			\bigcirc			V / /	43	35%	R	59		41	37%	R	57	
	Right			1						$\vee \square$	4	0%	-	4		44	2%	Α	45	\square
~	Left	73	-33%	R	49		142	-22% R	111	$\langle \rangle \rangle$	///							\sim		
NE N	Thru	120	-33%	R	80		87	-22% R	68											
-	Right	77	-32%	R	52		152	-22% R	118				$\langle \rangle$			\Box			\square	
	Left	53	0%	-	53		41	0% -	41				1			\square				
8 Z	Thru	303	0%	-	303	304	359	0% -	359	360	320	1%	A	324		368	1%	Α	372	
	Right			\bigcirc			\bigcirc				107	35%	R	145	\langle / \rangle	148	37%	R	203	
	Left	///		//							139	35%	R	188		210	37%	R	288	
SB	Thru	240	0%	R	240	314	405	0% R	405	574	174	1%	A	176		394	1%	Α	398	\square
	Right	41	0%	-	41		75	0% -	75											

									1st /	Avenue	e Inters	sectior	າຣ							
					F	larriso	n Stre	et							Bataar	n Drive	•			
D	irection			AN	Λ			P	М				AM					PM		
		2001	%Δ	di	2009	Bal-	2001	% Adi	2009	Bal-	2001	% Δα	4i	2009	Bal-	2001	% Δα	41	2009	Bal-
		Vol	70 A	uj.	Vol	anced	Vol	70 Auj.	Vol	anced	Vol	70 AC	л .	Vol	anced	Vol	70 AC	<i>ч</i> ј.	Vol	anced
	Left					\vee		X///	1///		190	-9%	R	173		161	7%	R	173	
B	Thru					\vee					82	5%	R	87		42	100%	R	84	
	Right						\bigcirc			$V \square$	235	-9%	R	214		282	7%	R	302	
	Left	98	0%	R	98		164	6% R	174		(//)						V / /	\square		$\langle \rangle \rangle$
NB	Thru	40	38%	R	56		30	57% R	48				\square					\square		
-	Right	426	0%	R	426		267	6% R	284									$\langle \rangle$		
	Left	278	38%	R	384		209	54% R	322				11		V / /			\square		
BB	Thru	608	28%	Α	779	583	640	28% A	820	635	696	14%	Α	794	V / /	688	14%	Α	785	
	Right			\sim				V / / /	X///	X///	0	0%	-	0		0	0%	-	0	
	Left			11	111	∇Z		X / / /	1///		253	5%	R	266	11	200	100%	R	400	///
SB	Thru	676	28%	Α	866		934	28% A	1196		521	14%	Α	594	698	798	14%	Α	910	970
	Right	126	38%	R	174		138	54% R	213								///	//		
								1.1.0.7												

A = Volume Adjusted by % change in Crossroad ADT R = Volume Adjusted by % change in ramp count Volume

Cross Street Intersection Turning Volume Adjustment Summary

							De	es Plair	nes Av	enue li	ntersectio	ons					
					CTA S	tation						ŀ	larriso	n Stre	et		
Di	rection		AN	1			PN	Λ			AM				PM		
		2001	% Adi	2009	Bal-	2001	% Adi	2009	Bal-	2001	% Adi	2009	Bal-	2001	% Adi	2009	Bal-
		Vol	70 / Kaj.	Vol	anced	Vol	70 / Kuj.	Vol	anced	Vol	70 / Kaj.	Vol	anced	Vol	70 / Kaj.	Vol	anced
	Left	51	0%	51		63	0%	63		70	-34% R	47		150	-19% R	122	
EB	Thru									109	-35% R	71	1///	21	-19% R	18	
	Right	7	0% 🥢	7		80	0% 🥖	80		35	-23% R	27		162	-19% R	132	
	Left	///								26	0% -	26		52	0% -	52	
NB	Thru								$\vee / /$						V///		V / /
-	Right									102	0% -	102		81	0% -	81	
	Left	159	0%	159		157	0%	157	$\langle \rangle \rangle$								
NB	Thru	735	0%	735	744	707	0%	707	664	817	0% -	817	V//	778	0% -	778	
	Right								\bigcirc	10	0% -	10		29	0% -	29	
	Left			///				11		12	0% -	12	11	52	0% -	52	
SB	Thru	818	0% 🥖	818	847	942	0% 🥢	942	985	236	0% -	236		581	0% -	581	
	Right	81	0% 🥢	81		40	0%	40									

				ŀ	larlem	Avenu	le					Α	ustin B	ouleva	ard		
				Ra	mp Int	ersect	ion					Ra	imp Int	ersect	ion		
Di	rection		AN	1			PN	1			AM				F	PM	
		2001	% Adi	2009	Bal-	2001	% Adi	2009	Bal-	2001	% Adi	2009	Bal-	2001	% Adi	2009	Bal-
		Vol	70 / Kaj.	Vol	anced	Vol	70 7 Kaj.	Vol	anced	Vol	70 / Kaj.	Vol	anced	Vol	70 / Cuj.	Vol	anced
	Left	283	0% -	283		212	9% R	232		96	13% R	109		122	31%	R 160	
EB	Thru															X	
	Right	117	0% -	117		208	10% R	229		64	13% R	73		228	32%	R 301	
	Left	188	-13% R	164	11	310	-4% R	298		566	-14% R	487	111	730	5%	R 767	
NE	Thru				V / /										////	\times	V//
-	Right	224	-13% R	195		294	-4% R	283		466	-14% R	401		317	5%	R 333	\vee
	Left	277	34% R	372	11	222	27% R	282	\sim	246	42% R	350		182	62%	R 295	
NB	Thru	598	7% A	640	732	553	7% A	592	802	159	30% A	207	479	180	30%	A 234	479
	Right	375	-4% R	360		310	16% R	360	\langle / \rangle	686	-8% R	632		162	20%	R 195	
	Left	476	-4% R	457		405	16% R	470	\square	595	-8% R	548		639	20%	R 767	
SB	Thru	394	7% A	422	434	690	7% A	739	745	202	30% A	263	481	140	30%	A 182	306
	Right	232	34% R	311		320	27% R	407		128	41% R	181		108	62%	R 175	

									Centra	al Aven	ue Inte	ersecti	ons	5						
					F	lourno	y Stre	et							EB R	amps				
Di	rection			AM				Р	Μ				AM					PM		
		2001	% Ad	i	2009	Bal-	2001	% Adi	2009	Bal-	2001	% Δα	łi	2009	Bal-	2001	% Δα	41	2009	Bal-
		Vol	70 Au	J.	Vol	anced	Vol	70 Auj.	Vol	anced	Vol	70 AC	л ј.	Vol	anced	Vol	70 AC	л ј.	Vol	anced
	Left			$\langle \rangle$							129	-1%	R	128		227	27%	R	289	
Ш	Thru			1							0	0%	R	0	V / /	0	0%	R	0	
	Right			01	\square				X / /		184	-1%	R	183		228	28%	R	292	
~	Left	164	-1%	R	163		138	-9% R	126	11			\square							
Š	Thru	56	-3%	R	55		88	56% F	138				\sim		1///			\sim		
-	Right	234	-1%	R	232		198	-9% F	181				\square					\sim		
	Left	298	-4%	R	287		171	56% R	267				\sim							\square
8 Z	Thru	308	12%	A	345	288	698	12% A	782	665	447	0%	-	447		642	0%	-	642	$\langle \rangle \rangle$
	Right			$^{\prime}$			\square		$\overline{V//}$		324	5%	R	341		180	54%	R	278	
	Left							V//	$\overline{V//}$		268	5%	R	282		209	54%	R	322	
SB	Thru	457	12%	A	512		784	12% A	879		353	0%	-	353	///	713	0%	-	713	683
	Right	160	-4%	R	154		165	56% F	258				//							

									L	_arami	e Aven	ue Int	ersect	ions	5						
_					F	lourno	y Stre	et							L	exingto	on Stre	et			
D	irection			AN	1				PN	1				AM					PM		
		2001	%Δ	di	2009	Bal-	2001	% Ad	li	2009	Bal-	2001	% Δα	41	2009	Bal-	2001	% Δ(41	2009	Bal-
		Vol	70 A	uj.	Vol	anced	Vol	70 Au	ŋ.	Vol	anced	Vol	70 AC	л ј.	Vol	anced	Vol	70 A	л ј.	Vol	anced
	Left			1	///			\sim	2		$\langle \rangle \rangle$	24	4%	Α	25		114	4%	Α	119	
Ш	Thru			1		111		$\vee / /$	2			10	7%	R	11		94	4%	Α	98	
	Right			1					2		(//)	3	0%	-	3		106	4%	Α	111	
	Left	172	36%	R	234		236	6%	R	251	$\langle \rangle \rangle$		V / /.			\sim			$\langle \rangle$		
NB	Thru	41	37%	R	57		23	9%	R	26			V / /	//			\bigcirc		$\langle \rangle \rangle$	\cdots	
_	Right	286	36%	R	389		339	6%	R	360				\square					\mathcal{D}		
	Left	39	21%	R	48		49	20%	Α	59		16	6%	R	17		59	5%	R	62	
BB	Thru	134	20%	Α	161	133	315	20%	A	378	319	149	4%	Α	155		251	4%	Α	262	
	Right					///			1			245	-26%	R	182	///	71	42%	R	101	
	Left	///	\mathbb{Z}		///				2		$\langle \rangle \rangle$	315	-26%	R	234	111	253	42%	R	360	////
SB	Thru	578	20%	Α	694		419	20%	Α	503	(/)	453	4%	Α	472	582	340	4%	Α	354	328
	Right	33	21%	R	40		24	21%	R	30		48	4%	Α	50		62	4%	Α	65	

A = Volume Adjusted by % change in Crossroad ADT R = Volume Adjusted by % change in ramp count Volume

Cross Street Intersection Turning Volume Adjustment Summary

									Cicero	o Aven	ue Inte	rsection	ons							
					F	lourno	y Stre	et						L	exingto	on Stre	et			
Di	rection			AN				PN	Λ				AM					PM		
		2001	%Δ	di	2009	Bal-	2001	% Adi	2009	Bal-	2001	% Δα	4i	2009	Bal-	2001	% Δα	41	2009	Bal-
		Vol	70 A	uj.	Vol	anced	Vol	70 Auj.	Vol	anced	Vol	70 AC	4j.	Vol	anced	Vol	70 AC	<i>ч</i> ј.	Vol	anced
	Left			\square							278	81%	R	504		332	8%	R	359	
E	Thru		\square	$\langle \rangle$				V / / /	///		18	83%	R	33	///	34	9%	R	38	
	Right		\square	\mathbb{Z}	\square						336	81%	R	609		406	8%	R	439	
~	Left	4	0%	-	4		4	20% R	5		///		\square					\mathbb{Z}		
Š	Thru	8	0%	-	8		8	0% -	8		$\langle \rangle \rangle$		\square					\sim		
_	Right			//							$\langle \rangle \rangle$		\square					\sim		
	Left	361	0%	R	361	$\langle \rangle$	336	9% R	367		(//)		\sim		11					
8 Z	Thru	1153	1%	Α	1165	1401	962	1% A	972	1287	1041	20%	Α	1250		973	20%	Α	1168	1295
	Right			\square							4	25%	R	5		10	20%	Α	12	
	Left		///						V//		3	33%	R	4		10	20%	Α	12	
SB	Thru	596	1%	Α	602		1049	1% A	1060		595	30%	R	774	599	1044	20%	Α	1253	1053
	Right	304	0%	R	304		298	9% R	325		\square		11		V / /			\sim		
				A = V	olume Adju	isted by % c	hange in C	rossroad ADT												

R = Volume Adjusted by % change in ramp count Volume

Summary

uo		25th A	venue	•		17th A	venue	•		9th A	venue	
ectio	Congr	ess St.	Lexing	ton St.	Harriso	n Street	Bataa	n Drive	Harriso	n Street	Bataar	n Drive
Dire	AM	PM										
	Q % of Storage											
EB Left	7%	16%										
EB Right	23%	82%										
WB Left					120%	165%						
WB Right												
NB Left	288%	168%										
NB Right												
SB Left												
SB Right												

uo		1st Av	venue		Des	Plaine	es Ave	enue	Har Av	lem /e.	Au: Bly	stin vd.
ectio	Harriso	n Street	Bataa	n Drive	CTA S	Station	Harriso	n Street	I-290 F	Ramps	I-290 F	Ramps
Dire	AM	PM										
	Q % of Storage											
EB Left					300%	370%	94%	292%	74%	55%	76%	114%
EB Right			66%	164%	10%	90%	55%	380%	12%	44%	3%	62%
WB Left	124%	193%							31%	69%	98%	259%
WB Right	276%	178%							26%	47%	163%	104%
NB Left					43%	44%			213%	146%	528%	382%
NB Right									220%	220%	833%	105%
SB Left							24%	103%	148%	171%	348%	609%
SB Right									113%	197%	76%	65%

Direction	Central Avenue				Laramie Avenue				Cicero Avenue			
	I-290 WB Ramp		I-290 EB Ramp		Flournoy Street		Lexington Street		Flournoy Street		Lexington Street	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
	Q % of Storage	Q % of Storage	Q % of Storage	Q % of Storage	Q % of Storage	Q % of Storage						
EB Left	,	,	22%	59%	,	,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	,	,	,	474%	287%
EB Right			7%	19%							689%	255%
WB Left	85%	65%			98%	70%			5%	5%		
WB Right	19%	15%			100%	65%						
NB Left	110%	110%							153%	147%		
NB Right												
SB Left			124%	136%			58%	71%			5%	14%
SB Right	39%	68%					14%	16%	152%	176%		
Detail

uo							25th /	Avenue						
ectio			Co	ngress St						L	exington	St.		
Dire		AN	Λ			PM			AI	И			PM	
	Eixisting Storage L	# Cars	Queue L	Q % of Storage	# Cars	Queue L	Q % of Storage	Eixisting Storage L	# Cars	Queue L	Q % of Storage	# Cars	Queue L	Q % of Storage
EB Left	76	0.2	5	7%	0.5	12.5	16%							
EB Right	76	0.7	17.5	23%	2.5	62.5	82%							
WB Left														
WB Right														
NB Left	73	8.4	210	288%	4.9	122.5	168%							
NB Right														
SB Left														
SB Right														

uo							1st A	venue						
ectio			Harr	ison Stre	et					E	Bataan Dri	ive		
Dire		A	Λ			PM			A	М			PM	
	Eixisting Storage L	# Cars	Queue L	Q % of Storage	# Cars	Queue L	Q % of Storage	Eixisting Storage L	# Cars	Queue L	Q % of Storage	# Cars	Queue L	Q % of Storage
EB Left														
EB Right								253	6.7	167.5	66%	16.6	415	164%
WB Left	157	7.8	195	124%	12.1	302.5	193%							
WB Right	152	16.8	420	276%	10.8	270	178%							
NB Left														
NB Right														
SB Left														
SB Right														

u						C	Central	Avenu	е					
ectio			I-290) WB Ram	р					1-2	290 EB Ra	mp		
Dire		AN	Λ			PM			A	M			РМ	
-	Eixisting Storage L	# Cars	Queue L	Q % of Storage	# Cars	Queue L	Q % of Storage	Eixisting Storage L	# Cars	Queue L	Q % of Storage	# Cars	Queue L	Q % of Storage
EB Left								660	5.9	147.5	22%	15.6	390	59%
EB Right								660	1.8	45	7%	4.9	122.5	19%
WB Left	200	6.8	170	85%	5.2	130	65%							
WB Right	200	1.5	37.5	19%	1.2	30	15%							
NB Left	77	3.4	85	110%	3.4	85	110%							
NB Right														
SB Left								143	7.1	177.5	124%	7.8	195	136%
SB Right	140	2.2	55	39%	3.8	95	68%							

Detail

uc							17th A	venue						
ectic			Har	rison Stre	et					Ba	ataan Driv	е		
Dire		A	М			PM			A	М			PM	
	Eixisting Storage L	# Cars	Queue L	Q % of Storage	# Cars	Queue L	Q % of Storage	Eixisting Storage L	# Cars	Queue L	Q % of Storage	# Cars	Queue L	Q % of Storage
EB Left														
EB Right														
WB Left	179	8.6	215	120%	11.8	295	165%							
WB Right														
NB Left														
NB Right														
SB Left														
SB Right														

uo						Des	Plain	es Aven	ue					
ectio			C	TA Statior	ı					Har	rison Stre	et		
Dire		A	М			PM			Α	М			PM	
	Eixisting Storage L	# Cars	Queue L	Q % of Storage	# Cars	Queue L	Q % of Storage	Eixisting Storage L	# Cars	Queue L	Q % of Storage	# Cars	Queue L	Q % of Storage
EB Left	25	3.0	75	300%	3.7	92.5	370%	77	2.9	72.5	94%	9	225	292%
EB Right	25	0.1	2.5	10%	0.9	22.5	90%	77	1.7	42.5	55%	11.7	292.5	380%
WB Left														
WB Right														
NB Left	250	4.3	107.5	43%	4.4	110	44%							
NB Right														
SB Left								92	0.9	22.5	24%	3.8	95	103%
SB Right														

uo						La	aramie	Avenu	e					
ectio			Flo	urnoy Stre	eet					Lexi	ington Str	eet		
Dire		A	И			PM			Α	М			PM	
	Eixisting Storage L	# Cars	Queue L	Q % of Storage	# Cars	Queue L	Q % of Storage	Eixisting Storage L	# Cars	Queue L	Q % of Storage	# Cars	Queue L	Q % of Storage
EB Left														
EB Right														
WB Left	205	8	200	98%	5.7	142.5	70%							
WB Right	205	8.2	205	100%	5.3	132.5	65%							
NB Left														
NB Right														
SB Left								259	6	150	58%	7.4	185	71%
SB Right								259	1.4	35	14%	1.7	42.5	16%

Detail

u							9th A	venue						
ectic			Har	rison Stre	et					Ba	ataan Driv	е		
Dire		A	М			PM			A	И			PM	
	Eixisting Storage L	# Cars	Queue L	Q % of Storage	# Cars	Queue L	Q % of Storage	Eixisting Storage L	# Cars	Queue L	Q % of Storage	# Cars	Queue L	Q % of Storage
EB Left														
EB Right														
WB Left														
WB Right														
NB Left														
NB Right														
SB Left														
SB Right														

uo			Har	lem Av	ve.					Aus	stin Bl	/d.		
ectio			I-2	90 Ramps	S					I-2	290 Ramps	s		
Dire		A	M			РМ			A	M			РМ	
	Eixisting Storage L	# Cars	Queue L	Q % of Storage	# Cars	Queue L	Q % of Storage	Eixisting Storage L	# Cars	Queue L	Q % of Storage	# Cars	Queue L	Q % of Storage
EB Left	750	22.2	Storage Storage <t< td=""><td>55%</td><td>182</td><td>5.5</td><td>137.5</td><td>76%</td><td>8.3</td><td>207.5</td><td>114%</td></t<>				55%	182	5.5	137.5	76%	8.3	207.5	114%
EB Right	750	750 22.2 555 74% 16.5 412.5 4 750 3.5 87.5 12% 13.1 327.5 4						750	1.0	25	3%	18.5	462.5	62%
WB Left	900	11	275	31%	24.8	620	69%	880	34.5	862.5	98%	91.0	2275	259%
WB Right	900	9.2	230	26%	16.8	420	47%	530	34.6	865	163%	22.1	552.5	104%
NB Left	171	14.6	365	213%	10	250	146%	150	31.7	792.5	528%	22.9	572.5	382%
NB Right	151	13.3	332.5	220%	13.3	332.5	220%	148	49.3	1232.5	833%	6.2	155	105%
SB Left	492	29.2	730	148%	33.6	840	171%	165	23	575	348%	40.2	1005	609%
SB Right	220	9.9	247.5	113%	17.3	432.5	197%	135	4.1	102.5	76%	3.5	87.5	65%

uo						c	cicero	Avenue	•					
ectio			Flo	urnoy Stre	et					Lexi	ngton Str	eet		
Dire		A	М			PM			Α	М			PM	
	Eixisting Storage L	# Cars	Queue L	Q % of Storage	# Cars	Queue L	Q % of Storage	Eixisting Storage L	# Cars	Queue L	Q % of Storage	# Cars	Queue L	Q % of Storage
EB Left								95	18	450	474%	10.9	272.5	287%
EB Right								95	26.2	655	689%	9.7	242.5	255%
WB Left	105	0.2	5	5%	0.2	5	5%							
WB Right														
NB Left	80	4.9	122.5	153%	4.7	117.5	147%							
NB Right														
SB Left								54	0.1	2.5	5%	0.3	7.5	14%
SB Right	105	6.4	160	152%	7.4	185	176%							

SIGNALIZED INTERSECTION SUMMARY	
Eastbound Westbound Northbound Southbou	ind
L T R L T R L T R L T	R
No. Lanes $ 1 \cup 1 \cup \cup \cup 1 2 \cup \cup 2$	0
LGCONIIG L R L T I TR	212
Volume $ 5 \\ 80 \\ 414 \\ 948 520 \\ 12 0 11 0 10 11 0 10 10 10 10 10 10 10 10 1$	313
	0 1
RIOR VOL 55	02
Duration 0.25 Area Type: All other areas	
Signal Operations)
Phase combination 1 2 3 4 5 0 7 6 EP Loft A Imp Loft A A	
Thru Thru A A	
Right A Right	
Peds Peds	
WB Left SB Left	
Thru A	
Right A	
Peds	
NB Right EB Right A	
SB Right WB Right	
Green 8.0 13.0 34.0	
Yellow 4.0 4.0 4.0	
All Red 1.0 1.0 1.0	
Cycle Length: 70.0	secs
Intersection Performance Summary	
Appr/ Lane Adj Sat Ratios Lane Group Approach	
Lane Group Flow Rate	
Grp Capacity (s) v/c g/C Delay LOS Delay LOS	
Eastbound	
L 191 1487 0.03 0.13 26.7 C	
15.6 В	
R 513 1330 0.05 0.39 13.5 B	
Westbound	
Northbound	
L 520 1487 0.84 0.76 19.3 B	
T 1613 2131 0.62 0.76 4.6 A 9.1 A	
Southbound	
TR 1361 2722 0.59 0.50 13.0 B 13.0 B	
Intersection Delay = 10.6 (sec/veh) Intersection LOS = B	

I-290 Existing

Phone: Fax: E-Mail: _____OPERATIONAL ANALYSIS______

Analyst: Agency/Co.: PB Date Performed: 6/25/2010 Analysis Time Period: AM Peak Hour Intersection: Congress Street & 25th Avenue Area Type: All other areas Jurisdiction: Analysis Year: Existing Project ID: I-290 Phase 1 Study E/W St: Congress Street N/S St: 25th Avenue

_____VOLUME DATA______

	Eas	stbou	nd	We	stbou	ınd		No	rthbou	ınd	Sou	ithbou	ind
	L	Т	R	L	Т	R	ļL		Т	R	L	Т	R
Volumo	 ह								019		 	526	212
VOLUME VOLUME			00 1 E				115	4	940 1E			520 1E	3⊥3 1⊑
s Heavy ven			10 05				1 1 2	<u>о г</u>	10 05			T 2	
	0.95		0.95				0.	95	0.95			0.95	0.95
PK 15 VOL	2		21				110	9	249			138	82
Hi Ln Vol													
% Grade		0							0			0	
Ideal Sat	1800		1800				18	00	1300			1800	
ParkExist				ĺ			Í				ĺ		
NumPark	ĺ			İ			İ				İ		
No. Lanes	1	0	1	0	0	0	İ	1	2	0	j o	2	0
LGConfig	L		R				L		Т			TR	
Lane Width	12.0		12.0	İ			12	.0	12.0		İ	11.0	
RTOR Vol	ĺ		55	İ			İ				İ		82
Adj Flow	5		26	ĺ			43	б	998		ĺ	797	
%InSharedLn	ĺ			İ			j				İ		
Prop LTs	ĺ						1.	00	0 0.00	0	İ	0.00	jo j
Prop RTs			1.000				İ	0	.000		0	.305	İ
Peds Bikes	0			0			İ				0		
Buses	0		0	İ			0		5		İ	5	ĺ
%InProtPhase	5						j o	.0			İ		
Duration	0.25		Area	Type:	All	other	are	as					I

_____OPERATING PARAMETERS______OPERATING PARAMETERS_____

	Eas	stbou	ınd	Wes	stbou	nd	No	rthbo	und	Sc	uthbo	und
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
							.			.		
Init Unmet	0.0		0.0				0.0	0.0			0.0	
Arriv. Type	3		3				3	3			3	
Unit Ext.	3.0		3.0				3.0	3.0			3.0	
I Factor		1.00	0					1.00	0		1.00	0
Lost Time	2.0		2.0	ĺ			2.0	2.0		Ì	2.0	ĺ
Ext of g	3.0		3.0	ĺ			3.0	3.0		ĺ	3.0	ĺ
Ped Min g	ĺ	3.2		Ì	3.2		ĺ			Ì	3.2	İ

				PH	ASE	DATA_						
Pha	se Combination	1	2	3	4			5	6	7	8	
ΕB	Left Thru Right Peds	A A				NB	Left Thru Right Peds	A A	A A			
WB	Left Thru Right Peds					SB	Left Thru Right Peds		A A			
NB	Right				ļ	EB	Right	A				
SB	Right					WB	Right					
Gre Yel All	en 8 low 7 Red 2	8.0 4.0 1.0			I			13.0 4.0 1.0	34.0 4.0 1.0			

Cycle Length: 70.0 secs

			VOLUM	IE ADJI	USTMEN	T AND	SA	TURATIC	N FLO	W WORK	SHEET_		
Volum	e Adjus	stment		-			-	1					
		Eas	tboun	ld	Wes	tbound	d	NC	orthbou	und	Soi	ithbo	und
		L 	Т	R	L 	Т	R	L 	Т	R	L 	Т	R
Volum	e, V	<u></u> 5		80				414	948			526	313
PHF		0.95		0.95				0.95	0.95			0.95	0.95
Adj f	low	5		26				436	998			554	243
No. La	anes	1	0	1	0	0	0	1	. 2	0	0	2	0
Lane g	group	L		R				L	Т			TR	
Adj f	low	5		26				436	998		ĺ	797	ĺ
Prop 1	LTs							1.00	0.00	0 0		0.0	00
Prop 1	RTs	ĺ	1	.000	İ			0	.000		į o.	305	İ
Satura	ation 1 Eas	Flow R stboun	ate (d	see E:	xhibit Westbo	16-7 und	to	determ Nort	ine tl hbound	he adj d	ustmer Sou	nt fa uthbo	ctors)_ und
LG	L		R					L	Т			TR	
So	1800		1800)				1800	1300			180	0
Lanes	1	0	1	0	0	0		1	2	0	0	2	0
fW	1.000		1.00	0				1.000	1.000			0.9	67
fHV	0.870		0.87	0				0.870	0.870			0.8	70
fG	1.000		1.00	0				1.000	1.000			1.0	00
fP	1.000		1.00	0				1.000	1.000			1.0	00
fBB	1.000		1.00	0				1.000	0.990			0.9	90
fA	1.000		1.00	0				1.000	1.000			1.0	00
fLU	1.000		1.00	0				1.000	0.952			0.9	52
frt			0.85	0					1.000			0.9	54
fLT	0.950							0.950	1.000			1.0	00
Sec.								0.256					
fLpb	1.000							1.000	1.000			1.0	00
fRpb			1.00	0					1.000			1.0	00
S	1487		1330	1				1487	2131			272	2
Sec.								400					
				CAI	PACITY	AND :	LOS	WORKSH	EET				
Capac	ity Ana	alysis	and	Lane (Group	Capac	ity						

			Adj	Adj	Sat	F	low	Gre	en -	-Lane (Group	
Appr Mvmt	/ Lane Group	Flo	w Rate (v)	Flow (s	Rate ;)	Ra (v	atio v/s)	Rat (g/	io Ca C)	apacity (c)	y v/c Ratio	
Eastbou	nd											
Prot												
Perm												
Left	L	5		148	37	# (00.0	0.	13	191	0.03	
Prot												
Perm												
Thru												
Right	t R	2	6	133	0	(0.02	0.	39	513	0.05	
Westbour	nd											
Prot												
Perm												
Left												
Prot												
Perm												
Thru												
Right	t											
Northboy	und											
Prot		2	97	148	37	# (0.20	0.	200	297	1.00	
Perm		1	39	400)	# (0.35	0.	557	223	0.62	
Left	L	4	36					0.	76	520	0.84	
Prot												
Perm												
Thru	Т	9	98	213	31	(0.47	0.	76	1613	0.62	
Right	t											
Southboy	und											
Prot												
Perm												
Left												
Prot												
Perm												
Thru	TR	7	97	272	2	(0.29	Ο.	50	1361	0.59	
Right	t											
Sum of :	flow rati	os for	critic	cal lan	le gro	oups	s, Yc	= S	um (v	/s) =	= 0.55	
Total lo	ost time :	per cy	cle, I	L = 8.0)0 se	ec				(
Critica.	l flow ra	te to	capacit	ty rati	.0,		Xc	= (YC)(C)/	(C-L) =	= 0.62	
a . 1	D 1	1 7 9 9										
Control	Delay an	a LOS	Determi	Ination	l							
Appr/	Ratios	UNI	Prog	Lane	Incre	emer	ntal	Res	Lane	Group	Approa	acn
Lane	/	Del	Adj	Grp	Facto	or I	Jel	Del				
Grp V	/c g/C	a1	Fact	Сар	к		a∠ 	a.3	Dela	ау LOS		LOS
Eastbour	nd											
L 0.	03 0.13	26.7	1.000	191	0.11	(0.1	0.0	26.7	С		
											15.6	В
R 0.0	05 0.39	13.5	1.000	513	0.11	(0.0	0.0	13.5	В		
Westbou	nd											
Northbo	und											
L 0.	84 0.76	7.7	1.000	520	0.37	-	11.6	0.0	19.3	В		
т 0.0	62 0.76	3.9	1.000	1613	0.20	().7	0.0	4.6	A	9.1	A
	- • • •				— •		-			-		
Southboy	und											
TR 0.5	59 0.50	12.4	1.000	1361	0.18	(0.7	0.0	13.0	В	13.0	В

SUPPLEMENTAL PERMITTED LT WORKSHEET for exclusive lefts Input EΒ WΒ NBSB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 70.0 sec Total actual green time for LT lane group, G (s) 52.0 39.0 Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) 35.0 Number of lanes in LT lane group, N 1 Number of lanes in opposing approach, No 2 Adjusted LT flow rate, VLT (veh/h) 436 Proportion of LT in LT lane group, PLT 1.000 Proportion of LT in opposing flow, PLTo 0.00 Adjusted opposing flow rate, Vo (veh/h) 797 Lost time for LT lane group, tL 4.00 Computation LT volume per cycle, LTC=VLTC/3600 8.48 Opposing lane util. factor, fLUo 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) 8.14 gf=G[exp(- a * (LTC ** b))]-tl, gf<=g 0.0 Opposing platoon ratio, Rpo (refer Exhibit 16-11) 1.00 Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] 0.50 qq, (see Exhibit C16-4,5,6,7,8) 10.61 gu=g-gq if gq>=gf, or = g-gf if gq<gf 28.39 n=Max(gq-gf)/2,0)5.30 PTHo=1-PLTo 1.00 PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]1.00 EL1 (refer to Exhibit C16-3) 2.85 EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g 0.10 0.00 gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) 0.26 flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** 0.256 Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PERMITTED LT WORKSHEET

for	shared lefts					
Input						
			EB	WB	NB	SB
Opposed by Single(S) or Multiple(M)	lane approach					
Cycle length, C	70.0	sec				
Total actual green time for LT lane	group, G (s)					
Effective permitted green time for L'	T lane group,	g(s)				
Opposing effective green time, go (s)					
Number of lanes in LT lane group, N						

Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT 0.000 0.000 Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 0.952 0.952 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min = fmin; max = 1.00)flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET Permitted Left Turns EΒ WΒ $^{\rm NB}$ SB Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Pedestrian flow rate, Vpedg (p/h) 0CCpedq Opposing queue clearing green, gq (s) Eff. ped. green consumed by opp. veh. queue, gq/gp OCCpedu Opposing flow rate, Vo (veh/h) OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion of left turns, PLT Proportion of left turns using protected phase, PLTA Left-turn adjustment, fLpb Permitted Right Turns Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Conflicting bicycle volume, Vbic (bicycles/h) Vpedg OCCpedq Effective green, g (s) Vbicg

OCCbicg OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion right-turns, PRT Proportion right-turns using protected phase, PRTA Right turn adjustment, fRpb SUPPLEMENTAL UNIFORM DELAY WORKSHEET EBLT WBLT NBLT SBLT Cycle length, C 70.0 sec Adj. LT vol from Vol Adjustment Worksheet, v 436 v/c ratio from Capacity Worksheet, X 0.84 Protected phase effective green interval, g (s) 14.0 Opposing queue effective green interval, gq 10.61 Unopposed green interval, gu 28.39 Red time r=(C-g-gq-gu)17.0 Arrival rate, qa=v/(3600(max[X,1.0]))0.12 Protected ph. departure rate, Sp=s/3600 0.413 Permitted ph. departure rate, Ss=s(qq+qu)/(qu*3600) 0.15 XPerm 1.09 XProt 0.65 Case 3 2.45 Queue at beginning of green arrow, Qa Queue at beginning of unsaturated green, Qu 1.28 Residual queue, Or 0.39 Uniform Delay, d1 7.7 ____DELAY/LOS WORKSHEET WITH INITIAL QUEUE___ Initial Dur. Uniform Delay Initial Final Initial Lane Unmet Unmet Queue Unmet Oueue Group Appr/ Lane Demand Demand Unadj. Adj. Param. Demand Delay Delav Group Q veh t hrs. ds dl sec Q veh d3 sec d sec u Eastbound 0.0 0.00 30.5 26.7 0.00 0.0 0.0 26.7 L 0.0 0.0 0.0 0.00 21.5 13.5 0.00 0.0 0.0 13.5 R Westbound 0.0 0.0 0.0 0.0 0.0 0.0 Northbound 0.00 L 0.0 7.7 0.00 0.0 0.0 19.3 8.5 т 0.0 0.00 3.9 0.00 0.0 0.0 4.6 0.0 0.0 Southbound 0.0 0.0 0.0 0.00 12.4 0.00 ΤR 17.5 0.0 0.0 13.0 0.0 0.0 Intersection Delay 10.6 sec/veh Intersection LOS B

_____BACK OF QUEUE WORKSHEET_____

	Eastbou	ınd	Westbo	und	Nor	thbound	Southbound
LaneGroup	L	R			L	Т	TR
Init Queue	0.0	0.0			0.0	0.0	0.0
Flow Rate	5	26			436	524	418
So	1800	1800			1800	1300	1800
No.Lanes	1 0	1 0	0	0	1	2 0	0 2 0
SL	1487	1330			687	1119	1429
LnCapacity	191	513			520	847	714
Flow Ratio	0.0	0.0			0.6	0.5	0.3
v/c Ratio	0.03	0.05			0.84	0.62	0.59
Grn Ratio	0.13	0.39			0.76	0.76	0.50
I Factor	1.000)				1.000	1.000
AT or PVG	3	3			3	3	3
Pltn Ratio	1.00	1.00			1.00	1.00	1.00
PF2	1.00	1.00			1.00	1.00	1.00
Q1	0.1	0.3			2.5	4.7	5.7
kB	0.2	0.4			0.4	0.5	0.5
Q2	0.0	0.0			1.8	0.9	0.7
Q Average	0.1	0.3			4.3	5.5	6.4
Q Spacing	25.0	25.0			25.0	25.0	25.0
Q Storage	0	90			90	0	0
Q S Ratio		0.1			1.2		
70th Percent	cile Output	::					
fB%	1.2	1.2			1.2	1.2	1.2
BOQ	0.1	0.4			5.1	6.5	7.6
QSRatio		0.1			1.4		
85th Percent	cile Output	::					
fB%	1.6	1.6			1.6	1.5	1.5
BOQ	0.1	0.5			6.6	8.5	9.9
QSRatio		0.1			1.8		
90th Percent	cile Output	;:					
fB%	1.8	1.8			1.7	1.7	1.7
BOQ	0.2	0.6			7.3	9.4	10.8
QSRatio		0.2			2.0		
95th Percent	cile Output						
fB%	2.1	2.1			2.0	1.9	1.9
BOQ	0.2	0.7			8.4	10.7	12.3
QSRatio		0.2			2.3		
98th Percent	ci⊥e Output	;:					
±B%	2.7	2.7			2.4	2.4	2.3
BOQ	0.2	0.9			10.3	13.0	14.8
QSRatio		0.3			2.9		

_____ERROR MESSAGES_____

No errors to report.

Analyst: Agency: Date: Period: Project E/W St:	PB 6/25/2 PM Pea ID: I- Congre	010 k Hour 290 Pha ss Stre	ase 1 Steet	tudy		Int Are Jur Yea N/S	er.: C a Type isd: r : E St: 2	ongre: : All xistin 5th Ar	ss Str other ng venue	eet & area	25t 18	h Av	venue
			SI(GNALIZI	ED IN	TERSE	CTION	SUMMAI	RY				
		Eastbou	ind	West	tboun	.d	Nor	thboui	nd	Sou	ithbo [.]	und	
	ļL	і Т.	R		.L.	R	ЦЦ	.T.	R	Ь	.L.	R	
	-	1 0	1						·				
NO. Lane	S I T	1 0	T		0	0			0	0		0	
Volumo		1	0.1	1				1 619			1251	266	
Vorume Lane Wid	+b 12	0	91 12 0				4 4 5 1 2 0	12 0			11 0	200	
RTOR Vol			22.0				112.0	12.0			11.0	21	
KIOK VOI	I		22	I			I		I			21	I
Duration	0.	25	Area 1	Type: A	All o	ther	areas						
Dhage Co	mhinat	ion 1	 2	23 2		l	TOUR		6			<u></u>	
EB Left			2	J	Т	 NB	I.⊖ft	A	D D	,		0	
Thru		11					Thru	A	A				
Righ	t	А				Ì	Right						
Peds						i	Peds						
WB Left						SB	Left						
Thru						İ	Thru		A				
Righ	t					Ì	Right		А				
Peds							Peds						
NB Righ	t					EB	Right	A					
SB Righ	t					WB	Right						
Green		7.0						10.0	43.0				
Yellow		4.0						4.0	4.0				
All Red		1.0						1.0	1.0 1. T				
		т	ntorgo	ation I	Dorfo	rmana	o Gumm	Cyc.	le Len	gtn:	/5.0		secs
<u>Appr/</u>	 Lane	۱۱ ۵ د	licersed Ni Sat	Rat	FEIIU Fing	I Maric	Lane	ary Group	 	roach			
Lane	Group	Flo	w Rate	Rai	CIUD		Lanc	Group	прр	LOUCI	-		
Grp	Capaci	.tv	(s)	 v/c	q/	C	Delav	LOS	Dela	v LOS	5		
Eastboun	u 150	1 /	197	0 0 0	Λ	1 1	30 1	C					
Ц	109	14	607	0.00	0.	± ±	30.4	C	21 0	C			
R	408	1 3	30	0 18	0	31	193	в	21.0	C			
Westboun	d	1.	50	0.10	0.	51	17.5	D					
	_												
Northbou	nd							_					
	314	14	187	0.82	0.	79	36.6	D	11 0	-			
.Т.	2321	29	950	0.28	Ο.	19	2.3	А	11.9	В			
Southbou	nd												
TR	1634	27	86	1.03	0.	59	45.3	D	45.3	D			
		-	_	-	_		. .						
	Inter	section	n Delay	= 33.2	2 (s	ec/ve	h) I	nterse	ection	LOS	= C		

I-290 Existing

Phone: Fax: E-Mail: _____OPERATIONAL ANALYSIS______OPERATIONAL ANALYSIS_____

Analyst:	
Agency/Co.:	PB
Date Performed:	6/25/2010
Analysis Time Period:	PM Peak Hour
Intersection:	Congress Street & 25th Avenue
Area Type:	All other areas
Jurisdiction:	
Analysis Year:	Existing
Project ID: I-290 Phase 1	l Study
E/W St: Congress Street	N/S St: 25th Avenue

_____VOLUME DATA______

	Eas	stbou	nd	Wes	stbou	nd		Noi	rthbou	ınd	Soı	ıthboı	ind
	L	Т	R	L	Т	R	ļ	L	Т	R	L	Т	R
Volumo	 10		01	<u></u>				242	619			1251	266
	1 C		91 1 F					243 1 F	1 -	ļ		1551	200 1r
<pre>% Heavy ven</pre>			15					15	15			15	12
PHF	0.95		0.95					0.95	0.95			0.95	0.95
PK 15 Vol	3		24					64	163			356	70
Hi Ln Vol													
% Grade		0							0			0	
Ideal Sat	1800		1800	ĺ			:	1800	1800	ĺ		1800	İ
ParkExist							- i			İ			ĺ
NumPark							İ			İ			ĺ
No. Lanes	1	0	1	0	0	0	İ	1	2	0	0	2	0
LGConfig	L		R					L	Т			TR	
Lane Width	12.0		12.0	İ			;	12.0	12.0	j		11.0	j
RTOR Vol	İ		22	İ			İ			j			21
Adj Flow	13		73					256	651	ĺ		1680	ĺ
%InSharedLn	ĺ			İ			İ			j			j
Prop LTs	ĺ						j	1.000	0.00	0 j		0.00)0 İ
Prop RTs			1.000				İ	0.	.000	j	0.	.154	i
Peds Bikes	0			0			İ			j	0		i
Buses	0		0					0	5	j		5	j
%InProtPhase	2						İ	0.0		İ			İ
Duration	0.25		Area 🛙	Гуре:	All	other	a	reas					

_____OPERATING PARAMETERS______OPERATING PARAMETERS_____

	Eas	stbou	ınd	We	stbou	nd	No	rthbou	ınd	So	uthbo	und
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
							.					
Init Unmet	0.0		0.0				0.0	0.0			0.0	
Arriv. Type	3		3				3	3			3	
Unit Ext.	3.0		3.0				3.0	3.0		ĺ	3.0	Í
I Factor		1.00	0					1.000)		1.00	0
Lost Time	2.0		2.0	ĺ			2.0	2.0		ĺ	2.0	Í
Ext of g	3.0		3.0	İ			3.0	3.0		İ	3.0	İ
Ped Min g		3.2		İ	3.2		İ			İ	3.2	İ

				PH	ASE	data_					
Pha	se Combination	1	2	3	4			5	6	7	8
EB	Left Thru Right Peds	A A				NB	Left Thru Right Peds	A A	A A		
WB	Left Thru Right Peds					SB	Left Thru Right Peds		A A		
NB	Right					EB	Right	A			
SB	Right					WB	Right				
Gree Yel All	en low Red	7.0 4.0 1.0						10.0 4.0 1.0	43.0 4.0 1.0		

Cycle Length: 75.0 secs

Volume Adjustment Eastbound Westbound Northbound Southbound L T R L T R L T R Volume, V 12 91 243 618 1351 266 PHF 0.95 0.95 0.95 0.95 0.95 0.95 Adj flow 13 73 256 651 1422 258	I
L T R L T R L T R L T R Volume, V 12 91 243 618 1351 266 PHF 0.95 0.95 0.95 0.95 0.95 0.95 Adj flow 13 73 256 651 1422 258	
L T R L T R L T R Volume, V 12 91 243 618 1351 266 PHF 0.95 0.95 0.95 0.95 0.95 0.95 Adj flow 13 73 256 651 1422 258	
Volume, V 12 91 243 618 1351 266 PHF 0.95<	
PHF 0.95	-
Adj flow 13 73 256 651 1422 258	İ
	İ
No. Lanes 1 0 1 0 0 0 1 2 0 0 2 0	İ
Lane group L R L T T TR	İ
Adj flow 13 73 256 651 1680	ĺ
Prop LTs 1.000 0.000 0.000	
Prop RTs 1.000 0.000 0.154	Ì
Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors) Eastbound Westbound Northbound Southbound)
LG L R L T TR	
So 1800 1800 1800 1800 1800	
Lanes 1 0 1 0 0 0 1 2 0 0 2 0	
fW 1.000 1.000 1.000 0.967	
fHV0.8700.8700.8700.870	
fG 1.000 1.000 1.000 1.000 1.000	
fP 1.000 1.000 1.000	
fBB 1.000 1.000 0.990 0.990	
fA 1.000 1.000 1.000	
ELU 1.000 1.000 0.952 0.952	
ERT 0.850 1.000 0.977	
LT 0.950 0.950 1.000 1.000	
Sec. U.U83	
LLpb 1.000 1.000 1.000 flipb 1.000 1.000 1.000	
ICDU ICUU ICUU ICUU C 1497 1220 1497 2050 2796	
5 1407 1330 1407 2930 2780 Soci	
DEC. ISU CADACITY AND IOG MORGUPT	
Capacity Analysis and Lane Group Capacity	

			Adj	Adj	Sat	F	low	Gre	en	Lane G	roup	
Appr/ Mvmt	Lane Group	Flo	w Rate (v)	Flow (:	Rate s)	R. (atio v/s)	Rat (g/	io Ca C)	pacity (c)	v/c Ratio	
Eastbound	1											
Prot												
Perm												
Left	L	1	3	148	37	#	0.01	0.	11	159	0.08	
Prot												
Perm												
Thru												
Right	R	7	3	13:	30		0.05	0.	31	408	0.18	
Westbound	f											
Prot												
Perm												
Left												
Prot												
Perm												
Thru												
Right												
Northbour	nd											
Prot		2	18	148	37	#	0.15	Ο.	147	218	1.00	
Perm		3	8	130	C		0.29	Ο.	640	96	0.40	
Left	L	2	56					0.	79	314	0.82	
Prot												
Perm												
Thru	Т	6	51	29	50		0.22	0.	79	2321	0.28	
Right												
Southbour	nd											
Prot												
Perm												
Left												
Prot												
Derm												
Thru	ΨD	1	680	279	86	#	0 60	0	50	1631	1 03	
Pight	IK	T	000	270	50	Ħ	0.00	0.	59	TODE	1.05	
Right												
Sum of f	low rati	og for			ne aro		a Va			g) =	076	
Total los	st time	ber cv	cle I	L = 12	00 54	a a	5, 10	- 5		5/ -	0.70	
Critical	flow ra	te to	capacit	v rat	.00 BC	20	Xc	$= (\mathbf{V}\mathbf{C})$)(C)/($(C-T_{i}) =$	0 90	
CIICICAI	IIOW IA		capacit	ly rac.	10,		ne	- (10	,(c),(С Ц) –	0.90	
Control I	Delay an	d LOS	Determi	Inatio	n							
Appr/ H	Ratios	Unf	Prog	Lane	Incre	eme	ntal	Res	Lane	Group	Approa	ach
Lane		Del	Adj	Grp	Facto	or 1	Del	Del				
Grp v/c	c g/C	d1	Fact	Cap	k	(d2	d3	Dela	y LOS	Delay	LOS
Eastbound	1											
L 0.08	3 0.11	30.2	1.000	159	0.11		0.2	0.0	30.4	С		
											21.0	С
R 0.18	3 0.31	19.1	1.000	408	0.11		0.2	0.0	19.3	В		
Westbound	i											
Northbour	nd											
Τ. Ο Α΄	2 0 79	21 2	1 000	314	0 36		15 2	0 0	36 6	Л		
- 0.02 Τ 0.02	3 0 79	2 2	1 000	2321	0 11		0 1	0 0	2. 3	Δ	11 9	в
- 0.20			±.000		U. 11		~ • ±	0.0	2.5	А	±±•)	
Southhour	nd											
Soucidoul	.											
TR 1.03	3 0.59	15.5	1.000	1634	0.50		29.8	0.0	45.3	D	45.3	D

SUPPLEMENTAL PERMITTED LT WORKSHEET		
for exclusive lefts		
Input	ND	съ
Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 75.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N	58.0 48.0 44.0	
Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation	2 256 1.000 0.00 1680 4.00	
LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio. Rpo (refer Exhibit 16-11)	5.33 0.952 18.38 0.0	0.952
<pre>Dyposing placeon lacto, kpc (left) Exhibit 10 11; Dyposing Queue Ratio, qro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)</gf </pre>	0.41 29.81 18.19 14.90	
PTHO=1-PLTO PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)] EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g	1.00 1.00 6.90	
gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=: or flt=[fm+0.91(N-1)]/N**	0.00 0.00 0.08 Em<=1.0)0)
Left-turn adjustment, fLT	0.083	
<pre>For special case of single-lane approach opposed by multilane approace text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-fact left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes For special case of multilane approach opposed by single-lane appro or when gf>gq, see text.</pre>	bach, to s, flt= bach	=fm.
SUPPLEMENTAL PERMITTED LT WORKSHEET for shared lefts		
Input ER WR	NB	SB
Dpposed by Single(S) or Multiple(M) lane approach Cycle length, C 75.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N		~~

Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT 0.000 0.000 Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 0.952 0.952 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min = fmin; max = 1.00)flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET Permitted Left Turns EΒ WΒ $^{\rm NB}$ SB Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Pedestrian flow rate, Vpedg (p/h) 0CCpedq Opposing queue clearing green, gq (s) Eff. ped. green consumed by opp. veh. queue, gq/gp OCCpedu Opposing flow rate, Vo (veh/h) OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion of left turns, PLT Proportion of left turns using protected phase, PLTA Left-turn adjustment, fLpb Permitted Right Turns Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Conflicting bicycle volume, Vbic (bicycles/h) Vpedg OCCpedq Effective green, g (s) Vbicg

OCCbicg OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion right-turns, PRT Proportion right-turns using protected phase, PRTA Right turn adjustment, fRpb SUPPLEMENTAL UNIFORM DELAY WORKSHEET EBLT WBLT NBLT SBLT Cycle length, C 75.0 sec Adj. LT vol from Vol Adjustment Worksheet, v 256 v/c ratio from Capacity Worksheet, X 0.82 Protected phase effective green interval, g (s) 11.0 Opposing queue effective green interval, gq 29.81 Unopposed green interval, gu 18.19 Red time r=(C-g-gq-gu)16.0 Arrival rate, qa=v/(3600(max[X,1.0]))0.07 Protected ph. departure rate, Sp=s/3600 0.413 Permitted ph. departure rate, Ss=s(qq+qu)/(qu*3600) 0.10 XPerm 1.97 XProt 0.42 Case 3 Queue at beginning of green arrow, Qa 2.82 Queue at beginning of unsaturated green, Qu 2.12 Residual queue, Or 1.68 Uniform Delay, d1 21.3 ____DELAY/LOS WORKSHEET WITH INITIAL QUEUE____ Initial Dur. Uniform Delay Initial Final Initial Lane Unmet Unmet Queue Unmet Oueue Group Appr/ Lane Demand Demand Unadj. Adj. Param. Demand Delay Delav Group Q veh t hrs. ds dl sec Q veh d3 sec d sec u Eastbound 0.0 0.00 33.5 30.2 0.00 0.0 0.0 30.4 L 0.0 0.0 0.0 0.00 26.0 19.1 0.00 0.0 0.0 19.3 R Westbound 0.0 0.0 0.0 0.0 0.0 0.0 Northbound 0.00 0.0 L 0.0 21.3 0.00 0.0 36.6 т 0.0 0.00 8.0 2.2 0.00 0.0 0.0 2.3 0.0 0.0 Southbound 0.0 0.0 0.0 0.00 15.5 0.00 ΤR 15.5 11.5 0.0 45.3 0.0 0.0 Intersection Delay 33.2 sec/veh Intersection LOS C

_____BACK OF QUEUE WORKSHEET_____

	Eastbou	ınd	Westbou	und	Nor	thbound	Southboun	d
LaneGroup	L	R			L	Т	TR	
Init Queue	0.0	0.0			0.0	0.0	0.0	İ
Flow Rate	13	73			256	341	882	İ
So	1800	1800			1800	1800	1800	İ
No.Lanes	1 0	1 0	0	0	1	2 0	0 2 0	İ
SL	1487	1330			383	1549	1463	İ
LnCapacity	159	408			314	1219	858	İ
Flow Ratio	0.0	0.1			0.7	0.2	0.6	İ
v/c Ratio	0.08	0.18			0.82	0.28	1.03	İ
Grn Ratio	0.11	0.31			0.79	0.79	0.59	ĺ
I Factor	1.000) į			İ	1.000	1.000	İ
AT or PVG	3	3			3	3	3	İ
Pltn Ratio	1.00	1.00			1.00	1.00	1.00	İ
PF2	1.00	1.00			1.00	1.00	1.00	ĺ
Q1	0.2	1.1			1.3	1.9	18.4	İ
kB	0.2	0.4			0.3	0.7	0.6	İ
Q2	0.0	0.1			1.1	0.3	9.5	İ
Q Average	0.3	1.2			2.4	2.2	27.9	İ
Q Spacing	25.0	25.0			25.0	25.0	25.0	ĺ
Q Storage	0	90			90	0	0	İ
Q S Ratio		0.3			0.7			İ
70th Percent	cile Output	;:			•			
fB%	1.2	1.2			1.2	1.2	1.1	
BOQ	0.3	1.4			2.9	2.6	32.1	
QSRatio		0.4			0.8			
85th Percent	cile Output	::						
fB%	1.6	1.6			1.6	1.6	1.4	
BOQ	0.4	1.9			3.8	3.5	39.6	
QSRatio		0.5			1.1			
90th Percent	cile Output	::						
fB%	1.8	1.8			1.8	1.8	1.5	
BOQ	0.5	2.1			4.3	3.9	41.8	
QSRatio		0.6			1.2			
95th Percent	cile Output	::						
fB%	2.1	2.1			2.0	2.0	1.6	
BOQ	0.5	2.5			4.9	4.5	45.4	
QSRatio		0.7			1.4			
98th Percent	cile Output	::						
fB%	2.7	2.6			2.5	2.5	1.8	
BOQ	0.7	3.1			6.2	5.6	50.7	
QSRatio		0.9			1.7			

_____ERROR MESSAGES_____

No errors to report.

Analyst: Agency: Date: Period: Project E/W St:	Analyst: Agency: PB Date: 6/25/2010 Period: AM Peak Hour Project ID: I-290 Phase 1 Study E/W St: Lexington Street SIGNALIZE							Inter.: Lexington Street & 25th Avenue Area Type: All other areas Jurisd: Year : Existing N/S St: 25th Avenue						ue	
				C.T.(מיד ד גדאי	ד רוידי			CITIMINA	υv					
	 I	 E.a.a		SI(JNALIZED INIEKS				SUMMA.	RI					
		EaS T	T T		wes T		ша ъ	I T NOL	undou.		т т				
		Ц	T	R		T	R		T	к	Ц	T	R		
No Topo	 					 1		-		 					
NO. Lane		Deft		0			U			0	0	 			
LGCONIIG	ſ Į	DerL	1 R	100		о Г.Т	(R. 4.0			10	1 1		. R		
volume	 	100	4 10 0	103	2	10	42	20	100	TO I	ΤΤ	610 10 C	50		
Lane wid		12.0	12.0	0.0		12.0	20		12.0			12.0	,		
RIOR VOL	·			80	l		38			0			3		
Duration		0.25		Area 1	Type:	All	other	areas							
					Sig	na⊥	Operat	ions							
Phase Co	mbin	ation	1	2	3	4			5	6	./		8		
EB Leit			A				NB	Leit	A						
Thru	L .		A					Thru	A						
Righ	ıt		A					Right	A						
Peds	5		_					Peds	X						
WB Leit			A				SB	Leit	A						
Thru	L		A					Thru	A						
Righ	ıt		A					Right	A						
Peds	5		Х					Peds							
NB Righ	ıt						EB	Right							
SB Righ	ıt						WB	Right							
Green			20.0						60.0						
Yellow			4.0						4.0						
All Red			1.0						1.0	_	_				
			_					-	Сус	le Ler	igth:	90.0)	sec	S
			Ir	nterseo	ction	Pert	ormanc	e Summ	ary						
Appr/	Lane			j Sat	Ra	tios	5	Lane	Group	App	proact	1			
Lane	Grou	p	F.TOA	v Rate											
Grp	Сара	cıty	(S)	v/c	ç	l\G	Delay	- LOS	Dela	ay LOS	6			
Eastboun															
DefL	238		102	22	0.67	' C	.23	38.6	D						
TR	318		136	54	0.09	0	.23	27.1	С	36.9) D				
	010		200	-	0.05				C		2				
Westboun	ıd														
LTR	290		124	14	0.02	c C	.23	26.6	С	26.6	5 C				
Northbou	ınd														
LTR	187	2	276	52	0.68	C	.68	9.7	А	9.7	А				
001+6-	 					Ū	-								
Souchdou	ma														
LTR	183	5	270)8	0.39	C	.68	6.5	A	б.5	A				
	Int	ersec	tion	Delay	= 11.	1 (sec/ve	eh) I	nters	ection	LOS	= B			

I-290 Existing

Phone: E-Mail:

Fax:

_____OPERATIONAL ANALYSIS______

Analyst:	
Agency/Co.:	PB
Date Performed:	6/25/2010
Analysis Time Period:	AM Peak Hour
Intersection:	Lexington Street & 25th Avenue
Area Type:	All other areas
Jurisdiction:	
Analysis Year:	Existing
Project ID: I-290 Phase 1	l Study
E/W St: Lexington Street	N/S St: 25th Avenue

_____VOLUME DATA______

	Eas	stbour	nd	Wes	stbour	nd	Noi	rthbou	ınd	Sou	ithbou	ınd
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume	152	1	103	 າ	0			1185	10	 1 1	616	<u> </u>
VOLUME & Hoorny Mob		т 1 с	15	<u>4</u> 1 ⊑	1 5	т <i>2</i> 1 с	20 1 c	1 5	15	± ± 1 ⊑	1 5	1 5
S HEAVY VEII		T 2	T 2		T 2	T 2		T 2	T 2		T 2	T 2
	0.95	0.95	0.95	0.95	0.95	0.95	10.95	0.95	0.95	10.95	0.95	0.95
PK 15 VOL	40	T	27	ļ⊥	0	$\perp \perp$	5	312	3	3	162	13
Hı Ln Vol												
% Grade		0			0			0			0	
Ideal Sat	1800	1800			1800			1800			1800	
ParkExist												
NumPark												
No. Lanes	0	2	0	0	1	0	0	2	0	0	2	0
LGConfig	DefI	L TR			LTF	ર		LTF	ર		LTF	ર
Lane Width	12.0	12.0			12.0			12.0		ĺ	12.0	
RTOR Vol	ĺ		80	ĺ		38	İ		0	İ		3
Adj Flow	160	28		ĺ	б		İ	1279		İ	709	
%InSharedLn										İ		
Prop LTs	1.000	0.0	0 0	ĺ	0.33	33	ĺ	0.01	LG	ĺ	0.01	L7
Prop RTs	0.	.857		0.	.667		0	.009		0.	.069	
Peds Bikes	0			10) 0 ()	1	0 0 0)	0		
Buses	0	0			0		İ	5		İ	5	
%InProtPhase	5						İ			İ		
Duration	0.25		Area :	Гуре:	All d	other a	areas					

	Eas	Eastbound			Westbound			Northbound			Southbound		
	L	Т	R	LTR			L	Т	R	L	Т	R	
Init Unmet	0.0	0.0			0.0			0.0			0.0		
Arriv. Type	3	3			3			3			3		
Unit Ext.	3.0	3.0			3.0			3.0			3.0		
I Factor		1.000			1.000			1.00	C		1.00	0	
Lost Time	2.0	2.0			2.0			2.0			2.0		
Ext of g	3.0	3.0			3.0			3.0			3.0		
Ped Min g		15.2	ĺ		14.4	ĺ		12.9			12.2	ĺ	

_____OPERATING PARAMETERS______

	PHASE DATA										
Dha	a Combination	1	2	2	1			F	6	7	0
Plla		Ţ	2	2	4			5	0	/	0
EB	Left	А				NB	Left	A			
	Thru	A					Thru	A			
	Right	A			İ		Right	A			
	Peds				İ		Peds	Х			
WB	Left	А				SB	Left	A			
	Thru	A			Í		Thru	A			
	Right	А					Right	A			
	Peds	Х					Peds				
NB	Right				ļ	EB	Right				
SB	Right				ļ	WB	Right				
Gre	en	20.0						60.0			
Yel	low	4.0						4.0			
All	Red	1.0						1.0			

Cycle Length: 90.0 secs

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET									
Volume Adju	stment								
	Eastbound	Westbound	Northbound	Southbound					
	LTR	LTR	L T R	LTR					
Volume, V	<u></u> 152 4 103	2 0 42	20 1185 10	11 616 50					
PHF	0.95 0.95 0.95	0.95 0.95 0.95	0.95 0.95 0.95	0.95 0.95 0.95					
Adj flow	160 4 24	2 0 4	21 1247 11	12 648 49					
No. Lanes	0 2 0	0 1 0	0 2 0	0 2 0					
Lane group	DefL TR	LTR	LTR	LTR					
Adj flow 160 28 6 1279 709									
Prop LTs	1.000 0.000	0.333	0.016	0.017					
Prop RTs	0.857	0.667	0.009	0.069					
LGDefLTRLTRLTRLTRLTRSo180018001800180018001800Lanes020010020fW1.0001.0001.0001.0001.0001.000fHV0.8700.8700.8700.8700.870fG1.0001.0001.0001.0001.000fP1.0001.0001.0001.0001.000fBB1.0001.0001.0001.0001.000fLU1.0001.0001.0000.9520.952fRT0.8710.9100.9990.990fLT0.7541.0000.9600.9380.928sec									
LLPD U.800	1 000	1.000	1 000	1 000					
с 1000	1364	1244	2762	2708					
	TOOT	1211	2102	2700					
DEC.	CA	PACITY AND LOS W	ORKSHEET						
CAPACITI AND LOS WORKSHEET									

Capacity Analysis and Lane Group Capacity

Eastbound Prot Perm Left DefL 160 1022 # 0.16 0.23 238 0.67 Prot Perm Thru TR 28 1364 0.02 0.23 318 0.09 Right Westbound Prot Perm Left Prot Perm Thru LTR 6 1244 0.00 0.23 290 0.02 Right Southbound Prot Perm Left Prot Perm Thru LTR 1279 2762 # 0.46 0.68 1872 0.68 Right Southbound Frot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, $Xc = (Yc)(C)/(C-L) = 0.68$ Control Delay and LOS Determination Approach Lane $V/c g/C dl$ Pact Cap k d2 d3 $Delay LOS$ Eastbound DefL 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.02 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.02 0.23 26.6 1.000 290 0.11 0.0 0.0 26.6 C 26.6 C Northbound LTR 0.02 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	Ar Mu	ppr/ /mt	Lane Group	Flo	Adj w Rate (v)	Adj Flow (Sat Rate s)	Flow Ratio (v/s)	Gre Rat (g/	en tio Ca (C)	Lane G pacity (c)	roup v/c Ratio	
Prot Perm Left DefL 160 1022 $#$ 0.16 0.23 238 0.67 Perm Thru DefL 160 1022 $#$ 0.16 0.23 238 0.67 Perm Thru TR 28 1364 0.02 0.23 318 0.09 Right Northbound Prot Perm Left Prot Perm Left Prot Perm Left Prot Perm Left Prot Perm Left Southbound Prot Perm Left Subpound Prot Perm Left Frot Perm Left Subpound Prot Perm Left Subpound Prot Perm Left Frot Perm Left Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 Control Delay and LOS Determination Appr/Ratios Unf Prog Lane Incremental Res Lane Group Approach EaseBound Delay LOS Delay LOS Delay LOS Delay LOS TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.02 0.23 26.6 1.000 290 0.11 0.0 0.0 26.6 C 26.6 C Northbound	Easth	oound											
Perm Left DefL 160 1022 $#$ 0.16 0.23 238 0.67 Prot Perm Thru TR 28 1364 0.02 0.23 318 0.09 Right Westbound Prot Perm Left Prot Perm Left Prot Perm Thru LTR 6 1244 0.00 0.23 290 0.02 Right Northbound Prot Perm Thru LTR 1279 2762 $#$ 0.46 0.68 1872 0.68 Southbound Prot Perm Thru LTR 1279 2762 $#$ 0.46 0.68 1872 0.68 Southbound Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio. Xc = (Yc)(C)/(C-L) = 0.68 Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Lane Group Approach Lane Del Adj Grp Factor Del Del Grp v/c g/C dl Fact Cap k d2 d3 Delay LOS Delay LOS Eastbound DefL 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	Pr	rot											
Left DefL 160 1022 # 0.16 0.23 238 0.67 Prot Perm Thru TR 28 1364 0.02 0.23 318 0.09 Right Northbound Prot Perm Thru LTR 6 1244 0.00 0.23 290 0.02 Right Northbound Prot Perm Left Prot Perm Left Prot Perm Left Prot Perm Left Prot Perm Left Southbound Prot Perm Left Sum for varies for critical lane groups, Yc = Sum (v/s) = 0.68 Control Delay and LOS Determination Approach Sum for low varies for critical lane groups, Yc = Sum (v/s) = 0.62 Total lost time per cycle, L = 8.00 sec Control Delay and LOS Determination Approach Approach Control Delay and LOS Determination Approx Right Sum 67 (0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	Pe	erm											
Prot Perm Thru TR 28 1364 0.02 0.23 318 0.09 Right Westbound Prot Perm Left Prot Perm Thru LTR 6 1244 0.00 0.23 290 0.02 Right Northbound Prot Perm Left Prot Perm Thru LTR 1279 2762 # 0.46 0.68 1872 0.68 Right Southbound Prot Perm Thru LTR 1279 2762 # 0.46 0.68 1872 0.68 Right Southbound Prot Perm Left Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Southbound Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Southbound Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Southbound Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Southbound Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Southbound Delay LOS Determination Approach Thru Southous 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	Le	eft	DefL	1	60	10	22	# 0.16	0.	23	238	0.67	
Perm Thru TR 28 1364 0.02 0.23 318 0.09 Right Westbound Port Perm 1244 0.00 0.23 290 0.02 Perm Thru LTR 6 1244 0.00 0.23 290 0.02 Northbound Perm Thru LTR 6 1244 0.00 0.23 290 0.02 Northbound Perm Thru LTR 1279 2762 # 0.46 0.68 1872 0.68 Southbound Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 0.62 Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.68 Control Delay and LOS Determination	Pr	rot											
Thru TR 28 1364 0.02 0.23 318 0.09 Right Westbound Prot Perm Left Delay LOS Del Adj Grp Factor Del and Delay LOS Eastbound LER 0.02 0.23 27.0 1.000 318 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	Pe	erm											
Right Westbound Prot Perm Left Prot Perm Thru LTR 6 1244 0.00 0.23 290 0.02 Right Northbound Prot Perm Left Prot Perm Left Prot Perm Left Prot Perm Thru LTR 1279 2762 # 0.46 0.68 1872 0.68 Southbound Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Sum of flow rates for critical lane groups, Yc = Sum (v/s) = 0.62 Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.68 Control Delay and LOS Determination Lane Del Adj Grp Factor Del Del Grp v/c g/C dl Fact Cap k d2 d3 Delay LOS Pathown Delay LOS 28 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	Tł	ıru	TR	2	8	13	64	0.02	0.	23	318	0.09	
Westbound Prot Perm Left Prot Perm Thru LTR 6 1244 0.00 0.23 290 0.02 Right Northbound Prot Perm Left Prot Perm Left Prot Perm Left Prot Perm Thru LTR 1279 2762 # 0.46 0.68 1872 0.68 Right Southbound Prot Perm Left Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.68 Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Lane Group Approach Lane Del Adj Grp Factor Del Del Delay LOS Eastbound Deft 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	Ri	ight											
Prot Perm Left Prot Perm Thru LTR 6 1244 0.00 0.23 290 0.02 Right Northbound Prot Perm Thru LTR 6 1244 0.00 0.23 290 0.02 Right Northbound Prot Perm Left Prot Perm Left Prot Perm Thru LTR 709 2762 # 0.46 0.68 1872 0.68 Right Southbound Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.68 Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Lane Group Approach Lane Del Adj Grp Factor Del Del <u></u> Del Adj Grp Factor Del Del <u></u> Del Adj Grp Factor Del Del <u></u> Del Adj Grp Factor Del Del <u></u> Del Adj Grp Factor Del Del <u></u> Del Adj Grp Factor Del Del <u></u> Del Adj Grp Factor Del Del <u></u> Del Adj Grp Factor Del Del <u></u> Del Adj Grp Factor Del Del <u></u> Del Adj Grp Factor Del Del <u></u> Del Adj Grp Factor Del Del <u></u> Del Adj Grp Factor Del Del <u></u> Delay LOS Eastbound DefL 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	West	bound											
Perm Left Prot Perm Thru LTR 6 1244 0.00 0.23 290 0.02 Right Northbound Prot Perm Left Prot Perm Thru LTR 1279 2762 # 0.46 0.68 1872 0.68 Right Southbound Prot Perm Left Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio. Southout Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Lane Group Approach Lane Del Adj Grp Factor Del Del Delay LOS Eastbound Deft 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	Pr	rot											
Left Perm Perm Thru LTR 6 1244 0.00 0.23 290 0.02 Right Northbound Prot Perm Thru LTR 1279 2762 # 0.46 0.68 1872 0.68 Right Southbound Prot Perm Thru LTR 1279 2762 # 0.46 0.68 1872 0.68 Right Southbound Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, $Xc = (Yc)(C)/(C-L) = 0.68$ Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Eastbound DefL 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	Pe	erm											
Prot Perm Thru LTR 6 1244 0.00 0.23 290 0.02 Right Northbound Prot Perm Left Prot Perm Thru LTR 1279 2762 # 0.46 0.68 1872 0.68 Right Southbound Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, $Xc = (Yc)(C)/(C-L) = 0.68$ Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Appr/ Ratios Unf Prog Lane Incremental Res Grp v/c g/C dl Fact Cap k d2 d3 Delay LOS Delay LOS Eastbound DefL 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	Le D	eit											
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Pr	rot											
Thru Link 6 1244 0.00 0.23 290 0.02 Right Northbound Port Perm 1244 0.00 0.23 290 0.02 Pern Det Perm Thru LITR 1279 2762 # 0.46 0.68 1872 0.68 Right Southbound Prot Perm 1244 0.00 0.23 20.68 1872 0.68 Southbound Prot Perm 1279 2762 # 0.46 0.68 1872 0.68 Southbound Prot Perm 1244 0.00 0.68 1835 0.39 Southbound Prot Perm 1279 2708 0.26 0.68 1835 0.39 Southbound Perm Left Prot Perm 1244 0.00 1835 0.39 Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 0.62 1835 0.39 Control Delay and LOS Determination Appr/ Appr/ Adj Grp Factor Del Del Delay LOS Delay LOS Grp v/c g/C dl	Pe	erm		-		1.0		0 00	0	0.0		0 0 0	
Night Northbound Prot Perm Left Prot Perm Thru LTR 1279 Southbound Prot Perm Left Prot Perm Left Prot Perm Left Prot Perm Left Prot Perm Left Prot Perm Left Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 0.62 1062 1062 Control Delay and LOS Determination. Xc = (Yc)(C)/(C-L) = 0.68 20 1000 20	Tr.	iru	LTR	6		12	44	0.00	Ο.	23	290	0.02	
Prot Perm Left Perm Thru LTR 1279 2762 $# 0.46$ 0.68 1872 0.68 Right Southbound Prot Perm Left Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.68 Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Lane <u>Control Delay and LOS Determination</u> Appr/ Ratios Unf Prog Lane Incremental Res Lane Group Approach Eastbound DefL 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	K1	Ignt	4										
Perm Left Prot Perm Thru LTR 1279 2762 # 0.46 0.68 1872 0.68 Right Southbound Prot Perm Left Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.68 Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Lane Group Approach Lane Del Adj Grp Factor Del Del Grp v/c g/C dl Fact Cap k d2 d3 Delay LOS Eastbound DefL 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	NOT.LL	nuoun	<u>ــــــــــــــــــــــــــــــــــــ</u>										
Left Prot Perm Thru LTR 1279 2762 # 0.46 0.68 1872 0.68 Right Southbound Prot Perm Left Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.68 Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Lane Group Approach Lane Del Adj Grp Factor Del Del Grp v/c g/C dl Fact Cap k d2 d3 Delay LOS Eastbound DefL 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.02 0.23 26.6 1.000 290 0.11 0.0 0.0 26.6 C 26.6 C Northbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	PI												
Prot Perm Thru LTR 1279 2762 $\#$ 0.46 0.68 1872 0.68 Right Southbound Prot Perm Left Port Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 0.62 0.62 0.61 0.62 Sum of flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.68 0.68 0.68 0.62 Control Delay and LOS Determination	Pe	21 III 25 +											
Perm Thru LTR 1279 2762 # 0.46 0.68 1872 0.68 Right Southbound Prot Perm 126 0.68 1835 0.39 Right Derot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 0.68 1835 0.39 Sum of flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.68 0.68 0.68 0.68 0.68 Control Delay and LOS Determination	лс Ли												
Thru LTR 1279 2762 # 0.46 0.68 1872 0.68 Right Southbound Prot Perm 12ft 0.68 1835 0.39 Perm Left Prot Perm 12ft 0.68 1835 0.39 Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 0.68 1835 0.39 Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.68 0.68 0.68 0.68 Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Image: Del Adj Grp Factor Del Del Delay LOS Delay LOS Eastbound Deff 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.68 0.68 8.7 1.000 1.02 0.0 9.7 A 9.7 A	F I De												
Right 12/9 2/92 $= 0.10^{\circ}$ 0.00° $10/2$ 0.00° Southbound Prot Perm Left Prot Perm Thru LTR 709 2708 0.26° 0.68° 1835° 0.39° Sum of flow ratios for critical lane groups, Yc = Sum (v/s) $= 0.62^{\circ}$ 0.62° 0.62° Sum of flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.68 0.68° 0.62° Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Lane Group Approach Lane Del Adj Grp Factor Del Del Delay LOS Delay LOS Eastbound Del Adj Grp 0.00 38.6 D TR 0.02 0.23 27.0 1.000 318 0.11 0.0 26.6 C 26.6 C Northbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 <t< td=""><td>ר בי די</td><td>5 L III 7 M II</td><td>T.TP</td><td>1</td><td>279</td><td>27</td><td>62</td><td># 0 46</td><td>0</td><td>68</td><td>1872</td><td>0 68</td><td></td></t<>	ר בי די	5 L III 7 M II	T.TP	1	279	27	62	# 0 46	0	68	1872	0 68	
Southbound Prot Perm Left Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, $Xc = (Yc)(C)/(C-L) = 0.68$ Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Lane Group Approach Lane Del Adj Grp Factor Del Del Delay LOS Grp v/c g/C dl Fact Cap k d2 d3 Delay LOS Eastbound DefL 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.02 0.23 26.6 1.000 290 0.11 0.0 0.0 26.6 C 26.6 C Northbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	II Ri	iaht	штк	1	21)	27	02	# 0.10	0.	00	1072	0.00	
Boothermond Perm Left Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.68 Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Lane Group Approach Lane Del Adj Grp Factor Del Del	South	bound	4										
Perm Left Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.68 Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Lane Group Approach Lane Del Adj Grp Factor Del Del Delay LOS Delay LOS Grp v/c g/C dl Fact Cap k d2 d3 Delay LOS Delay LOS Eastbound DefL 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.02 0.23 26.6 1.000 290 0.11 0.0 0.0 26.6 C 26.6 C Northbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	Dr												
Left Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Sum of flow ratios for critical lane groups, Yc = Sum $(v/s) = 0.62$ Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, Xc = $(Yc)(C)/(C-L) = 0.68$ Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Lane Group Approach Lane Del Adj Grp Factor Del Del Grp v/c g/C dl Fact Cap k d2 d3 Delay LOS Delay LOS Eastbound DefL 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.02 0.23 26.6 1.000 290 0.11 0.0 0.0 26.6 C 26.6 C Northbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	E I De	- OC - rm											
Prot Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.68 Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Lane Group Approach Lane Del Adj Grp Factor Del Del	I.e	>⊥ >f+											
Perm Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.68 Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Lane Group Approach Lane Del Adj Grp Factor Del Del Delay LOS Delay LOS Eastbound DefL 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.02 0.23 26.6 1.000 290 0.11 0.0 0.0 26.6 C 26.6 C Northbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	Dr	rot											
Thru LTR 709 2708 0.26 0.68 1835 0.39 Right Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.68 Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Lane Group Approach Lane Del Adj Grp Factor Del Del Delay LOS Delay LOS Grp v/c g/C dl Fact Cap k d2 d3 Delay LOS Delay LOS Eastbound DefL 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.02 0.23 26.6 1.000 290 0.11 0.0 0.0 26.6 C 26.6 C Northbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	De	- oc -rm											
Right Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.68 Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Lane Group Approach Lane Del Adj Grp Factor Del Del Grp v/c g/C dl Fact Cap k d2 d3 Delay LOS Delay LOS Eastbound DefL 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.02 0.23 26.6 1.000 290 0.11 0.0 0.0 26.6 C 26.6 C Northbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	T	1r11	I'LL	7	09	2.7	0.8	0.26	0.	68	1835	0.39	
Sum of flow ratios for critical lane groups, Yc = Sum $(v/s) = 0.62$ Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, Xc = $(Yc)(C)/(C-L) = 0.68$ Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Lane Group Approach Lane Del Adj Grp Factor Del Del Delay LOS Delay LOS Grp v/c g/C dl Fact Cap k d2 d3 Delay LOS Delay LOS Eastbound DefL 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.02 0.23 26.6 1.000 290 0.11 0.0 0.0 26.6 C 26.6 C Morthbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound Southbound	Ri	laht			0.2			0.20		•••	2000	0.05	
Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.62 Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, Xc = $(Y_{C})(C)/(C-L) = 0.68$ Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Lane Group Approach Lane Del Adj Grp Factor Del Del Grp v/c g/C dl Fact Cap k d2 d3 Delay LOS Eastbound DefL 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.02 0.23 26.6 1.000 290 0.11 0.0 0.0 26.6 C 26.6 C Northbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound													
Total lost time per cycle, L = 8.00 sec Critical flow rate to capacity ratio, $Xc = (Yc)(C)/(C-L) = 0.68$ Control Delay and LOS Determination Appr/ Ratios Unf Prog Lane Incremental Res Lane Group Approach Lane Del Adj Grp Factor Del Del Delay LOS Delay LOS Grp v/c g/C dl Fact Cap k d2 d3 Delay LOS Delay LOS Eastbound DefL 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.02 0.23 26.6 1.000 290 0.11 0.0 0.0 26.6 C 26.6 C Northbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	Sum c	ot tild	ow rati	os ior	critic	cal la	ne gro	oups, Yo	2 = 2	Sum (v/	s) =	0.62	
Control Delay and LOS Determination	Criti	L LOSI	t time	per cy	cie, i	= 8.	uu se	ec v		γ	ат) <u>–</u>	0 6 9	
Control Delay and LOS Determination	CIIUI	LCall	LIOW IA	LE LO	Capacit	ly Ial	10,	AC	; = (10	:)(C)/(С-ц) –	0.00	
Appr/ Ratios Oni Prog Lane Incremental Res Lane Group Lane Group Approach Lane Del Adj Grp Factor Del Del Delay LOS Delay LOS Delay LOS Grp v/c g/C dl Fact Cap k dl dl Delay LOS Delay LOS Delay LOS Eastbound DefL 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.02 0.23 26.6 1.000 290 0.11 0.0 0.0 26.6 C 26.6 C Northbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound LTR 0.68 0.68 8.7 1.000 1872 0.25	Contr	col De	elay an	d LOS	Determ:	inatio	n					7	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Appr/	Ka Ka	aLIOS		Prog	Lane	Incre Factor		Kes	Lane	Group	Appro	aCII
Eastbound DefL 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.02 0.23 26.6 1.000 290 0.11 0.0 0.0 26.6 C 26.6 C Northbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	Grp	v/c	g/C	d1	Fact	Cap	k	d2	d3	Dela	y LOS	Delay	LOS
Eastbound DefL 0.67 0.23 31.4 1.000 238 0.24 7.2 0.0 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.02 0.23 26.6 1.000 290 0.11 0.0 0.0 26.6 C 26.6 C Northbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound													
Deris 0.07 0.23 31.4 1.000 238 0.24 7.2 0.00 38.6 D TR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.02 0.23 26.6 1.000 290 0.11 0.0 0.0 26.6 C 26.6 C Northbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A	Last Dof		0 7 7	21 /	1 000	220	0 04	ч 0	0 0	20 C			
IR 0.09 0.23 27.0 1.000 318 0.11 0.1 0.0 27.1 C 36.9 D Westbound LTR 0.02 0.23 26.6 1.000 290 0.11 0.0 0.0 26.6 C 26.6 C Northbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound L 0.10 0.10 1.0 0.0 9.7 A 9.7 A	Derr	0.67	0.23	31.4	1.000	230 210	0.24	/.Z	0.0	30.0 07 1		26.0	P
Westbound LTR 0.02 0.23 26.6 1.000 290 0.11 0.0 0.0 26.6 C 26.6 C Northbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	IR	0.09	0.23	27.0	1.000	210	0.11	0.1	0.0	27.1	C	30.9	D
LTR 0.02 0.23 26.6 1.000 290 0.11 0.0 0.0 26.6 C 26.6 C Northbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	Westb	oound											
Northbound LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	LTR	0.02	0.23	26.6	1.000	290	0.11	0.0	0.0	26.6	С	26.6	С
LTR 0.68 0.68 8.7 1.000 1872 0.25 1.0 0.0 9.7 A 9.7 A Southbound	North	nbound	Ĺ										
Southbound	LTR	0.68	0.68	8.7	1.000	1872	0.25	1.0	0.0	9.7	A	9.7	A
	South	nbound	d										
LTR 0.39 0.68 6.3 1.000 1835 0.11 0.1 0.0 6.5 A 6.5 A	LTR	0.39	0.68	6.3	1.000	1835	0.11	0.1	0.0	6.5	A	6.5	A

SUPPLEMENTAL PERMITTED LT WORKSHI	EET			
for exclusive lefts				
Input				
	EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach				
Cycle length, C 90.0 sec				
Total actual green time for LT lane group, G (s)	20.0			
Effective permitted green time for LT lane group, $g(s)$	21.0			
Number of lange in LT lang group N	∠⊥.U 1			
Number of lanes in opposing approach. No	⊥ 1			
Adjusted IT flow rate VIT (web/b)	⊥ 160			
Propertien of LT in LT lane group PLT	1 000			
Propertion of LT in opposing flow PLTO	1.000			
Adjusted opposing flow rate Vo (veh/h)	6			
Lost time for LT lane group th	4 0 0			
Computation	1.00			
LT volume per cycle, LTC=VLTC/3600	4.00			
Opposing lane util. factor, fLUo	1.000	1.000	0.952	0.952
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cvc)	0.15			
<pre>qf=G[exp(- a * (LTC ** b))]-tl, qf<=q</pre>	0.0			
Opposing platoon ratio, Rpo (refer Exhibit 16-11)	1.00			
Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0]	0.77			
gq, (see Exhibit C16-4,5,6,7,8)	0.00			
gu=g-gq if gq>=gf, or = g-gf if gq <gf< td=""><td>21.00</td><td></td><td></td><td></td></gf<>	21.00			
n=Max(gq-gf)/2,0)	0.00			
PTHo=1-PLTo	0.67			
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]	1.00			
EL1 (refer to Exhibit C16-3)	1.33			
EL2=Max((1-Ptho**n)/Plto, 1.0)	1.00			
fmin=2(1+PL)/g or fmin=2(1+Pl)/g	0.19			
gdiff=max(gq-gf,0)	0.00			
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)	0.75			
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-	-1)],(:	fmin<=:	Em<=1.0	00)
or flt=[fm+0.91(N-1)]/N**				
Leit-turn adjustment, iLT	0.754			
For special case of single-lane approach opposed by mu	l+ilan	a annr	aach	
FOI Special case of single-lane approach opposed by mu.	LUIIAIR	e appro	Jacii,	
* If Pl>=1 for shared left-turn lanes with N>1 then as	ssume (de-fact		
left-turn lane and redo calculations	55 and c			
** For permitted left-turns with multiple exclusive le	ft_turi	n lane:	s. flt:	=fm.
For special case of multilane approach opposed by sing	le-lane	e appro	oach	
or when qf>qq, see text.				
SUPPLEMENTAL PERMITTED LT WORKSHI	EET			
for shared lefts				
Input				
	EB	ŴВ	NB	SB
Opposed by Single(S) or Multiple(M) lane approach				
Cycle length, C 90.0 sec		20.0		
International green time for LT lane group, G (S)		∠∪.U 21 0	0U.U 61 0	0U.U 61 0
Encourse permitted green time for LT fane group, $g(s)$		∠⊥.U 21 0	01.U 61 0	01.U
Number of lanes in LT lane group N		∠⊥.∪ 1	2	01.U 2
Mamber of fames in hi fame Stoub, M		-	4	4

Number of lanes in opposing approach, No 2 2 2 Adjusted LT flow rate, VLT (veh/h) 2 21 12 0.000 0.333 0.016 0.017 Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo 0.00 0.02 0.02 Adjusted opposing flow rate, Vo (veh/h) 28 709 1279 Lost time for LT lane group, tL 4.00 4.00 4.00 Computation LT volume per cycle, LTC=VLTC/3600 0.05 0.53 0.30 1.000 1.000 0.952 0.952 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) 0.35 9.31 16.79 qf=G[exp(- a * (LTC ** b))]-tl, gf<=g</pre> 14.0 30.4 37.4 Opposing platoon ratio, Rpo (refer Exhibit 16-11) 1.00 1.00 1.00 0.77 0.32 0.32 Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) 0.00 3.56 13.27 6.96 30.58 23.64 gu=g-gq if gq>=gf, or = g-gf if gq<gf</pre> n=Max(gq-gf)/2,0)0.00 0.00 0.00 1.00 0.98 PTHo=1-PLTo 0.98 $PL^*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]$ 0.33 0.04 0.04 EL1 (refer to Exhibit C16-3) 1.42 2.92 5.17 EL2=Max((1-Ptho**n)/Plto, 1.0) 1.00 1.00 fmin=2(1+PL)/g or fmin=2(1+Pl)/g 0.13 0.03 0.03 gdiff=max(gq-gf,0) 0.00 0.00 0.00 fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) 0.96 0.97 0.95 flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT 0.960 0.938 0.928 For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. _SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET_____ Permitted Left Turns EΒ WB NB SB Effective pedestrian green time, gp (s) 20.0 60.0 Conflicting pedestrian volume, Vped (p/h) 100 100 Pedestrian flow rate, Vpedg (p/h) 450 150 0.225 0.075 OCCpedq Opposing queue clearing green, gq (s) 0.00 13.27 Eff. ped. green consumed by opp. veh. queue, gq/gp 0.000 0.221 OCCpedu 0.225 0.067 Opposing flow rate, Vo (veh/h) 1279 6 OCCr 0.223 0.011 2 Number of cross-street receiving lanes, Nrec 2 Number of turning lanes, Nturn 1 1 ApbT 0.866 0.993 Proportion of left turns, PLT 1.000 0.017 Proportion of left turns using protected phase, PLTA 0.000 0.000 Left-turn adjustment, fLpb 0.866 1.000 Permitted Right Turns Effective pedestrian green time, gp (s) 20.0 60.0 Conflicting pedestrian volume, Vped (p/h) 100 100 Conflicting bicycle volume, Vbic (bicycles/h) 0 0 450 150 Vpedg 0.225 0.075 OCCpedq Effective green, g (s) 21.0 61.0 0 0 Vbicg

DCCbicg 0.020 0.020 DCCr 0.225 0.075 Number of cross-street receiving lanes, Nrec 2 2											
Number ApbT	of turni	ng lanes	, Nturn				1 0.8	1 65 0.955			
Proport Proport Right t	ion righ ion righ urn adju	t-turns, t-turns stment,	PRT using pro fRpb	otected	phase, Pi	RTA	0.6 0.0 0.9	67 0.009 00 0.000 10 1.000			
		SU	PPLEMENT	AL UNIFO	RM DELAY	WORKSHE	ET				
						E	BLT WBL	T NBLT SBLT			
Cycle 1 Adj. LT V/c rat Protect Opposin Unoppos Red tim Arrival Protect Permitt XPerm XProt Case Queue a Queue a Residua Uniform	ength, C vol from ed phase g queue ed green e r=(C-g rate, g ed ph. d ed ph. d t beginn t beginn l queue, Delay, o	m Vol Ad Capacity effectiv interva -gq-gu) a=v/(360 eparture eparture ing of g ing of u Qr dl	<pre>justment Workshee ve green e green 1, gu 0(max[X,] rate, S] rate, S3 reen arro nsaturate</pre>	Workshe et, X interva interval 1.0])) o=s/3600 s=s(gq+g ow, Qa ed green	90.0 et, v 1, g (s) , gq u)/(gu*3 , Qu	sec					
		DELAY/	LOS WORK	SHEET WI	TH INITI.	AL QUEUE					
Appr/	Initial Unmet	Dur. Unmet	Uniform	Delay	Initial Queue	Final Unmet	Initial Oueue	Lane Group			
Lane Group	Demand Q veh	Demand t hrs.	Unadj. ds	Adj. dl sec	Param. u	Demand Q veh	Delay d3 sec	Delay d sec			
Eastbou	 nd										
DefL TR	0.0 0.0 0.0	0.00 0.00	34.5 34.5	31.4 27.0	0.00 0.00	0.0 0.0	0.0 0.0 0.0	38.6 27.1			
Westbou	nd										
LTR	0.0 0.0 0.0	0.00	34.5	26.6	0.00	0.0	0.0 0.0 0.0	26.6			
Northbo	und										
LTR	0.0 0.0 0.0	0.00	14.5	8.7	0.00	0.0	0.0 0.0 0.0	9.7			
Southbo	und						0 0				
LTR	0.0 0.0 0.0	0.00	14.5	6.3	0.00	0.0	0.0 0.0 0.0	6.5			
	Intersec	tion Del	ay 11.1	sec/v	eh I:	ntersect	ion LOS	В			
			BACK	OF QUEU	E WORKSH	EET					

	Eastbound	Westbound	Northbound	Southbound		
LaneGroup	DefL TR	LTR	LTR	LTR		
Init Queue	0.0 0.0	0.0	0.0	0.0		
Flow Rate	160 28	6	671	372		
So	1800 1800	1800	1800	1800		
No.Lanes	0 2 0	0 1 0	0 2 0	0 2 0		
SL	1022 1364	1244	1450	1422		
LnCapacity	238 318	290	983	963		
Flow Ratio	0.2 0.0	0.0	0.5	0.3		
v/c Ratio	0.67 0.09	0.02	0.68	0.39		
Grn Ratio	0.23 0.23	0.23	0.68	0.68		
I Factor	1.000	1.000	1.000	1.000		
AT or PVG	3 3	3	3	3		
Pltn Ratio	1.00 1.00	1.00	1.00	1.00		
PF2	1.00 1.00	1.00	1.00	1.00		
Q1	3.6 0.5	0.1	10.1	4.1		
kВ	0.3 0.3	0.3	0.7	0.7		
Q2	0.6 0.0	0.0	1.4	0.4		
Q Average	4.2 0.6	0.1	11.5	4.5		
Q Spacing	25.0 25.0	25.0	25.0	25.0		
Q Storage	0 0	0	0	0		
Q S Ratio				İ İ		
70th Percent	tile Output:					
fB%	1.2 1.2	1.2	1.2	1.2		
BOQ	5.0 0.7	0.1	13.5	5.3		
QSRatio						
85th Percent	tile Output:					
fB%	1.6 1.6	1.6	1.5	1.6		
BOQ	6.6 0.9	0.2	17.3	7.0		
QSRatio						
90th Percent	tile Output:					
fB%	1.7 1.8	1.8	1.6	1.7		
BOQ	7.2 1.0	0.2	18.7	7.7		
QSRatio						
95th Percent	tile Output:					
fB%	2.0 2.1	2.1	1.8	2.0		
BOQ	8.3 1.2	0.3	20.9	8.8		
QSRatio						
98th Percent	tile Output:					
fB%	2.4 2.7	2.7	2.1	2.4		
BOQ	10.2 1.5	0.3	24.3	10.8		
QSRatio						

_____ERROR MESSAGES_____

No errors to report.

Analyst: Agency: Date: Period: Project	PB 6/25 PM P ID:	/2010 eak H I-290) Iour) Phas	se 1 St	tudy			Int Are Jur Yea	er.: L a Type isd: r : E S+: 2	exin : Al xist 5th	gton l ot ing	St her	reet are	& 2 as	25th	Ave:	nue
	LCAT	iigeoi	DUI					N/ D	DC Z	5 011		uc					
				SIC	GNALIZ	ED I	ENTE	ERSE	CTION	SUMM	ARY_						
		Eas	tbour	nd	Wes	tbou	und _		Nor	thbo	und		So	uthk	ound	E	
		Ц	T	R		T	R	C		T	R		Ц	T	ſ	۲	
No. Lane	s	0	2	0	0	1	0)	0	2	0	I 	0	2	2 ()	Ì
LGConfig	· İ		LTF	ર		LЛ	ΓR			LT	R	İ		I	JTR		İ
Volume		112	6	162	9	5	29)	37	741	15		36	124	13 65	5	
Lane Wid	th		12.0	4 1	1	12.0)	,		12.0	1			12.	0		
RIOR VOL	I			41	I		24	ŧ			T	I			Z		I
Duration		0.25		Area '	Type:	All	oth Ope	ler	areas ions								
Phase Co	mbin	atior	1 1	2	S±9 3	4	1	Luc	10110	5		6	7		8		
EB Left			A				İ	NB	Left	А							
Thru			A				ļ		Thru	A							
Righ	t		A						Right	A							
WB Left			Δ					SB	reas Left	A A							
Thru			A				ł	52	Thru	A							
Righ	t		A				İ		Right	A							
Peds			Х						Peds								
NB Righ	t							EB	Right								
SB Right Green	.C		17 0				I	ŴВ	Right	63	0						
Yellow			4.0							4.0	0						
All Red			1.0							1.0							
										Су	cle	Len	gth:	90.	0	se	CS
			Ir	ntersed	ction	Perf	Eorm	nanc	e Summ	ary_		7					
Lane	Grou	n	Flov	J Sal w Rate	Ka	LIOS	5		Lane	Grou	þ	арр	road	11			
Grp	Capa	city	1 101	(s)	v/c	c	g/C		Delay	LOS	– – D	ela	y LO	S			
Eastboun																	
T TTD	/ 1 E		205	76	0 6 0			`	25.2	П	2	E 2	ط				
LIK	410		201	/0	0.00		.20)	33.3	D	3	5.5	D				
Westboun	d																
LTR	237		118	36	0.08	C	0.20)	29.4	С	2	9.4	С				
Northbou	nd																
LTR	172	5	242	26	0.48	C).71	L	5.9	A	5	.9	A				
Southbou	nd																
LTR	189	4	266	54	0.75	C).71	L	9.6	A	9	.6	A				
	Intersection Delay = 11.1							sec/veh) Inters				ion	LOS	= E	3		

I-290 Existing

Phone: Fax: E-Mail:

_____OPERATIONAL ANALYSIS______

Analyst:	
Agency/Co.:	PB
Date Performed:	6/25/2010
Analysis Time Period:	PM Peak Hour
Intersection:	Lexington Street & 25th Avenue
Area Type:	All other areas
Jurisdiction:	
Analysis Year:	Existing
Project ID: I-290 Phase	1 Study
E/W St: Lexington Street	N/S St: 25th Avenue

_____VOLUME DATA_______

	Eastbound			Wes	stbour	nd	Noi	rthbou	ınd	Sou	ıthboı	ind
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volumo		6	160				 				1010	
		0	TOZ	9	5	29	3/	/4⊥	15	30	1243	05
% Heavy Veh	15	15	15	15	15	15	115	15	15	115	15	15
PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
PK 15 Vol	29	2	43	3	2	8	10	195	4	9	327	17
Hi Ln Vol				ĺ			ĺ			ĺ		ĺ
% Grade		0			0			0			0	
Ideal Sat		1800			1800			1800			1800	
ParkExist				ĺ			ĺ			ĺ		ĺ
NumPark							Ì			ĺ		ĺ
No. Lanes	0	2	0	0	1	0	0	2	0	0	2	0
LGConfig		LTI	ર	LTR				LTF	ર	LTR		
Lane Width		12.0		12.0			12.0			12.0		
RTOR Vol			41	24			ĺ		1	2		
Adj Flow		251		19			834				1412	ĺ
%InSharedLn				İ			İ			İ		İ
Prop LTs		0.4	70	ĺ	0.47	74	Ì	0.04	17	ĺ	0.02	27
Prop RTs	0.	.506		0.	263		0	.018		0.	.047	ĺ
Peds Bikes	0			20)0 ()	20	0 0 0)	0		ĺ
Buses		0			0			5			5	ĺ
%InProtPhase	9											İ
Duration	0.25		Area 🗄	Гуре:	All d	other a	areas					

	Ea	stbou	nd	We	Westbound			rthbc	ound	Sc	Southbound				
	L	Т	R	L	Т	R	L	Т	R	L	Т	R			
Init Unmet	·	0.0		- 	0.0		- 	0.0		- 	0.0				
Arriv. Type		3		3			3			3					
Unit Ext.		3.0		3.0			3.0			3.0					
I Factor		1.00	0	Ì	1.000			1.000			1.000				
Lost Time		2.0		Ì	2.0			2.0			2.0				
Ext of g		3.0		Ì	3.0			3.0			3.0				
Ped Min g	15.2			Ì	16.5			13.6			12.2				

_____OPERATING PARAMETERS______OPERATING PARAMETERS_____

	PHASE DATA											
Dha	a Combination	1	2	2	1			F	6	7	0	
Plla		Ŧ	2	2	- 1			5	0	/	0	
EB	Left	А				NB	Left	A				
	Thru	A			ĺ		Thru	A				
	Right	A			İ		Right	A				
	Peds				İ		Peds	Х				
WB	Left	A				SB	Left	A				
	Thru	A			İ		Thru	A				
	Right	A					Right	A				
	Peds	Х					Peds					
NB	Right				ļ	EB	Right					
SB	Right					WB	Right					
Gre	en i	17.0			1			63.0				
Yel	low	4.0						4.0				
All	Red 2	1.0						1.0				

Cycle Length: 90.0 secs

, , , , , , , , , , , , , , , , , , ,	East	thour	nd	We	sthour	nd	No1	rthbo	und	L Soi	uthbo	und	
		T	R	L	T	R		Т	R	L	T	R	
Volume, V	112 6	6	162	 9	5	29	 37	741	15	<u></u> 36	1243	65	
PHF	0.95 (0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj flow	118 6	б	127	9	5	5	39	780	15	38	1308	66	
No. Lanes	0	2	0	0	1	0	0	2	0	0	2	0	
Lane group	oup LTR				LTR			LTI	R	LTR			
Adj flow	251				19			834		1412			
Prop LTs	İ	70	0.474			İ	0.0	47	0.027				
Prop RTs	0.5	506		0.263			0	.018		j o	0.047		
LG So	LTR 1800 2	0	0	18) 1)0	0	-	1800	0	0	180	0	
LG So Lanes O EW EHV EG EP EBB	LTR 1800 2 1.000 0.870 1.000 1.000 1.000	0	0	180 1.0 0.8 1.0 1.0 1.0	0 000 000 000 000 000 000	0		1800 2 1.000 0.870 1.000 1.000 0.990	0	0	180 2 1.0 0.8 1.0 1.0 0.9	0 00 70 00 00 90	
LG So Lanes O fW fHV fG fP fBB fA	LTR 1800 2 1.000 0.870 1.000 1.000 1.000 1.000	0	0	180 1.0 0.8 1.0 1.0 1.0 1.0	0 000 000 000 000 000 000 000	0		1.000 2 1.000 0.870 1.000 1.000 0.990 1.000	0	0	180 2 1.0 0.8 1.0 1.0 0.9 1.0	0 000 70 00 00 90	
LG So Lanes O fW fHV fG fP fBB fA fLU	LTR 1800 2 1.000 0.870 1.000 1.000 1.000 1.000 0.952	0	0	180 1 1.0 0.8 1.0 1.0 1.0 1.0 1.0	0 000 000 000 000 000 000 000 000	0		1800 2 1.000 0.870 1.000 1.000 0.990 1.000 0.952	0	0	180 2 1.0 0.8 1.0 1.0 0.9 1.0 0.9	0 000 70 00 00 90 00 52	
LG So Lanes O fW fHV fG fP fBB fA fLU fRT	LTR 1800 2 1.000 0.870 1.000 1.000 1.000 0.952 0.924	0	0	180 1 1.0 0.8 1.0 1.0 1.0 1.0 1.0 0.9	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0		L 800 2 L . 000 D . 870 L . 000 L . 000 D . 990 L . 000 D . 952 D . 997	0	0	180 2 1.0 0.8 1.0 1.0 0.9 1.0 0.9 0.9	0 00 70 00 90 90 52 93	
LG So Lanes O fW fHV fG fP fBB fA fLU fRT fLT	LTR 1800 2 1.000 0.870 1.000 1.000 1.000 0.952 0.924 0.875	0	0	180 1 1.0 1.0 1.0 1.0 1.0 1.0 1.0 0.9 0.8	0 000 000 000 000 000 000 000 000 000	0		L 800 2 L . 000 D . 870 L . 000 L . 000 L . 000 D . 990 L . 000 D . 952 D . 997 D . 826	0	0	180 2 1.0 0.8 1.0 1.0 0.9 1.0 0.9 0.9 0.9	0 0 0 7 0 0 0 0 0 0 0 0 5 2 9 3 1 0	
LG So Lanes O fW fHV fG fP fBB fA fLU fRT fLT Sec.	LTR 1800 2 1.000 0.870 1.000 1.000 1.000 1.000 0.952 0.924 0.875	0	0	180 1 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	0 000 000 000 000 000 000 000 000 000	0		L 800 2 L . 000 D . 870 L . 000 L . 000 D . 990 L . 000 D . 952 D . 997 D . 826	0	0	180 2 1.0 0.8 1.0 1.0 0.9 1.0 0.9 0.9 0.9	0 000 70 00 90 90 52 93 10	
LG So Lanes O fW fHV fG fP fBB fA fLU fRT fLT Sec. fLpb	LTR 1800 2 1.000 0.870 1.000 1.000 1.000 1.000 0.952 0.924 0.875 0.861	0	0	180 1 1.0 0.8 1.0 1.0 1.0 1.0 0.9 0.9 0.9 1.0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0		L 800 2 1.000 0.870 1.000 0.990 1.000 0.952 0.997 0.826 1.000	0	0	180 2 1.0 0.8 1.0 1.0 0.9 1.0 0.9 0.9 0.9	0 0 0 7 0 0 0 0 0 0 5 2 9 3 1 0 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	
LG So Lanes O fW fHV fG fP fBB fA fLU fRT fLT Sec. fLPb fRpb	LTR 1800 2 1.000 0.870 1.000 1.000 1.000 1.000 0.952 0.924 0.875 0.861 1.000	0	0	180 1 1.0 0.8 1.0 1.0 1.0 1.0 0.9 0.9 1.0 0.9 1.0 0.9 1.0 0.9 0.9 1.0 1.0 0.9 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0		L 800 2 L . 000 D . 870 L . 000 D . 990 L . 000 D . 952 D . 997 D . 826 L . 000 D . 998	0	0	180 2 1.0 0.8 1.0 1.0 0.9 1.0 0.9 0.9 0.9 0.9 0.9	0 0 0 7 0 0 0 0 0 0 0 5 2 9 3 1 0 9 9 9 0 0 0	
LG So Lanes 0 fW fHV fG fBB fA fLU fRT fLT Sec. fLpb fRpb S	LTR 1800 2 1.000 0.870 1.000 1.000 1.000 0.952 0.924 0.875 0.861 1.000 2076	0	0	180 1 1.0 0.8 1.0 1.0 1.0 1.0 0.9 0.8 1.0 0.9 1.1 0.9 1.1 0.9 1.1 0.9 1.1 0.9 1.1 0.9 1.1 0.9 1.0 1.0 0.9 1.0 1.0 1.0 0.9 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0		L 800 2 L . 000 D . 870 L . 000 L . 000 D . 990 L . 000 D . 952 D . 952 D . 997 D . 826 L . 000 D . 998 2426	0	0	180 2 1.0 0.8 1.0 1.0 0.9 1.0 0.9 0.9 0.9 0.9 0.9 0.9 1.0 266	0 0 0 7 0 0 0 0 0 0 0 5 2 9 3 1 0 9 9 9 0 0 4	

				Adj	Adj	Sat	Flow	Gree	enI	Lane G	roup	
Ар	pr/	Lane	Flo	w Rate	Flow	Rate	Ratio	Rat	io Car	pacity	v/c	
Μv	rmt	Group		(v)	(s)	(v/s)	(g/(2)	(C)	Ratio	
	ound											
Dr												
F L Do	rm											
re To	; . . +											
це Dr												
F I Do												
re Th		ד ידי ד	n	E 1	20	76	# 0 1 2	0 '	20	11 ⊑	0 6 0	
тн р;	aht	LIK	2	51	20	70	# 0.12	0.2	20 -	±10	0.00	
Woath	.giit											
Dr												
Г I D Ф	rm											
r C T.O	51 III 51 F +											
Dr												
F L Do	rm											
гс Th	: L III	סידי ד	1	٥	11	86	0 0 2	0 '	20 7	727	0 08	
т II т II	ah+	птк	T)	1 1	00	0.02	0.2	5U 2	101	0.00	
North	hour	٩										
P1 D0	rm											
re Lo												
Ъ∽	ot											
Г I D Ф	rm											
гс Th	III 1 ~ 11	T.TP	Q	34	24	26	0 34	0 7	71 7	1725	0 4 8	
Pi	aht	штк	0	JI	21	20	0.54	0.	/	L/2J	0.10	
South	bound	٩										
Doucin		A										
Г I D p	rm											
I.e												
Dr	ot											
De	rm											
тh	1711	T.TR	1	412	26	64	# 0 53	0 7	71 1	894	0 75	
Ri	aht.	D 110	-		20	01	1 0.55	۰.			0.75	
Sum o	of flo	ow rati	os for	critio	cal la	ne gro	oups, Yc	= S1	um (v/s	3) =	0.65	
Total	. lost	t time	per cy	cle, 1	L = 8.	00 se	C					
Criti	.cal f	flow ra	te to	capacit	ty rat	io,	Xc	= (YC)(C)/(C	C-L) =	0.71	
Contr			d t og	Dotorm	inatio	n						
Appr/	DI De	etay an atiog	U 105 Unf	Decerm. Drog	I.ane	II	mental	 Reg	Iane (Appro	 ach
Lane	100	ICIOD	Del	Adi	Grn	Facto	nr Del	Del		JIOUP	мррго	acii
Grp	v/c	q/C	d1	Fact	Cap	k	d2	d3	Delay	/ LOS	Delay	LOS
Eastb	ound											
LTR	0.60	0.20	32.8	1.000	415	0.19	2.5	0.0	35.3	D	35.3	D
Westb	ound											
LTR	0.08	0.20	29.3	1.000	237	0.11	0.1	0.0	29.4	С	29.4	С
		-										
North	bound	t l										
םית. ד	0 10	0 71	57	1 000	1705	0 1 1	0 2	0 0	5 0	7	5 0	δ
лтк	0.40	0./1	5.7	1.000	1/2J	0.11	0.2	0.0	5.2	А	5.9	A
South	bound	3										
~~~~		~										
LTR	0.75	0.71	8.0	1.000	1894	0.30	1.7	0.0	9.6	A	9.6	A
		· · · —							· · <del>·</del>	-	<del>-</del>	

SUPPLEMENTAL PERMITTED LT WORKSHEET for exclusive lefts Input EΒ WB NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 90.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo 1.000 0.952 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. _SUPPLEMENTAL PERMITTED LT WORKSHEET_ for shared lefts Input EΒ WΒ NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 90.0 sec Total actual green time for LT lane group, G (s) 17.0 17.0 63.0 63.0 Effective permitted green time for LT lane group, g(s) 18.0 18.0 64.0 64.0 Opposing effective green time, go (s) 18.0 18.0 64.0 64.0 Number of lanes in LT lane group, N 1 2 2 2

Intersection LOS = B

Intersection delay = 11.1 (sec/veh)

Number of lanes in opposing approach, No 1 2 2 2 9 Adjusted LT flow rate, VLT (veh/h) 118 39 38 Proportion of LT in LT lane group, PLT 0.470 0.474 0.047 0.027 Proportion of LT in opposing flow, PLTo 0.47 0.47 0.03 0.05 Adjusted opposing flow rate, Vo (veh/h) 19 251 1412 834 Lost time for LT lane group, tL 4.00 4.00 4.00 4.00 Computation LT volume per cycle, LTC=VLTC/3600 2.95 0.23 0.98 0.95 1.000 0.952 0.952 0.952 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) 0.47 3.30 18.54 10.95 qf=G[exp(- a * (LTC ** b))]-tl, gf<=g</pre> 0.0 8.6 22.5 22.9 Opposing platoon ratio, Rpo (refer Exhibit 16-11) 1.00 1.00 1.00 1.00 0.80 0.80 0.29 0.29 Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) 0.00 5.68 14.22 4.36 18.00 9.44 41.50 41.08 gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)0.00 0.00 0.00 0.00 0.53 0.53 0.97 PTHo=1-PLTo 0.95  $PL^* = PLT[1+(N-1)g/(gf+gu/EL1+4.24)]$ 0.97 0.47 0.14 0.07 EL1 (refer to Exhibit C16-3) 1.40 1.81 5.90 3.31 EL2=Max((1-Ptho**n)/Plto, 1.0)1.00 1.00 1.00 1.00 0.22 0.16 0.04 0.03 fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) 0.00 0.00 0.00 0.00 fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) 0.84 0.85 0.74 0.91 flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT 0.875 0.854 0.826 0.910 For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. _SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET_____ Permitted Left Turns EΒ WB NB SB Effective pedestrian green time, gp (s) 17.0 63.0 Conflicting pedestrian volume, Vped (p/h) 200 200 Pedestrian flow rate, Vpedg (p/h) 1058 285 0.506 0.143 OCCpedq Opposing queue clearing green, gq (s) 0.00 4.36 Eff. ped. green consumed by opp. veh. queue, gq/gp 0.000 0.069 0.506 OCCpedu 0.138 Opposing flow rate, Vo (veh/h) 19 834 0.493 0.043 OCCr 2 Number of cross-street receiving lanes, Nrec 2 Number of turning lanes, Nturn 1 1 ApbT 0.704 0.974 Proportion of left turns, PLT 0.470 0.027 Proportion of left turns using protected phase, PLTA 0.000 0.000 Left-turn adjustment, fLpb 0.861 0.999 Permitted Right Turns Effective pedestrian green time, gp (s) 17.0 63.0 Conflicting pedestrian volume, Vped (p/h) 200 200 Conflicting bicycle volume, Vbic (bicycles/h) 0 0 1058 285 Vpedg 0.506 0.143 OCCpedq Effective green, g (s) 18.0 64.0 0 0 Vbicg
OCCbicg OCCr		0.0 0.5	20 0.020 06 0.143					
Number Number ApbT	of cross of turnin	-street ng lanes	receiving , Nturn	g lanes,	Nrec		2 1 0.6	2 1 97 0.914
Proport	ion righ	t-turns,	PRT				0.2	63 0.018
Proport	ion right	t-turns	using pro	otected	phase, P	RTA	0.0	00 0.000
Right t	urn adju	stment,	IRpb				0.9	20 0.998
		SU	PPLEMENT	AL UNIFO	RM DELAY	WORKSHE	ET	
Cvcle 1	ength C				90.0	E	BLT WBL	T NBLT SBLT
Adj. LT	vol fro	m Vol Ad	justment	Workshe	et, v	bee		
v/c rat	io from (	Capacity	Workshee	et, X				
Opposin	ed phase	effectiv	ve green e green	interva interval	I, g (s)			
Unoppos	ed green	interva	l, gu		/ 54			
Red tim	e r=(C-g	-gq-gu)	0 (	1 0 1 \ \				
Protect	ed ph. de	a=v/(360 eparture	rate, Si	p=s/3600				
Permitt	ed ph. de	eparture	rate, S	s=s(gq+g	u)/(gu*3	600)		
XPerm								
Case								
Queue a	t beginn	ing of g	reen arro	ow, Qa				
Queue a Residua	t beginn: 1 gueue	ing of u Or	nsaturate	ed green	, Qu			
Uniform	Delay,	d1						
		DELAY/	LOS WORK	снеет ит	тн тмттт	AI. OIIEIIE		
	Initial	Dur.	Uniform	Delay	Initial	Final	Initial	Lane
Appr/ Lane	Unmet Demand	Unmet Demand	 Unadj.	 Adj.	Queue Param.	Unmet Demand	Queue Delay	Group Delay
Group	Q veh	t hrs.	ds	dl sec	u	Q veh	d3 sec	d sec
Eastbou	nd							
T.TR	0.0	0 00	36 0	32 8	0 0 0	0 0	0.0	35 3
LIK	0.0	0.00	50.0	52.0	0.00	0.0	0.0	
Westbou	nd							
ם יידי ד	0.0	0 00	26 0	20.2	0 00	0 0	0.0	20 4
LIK	0.0	0.00	30.0	29.3	0.00	0.0	0.0	29.4
Northbo	und							
Ţ.ŢŢ	0.0	0 00	13 0	57	0 00	0 0	0.0	5 9
LIK	0.0	0.00	13.0	5.7	0.00	0.0	0.0	5.9
Southbo	und						0 0	
T.T.P	0.0	0 00	13 0	8 0	0 0 0	0 0	0.0	9 6
	0.0	0.00	13.0	0.0	0.00	0.0	0.0	2.0
	Intersec	tion Del	ay 11.1	sec/v	eh I:	ntersect	ion LOS	В
			BACK	OF QUEU	E WORKSH	ЕЕТ		

	Eastbound	Westbound	Northbound	Southbound		
LaneGroup	LTR	LTR	LTR	LTR		
Init Queue	0.0	0.0	0.0	0.0		
Flow Rate	131	19	438	741		
So	1800	1800	1800	1800		
No.Lanes	0 2 0	0 1 0	0 2 0	0 2 0		
SL	1090	1186	1274	1399		
LnCapacity	217	237	905	994		
Flow Ratio	0.1	0.0	0.3	0.5		
v/c Ratio	0.60	0.08	0.48	0.75		
Grn Ratio	0.20	0.20	0.71	0.71		
I Factor	1.000	1.000	1.000	1.000		
AT or PVG	3	3	3	3		
Pltn Ratio	1.00	1.00	1.00	1.00		
PF2	1.00	1.00	1.00	1.00		
Q1	3.0	0.4	4.8	11.4		
kB	0.3	0.3	0.7	0.7		
Q2	0.4	0.0	0.6	1.9		
Q Average	3.4	0.4	5.4	13.3		
Q Spacing	25.0	25.0	25.0	25.0		
Q Storage	0	0	0	0		
Q S Ratio						
70th Percent	tile Output:					
fB%	1.2	1.2	1.2	1.2		
BOQ	4.0	0.5	6.4	15.6		
QSRatio						
85th Percent	tile Output:					
fB%	1.6	1.6	1.6	1.5		
BOQ	5.3	0.7	8.4	19.8		
QSRatio						
90th Percent	tile Output:					
fB%	1.7	1.8	1.7	1.6		
BOQ	5.9	0.7	9.3	21.3		
QSRatio						
95th Percent	tile Output:					
fB%	2.0	2.1	1.9	1.8		
BOQ	6.8	0.9	10.5	23.7		
QSRatio						
98th Percent	tile Output:					
fB%	2.5	2.7	2.4	2.1		
BOQ	8.4	1.1	12.8	27.4		
QSRatio						

Analyst: Agency: PB Date: 6/25/2010 Period: AM Peak Hour Project ID: I-290 Phase 1 Study E/W St: Bataan Drive								Inter.: Bataan Drive & 17th Avenue Area Type: All other areas Jurisd: Year : Existing N/S St: 17th Avenue							
				<b>G T</b> (					am = 0.11						
			1	SIG	SNAL12	LED	TN,I	'ERSE	CTION	SUMM	ARY		+ 1- 1		 I
		Eas	uodja m		wes		bunc	1	NOT	TUDO	una 🔤	501	ισαπσι	una D	
		Ц	T	ĸ	Ш	T		ĸ		T	ĸ		T	ĸ	
No Iono	-  -		 ົ				<u> </u>				 				 
ICConfig		0	2 T TT		0	C	,	0		2 TD	U	Defi	- <u>т</u>	0	
Volume		55	66	131						351	156	74	177		
Lane Wid	+h	55	12 0	131					1	12 0	100	12 0	12 0		
RTOR Vol			12.0	114						12.0	51	12.0	12.0		
									1		01				I
Duration	. (	0.25		Area 1	Type:	All	L ot	her	areas ions						
Phase Co	mbina	atior	1 1	2	3	91101	4	Jerue	10110	5	6	7	8	 3	
EB Left			A	_	-		-	NB	Left	-	-			-	
Thru	L		A				İ		Thru		А				
Righ	t		A				j		Right		A				
Peds							İ		Peds						
WB Left								SB	Left	A	A				
Thru									Thru	A	A				
Right									Right						
Peds									Peds						
NB Righ	lt							EB	Right						
SB Righ	lt							WB	Right						
Green			25.0							67.0	35.0	)			
Yellow			4.0							3.0	4.0				
All Red			1.0							0.0	1.U 2.To	ath.	140 (	h	~~~~
			Ir	ntersed	ction	Per	for	manc	e Summ	arv.	ле пег	Ig til •	140.0	J	secs
Appr/	Lane		 Ad	j Sat	Ra	atic	)s		Lane	Group	 р Дру	proach	 າ		
Lane	Group	2	Flov	v Rate				_							
Grp	Capad	city	(	(s)	v/c		g/C		Delay	LOS	Dela	ay LOS	5		
 Eastboun	.d														
TED			214		0 0/	-	0 1	0	40.0	P	40.0				
LTR	587		316	52	0.20	D	0.1	_9	49.0	D	49.0	ע נ			
Westboun	ld														
Northbou	ind														
Ψ₽	816		315	75	0 50	a	0 2	06	46 6	П	46 6	а П			
T 1/	010		JTI		0.01		0.2	-0	10.0	U	-10.0	ע י			
Southbou	Ind														
DefL	933		164	<b>1</b> 1	0.08	3	0.7	77	5.0	A					
Т	1308	3	172	27	0.14	1	0.7	76	1.0	А	2.2	A			
	Inte	ersed	tion	Delay	= 34	.0	(se	ec/ve	h) I	nter	sectior	n LOS	= C		

Phone: E-Mail: Fax:

_____OPERATIONAL ANALYSIS______

Analyst:	
Agency/Co.:	PB
Date Performed:	6/25/2010
Analysis Time Period:	AM Peak Hour
Intersection:	Bataan Drive & 17th Avenue
Area Type:	All other areas
Jurisdiction:	
Analysis Year:	Existing
Project ID: I-290 Phase 2	l Study
E/W St: Bataan Drive	N/S St: 17th Avenue

_____VOLUME DATA______

	Eastbound			Wes	stbou	ınd	No	rthbo	und	Southbound		
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume	65	66	131					351	156	74	177	I
% Heavy Veh	10	10	10				ĺ	10	10	10	10	ĺ
PHF	0.95	0.95	0.95				ĺ	0.95	0.95	0.95	0.95	
PK 15 Vol	17	17	34					92	41	19	47	
Hi Ln Vol												
% Grade		0						0			0	
Ideal Sat		1900						1900		1900	1900	
ParkExist												
NumPark												
No. Lanes	0	2	0	0	0	0	0	2	0	0	2	0
LGConfig		LTI	ર					TR		Defl	LΤ	
Lane Width		12.0						12.0		12.0	12.0	
RTOR Vol			114						51			
Adj Flow		155						480		78	186	
%InSharedLn												
Prop LTs		0.43	39					0.0	00	1.000	0.00	0
Prop RTs	0.	.116					0	.231		0	.000	
Peds Bikes	0			0			0					
Buses		0						0		0	0	
%InProtPhase	9									0.0		
Duration	0.25		Area '	Type:	All	other	areas					

	Eastbound			Westbound			Northbound			So	Southbound		
	L	Т	R	L	Т	R	L	Т	R	L	Т	R	
Trait IImmot							·			_			
INIC UNMEL		0.0						0.0		10.0	0.0	ļ	
Arriv. Type		3						3		3	6		
Unit Ext.		3.0						3.0		3.0	3.0		
I Factor		1.00	0					1.00	0		0.96	3	
Lost Time		2.0						2.0		2.0	2.0		
Ext of g		3.0		ĺ			Í	3.0		3.0	3.0		
Ped Min g		3.2		ĺ	3.2		ĺ	3.2		Ì		İ	

## _____OPERATING PARAMETERS_____OPERATING PARAMETERS_____

	PHASE DATA										
Pha	se Combination	1	2	3	4			5	6	7	8
EB	Left Thru Right Peds	A A A				NB	Left Thru Right Peds		A A		
WB	Left Thru Right Peds					SB	Left Thru Right Peds	A A	A A		
NB	Right				ļ	EB	Right				
SB	Right					WB	Right				
Gre Yel All	en 2 low 4 Red 2	25.0 4.0 1.0			I			67.0 3.0 0.0	35.0 4.0 1.0		

	VOLU	IME ADJU	JSTMEN'	r and	SATU	RATIO	N FLO	W WORK	SHEET_		
Volume Adju	stment										
	Eastbou	ınd	Wes	tboun	d	Noi	thbo	und	Sou	thboun	d
	L T	R	L	Т	R	L	Т	R	L	Т	R
Volume, V	65 66	131	 				351	156	74	177	 
PHF	0.95 0.95	0.95					0.95	0.95	0.95	0.95	
Adj flow	68 69	18	ĺ			İ	369	111	78	186	
No. Lanes	0 2	0	0	0	0	0	2	0	0	2	0
Lane group	L1	'R	ĺ			İ	TR		DefL	Т	
Adj flow	155		ĺ			İ	480		78	186	
Prop LTs	0.4	39	ĺ			İ	0.0	00	1.000	0.000	İ
Prop RTs	0.116		İ			0	.231		0.	000	İ
Saturation	Flow Rate	(see E:	xhibit	16-7	to d	eterm	ine t	he adj	ustmen	t fact	ors)
Ea	stbound	T	Westbo	und		North	nboun	d	Sou	thboun	d
LG	LTR						TR		DefL	Т	
So	1900					-	1900		1900	1900	
Lanes O	2 0	0	0	0	0		2	0	0	2	0
fW	1.000					-	1.000		1.000	1.000	
fHV	0.909					(	0.909		0.909	0.909	
fG	1.000					-	1.000		1.000	1.000	
fP	1.000					-	1.000		1.000	1.000	
fBB	1.000					-	1.000		1.000	1.000	
fA	1.000					-	1.000		1.000	1.000	
fLU	0.952					(	0.952		1.000	1.000	
fRT	0.983					(	0.965			1.000	
fLT	0.979					-	1.000		0.950	1.000	
Sec.									0.276		
fLpb	1.000					-	1.000		1.000	1.000	
fRpb	1.000					-	1.000			1.000	
S	3162					-	3175		1641	1727	
Sec.									476		
		CAI	PACITY	AND	LOS W	ORKSHI	CET				
Capacity An	alysis and	Lane (	group (	Capac	ıty						

A: M	ppr/ vmt	Lane Group	Flo	Adj w Rate (v)	Adj Flow (	Sat Rate s)	H H	Flow Ratio (v/s)	Gre Rat (g/	een io C)	La Capa	ane G acity (c)	roup v/c Ratio	
East	bound													
P	rot													
P	erm													
$\mathbf{L}$	eft													
P	rot													
Р	erm													
- T	hru	T'LLB	1	55	31	62	#	0 05	0	19	5	87	0 26	
R	iaht	<b>D 1 1 1</b>	-	55	51	02		0.05	0.	± 2	0	0 1	0.20	
Weet	hound													
D'	rot													
г. 														
P	erm													
· ل	eit													
P	rot													
P	erm													
T.	hru													
R	ight													
Nort	hbound	b												
P	rot													
P	erm													
L	eft													
P	rot													
P	erm													
- T	hru	Τ̈́R	4	80	31	75	#	0 15	0	26	8	16	0 59	
R	iaht		-	00	51	, 5		0.15	0.	20	0	10	0.00	
Sout	hhound	4												
JUUC.	rot	1	7	0	16	11		0 05	0	106	7	70	0 1 0	
P.			7	0	10	41 6		0.05	0.	700 206	1		0.10	
P	er ill	Deft	0	0	4/	0		0.00	0.	200	т. О	20	0.00	
р Т	ert	Derr	1	0					Ο.	//	9	55	0.08	
P:	rot													
P	erm										_			
Т.	hru	Т	T	86	17	27	Ħ	0.11	0.	76	T.	308	0.14	
R	ıght													
Sum	of flo	ow rati	os for	critic	cal la	ne gro	our	ps, Yc	= 5	Sum (	v/s	) =	0.31	
Tota	l lost	t time	per cy	cle, I	_ = 12	.00 se	ЭC							
Crit	ical i	flow ra	te to	capacit	y rat	io,		Хc	= (Yc	e)(C)	/ ( C	-L) =	0.34	
Cont	rol De	elay an	d LOS	Determi	natio	n								
Appr	/ Ra	atios	Unf	Prog	Lane	Incre	eme	ental	Res	Lan	e G	roup	Appro	ach
Lane			Del	Adj	Grp	Facto	or	Del	Del					
Grp	v/c	g/C	d1	Fact	Cap	k		d2	d3	De	lay	LOS	Delay	LOS
East.	bouna													
LTR	0.26	0.19	48.8	1.000	587	0.11		0.2	0.0	49.	0	D	49.0	D
West	bound													
Nort'	hhour	4												
INUL L.	uil(	A												
TR	0.59	0.26	45.5	1.000	816	0.18		1.1	0.0	46.	б	D	46.6	D
S011+	hhour	4												
Doft		د 77	Б ()	1 000	022	0 1 1		0 0	0 0	<b>ح</b> 0		7		
лагр					ここで 1 つ ∩ ∩	0.11		0.0	0.0	1 0		A	<b>~</b> ~	7
T.	∪.⊥4	0./6	4.0	0.206	1308	υ.ΙΙ		υ.υ	0.0	<b>⊥.</b> 0		А	2.2	А

SUPPLEMENTAL PERMITTED LT WORKSHEET			
for exclusive lefts			
Input	чтр		CD
Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 140.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time, go (s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation	WΒ	NB	105.0         40.0         36.0         1         2         78         1.000         0.00         480         4.00
<pre>LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf&lt;=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq&gt;=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0) PTHo=1-PLTO PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)] EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)</gf </pre>	0.952	1.000	3.03 0.952 9.80 0.0 1.00 0.74 16.94 23.06 8.47 1.00 1.00 2.09 0.10 0.00 0.28
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(f or flt=[fm+0.91(N-1)]/N**	min<=f	m<=1.0	0.28
Left-turn adjustment, fLT			0.276
<pre>For special case of single-lane approach opposed by multilane see text. * If Pl&gt;=1 for shared left-turn lanes with N&gt;1, then assume d left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn For special case of multilane approach opposed by single-lane or when gf&gt;gq, see text.</pre>	e appro le-fact 1 lanes 2 appro	ach, :o s, flt= bach	-fm.
SUPPLEMENTAL PERMITTED LT WORKSHEET			
Input			
EB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 140.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N	WB	NB	SB

Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) 0.439 Proportion of LT in LT lane group, PLT 0.000 0.000 Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 0.952 1.000 0.952 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min = fmin; max = 1.00)flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET Permitted Left Turns EΒ WΒ NB SB Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Pedestrian flow rate, Vpedg (p/h) 0CCpedq Opposing queue clearing green, gq (s) Eff. ped. green consumed by opp. veh. queue, gq/gp OCCpedu Opposing flow rate, Vo (veh/h) OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion of left turns, PLT Proportion of left turns using protected phase, PLTA Left-turn adjustment, fLpb Permitted Right Turns Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Conflicting bicycle volume, Vbic (bicycles/h) Vpedg OCCpedq Effective green, g (s) Vbicg

OCCbicg OCCr Number of Number of ApbT Proport: Proport: Right tu	of cross- of turnin ion right ion right urn adjus	-street : ng lanes t-turns, t-turns : stment, :	receiving , Nturn PRT using pro fRpb	g lanes, otected p	Nrec phase, Pl	RTA					
		SU	PPLEMENTA	AL UNIFO	RM DELAY	WORKSHE	ET				
EBLT WBLT NBLT Cycle length, C 140.0 sec Adj. LT vol from Vol Adjustment Worksheet, v v/c ratio from Capacity Worksheet, X Protected phase effective green interval, g(s) Opposing queue effective green interval, gq Unopposed green interval, gu Red time r=(C-g-gq-gu) Arrival rate, qa=v/(3600(max[X,1.0])) Protected ph. departure rate, Sp=s/3600 Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600) XPerm XProt Case Queue at beginning of green arrow, Qa Queue at beginning of unsaturated green, Qu Residual queue, Qr Uniform Delay, dl											
DELAY/LOS WORKSHEET WITH INITIAL QUEUE											
Appr/ Lane	Initial Unmet Demand	Dur. Unmet Demand	Uniform  Unadj.	Delay Adj.	Initial Queue Param.	Final Unmet Demand	Initial Queue Delay	Lane Group Delay			
Group	Q veh	t hrs.	ds	dl sec	u	Q veh	d3 sec	d sec			
Eastbour	nd 0.0 0.0 0.0	0.00	57.0	48.8	0.00	0.0	0.0 0.0 0.0	49.0			
Westbour	nd 0.0 0.0 0.0						0.0 0.0 0.0				
Northbou	und										
TR	0.0 0.0 0.0	0.00	52.0	45.5	0.00	0.0	0.0 0.0 0.0	46.6			
Southbou	und										
DefL T	0.0 0.0 0.0	0.00 0.00	17.0	5.0 4.6	0.00 0.00	0.0 0.0	0.0 0.0 0.0	5.0 1.0			
	Intersect	cion Dela	ay 34.0 BACK	sec/ve	eh In E WORKSH	ntersect	ion LOS	С			

	Eastbound	Westbound	Northbound	Southbound
LaneGroup	LTR		TR	DefL T
Init Queue	0.0		0.0	0.0 0.0
Flow Rate	81		252	78 186
So	1900		1900	1900 1900
No.Lanes	0 2 0	0 0 0	0 2 0	0 2 0
SL	1660		1667	1210 1727
LnCapacity	308		428	933 1308
Flow Ratio	0.0		0.2	0.1 0.1
v/c Ratio	0.26		0.59	0.08 0.14
Grn Ratio	0.19		0.26	0.77 0.76
I Factor	1.000		1.000	0.963
AT or PVG	3		3	3 6
Pltn Ratio	1.00	ĺ	1.00	1.00 1.25
PF2	1.00	ĺ	1.00	1.00 0.21
Q1	2.7		8.6	0.7 0.4
kB	0.4	ĺ	0.5	0.8 1.0
Q2	0.2	ĺ	0.7	0.1 0.2
Q Average	2.9	ĺ	9.3	0.8 0.6
Q Spacing	25.0		25.0	25.0 25.0
Q Storage	0		0	0 0
Q S Ratio				
70th Percent	tile Output:	•		
fB%	1.2		1.2	1.2 1.2
BOQ	3.4		11.0	1.0 0.7
QSRatio				
85th Percent	ile Output:			
fB%	1.6		1.5	1.6 1.6
BOQ	4.5		14.2	1.3 0.9
QSRatio				
90th Percent	ile Output:			
fB%	1.7		1.7	1.8 1.8
BOQ	5.0		15.4	1.4 1.0
QSRatio				
95th Percent	ile Output:			
fB%	2.0		1.9	2.1 2.1
BOQ	5.7		17.3	1.7 1.2
QSRatio				
98th Percent	ile Output:			
fB%	2.5		2.2	2.6 2.7
BOQ	7.1		20.4	2.1 1.6
QSRatio				i i

Analyst: Agency: 1 Date: Period: 1 Project 2 E/W St: 1	PB 6/25/2 PM Pea ID: I- Bataan	010 k Hour 290 Phase 1 Drive	Study		Int Are Jur Yea: N/S	er.: B a Type isd: r : E St: S	ataan : All xistin . 17th	Drive other ng n Aven	& S. area	. 17th as	a Ave	nue
			SIGNALIZE	D INT	ERSE	CTION	SUMMAI	RY				
	-	Eastbound	West	bounc	1	Nor	thbour	nd	Soi	uthbou	ind	
	ļL	I T R	ļ Ц	.1.	R	ļ Ц	.1.	R	Ц	T.	R	
NT - T												-!
No. Lane:	s			0	0	TR			0	∠ 	0	
LGCONIIG		LIR 02 1/7					110 -		110	ЦЦ 276		
Vorume Lane Widt	/J +h					1	+⊥0 _ 1 2 ∩			12 0		
RTOR Vol		113				1	12.0	20		12.0		
KIOK VOI	I	113	I			I	2	20				I
Duration	0.	25 Are	a Type: A	ll ot	her	areas						
Phase Cor	mbinat	ion 1 2	31911 3	4	erac	10115	 5	6	 7	8		
EB Left		A 2	0	-	NB	Left	U	Ū.		0		
Thru		A		İ		Thru		А				
Right	t	А				Right		А				
Peds				İ		Peds						
WB Left				ĺ	SB	Left	A	A				
Thru						Thru	A	A				
Right	t					Right						
Peds						Peds						
NB Right	t				ΕB	Right						
SB Right	t	05 0			WB	Right		<u> </u>				
Green		25.0					67.0	35.0				
Yellow		4.0					3.0	4.0				
All Red		1.0					0.0	1.U	la •	140 0		
		Intor	anation D	orfor	mana	o Cumm	Cyc.	le Len	gtn.	140.0	S	ecs
	 I.ano	Incer	t Pat	ing	mane	T.ang	ary Group	 	roact			
Lane (	Group	Flow Ra	te Rat	105		цапс	Group	прр	LOUCI	1		
Grp (	Capaci	tv (s)	v/c	a/0	-	Delav	LOS	Dela	v LOS			
Eastbound	a											
LTR	583	3139	0.34	0.1	9	49.9	D	49.9	D			
Westbound	d											
Northbou	nd											
TR	824	3203	0.65	0.2	26	48.1	D	48.1	D			
Southbour	nd											
LT	2064	3251	0.25	0.7	6	1.1	A	1.1	A			
	Inter	section Del	ay = 29.0	(se	ec/ve	h) I	nterse	ection	LOS	= C		

Phone: E-Mail: Fax:

_____OPERATIONAL ANALYSIS______OPERATIONAL ANALYSIS_____

PB					
6/25/2010					
PM Peak Hour					
Bataan Drive &	venue				
All other area	as				
Existing					
1 Study					
	N/S	St:	s.	17th	Avenue
	PB 6/25/2010 PM Peak Hour Bataan Drive & All other area Existing 1 Study	PB 6/25/2010 PM Peak Hour Bataan Drive & S. All other areas Existing 1 Study N/S	PB 6/25/2010 PM Peak Hour Bataan Drive & S. 17th All other areas Existing 1 Study N/S St:	PB 6/25/2010 PM Peak Hour Bataan Drive & S. 17th Av All other areas Existing 1 Study N/S St: S.	PB 6/25/2010 PM Peak Hour Bataan Drive & S. 17th Avenue All other areas Existing 1 Study N/S St: S. 17th

_____VOLUME DATA______

	Eas	stbou	nd	Wes	stbou	nd	No	rthbo	und	Soi	uthbou	nd
	L	Т	R	Ĺ	Т	R	L	Т	R	L	Т	R
Volume	  73	83	147	 				418	107	  112	376	
% Heavy Veh	10	10	10	İ				10	10	10	10	
PHF	0.95	0.95	0.95	İ			Ì	0.95	0.95	0.95	0.95	
PK 15 Vol	19	22	39	İ			Ì	110	28	29	99	
Hi Ln Vol	İ			İ			İ			İ		
% Grade	İ	0		İ			İ	0		İ	0	
Ideal Sat	ĺ	1900		ĺ			İ	1900		ĺ	1900	
ParkExist	ĺ			ĺ						ĺ		
NumPark												
No. Lanes	0	2	0	0	0	0	0	2	0	0	2	0
LGConfig		LTI	R					TR			LT	
Lane Width		12.0						12.0			12.0	
RTOR Vol			113						20			
Adj Flow		200						532			514	
%InSharedLn												
Prop LTs		0.3	85					0.0	00		0.23	0
Prop RTs	0	.180					0	.173		0	.000	
Peds Bikes	0			0			0					
Buses		0						0			0	
%InProtPhase	9									0.0		
Duration	0.25		Area 🗄	Гуре:	All	other	areas					

	Eastbound   L T R			We	stbou	nd	No	rthbc	ound	Southbound		
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
 Init Unmet		0.0		 				0.0		-  	0.0	
Arriv. Type		3		ĺ				3			6	
Unit Ext.		3.0		İ			İ	3.0		İ	3.0	
I Factor	ĺ	1.00	0	ĺ			İ	1.00	0		0.85	4
Lost Time	ĺ	2.0		ĺ			İ	2.0			2.0	
Ext of g		3.0						3.0			3.0	
Ped Min g		3.2		ĺ	3.2		1	3.2				

## _____OPERATING PARAMETERS______OPERATING PARAMETERS_____

				PH	ASE	DATA_					
Pha	se Combination	1	2	3	4			5	6	7	8
EB	Left Thru Right Peds	A A A				NB	Left Thru Right Peds		A A		
WB	Left Thru Right Peds					SB	Left Thru Right Peds	A A	A A		
NB	Right					EB	Right				
SB	Right					WB	Right				
Gre Yel All	en : low : Red :	25.0 4.0 1.0			I			67.0 3.0 0.0	35.0 4.0 1.0		

vorume Raja	Eac	thour	hđ	Wee	thour	hd		rthho	und		uthhou	ind
	т.	T	R	і мса Іт.	T	R	T.	טעננט בי, ד	R	Т.	T	R
		T	IC IC		T	IC IC		T	R		T	IC IC
Volume, V	73	83	147				-   <u></u>	418	107	112	376	
PHF	0.95	0.95	0.95	ĺ			İ	0.95	0.95	0.95	0.95	
Adj flow	77	87	36	İ			İ	440	92	118	396	
No. Lanes	0	2	0	j o	0	0	0	) 2	0	j o	2	0
Lane group	İ	LTF	ξ	İ			İ	TR		İ	LT	
Adj flow	İ	200		İ			İ	532		İ	514	
Prop LTs	i	0.38	35	İ			i	0.0	00	i	0.23	30
Prop RTs	j 0.	180		İ			j 0	.173		j o	.000	
LG	LTR	a	,	105000	ana		NOLU	TR	u	50	LT	
LG	LTR	a	,	NCBCD0	ana		NOLC	TR	a	50	LT	
LG So	LTR 1900	0	0	0	0		NOT	TR 1900 2	0	0	LT 1900	)
LG So Lanes O fw	LTR 1900 2	0	0	0	0	(	)	TR 1900 2	0	0	LT 1900 2	) 0
LG So Lanes O fW fHV	LTR 1900 2 1.000	0	0	0	0	(	)	TR 1900 2 1.000	0	0	LT 1900 2 1.00	) 0 ) 0
LG So Lanes O fW fHV fG	LTR 1900 2 1.000 0.909 1.000	0	0	0	0	(	)	TR 1900 2 1.000 0.909 1.000	0	0	LT 1900 2 1.00 0.90	) 0 ) 0 ) 9 ) 0
LG So Lanes O fW fHV fG fP	LTR 1900 2 1.000 0.909 1.000 1.000	0	0	0	0	(	)	TR 1900 2 1.000 0.909 1.000 1.000	0	0	LT 1900 2 1.00 0.90 1.00 1.00	) 0 ) 0 ) 9 ) 0 ) 0
LG So Lanes O fW fHV fG fP fBB	LTR 1900 2 1.000 0.909 1.000 1.000 1.000	0	0	0	0	(	)	TR 1900 2 1.000 0.909 1.000 1.000 1.000	0	0	LT 1900 2 1.00 0.90 1.00 1.00 1.00	) 00 09 00 00
LG So Lanes O fW fHV fG fP fBB fA	LTR 1900 2 1.000 0.909 1.000 1.000 1.000 1.000	0	0	0	0	(	)	TR 1900 2 1.000 0.909 1.000 1.000 1.000 1.000	0	0	LT 1900 2 1.00 0.90 1.00 1.00 1.00	) 0 0 0 0 0 0 0 0 0 0 0 0 0
LG So Lanes O fW fHV fG fP fBB fA fLU	LTR 1900 2 1.000 0.909 1.000 1.000 1.000 1.000 0.952	0	0	0	0	(	)	TR 1900 2 1.000 0.909 1.000 1.000 1.000 1.000 0.952	0	0	LT 1900 2 1.00 1.00 1.00 1.00 1.00 0.95	) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
LG So Lanes O fW fHV fG fP fBB fA fLU fRT	LTR 1900 2 1.000 0.909 1.000 1.000 1.000 1.000 0.952 0.973	0	0	0	0	(	)	TR 1900 2 1.000 0.909 1.000 1.000 1.000 1.000 0.952 0.974	0	0	LT 1900 2 1.00 1.00 1.00 1.00 1.00 0.95 1.00	0 00 09 00 00 00 00 00 52 00
LG So Lanes O fW fHV fG fP fBB fA fLU fRT fLT	LTR 1900 2 1.000 0.909 1.000 1.000 1.000 1.000 0.952 0.973 0.981	0	0	0	0	(	)	TR 1900 2 1.000 0.909 1.000 1.000 1.000 0.952 0.974 1.000	0	0	LT 1900 2 1.00 1.00 1.00 1.00 1.00 0.95 1.00 0.98	0 00 00 00 00 00 00 00 00 00 00 00 00 0
LG So Lanes 0 fW fHV fG fP fBB fA fLU fRT fLT Sec.	LTR 1900 2 1.000 0.909 1.000 1.000 1.000 1.000 0.952 0.973 0.981	0	0	0	0	(	)	TR 1900 2 1.000 0.909 1.000 1.000 1.000 1.000 0.952 0.974 1.000	0	0	LT 1900 2 1.00 1.00 1.00 1.00 1.00 1.00 0.95 1.00 0.98 0.56	0 00 00 00 00 00 00 00 00 00 00 00 00 0
LG So Lanes 0 fW fHV fG fP fBB fA fLU fRT fLT Sec. fLpb	LTR 1900 2 1.000 0.909 1.000 1.000 1.000 1.000 0.952 0.973 0.981 1.000	0	0	0	0	(	)	TR 1900 2 1.000 0.909 1.000 1.000 1.000 1.000 0.952 0.974 1.000 1.000	0	0	LT 1900 2 1.00 1.00 1.00 1.00 1.00 0.95 1.00 0.98 0.56 1.00	0 00 00 00 00 00 00 00 00 00 00 00 00 0
LG So Lanes 0 fW fHV fG fP fBB fA fLU fRT fLT Sec. fLpb fRpb	LTR 1900 2 1.000 0.909 1.000 1.000 1.000 1.000 0.952 0.973 0.981 1.000 1.000	0	0	0	0	(	)	TR 1900 2 1.000 0.909 1.000 1.000 1.000 1.000 0.952 0.974 1.000 1.000	0	0	LT 1900 2 1.00 1.00 1.00 1.00 1.00 0.95 1.00 0.98 0.56 1.00 1.00	0 00 00 00 00 00 00 00 00 00 00 00 00 0
LG So Lanes 0 fW fHV fG fP fBB fA fLU fRT fLT Sec. fLpb fRpb S	LTR 1900 2 1.000 0.909 1.000 1.000 1.000 1.000 0.952 0.973 0.981 1.000 1.000 3139	0	0	0	0	(	)	TR 1900 2 1.000 0.909 1.000 1.000 1.000 1.000 0.952 0.974 1.000 1.000 1.000 3203	0	0	LT 1900 2 1.00 0.90 1.00 1.00 1.00 0.95 1.00 0.56 1.00 1.00 3251	0 00 00 00 00 00 00 00 00 00 00 00 00 0

-	7 /	Teme		Adj	Adj	Sat	Flow	Gre	enL	ane Gi	roup	
ľ	Appr/ Mvmt	Lane Group	F.TO	w Rate (v)	F.TOM (	Rate s)	Ratio (v/s)	Rat (g/	10 Cap C)	acity (c)	v/c Ratio	
East	tbound											
I	Prot											
I	Perm											
1	Left											
I	Prot											
I	Perm											
	Thru	LTR	2	00	31	39	# 0.06	0.	19 5	83	0.34	
F	Right											
West	tbound											
I	Prot											
I	Perm											
I	Left											
I	Prot											
I	Perm											
-	Thru											
F	Right											
Nort	thbound	d										
I	Prot											
Ţ	Perm											
I	Left											
- 1	Prot											
ī	Perm											
-	Thru	Ψ₽	5	30	30	03	# 0 17	0	26 8	24	0 65	
- 1	Piaht	110	5	52	52	05	π 0.17	0.	20 0	21	0.05	
2011	thhour	4										
JUUG	Drot	a										
1 T	PIOL											
1 T	Perm Loft											
1	Lегс		F	1 /	2.0	<b>F</b> 1	<u>но 1с</u>	0	1 1 1	FDD	0 24	
ł	Prot		5	14	3∠ 10	51	# U.16	0.	4/1 I	533 21	0.34	
ł	Perm		0	1 4	18	60	0.00	0.	286 5	31 0C1	0.00	
-	rnru	Г.Т.	5	14				υ.	/6 2	064	0.25	
ł	Right											
Sum	of flo	ow rati	os for	critic	cal la	ne gro	oups, Yo	c = S	um (v/s	) =	0.39	
Tota	al los	t time	per cy	cle, I	L = 12	.00 se	C					
Crit	tical :	flow ra	te to	capacit	ly rat	io,	Xc	c = (Yc	)(C)/(C	-L) =	0.42	
Cont	trol De	elay an	d LOS	Determi	inatio	n						
Appı	r/ Ra	atios	Unf	Prog	Lane	Incre	emental	Res	Lane G	roup	Appro	ach
Lane	e		Del	Adj	Grp	Facto	or Del	Del				
Grp	v/c	g/C	d1	Fact	Сар	k	d2	d3	Delay	LOS	Delay	LOS
 East	tbound											
	0.01	0.7.0	10 -	1 000	500	0 1 -	<u> </u>	0 0	4.0 0		4.0.0	-
ĿΊR	0.34	0.19	49.6	1.000	583	0.11	0.4	υ.Ο	49.9	ע	49.9	D
West	tbound											
Nort	thbound	d										
TR	0.65	0.26	46.3	1.000	824	0.22	1.8	0.0	48.1	D	48.1	D
Sout	thbound	d										
тm		0 76	<b>Б</b> 1	0 206	2064	0 1 1	0 1	0 0	1 1	7	1 1	7
ТПТ	0.25	0./0	⊃.⊥	0.200	2004	0.11	υ.⊥	0.0	1.1	А	1.1	А

SUPPLEMENTAL PERMITTED LT WORKSHEET for exclusive lefts Input EΒ WB NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 140.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo 0.952 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. _SUPPLEMENTAL PERMITTED LT WORKSHEET_ for shared lefts Input EΒ WΒ NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 140.0 sec Total actual green time for LT lane group, G (s) 105.0 Effective permitted green time for LT lane group, g(s)40.0 36.0 Opposing effective green time, go (s) Number of lanes in LT lane group, N 2

Intersection LOS = C

Intersection delay = 29.0 (sec/veh)

2 Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) 118 0.385 Proportion of LT in LT lane group, PLT 0.000 0.230 Proportion of LT in opposing flow, PLTo 0.00 Adjusted opposing flow rate, Vo (veh/h) 532 Lost time for LT lane group, tL 4.00 Computation LT volume per cycle, LTC=VLTC/3600 4.59 0.952 0.952 0.952 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) 10.87 qf=G[exp(-a * (LTC ** b))]-t], qf <= q0.0 Opposing platoon ratio, Rpo (refer Exhibit 16-11) 1.00 Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] 0.74 gq, (see Exhibit C16-4,5,6,7,8) 19.11 gu=g-gq if gq>=gf, or = g-gf if gq<gf 20.89 9.56 n=Max(gq-gf)/2,0)PTHo=1-PLTo 1.00 0.95 PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) 2.44 EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g 0.10 gdiff=max(gq-gf,0) 0.00 fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min=fmin;max=1.00)0.22 flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** 0.566 Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET Permitted Left Turns EΒ WΒ NB SB Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Pedestrian flow rate, Vpedg (p/h) 0CCpedq Opposing queue clearing green, gq (s) Eff. ped. green consumed by opp. veh. queue, gq/gp OCCpedu Opposing flow rate, Vo (veh/h) OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion of left turns, PLT Proportion of left turns using protected phase, PLTA Left-turn adjustment, fLpb Permitted Right Turns Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Conflicting bicycle volume, Vbic (bicycles/h) Vpedg OCCpedq Effective green, g (s) Vbicg

OCCbicg								
Number	of cross	-street	receivin	q lanes,	Nrec			
Number	of turni	ng lanes	, Nturn	<u> </u>				
ApbT	ion right	t_turna	הסת					
Proport	ion righ	t-turns,	using pr	otected	phase, P	RTA		
Right t	urn adju	stment,	fRpb		-			
		SU	PPLEMENT.	AL UNIFC	RM DELAY	WORKSHE	ET	
						म	BIT WRI.	T NBLT SBLT
Cycle l	ength, C				140.0	sec		
Adj. LT	vol from	m Vol Ad	justment	Workshe	et, v			
v/c rat Protect	10 from ( ed phase	Capacity effecti	Workshe ve green	et, X interva	] a (s)			
Opposin	g queue (	effectiv	e green	interval	, gq			
Unoppos	ed green	interva	l, gu					
Red time Arrival	e r=(C-g rate, g	-gq-gu) a=v/(360	O(max[X.	1 01))				
Protect	ed ph. de	eparture	rate, S	p=s/3600				
Permitt	ed ph. de	eparture	rate, S	s=s(gq+g	u)/(gu*3	600)		
XPerm XProt								
Case								
Queue a	t beginn	ing of g	reen arr	ow, Qa	0			
Queue a Residua	t beginn: l queue,	ing of u Or	nsaturat	ea green	, Qu			
Uniform	Delay,	d1						
		DELAY/	LOS WORK	SHEET WI	TH INITI.	AL QUEUE		
	Initial	Dur.	Uniform	Delay	Initial	Final	Initial	Lane
Appr/	Unmet	Unmet			Queue	Unmet	Queue	Group
Lane Group	Demand Q veh	Demand t hrs.	Unadj. ds	Adj. dl sec	Param. u	Demand Q veh	Delay d3 sec	Delay d sec
Eastbou	 nd							
	0.0						0.0	
LTR	0.0	0.00	57.0	49.6	0.00	0.0	0.0	49.9
	0.0						0.0	
Westbou	nd							
	0.0						0.0	
	0.0						0.0	
Northbo	und							
чъ	0.0	0 0 0	E 2 0	16 2	0 0 0	0 0	0.0	10 1
TR	0.0	0.00	52.0	40.3	0.00	0.0	0.0	48.1
Southbo	und						0 0	
LT	0.0	0.00	17.0	5.1	0.00	0.0	0.0	1.1
	0.0		± / • 0	J.T			0.0	-•-
	Intersec	tion Del	ay 29.0	sec/v	reh I	ntersect	ion LOS	C
			BACK	OF QUEU	E WORKSH	EET		

	Eastbound	Westbound	Northbound	Southbound
LaneGroup	LTR		TR	LT
Init Queue	0.0	Ì	0.0	0.0
Flow Rate	105	Ì	279	269
So	1900	Ì	1900	1900
No.Lanes	0 2 0	0 0 0	0 2 0	0 2 0
SL	1648	İ	1682	1431
LnCapacity	306	İ	432	1084
Flow Ratio	0.1	İ	0.2	0.2
v/c Ratio	0.34	İ	0.65	0.25
Grn Ratio	0.19	ĺ	0.26	0.76
I Factor	1.000	Ì	1.000	0.854
AT or PVG	3	Ì	3	6
Pltn Ratio	1.00	Ì	1.00	1.25
PF2	1.00	ĺ	1.00	0.22
Q1	3.6	Ì	9.7	0.6
kB	0.4	ĺ	0.5	0.8
Q2	0.2	ĺ	0.9	0.3
Q Average	3.8	ĺ	10.6	0.9
Q Spacing	25.0	Ì	25.0	25.0
Q Storage	0		0	0
Q S Ratio				
70th Percent	tile Output:			
fB%	1.2		1.2	1.2
BOQ	4.5		12.5	1.1
QSRatio				
85th Percent	tile Output:			
fB%	1.6		1.5	1.6
BOQ	5.9		16.0	1.4
QSRatio				
90th Percent	tile Output:			
fB%	1.7		1.6	1.8
BOQ	6.5		17.4	1.6
QSRatio				
95th Percent	tile Output:			
fB%	2.0		1.8	2.1
BOQ	7.5		19.4	1.9
QSRatio				l İ
98th Percent	tile Output:			•
fB%	2.4		2.1	2.6
BOQ	9.3		22.7	2.4
QSRatio				

Analyst: Agency: Date: Period: Project E/W St:	PB 6/25/2( AM Peak ID: I-2 Harrisc	)10 K Hour 290 Phas on Stree	se 1 S [.] et	tudy		Int Are Jur Yea N/S	er.: Ha a Type isd: r : E: St: 1	arriso : All xistin 7th Av	on Str other ng venue	eet & area	217th as	Ave	nue
			C.T.		יאד כיק		OTT ON	OTTNANA 7	770				
	 Ι τ		SI	GNALIZI Wogi	ED IN bour	A	L Nor	SUMMAI + bbour	₹⊻	 S 01			
		sastbour T		wes   T		u D		T T		T SOL		una D	
		T	K		T	IC IC		T		ш	T	K	
No Iane	c	0 0		   1	 2		0		·		 2		
ICConfig		0 0	0	⊥   ⊤	2 TD	0	Doft	2 T	0	0	2 TD	0	
Volume					226 ·	155		197			17/	106	
Vorume Tane Wid	+ h				120	100		107 12 0			12 0	100	
DAILE WIG				1 2 • 0 . 	12.0	22	112.0	12.0			12.0	63	
RIOR VOI	I			I		55	I		I			05	I
Duration	0.2	25	Area '	Туре: Л	All o	ther	areas						
				Sign	nal Oj	perat	ions						
Phase Co	mbinati	lon l	2	3	4			5	6	1		8	
EB Leit						NB	Leit	A	A				
Thru	L.						Thru	A	А				
Rign	t						Right						
Peas		7					Peas						
WB LEIC		A A				55 	Thru		7				
IIII u Diab	+	A A				1	Diaht		A 7				
RIGII	L	A				1	Doda		A				
NP Pich	+					 	Peus Piaht						
RB RIGH	+						Right						
Green		25 0					Right	67 0	35 0				
Vellow		2J.U 1 0						3 0	1 0				
All Rod		1 0						0.0	1 0				
AII Keu		1.0						Cvc	⊥.∪ le Len	ath:	140	0	GACG
		Tr	terge	ction 1	Derfo	rmanc	e Summ	arv		guii	140.	0	5005
Appr/	Lane		i Sat	Rai	tios		Lane (	Group	App	roacł	 า		
Lane	Group	Flow	, Bate	ita	0100		Dane	oroup	1122	Louoi	-		
Grp	Capacit	cy (	s)	v/c	g/	C	Delay	LOS	Dela	y LOS	5		
		<u> </u>											
Eastboun	d												
Westboun	d												
L	305	164	1	0.39	0.	19	50.9	D					
TR	586	315	55	0.80	0.	19	62.6	Е	60.2	Е			
Northbou	nd												
DefL	1030	164	1	0.23	0.	76	4.9	A					
Т	1308	172	27	0.15	0.	76	1.0	A	3.2	A			
Southbou	nd												
ΨD	Q O 1	210	1	0 20	0	26	/1 0	П	/1 0	Г			
71	ΟΔΙ	212	<i>′</i> ⊥	0.20	υ.	20	41.0	D	41.0	ע			
	Inters	section	Delay	= 37.	) (s	ec/ve	h) I	nterse	ection	LOS	= D		

Phone: Fax: E-Mail: _____OPERATIONAL ANALYSIS______

Analyst:Agency/Co.:PBDate Performed:6/25/2010Analysis Time Period:AM Peak HourIntersection:Harrison Street &17th AvenueArea Type:All other areasJurisdiction:Jurisdiction:Analysis Year:ExistingProject ID:I-290 Phase 1 StudyE/W St:Harrison StreetN/S St:17th Avenue

_____VOLUME DATA______

	Eas	stbou	nd	Wes	stbour	nd	Noi	rthbou	nd	Sou	ithboi	ind
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
J					206	1		100			1 1 4	106
Volume				1 1 4	326	155	230	T8./			174	T00
% Heavy Veh				10	10	10	10	10			10	10
PHF				0.95	0.95	0.95	0.95	0.95			0.95	0.95
PK 15 Vol				30	86	41	61	49			46	28
Hi Ln Vol	ĺ			İ			İ					İ
% Grade	ĺ			ĺ	0		Ì	0			0	ĺ
Ideal Sat				1900	1900		1900	1900			1900	
ParkExist	ĺ			İ			İ					İ
NumPark				İ			İ					İ
No. Lanes	j o	0	0	1	2	0	0	2	0	0	2	0
LGConfig				L	TR		Defl	с т			TR	
Lane Width	ĺ			12.0	12.0		12.0	12.0			12.0	İ
RTOR Vol	ĺ			İ		33	İ					63
Adj Flow				120	471		242	197			228	Í
%InSharedLn	ĺ			İ			İ					İ
Prop LTs				ĺ	0.00	00	1.000	0.00	0		0.00	0
Prop RTs	ĺ			0.	.272		0	.000		0.	197	ĺ
Peds Bikes	0			0			Ì			0		ĺ
Buses				0	0		0	0			0	ĺ
%InProtPhase	2						0.0					İ
Duration	0.25		Area 🗄	Гуре:	All d	other a	areas					

## _____OPERATING PARAMETERS______OPERATING PARAMETERS_____

	Eas	stbou	Ind	Wes	stbo	und		No	rthbo	und	Sc	uthbo	und
	L	Т	R	L	Т	R	ļ	L	Т	R	L	Т	R
							!				!		
Init Unmet				0.0	0.0			0.0	0.0			0.0	
Arriv. Type				3	3			3	6			3	
Unit Ext.				3.0	3.0			3.0	3.0			3.0	
I Factor				ĺ	1.0	00	ĺ		0.79	9	Ì	1.00	0
Lost Time				2.0	2.0			2.0	2.0			2.0	
Ext of g				3.0	3.0			2.0	3.0			3.0	
Ped Min g		3.2			3.2		ĺ				ĺ	3.2	ĺ

				PH2	ASE	DATA_					
Pha	se Combination	1	2	3	4			5	6	7	8
EB	Left Thru Right Peds					NB	Left Thru Right Peds	A A	A A		
WB	Left Thru Right Peds	A A A				SB	Left Thru Right Peds		A A		
NB	Right					EB	Right				
SB	Right					WB	Right				
Gre Yel All	en : low : Red :	25.0 4.0 1.0			I			67.0 3.0 0.0	35.0 4.0 1.0		

Volume Adiu	atmont	_VOLU	ME ADU	JOIME		D SAI	JRAIIO	N FLO	W WORK	SUFFI		
volume Adju	Eas	, thou	nd	We	stbou	nd	No	rthbo	und		uthbo	und
		T	R		Т	R		Т	R	T.	Т	R
		_			_			_			_	
Volume, V				114	326	155	230	187			174	106
PHF	İ			0.95	0.95	0.95	0.95	0.95		İ	0.95	0.95
Adj flow	Ì			120	343	128	242	197		Ì	183	45
No. Lanes	0	0	0	1	. 2	0	0	2	0	0	2	0
Lane group				L	TR		Def	L T			TR	
Adj flow				120	471		242	197			228	
Prop LTs					0.0	00	1.00	0 0.0	00		0.0	00
Prop RTs				0	.272		0	.000		0	.197	
Ea LG So Lanes 0 fw	0	.a 0	L 1900 1	Vesto I 19 2	00000000000000000000000000000000000000		DefL L900	T 1900 2	0	0	UTIDO TR 190 2	
т W Ғ Ш 77			1.00	10 1.	900	-	1.000 1.000	1.000			1.0	00
fG			1 00	$10^{-1}$	000			1 000			1 0	00
fP			1.00	$10^{-1}$	000	-	1.000	1.000			1.0	0.0
fBB			1.00	0 1.	000	-	L.000	1.000			1.0	00
fA			1.00	00 1.	000	-	L.000	1.000			1.0	00
fLU			1.00	0 0.	952		L.000	1.000			0.9	52
frt				Ο.	959			1.000			0.9	70
fLT			0.95	50 1.	000	(	0.950	1.000			1.0	00
Sec.						(	).497					
fLpb			1.00	00 1.	000		L.000	1.000			1.0	00
fRpb				1.	000			1.000			1.0	00
S			1641	L 31	55	-	L641	1727			319	1
Sec.						8	358					
			CAI	PACIT	'Y AND	LOS V	VORKSH	EET				

Capacity Analysis and Lane Group Capacity

				Adj	Adj	Sat	Flow	Gre	en	Lane G	roup	
App Myrr	pr/ nt	Lane Group	Flo	w Rate	Flow (s	Rate	Ratio	Rat	io Ca	pacity	v/c Ratio	
		G10up		(v) 			(v/s)	(9/		(0)		
astbo	ound											
Prc	ot											
Per	cm											
Lef	Ēt											
Pro	ot											
Per	rm											
Thr	cu											
Rig	ght											
lestbo	ound											
Pro	ot											
Per	cm											
Lef	Ēt	L	1	20	164	1	0.07	0.	19	305	0.39	
Pro	ot											
Per	^m											
- Cr Thr	^1J	ΤR	4	71	315	5	# 0 15	Ο	19	586	0 8 0	
Rio	nht		1	· -	515	-		•••				
n+9 Iorthb	 											
	55 unu 5+		n	42	161	1	# ∩ 1⊑	Ω	479	785	0 21	
P C	cm		ے م	т <b>С</b> і		т.	π 0.10	0.	296	215	0.01	
rei	 = +-	Doft	0	10	800		0.00	0.	200 76	440 1000	0.00	
ьег	_ L \+	регр	2	72				υ.	/0	T020	0.23	
Pro												
Per	m	m	-	07	1 0 0	7	0 1 1	0	76	1 2 0 0	0 1 5	
Thr	u u	T.	T	91	172	/	0.11	υ.	0 \	7308	0.15	
Kig	int -											
outhb_	ound	L										
Pro	ot											
Per	cm											
Lef	t											
Pro	ot											
Per	rm											
Thr	ru	TR	2	28	319	1	# 0.07	0.	26	821	0.28	
Rig	ght											
um of	 E flo	w rati	os for	critic	cal lan	e gro	ups, Yc	= S	 um (v/	(s) =	0.37	
otal	lost	time	per cy	cle, I	L = 13.	00 se	C					
ritic	cal f	low ra	te to	capacit	ty rati	ο,	Xc	= (Yc	)(C)/(	C-L) =	0.41	
ontro	ol De	lay an	d LOS	Determ	ination							
oppr/	Ка	LIOS	UNI	Prog	Lane	Incre	mental	Kes	Lane	Group	appro	acn
ane		~/ 7	Det a1	ACJ Foot	Grp	racto	r Del	Det				TOO
тЪ	v/C	g/C	αı	ract	cap	v	uΖ	us	Deta	ку ЦОЗ	ретаў	тор
astbo	ound											
lestbo	ound											
J 0	).39	0.19	50.1	1.000	305	0.11	0.8	0.0	50.9	D		
R 0	).80	0.19	54.6	1.000	586	0.35	8.0	0.0	62.6	Е	60.2	Е
- 0		/					5.0			-		_
[orthb	JOUING											
oft	) 22	0 76	4 Q	1 000	1030	0 1 1	0 1	0 0	4 Q	Δ		
	) 15	0.76	4 7	1 206	1308	0 11	0 0	0.0	1 0	Δ	3 2	Δ
0	· • ± 0	0.70	л./	0.200	T 2 0 0	0.11	0.0	0.0	<b>T</b> .0	А	J.Z	п
outhb	oound	l										
rr 0	).28	0.26	41.6	1.000	821	0.11	0.2	0.0	41.8	D	41.8	D

SUPPLEMENTAL PERMITTED LT WORKSH	EET			
for exclusive lefts				
Input				
Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 140.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h)	EB	WB	NB 105.0 40.0 36.0 1 2 242	SB
Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation			1.000 0.00 228 5.00	
LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq <gf n=Max(gq-gf)/2,0) PTHo=1-PLTO PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)] EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+P1)/g gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2 or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by mu</gf 	0.952 -1)],(f ltilane	Emin<=f	9.41 0.952 4.66 0.0 1.00 0.74 7.41 32.59 3.71 1.00 1.64 0.10 0.00 0.50 fm<=1.0 0.497	1.000
<pre>see text. * If Pl&gt;=1 for shared left-turn lanes with N&gt;1, then as left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive less For special case of multilane approach opposed by sing or when gf&gt;gq, see text.</pre>	ssume d ft-turn le-lane	le-fact lanes appro	to s, flt= pach	=fm.
SUPPLEMENTAL PERMITTED LT WORKSH	EET			
for shared lefts	EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 140.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N				

Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT 0.000 0.000 0.000 Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 0.952 0.952 1.000 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min = fmin; max = 1.00)flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET Permitted Left Turns EΒ WΒ NBSB Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Pedestrian flow rate, Vpedg (p/h) 0CCpedq Opposing queue clearing green, gq (s) Eff. ped. green consumed by opp. veh. queue, gq/gp OCCpedu Opposing flow rate, Vo (veh/h) OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion of left turns, PLT Proportion of left turns using protected phase, PLTA Left-turn adjustment, fLpb Permitted Right Turns Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Conflicting bicycle volume, Vbic (bicycles/h) Vpedg OCCpedq Effective green, g (s) Vbicg

OCCbicg OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion right-turns, PRT Proportion right-turns using protected phase, PRTA Right turn adjustment, fRpb ____SUPPLEMENTAL UNIFORM DELAY WORKSHEET__ EBLT WBLT NBLT SBLT Cycle length, C 140.0 sec Adj. LT vol from Vol Adjustment Worksheet, v 242 v/c ratio from Capacity Worksheet, X 0.23 Protected phase effective green interval, g (s) 67.0 Opposing queue effective green interval, gq 7.41 Unopposed green interval, gu 32.59 Red time r=(C-g-gq-gu)33.0 Arrival rate, qa=v/(3600(max[X,1.0]))0.07 Protected ph. departure rate, Sp=s/3600 0.456 Permitted ph. departure rate, Ss=s(qq+qu)/(qu*3600) 0.29 XPerm 0.28 XProt 0.22 Case 1 2.22 Queue at beginning of green arrow, Qa Queue at beginning of unsaturated green, Qu 0.50 Residual queue, Or 0.00 Uniform Delay, d1 4.8 ____DELAY/LOS WORKSHEET WITH INITIAL QUEUE____ Initial Dur. Uniform Delay Initial Final Initial Lane Appr/ Unmet Unmet Queue Unmet Oueue Group Lane Demand Demand Unadj. Adj. Param. Demand Delay Delav Group Q veh t hrs. ds dl sec Q veh d3 sec d sec u Eastbound 0.0 0.0 0.0 0.0 0.0 0.0 Westbound 0.0 0.00 57.0 50.1 0.00 0.0 0.0 50.9 T. 0.0 0.00 57.0 54.6 0.00 0.0 0.0 62.6 ΤR 0.0 0.0 Northbound 0.00 4.8 0.00 0.0 4.9 DefL 0.0 0.0 0.00 т 0.0 17.0 4.7 0.00 0.0 0.0 1.0 0.0 0.0 Southbound 0.0 0.0 0.0 0.00 41.6 0.00 41.8 ΤR 52.0 0.0 0.0 0.0 0.0 Intersection Delay 37.0 sec/veh Intersection LOS D

_____BACK OF QUEUE WORKSHEET_____

	Eastbound	Westbound	Northbound	Southbound
LaneGroup		L TR	DefL T	TR
Init Queue		0.0 0.0	0.0 0.0	0.0
Flow Rate		120 247	242 197	119
So		1900 1900	1900 1900	1900
No.Lanes	0 0 0	1 2 0	0 2 0	
SL		1641 1657	1348 1727	1675
LnCapacity		305 307	1030 1308	431
Flow Ratio		0.1 0.1	0.2 0.1	0.1
v/c Ratio		0.39 0.80	0.23 0.15	0.28
Grn Ratio		0.19 0.19	0.76 0.76	0.26
I Factor		1.000	0.799	1.000
AT or PVG		3 3	3 6	3
Pltn Ratio		1.00 1.00	1.00 1.25	1.00
PF2		1.00 1.00	1.00 0.21	1.00
Q1		4.1 9.2	2.5 0.4	3.7
kВ		0.4 0.4	0.7 0.8	0.5
Q2		0.3 1.5	0.2 0.1	0.2
Q Average		4.4 10.7	2.7 0.6	3.9
Q Spacing		25.0 25.0	25.0 25.0	25.0
Q Storage		0 0	0 0	0
Q S Ratio				İ İ
70th Percent	tile Output:			
fB%		1.2 1.2	1.2 1.2	1.2
BOQ		5.2 12.6	3.2 0.7	4.7
QSRatio				
85th Percent	tile Output:			
fB%		1.6 1.5	1.6 1.6	1.6
BOQ		6.8 16.2	4.3 1.0	6.1
QSRatio				
90th Percent	tile Output:			
fB%		1.7 1.6	1.7 1.8	1.7
BOQ		7.5 17.5	4.8 1.1	6.8
QSRatio				
95th Percent	tile Output:			
fB%		2.0 1.8	2.0 2.1	2.0
BOQ		8.6 19.6	5.5 1.2	7.7
QSRatio				
98th Percent	tile Output:			
fB%		2.4 2.1	2.5 2.7	2.4
BOQ		10.6 22.9	6.8 1.6	9.5
QSRatio				

Analyst: Agency: Date: Period: Project E/W St:	PB 6/25 PM P ID: Harr	/2010 eak H I-290 ison	our Phas Stree	se 1 St et	tudy		Int Are Jur Yea N/S	er.: H a Type isd: r : E St: 1	arris : All xisti: 7th A [.]	on Str other ng venue	eet & area	2 17t as	:h A	ven	ue
				ST	GNALTZ	лер ті	NTERSE	CTION	SUMMA	RY					
		Eas	tbour	nd	Wes	stbou	nd	Nor	thbou	nd		ithbo	ound		
	İ	L	T	R	I L	T	R	L	T	R	L	T	R	_	
	l				_										
No. Lane	s	0	0	0	   1	2.	0	0	2.	0	0	2	0		
LGConfig	-	•	Ū	U U	і — І т.	- TR	U U	Defl	T		0	— ТТ	ء ج		
Volume	ł				153	314	129	191	300	l l		335	10	5	
Lane Wid	th				12.0	12.0		12.0	12.0			12.(	ი _ ლ	0	
RTOR Vol							52						18		
	I				1		52	I		I			10		I
Duration		0.25		Area '	Type:	All (	other	areas							
Dhage Co	mbin		1	 2	3 2T <i>č</i>	JIIAL (	Jperac	10115		6					
FR Toft		ation	. 1	2	2	7		⊺ of t	7	7	/		0		
цв цетс Thru								Thru	A A	A A					
Pich	+							Diaht	л	Л					
Deda								Deda							
WB Loft			δ					I.oft							
MD LCIC Thru			Δ					Thru		Δ					
Pich	+		A N					Diaht		А 7					
Doda			A					Doda		A					
NB Righ	+						   FB	Right							
SB Righ	+							Right							
Green			25 0					Rigiic	67 0	35 0					
Vellow			<u> </u>						3 0	4 0					
All Red			1 0						0 0	1 0					
AII Reu			1.0						Cvc	le Len	ath:	140	.0	se	cs
			II	nterse	ction	Perf	ormanc	e Summ	ary		5	-			
Appr/	Lane		 Ad	j Sat	Ra	atios		Lane	Group	 qqА	roach	 า			
Lane	Grou	р	Flov	v Rate					-						
Grp	Capa	city		(s)	v/c	g	/ C	Delay	LOS	Dela	Y L08	5			
Eastboun	.d														
Westhoun	d														
T	305		16/	1 1	0 53	2 0	10	52 2	Л						
ц тр	106		219	±⊥ 21	1 01		10	105 /	D F	90 8	F				
IK	100		210	Γ	1.01		• 1 9	103.1	Ľ	90.0	Ľ				
Northbou	nd								_						
Deil	934	~	164	11	0.22	2 0	.76	5.6	A		_				
Л,	130	8	172	27	0.24	± 0	.76	1.1	A	2.9	A				
Southbou	nd														
TR	820		318	37	0.54	1 0	.26	45.6	D	45.6	D				
	Int	ersec	tion	Delay	= 48.	.1 (;	sec/ve	h) I	nters	ection	LOS	= D			

Phone: Fax: E-Mail: _____OPERATIONAL ANALYSIS______

Analyst:Agency/Co.:PBDate Performed:6/25/2010Analysis Time Period:PM Peak HourIntersection:Harrison Street & 17th AvenueArea Type:All other areasJurisdiction:Jurisdiction:Analysis Year:ExistingProject ID:I-290 Phase 1 StudyE/W St:Harrison StreetN/S St:17th Avenue

_____VOLUME DATA______

	Eas	tbou	nd	Wes	stbour	nd	No	rthbou	ınd	Soi	ıthboı	ind
	L	Т	R	L L	Т	R	L	Т	R	L	Т	R
TT - 7					214	100		200				105
Volume				1153	314	129	119T	300			335	105
% Heavy Veh				10	10	10	10	10			10	10
PHF				0.95	0.95	0.95	0.95	0.95			0.95	0.95
PK 15 Vol				40	83	34	50	79			88	28
Hi Ln Vol				ĺ			İ					Í
% Grade				ĺ	0		İ	0			0	ĺ
Ideal Sat				1900	1300		1900	1900			1900	İ
ParkExist												j
NumPark							Ì					i
No. Lanes	j o	0	0	1	2	0	0	2	0	j o	2	0
LGConfig				L	TR		Def1	с т			TR	İ
Lane Width				12.0	12.0		12.0	12.0			12.0	j
RTOR Vol				İ		52						18
Adj Flow	ĺ			161	412		201	316		ĺ	445	j
%InSharedLn												j
Prop LTs					0.00	0 0	1.000	0.00	0		0.00	j oc
Prop RTs	ĺ			j o.	.197		0	.000		jo.	207	j
Peds Bikes	j o			j o			İ			j o		j
Buses	ĺ			0	0		0	0			0	j
%InProtPhase	2			ĺ			0.0					j
Duration	0.25		Area 🗅	Гуре:	All d	other	areas					

## _____OPERATING PARAMETERS______OPERATING PARAMETERS_____

	Eas	stbou	nd	Wes	stbo	und		No	rthbo	und	So	uthbo	und	
	L	Т	R	L	Т	R		L	Т	R	L	Т	R	ļ
Init Unmet				0.0	0.0			0.0	0.0			0.0		
Arriv. Type				3	3			3	6			3		
Unit Ext.				3.0	3.0			3.0	3.0			3.0		
I Factor					1.0	00	ĺ		0.79	б	ĺ	1.00	0	ĺ
Lost Time				2.0	2.0			2.0	2.0			2.0		
Ext of g				3.0	3.0			2.0	3.0			3.0		
Ped Min g		3.2			3.2		ĺ				ĺ	3.2		ĺ

				PH2	ASE	DATA_					
Pha	se Combination	1	2	3	4			5	6	7	8
EB	Left Thru Right Peds					NB	Left Thru Right Peds	A A	A A		
WB	Left Thru Right Peds	A A A				SB	Left Thru Right Peds		A A		
NB	Right					EB	Right				
SB	Right					WB	Right				
Gre Yel All	en : low : Red :	25.0 4.0 1.0			I			67.0 3.0 0.0	35.0 4.0 1.0		

Volume Adiu	stment	-vollo -	ME ADUC	01111		D DAI	JIAIIO	N PLO	W WOILI			
vorume Auju	Eas	- stbou	nd	We	stbou	nd	No	rthbo	und	So	uthbo	und
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
	İ						_1			.		
Volume, V				153	314	129	191	300			335	105
PHF				0.95	0.95	0.95	0.95	0.95			0.95	0.95
Adj flow				161	331	81	201	316			353	92
No. Lanes	0	0	0	1	. 2	0	0	2	0	0	2	0
Lane group				$\mathbf{L}$	TR		Def	L T			TR	
Adj flow				161	412		201	316			445	
Prop LTs					0.0	00	1.00	0 0.0	00		0.0	00
Prop RTs				0	.197		0	.000		0	.207	
Ea LG	stbour	nd	(See L2 V L	lestk T	ound R	7 10 0	Nort DefL	hboun T	d	So	uthbo TR	und
So			1900	) 13	00		1900	1900			190	0
Lanes O	0	0	1	2	0		0	2	0	0	2	0
fW			1.00	001.	000		1.000	1.000			1.0	00
fHV			0.90	)9 0.	909		0.909	0.909			0.9	09
fG			1.00	0 1.	000		1.000	1.000			1.0	00
fP			1.00	00 1.	000		1.000	1.000			1.0	00
fBB			1.00	00 1.	000		1.000	1.000			1.0	00
fA			1.00	00 1.	000		1.000	1.000			1.0	00
fLU			1.00	0 0.	952		1.000	1.000			0.9	52
fRT				0.	971			1.000			0.9	69
fLT			0.95	50 1.	000		0.950	1.000			1.0	00
Sec.							0.303					
fLpb			1.00	)0 1.	000		1.000	1.000			1.0	00
t Rpb				1.	000			1.000			1.0	00
S			1641	. 21	84		1641	1727			318	7
Sec.			_				523					
			CAE	PACIT	'Y AND	LOS	WORKSH	EET				

Capacity Analysis and Lane Group Capacity

A M	ppr/ lvmt	Lane Group	Flo	Adj w Rate (v)	Adj Flow (†	Sat Rate s)	E F	Flow Ratio (v/s)	Gre Rat (g/	en io C)	La Capa	ane Gr acity (c)	roup v/c Ratio	
East	bound													
P	rot													
P	erm													
L	eft													
P	rot													
P	erm													
Т	'hru													
R	light													
West	bound													
P	rot													
P	erm	_	-	<b>C</b> 3		4 7		0 1 0	0	1.0		-	0 50	
ட் –	eit	Г	T	61	16	4⊥		0.10	0.	19	3(	15	0.53	
Р –	rot													
Р	erm		4	1.0	0.1	0.4		0 1 0	0	1.0			1 0 1	
Т	nru	.T.K	4	ΤZ	21	84	#	0.19	0.	Т.Ә	4(	16	1.01	
R	light	3												
Nort	npoun	a	-	0.1		4 1		0 1 0	^	4	_		0.05	
P -	rot		2	UΤ	16	4⊥ ⊃		0.12	0.	479	./ {	35	0.26	
P -	erm	Deft	0	0.1	52	3		0.00	0.	286	14	±9	0.00	
L -	ett	DerL	2	UΤ					Ο.	/6	9.	34	0.22	
Р	rot													
P	erm	m	~	1.0	1 -	0 7	. ار	0 1 0	^	76			0 0 4	
T	hru	.L.	3	10	Τ./.	27	Ħ	0.18	0.	76	I.	308	0.24	
R	light	3												
Sout	hbound	d												
P	rot													
P	erm													
ـــــــــــــــــــــــــــــــــــــ	eit													
P	rot													
P	erm					~ -				~ ~				
T	'hru	TR	4	45	31	87	#	0.14	0.	26	82	20	0.54	
R	ight													
		ow rati	og for			ne arc	- <u>—</u> -	ng Va		11m (	w/a	) _	0 51	
Tota	l logi	Jw iaci F time '	os loi per cv	cie I	ar 1a . = 12		o a F	<i>5</i> , 10	- 5	uni (	v/b	) –	0.51	
Crit	ical	flow ra	te to	capacit	v rat	io.	- 0	Хc	$= (Y_{C})$	) (C)	/(C-	-T.) =	0 56	
U		IA		Sapacit	- I LUC	_~,		210	(10	, ( )	, (C	<b>_</b> , _	5.50	
Cont	rol De	elav an	d LOS	Determi	natio	n								
Appr	·/ Ra	atios	Unf	Prog	Lane	Incre	eme	ental	Res	Lar	ne Gi	coup	Approa	ach
Lane	,		Del	Adi	Grp	Facto	or	Del	Del			<u>-</u>		
Grp	v/c	g/C	d1	Fact	Cap	k		d2	d3	De	lay	LOS	Delay	LOS
East	bound													
West	bound													
T,	0 53	0 19	51 5	1 000	305	0 13		1.7	0 0	53	2	D		
 ТР	1 01	0 19	57 0	1 000	406	0 50		48 4	0 0	105	. 4	- म	90 8	ਜ
T 1/	<b>T.</b> 0T	0.19	57.0	1.000	100	0.00		10.1	0.0	TUU	· • I	T.	20.0	T.
Nort	hbour	7												
Deft	. 0 22		56	1 000	924	0 1 1		0 1	0 0	56	5	Δ		
летп Д		0.70	5.0	1 20K	1308	0.11		0.1	0.0	1 1	,	Γ Δ	2 9	Δ
Ŧ	0.24	0.70	J. I	0.200	T 2 0 0	0.11		0.1	0.0	т.Т	-	л	4.7	Л
Sout	hbound	d												
TR	0.54	0.26	44.9	1.000	820	0.14		0.7	0.0	45.	б	D	45.6	D

SUPPLEMENTAL PERMITTED LT WORKSH	EET			
for exclusive lefts				
Input	FB	MB	NB	<b>GB</b>
Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 140.0 sec Total actual green time for LT lane group, G (s)			105.0	50
Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (yeb/b)			40.0 36.0 1 2 201	
Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL			1.000 0.00 445 5.00	
LT volume per cycle, LTC=VLTC/3600 Opposing lane util factor, fLUo	0 952		7.82 0.952	1 000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Oueue Ratio, gro=Max[1-Rpo(go/C),0]	0.952		9.09 0.0 1.00 0.74	1.000
gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq <gf n=Max(gq-gf)/2,0) PTHo=1-PLTo</gf 			15.52 24.48 7.76 1.00	
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)] EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g			1.00 2.02	
<pre>gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2- or_flt=[fm+0_91(N_1)]/N**</pre>	-1)],(f	imin<=:	0.00 0.30 Em<=1.0	00)
Left-turn adjustment, fLT			0.303	
For special case of single-lane approach opposed by mut see text. * If Pl>=1 for shared left-turn lanes with N>1, then as	ltilane ssume d	e appro	bach, to	
** For permitted left-turns with multiple exclusive less For special case of multilane approach opposed by sing or when gf>gq, see text.	ft-turn le-lane	lanes appro	s, flt: bach	=fm.
SUPPLEMENTAL PERMITTED LT WORKSHI	EET			
Input				
Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 140.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N	EB	WB	NB	SB

Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT 0.000 0.000 0.000 Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 0.952 0.952 1.000 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min = fmin; max = 1.00)flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET Permitted Left Turns EΒ WΒ NBSB Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Pedestrian flow rate, Vpedg (p/h) 0CCpedq Opposing queue clearing green, gq (s) Eff. ped. green consumed by opp. veh. queue, gq/gp OCCpedu Opposing flow rate, Vo (veh/h) OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion of left turns, PLT Proportion of left turns using protected phase, PLTA Left-turn adjustment, fLpb Permitted Right Turns Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Conflicting bicycle volume, Vbic (bicycles/h) Vpedg OCCpedq Effective green, g (s) Vbicg
OCCbicg OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion right-turns, PRT Proportion right-turns using protected phase, PRTA Right turn adjustment, fRpb ____SUPPLEMENTAL UNIFORM DELAY WORKSHEET__ EBLT WBLT NBLT SBLT Cycle length, C 140.0 sec Adj. LT vol from Vol Adjustment Worksheet, v 201 v/c ratio from Capacity Worksheet, X 0.22 Protected phase effective green interval, g (s) 67.0 Opposing queue effective green interval, gq 15.52 Unopposed green interval, gu 24.48 Red time r=(C-g-gq-gu)33.0 Arrival rate, qa=v/(3600(max[X,1.0]))0.06 Protected ph. departure rate, Sp=s/3600 0.456 Permitted ph. departure rate, Ss=s(qq+qu)/(qu*3600) 0.24 XPerm 0.38 XProt 0.18 Case 1 Queue at beginning of green arrow, Qa 1.84 Queue at beginning of unsaturated green, Qu 0.87 Residual queue, Or 0.00 Uniform Delay, d1 5.6 ____DELAY/LOS WORKSHEET WITH INITIAL QUEUE____ Initial Dur. Uniform Delay Initial Final Initial Lane Appr/ Unmet Unmet Queue Unmet Oueue Group Lane Demand Demand Unadj. Adj. Param. Demand Delay Delav Group Q veh t hrs. ds dl sec Q veh d3 sec d sec u Eastbound 0.0 0.0 0.0 0.0 0.0 0.0 Westbound 0.00 0.0 0.00 57.0 51.5 0.0 0.0 53.2 T. 0.0 0.00 57.0 57.0 0.00 1.5 0.0 105.4 ΤR 0.0 0.0 Northbound 0.00 0.0 DefL 0.0 5.6 0.00 0.0 5.6 0.00 т 0.0 17.0 5.1 0.00 0.0 0.0 1.1 0.0 0.0 Southbound 0.0 0.0 0.0 0.00 44.9 0.00 45.6 ΤR 52.0 0.0 0.0 0.0 0.0 Intersection Delay 48.1 sec/veh Intersection LOS D

_____BACK OF QUEUE WORKSHEET_____

	Eastbound	Westbound	Northbound	Southbound
LaneGroup		L TR	DefL T	TR
Init Queue		0.0 0.0	0.0 0.0	j 0.0 j
Flow Rate		161 216	201 316	233
So		1900 1300	1900 1900	1900
No.Lanes	0 0 0	1 2 0	0 2 0	
SL		1641 1147	1223 1727	1673
LnCapacity		305 213	934 1308	430
Flow Ratio		0.1 0.2	0.2 0.2	0.1
v/c Ratio		0.53 1.01	0.22 0.24	0.54
Grn Ratio		0.19 0.19	0.76 0.76	0.26
I Factor		1.000	0.796	1.000
AT or PVG		3 3	3 6	3
Pltn Ratio		1.00 1.00	1.00 1.25	1.00
PF2		1.00 1.00	1.00 0.22	1.00
Q1		5.7 8.4	2.1 0.8	7.8
kВ		0.4 0.4	0.7 0.8	0.5
Q2		0.5 3.3	0.2 0.3	0.6
Q Average		6.1 11.7	2.2 1.1	8.4
Q Spacing		25.0 25.0	25.0 25.0	25.0
Q Storage		0 0	0 0	0
Q S Ratio			İ	İ
70th Percent	tile Output:			
fB%		1.2 1.2	1.2 1.2	1.2
BOQ		7.3 13.7	2.7 1.3	10.0
QSRatio				
85th Percent	tile Output:			
fB%		1.5 1.5	1.6 1.6	1.5
BOQ		9.5 17.6	3.5 1.7	12.9
QSRatio				
90th Percent	tile Output:			
fB%		1.7 1.6	1.8 1.8	1.7
BOQ		10.4 19.0	3.9 1.9	14.0
QSRatio				
95th Percent	tile Output:			
fB%		1.9 1.8	2.0 2.1	1.9
BOQ		11.8 21.2	4.5 2.2	15.8
QSRatio				
98th Percent	tile Output:			
fB%		2.3 2.1	2.5 2.6	2.2
BOQ		14.3 24.6	5.7 2.8	18.8
QSRatio				

_____ERROR MESSAGES_____

No errors to report.

Phone: E-Mail: Fax:

Analyst: Agency/Co.: PB Date Performed: 6/25/2010 Analysis Time Period: AM Peak Hour Intersection: Harrison Street & 9th Avenue Jurisdiction: Units: U. S. Customary Analysis Year: Existing Project ID: I-290 Phase 1 Study East/West Street: Harrison Street North/South Street: 9th Avenue ______Worksheet 2 - Volume Adjustments and Site Characteristics______

	Eastbound		Westbound			Nor	thbou	ind	Sou	thbo	und	
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume	0	0	0	49	80	52	53	304	0	0	314	41
% Thrus Lef	t Lane	2				50			50		!	50

Ea	astbound	West]	oound	North	oound	Southbound	
LI	L L2	L1	L2	L1	L2	L1	L2
Configuration		LT	TR	$\mathbf{LT}$	Т	т	TR
PHF		0.95	0.95	0.95	0.95	0.95	0.95
Flow Rate		93	96	215	160	165	208
% Heavy Veh		10	10	10	10	10	10
No. Lanes		:	2		2		2
Opposing-Lanes			C	:	2	2	2
Conflicting-lanes		:	2		2		2
Geometry group			1	!	5	ļ	5
Duration, T 0.25 h	ſs.						

	Eastbo	und	Westbound		Northb	ound	Southb	ound
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rates:								
Total in Lane			93	96	215	160	165	208
Left-Turn			51	0	55	0	0	0
Right-Turn			0	54	0	0	0	43
Prop. Left-Turns			0.5	0.0	0.3	0.0	0.0	0.0
Prop. Right-Turns			0.0	0.6	0.0	0.0	0.0	0.2
Prop. Heavy Vehicle			0.1	0.1	0.1	0.1	0.1	0.1
Geometry Group			1		5		5	
Adjustments Exhibit	17-33:							
hLT-adj			0	.2	0	.5	0	.5

hRT-adj hHV-adj hadj, computed		-0.6 1.7 0.3 -0.2		-0.7 1.7 0.3 0.2		-0 1 0.2	.7 .7 0.0	
Worl	ksheet 4	- Depa	rture He	eadway a	nd Serv	ice Time_		
	Eastbo	ound	Westbo	ound	Northbo	ound	Southbo	ound
Flow rate	L1	L2	L1 93	L2 96	L1 215	L2 160	L1 165	L2 208
hd, initial value x, initial hd, final value x, final value Move-up time, m Service Time Worl	3.20 ksheet 5	3.20 - Capa	3.20 0.08 5.87 0.15 2 3.9 city and	3.20 0.09 5.42 0.14 .0 3.4 d Level o	3.20 0.19 5.77 0.34 2 3.5 of Serv	3.20 0.14 5.64 0.25 .3 3.3	3.20 0.15 5.66 0.26 2 3.4	3.20 0.18 5.51 0.32 .3 3.2
	Eastbo	ound	Westbound Nor		Northbo	ound	Southbo	ound
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rate Service Time Utilization, x Dep. headway, hd Capacity Delay LOS Approach: Delay LOS	10 52		93 3.9 0.15 5.87 343 9.92 A 9 A	96 3.4 0.14 5.42 346 9.34 A	215 3.5 0.34 5.77 465 11.48 B	160 3.3 0.25 5.64 410 10.22 B	165 3.4 0.26 5.66 415 10.32 B	208 3.2 0.32 5.51 458 10.76 B
THEETBECCTON DETAY	TO.00		THCE		дор д			

Phone: E-Mail: Fax:

Analyst: Agency/Co.: PB Date Performed: 6/25/2010 Analysis Time Period: PM Peak Hour Intersection: Harrison Street & 9th Avenue Jurisdiction: Units: U. S. Customary Analysis Year: Existing Project ID: I-290 Phase 1 Study East/West Street: Harrison Street North/South Street: 9th Avenue ______Worksheet 2 - Volume Adjustments and Site Characteristics______

	Eastbound			Westbound			Nor	thbou	ind	Sou	thbo	und
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
_												
Volume	0	0	0	111	68	118	41	360	0	0	574	75
% Thrus Lef	t Lane	9				50			50			50

	Eastbound		West!	oound	Northl	oound	Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration			LT	TR	$\mathbf{LT}$	Т	Т	TR
PHF			0.95	0.95	0.95	0.95	0.95	0.95
Flow Rate			151	159	232	189	302	380
% Heavy Veh			10	10	10	10	10	10
No. Lanes			2	2	:	2	:	2
Opposing-Lanes			(	C	:	2	:	2
Conflicting-lanes			2	2	:	2	:	2
Geometry group				1	!	5	!	5
Duration, T 0.25	hrs.							

	Eastbound		Westbound		North	bound	South	bound
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rates:								
Total in Lane			151	159	232	189	302	380
Left-Turn			116	0	43	0	0	0
Right-Turn			0	124	0	0	0	78
Prop. Left-Turns			0.8	0.0	0.2	0.0	0.0	0.0
Prop. Right-Turns			0.0	0.8	0.0	0.0	0.0	0.2
Prop. Heavy Vehicle			0.1	0.1	0.1	0.1	0.1	0.1
Geometry Group				1		5		5
Adjustments Exhibit	17-33:							
hLT-adj				0.2		0.5		0.5

	$\begin{array}{cccc} -0.6 & -0.7 \\ 1.7 & 1.7 \\ 0.3 & -0.3 & 0.3 & 0.2 \end{array}$		.7 .7 0.2	-0.7 1.7 0.2 0.0		
4 - Depar	rture H	eadway an	nd Serv	ice Time_		
ound	Westb	ound	Northbo	ound	Southbo	ound
L2	L1 151	L2 159	L1 232	L2 189	L1 302	L2 380
3.20	3.20 0.13 6.61 0.28 2	3.20 0.14 5.99 0.26	3.20 0.21 6.69 0.43	3.20 0.17 6.59 0.35	3.20 0.27 6.27 0.53	3.20 0.34 6.13 0.65
	4.6	4.0	4.4	4.3	4.0	3.8
5 - Capac	city and	d Level d	of Serv	ice		
ound L2	Westbo L1	ound L2	Northbo L1	ound L2	Southbo L1	ound L2
	151 4.6 0.28 6.61 401 12.13 B 11 B	159 4.0 0.26 5.99 409 11.13 B 1.62	232 4.4 0.43 6.69 482 14.35 B 11 B	189 4.3 0.35 6.59 439 12.74 B	302 4.0 0.53 6.27 552 15.72 C	380 3.8 0.65 6.13 581 19.35 C
	oound L2	bound Westbo L2 L1 151 4.6 0.28 6.61 401 12.13 B 11 B Intes	bound Westbound L2 L1 L2 151 159 4.6 4.0 0.28 0.26 6.61 5.99 401 409 12.13 11.13 B B 11.62 B Intersection	bound Westbound Northbourd L2 L1 L2 L1 151 159 232 4.6 4.0 4.4 0.28 0.26 0.43 6.61 5.99 6.69 401 409 482 12.13 11.13 14.35 B B B 11.62 13 B B B Intersection LOS C	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	bound Westbound Northbound Southbourd   L2 L1 L2 L1 L2 L1   151 159 232 189 302   4.6 4.0 4.4 4.3 4.0   0.28 0.26 0.43 0.35 0.53   6.61 5.99 6.69 6.59 6.27   401 409 482 439 552   12.13 11.13 14.35 12.74 15.72   B B B C 11.62 13.63 1"   B B B C C 11.62 13.63 1"

Phone: E-Mail: Fax:

Analyst: Agency/Co.: PB Date Performed: 6/25/2010 Analysis Time Period: AM Peak Hour Intersection: Bataan Drive & 9th Avenue Jurisdiction: Units: U. S. Customary Analysis Year: Existing Project ID: I-290 Phase 1 Study East/West Street: Bataan Drive North/South Street: 9th Avenue ______Worksheet 2 - Volume Adjustments and Site Characteristics______

		Eastbound			N N	Westbound Northbound			Southbound						
		L	Т	R	L	Т	R		L	Т	R	L	Т	R	
												_			
Volume		34	59	4	0	0	0		0	324	145	188	176	0	
% Thrus	Left	: Lan	e	50							50			50	

	Eastbound		West]	oound	North	oound	South	oound
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LT	TR			Т	TR	LT	Т
PHF	0.95	0.95			0.95	0.95	0.95	0.95
Flow Rate	65	35			170	322	289	92
% Heavy Veh	10	10			10	10	10	10
No. Lanes	2	2			:	2	2	2
Opposing-Lanes	C	)			:	2		2
Conflicting-lanes	2	2			:	2		2
Geometry group	1	-			!	5	I	5
Duration, T 0.25	hrs.							

	Eastb	ound	und Westbound Nort		Northbo	ound	Southboun	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rates:								
Total in Lane	65	35			170	322	289	92
Left-Turn	35	0			0	0	197	0
Right-Turn	0	4			0	152	0	0
Prop. Left-Turns	0.5	0.0			0.0	0.0	0.7	0.0
Prop. Right-Turns	0.0	0.1			0.0	0.5	0.0	0.0
Prop. Heavy Vehicle	e0.1	0.1			0.1	0.1	0.1	0.1
Geometry Group	1				5		5	
Adjustments Exhibit	t 17-33	:						
hLT-adj	0	.2			0	.5	0.	. 5

hRT-adj	- 0 1	.6			- ( 1	).7	- 0 1	.7
hadj, computed	0.3	0.1			0.2	-0.2	0.5	0.2
Wor	ksheet	4 - Dep	arture H	leadway a	and Serv	vice Time	2	
	Eastb	ound	Westh	ound	Northk	ound	Southb	ound
	L1	L2	L1	L2	L1	L2	L1	L2
Flow rate	65	35			170	322	289	92
hd, initial value	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
x, initial	0.06	0.03			0.15	0.29	0.26	0.08
hd, final value	6.07	5.89			5.39	5.06	5.81	5.47
x, final value	0.11	0.06			0.25	0.45	0.47	0.14
Move-up time, m	2	.0			2	2.3	2	.3
Service Time	4.1	3.9			3.1	2.8	3.5	3.2
Wor	ksheet Fastb	5 - Cap	acity an Westh	nd Level	of Serv	vice	Southb	
	T.1	T.2	T.1	T.2	T.1	T ₁ 2	T.1	1.2
		22						
Flow Rate	65	35			170	322	289	92
Service Time	4.1	3.9			3.1	2.8	3.5	3.2
Utilization, x	0.11	0.06			0.25	0.45	0.47	0.14
Dep. headway, hd	6.07	5.89			5.39	5.06	5.81	5.47
Capacity	315	285			420	572	539	342
Delay	9.82	9.25			9.92	11.86	13.50	9.06
LOS	A	A			A	В	В	A
Approach:								
Delay	9	.62			1	1.19	1	2.42
LOS	A				E	3	В	
Intersection Delay	11.51		Inte	ersectior	LOS B			

Phone: E-Mail: Fax:

Analyst: Agency/Co.: PB Date Performed: 6/25/2010 Analysis Time Period: PM Peak Hour Intersection: Bataan Drive & 9th Avenue Jurisdiction: Units: U. S. Customary Analysis Year: Existing Project ID: I-290 Phase 1 Study East/West Street: Bataan Drive North/South Street: 9th Avenue ______Worksheet 2 - Volume Adjustments and Site Characteristics______

	E	lastbou	ınd	W	lestbou	ınd		Nc	rthbo	und	So	uthbo	und	
	L	Т	R	L	Т	R		L	Т	R	L	Т	R	
							.				_			
Volume	31	57	45	0	0	0		0	372	203	288	398	0	
% Thrus L	eft La	ne	50							50			50	

	Eastbound		West	bound	North	oound	Southbound		
	L1	L2	L1	L2	L1	L2	L1	L2	
Configuration	LT	TR			Т	TR	LT	Т	
PHF	0.95	0.95			0.95	0.95	0.95	0.95	
Flow Rate	61	77			195	408	512	209	
% Heavy Veh	10	10			10	10	10	10	
No. Lanes	2	2			:	2	:	2	
Opposing-Lanes	C	)			:	2	:	2	
Conflicting-lanes	2	2			:	2	:	2	
Geometry group	1	_			!	5	!	5	
Duration, T 0.25	hrs.								

	Eastb	ound	Westh	oound	North	bound	South	bound
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rates:								
Total in Lane	61	77			195	408	512	209
Left-Turn	32	0			0	0	303	0
Right-Turn	0	47			0	213	0	0
Prop. Left-Turns	0.5	0.0			0.0	0.0	0.6	0.0
Prop. Right-Turns	0.0	0.6			0.0	0.5	0.0	0.0
Prop. Heavy Vehicle	e0.1	0.1			0.1	0.1	0.1	0.1
Geometry Group	1					5		5
Adjustments Exhibit	t 17-33	:						
hLT-adj	0	.2				0.5		0.5

hRT-adj hHV-adj	-0 1	.6.7			-0 1	.7.7	-0 1	.7
nadj, computed	0.3	-0.2			0.2	-0.2	0.5	0.2
Wor.	ksheet	4 - Depa	rture H	leadway a	nd Serv	ice Time		
	Eastb	ound	Westb	ound	Northb	ound	Southbo	ound
	L1	L2	L1	L2	L1	L2	L1	L2
Flow rate	61	77			195	408	512	209
hd, initial value	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
x, initial	0.05	0.07			0.17	0.36	0.46	0.19
hd, final value	6.87	6.40			6.05	5.68	6.16	5.86
x, final value	0.12	0.14			0.33	0.64	0.88	0.34
Move-up time, m	2	.0			2	.3	2	. 3
Service Time	4.9	4.4			3.7	3.4	3.9	3.6
Wor	ksheet	5 - Capa	city an	d Level	of Serv	ice		
	Eastb	ound	Westb	ound	Northb	ound	Southbo	ound
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rate	61	77			195	408	512	209
Service Time	4.9	4.4			3.7	3.4	3.9	3.6
Utilization, x	0.12	0.14			0.33	0.64	0.88	0.34
Dep. headway, hd	6.87	6.40			6.05	5.68	6.16	5.86
Capacity	311	327			445	625	583	459
Delay	10.78	10.41			11.67	18.05	37.49	11.55
LOS	В	В			В	С	Е	В
Approach:								
Delay	1	0.57			1	5.99	29	9.97
LOS	В				С		D	
Intersection Delay	22.37		Inte	rsection	LOS C			

Analyst: Agency: Date: Period: Project E/W St:	PB 6/25, AM Pe ID: I Harr:	/2010 eak H I-290 ison	lour Phas Stree	se 1 St et	tudy		Int Are Jur Yea N/S	er.: H a Type isd: r : E St: 1	larris 2: All Existi .st Av	on Stro other ng enue	eet area	& 1st as	Ave	enue
				STO	CNAT.T'	ד תיקד	ᠭᡣᢧᢑᠥ᠙ᢑ	CTTON	GIIMMA	ΡV				
		Fag	thou	91\ hd		stbou	nd	Nor	thhou	nd	<u> </u>	ut hho	und	
		T.	T	R	ј ис.   т.	т Т	R	T.	T	R	т.	T	R	
			-	10		-	10	-	-		-	-	10	
No Lane	s	0	0	0	   1	1	2	0	2	0	0	2	0	I 
LGConfig		Ũ	Ũ	Ū	і — І т.	- 1.T	R		<u>-</u> т.т	U I	Ũ	- TR	, U	
Volume					98	56	426	384	583			866	174	1
Lane Wid	th					10 0	10 0		12 0			10 0	, ± / .	-
RTOR Vol						10.0	0		12.0			±0.0	7	
nion voi	I				I		0	I		I			,	I
Duration		0.25		Area '	Type:	All	other	areas						
					Sig	gnal	Operat	ions						
Phase Co	mbina	ation	1	2	3	4	Ī		5	б	7		8	
EB Left							NB	Left	А					
Thru							İ	Thru	A					
Righ	t							Right						
Peds							İ	Peds						
WB Left			А				SB	Left						
Thru			A				İ	Thru		A				
Righ	t		A				İ	Right		A				
Peds							İ	Peds						
NB Righ	t						EB	Right						
SB Righ	t						WB	Right		A				
Green			30.0				I	-	90.0	65.0				
Yellow			4.0						4.0	4.0				
All Red			1.0						1.0	1.0				
									Cyc	le Len	gth:	200.	0	secs
			Iı	nterse	ction	Perf	ormanc	e Summ	ary		-			
Appr/	Lane		Ad	j Sat	Ra	atios		Lane	Group	App:	roac	h		
Lane	Group	0	Flo	w Rate					-					
Grp	Capa	city		(s)	v/c	g	/C	Delay	LOS	Dela	y LO	S		
_														
Eastboun	d													
Westboun	d													
L	237		15	32	0.32	2 0	.16	75.9	Е					
LT	246		158	87	0.35	5 0	.16	76.4	Е	42.4	D			
R	122	5	24	25	0.3	7 0	.50	30.2	С					
Northbou	nd			-		-			-					
LT	146	7	322	25	0.69	90	.46	7.9	A	7.9	А			
	2					-		-			-			
Southbou	nd													
TR	988		299	95	1.10	0 C	.33	127.5	F	127.	5 F			
	-					·								
	Inte	ersec	tion	Delay	= 63	.5 (	sec/ve	h) I	inters	ection	LOS	= E		

I-290 Existing

Phone: Fax: E-Mail:

_____OPERATIONAL ANALYSIS_____

Analyst: Agency/Co.: PB Date Performed: 6/25/2010 Analysis Time Period: AM Peak Hour Intersection: Harrison Street & 1st Avenue Area Type: All other areas Jurisdiction: Analysis Year: Existing Project ID: I-290 Phase 1 Study E/W St: Harrison Street N/S St: 1st Avenue

_____VOLUME DATA______

	Ea	stbou	nd	We	stbour	nd	No:	rthbou	ınd	Sou	ithbou	ind
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume	 			  98	56	426	384	583		 	866	 174
% Heavy Veh				10	10	10	10	10			10	10
PHF	l			0.95	0.95	0.95	0.95	0.95		l	0.95	0.95
PK 15 Vol	İ			26	15	112	101	153		İ	228	46
Hi Ln Vol	İ						i i			İ		
% Grade	İ				0		i i	0		İ	0	
Ideal Sat	İ			1900	1900	1900		1900		İ	1900	
ParkExist	İ			İ			İ			İ		İ
NumPark	Ì			İ			İ			ĺ		ĺ
No. Lanes	0	0	0	1	1	2	0	2	0	0	2	0
LGConfig	ĺ			L	LT	R	ĺ	LT		ĺ	TR	ĺ
Lane Width	ĺ			10.0	10.0	10.0		12.0		ĺ	10.0	ĺ
RTOR Vol						0						7
Adj Flow				75	87	448		1018			1088	
%InSharedLn				27								
Prop LTs					0.32	20		0.39	7		0.00	00
Prop RTs				0	.000	1.000	0	.000		0.	.162	
Peds Bikes	0			0						0		
Buses				0	0	0		0			0	
%InProtPhase	e											ĺ
Duration	0.25		Area '	Type:	All d	other	areas					

	Eastbound			Westbound				rthbo	und	Southbound			
	L	Т	R	L	Т	R	L	Т	R	L	Т	R	
							-			-			
Init Unmet				0.0	0.0	0.0		0.0			0.0		
Arriv. Type				3	3	3		6			3		
Unit Ext.				3.0	3.0	3.0		3.0			3.0		
I Factor					1.00	0		0.47	9		1.00	0	
Lost Time				2.0	2.0	2.0	Ì	2.0		İ	2.0	İ	
Ext of g				3.0	3.0	3.0		3.0			3.0		
Ped Min g	İ	3.2		İ	3.2		İ			İ	3.2	İ	

## _____OPERATING PARAMETERS______OPERATING PARAMETERS_____

				PHA	ASE D	DATA_					
Pha	se Combination	1	2	3	4			5	6	7	8
EB	Left Thru Right Peds					NB	Left Thru Right Peds	A A			
WB	Left Thru Right Peds	A A A				SB	Left Thru Right Peds		A A		
NB	Right					EB	Right				
SB	Right					WB	Right		А		
Gre Yel All	en : low : Red :	30.0 4.0 1.0			I			90.0 4.0 1.0	65.0 4.0 1.0		

Cycle Length: 200.0 secs

		VOLU	ME ADJU	JSTME	INT A	ND SAT	UR	ATION	J FLOV	WORKS	SHEET_		
Volume Adju	stment												
	Eas	tbou	nd	We	und		Nor	thbou	ind	Soi	ıthbo	und	
	L	Т	R	L	Т	R		L	Т	R	L	Т	R
Volume, V	 	·		98	56	426	-    	384	583		 	866	174
PHF				0.95	5 0.9	5 0.95	5   1	0.95	0.95			0.95	0.95
Adj flow				103	59	448	-  ·	404	614			912	176
No. Lanes	0	0	0	1	. 1	2		0	2	0	0	2	0
Lane group	ĺ			L	L	T R	Í		LT		ĺ	TR	Í
Adj flow	ĺ			75	87	448	Í		1018			1088	Í
Prop LTs	ĺ			ĺ	Ο.	320	Í		0.39	97		0.0	00
Prop RTs	ĺ			( C	.000	1.000	)	0.	.000		0	.162	ĺ
Saturation I	Flow R stbour	ate d	(see Ez	khibi Vesth	t 16	-7 to	det	termi North	ine th	ne adju M	ustmer Sou	nt fa ithbo	ctors)
LC	Debouii	.u	т.	T	.т	₽		NOT CI	T.T	A	500	ULLOU TR	ana
50			1900	יד 1 כ	000	1900		1	900			190	0
Laneg ()	0	0	1	) 1)		2	0	-		0	0	2	0
fw	0	U	0.97	33 0	933	0 933	0	1		0	0	0 9	33
fhV			0 90	)9 0. )9 0	909	0 909		-	) 909			0.9	09
fG			1.00	0 1.	000	1.000		1	.000			1.0	00
fP			1 00	)0 1	000	1 000		- 1	000			1 0	0.0
fBB			1 00	)0 1	000	1 000		-	000			1 0	00
fA			1.00	$10^{-1}$	000	1.000		-	.000			1.0	00
fIJU			1.00	$10^{-1}$	000	0.885		-	).952			0.9	52
fru				1.	000	0.850		1	.000			0.9	76
fLT			0.9	50 0.	984			-	).981			1.0	00
Sec.													
fLpb			1.00	00 1.	000			1	L.000			1.0	00
fRpb				1.	000	1.000		1	L.000			1.0	00
S			1532	2 15	87	2425			3225			299	5
Sec.			_	-									
			CAI	PACIT	Y AN	ID LOS	WOI	RKSHE	CET				
General to Per				<b>.</b>	<b>a</b>								

Capacity Analysis and Lane Group Capacity

Adj Adj Sat Flow Gree Appr/ Lane Flow Rate Flow Rate Ratio Rati Mvmt Group (v) (s) (v/s) (g/C	enLane Group Lo Capacity v/c C) (c) Ratio
Eastbound	
Prot	
Perm	
Left	
Prot	
Perm	
Thru	
Right	
Westbound	
Prot	
Perm	
Left L 75 1532 0.05 0.1	.6 237 0.32
Prot	
Perm	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	-6 246 0.35
RIGHL R 440 2425 U.18 U.5 Northbourd	JU 1223 U.37
Drot	
Derm	
rerm Left	
Prot	
Derm	
Thru $LT$ 1018 3225 $\pm$ 0.32 0.4	6 1467 0 69
Right	
Southbound	
Prot	
Perm	
Left	
Prot	
Perm	
Thru TR 1088 2995 # 0.36 0.3	33 988 1.10
Right	
Sum of flow ratios for critical lane groups, Yc = Su	1m (v/s) = 0.73
Total lost time per cycle, L = 12.00 sec	
Critical flow rate to capacity ratio, Xc = (Yc)	(C)/(C-L) = 0.78
Control Delay and LOS Determination	
Appr/ Ratios Unf Prog Lane Incremental Res	Lane Group Approach
Lane Del Adj Grp Factor Del Del	
Grp v/c g/C d1 Fact Cap k d2 d3	Delay LOS Delay LOS
Eastbound	
Weathound	
	70.4 E 42.4 D
R 0.37 0.50 30.1 1.000 1225 0.11 0.2 0.0	30.2 C
NOT CHEORIN	
	79 2 70 7
LI 0.07 0.10 13.1 0.105 1407 0.20 0.7 0.0	1.7 A 1.7 A
Southbound	
bouchbound	

SUPPLEMENTAL PERMITTED LT WORKSHEET for exclusive lefts Input EΒ WB NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 200.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo 1.000 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. _SUPPLEMENTAL PERMITTED LT WORKSHEET_ for shared lefts Input EΒ WB NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 200.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s)Opposing effective green time, go (s) Number of lanes in LT lane group, N

Intersection LOS = E

Intersection delay = 63.5 (sec/veh)

Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT 0.320 0.397 0.000 Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 1.000 0.952 0.952 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min = fmin; max = 1.00)flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET Permitted Left Turns EΒ WΒ NBSB Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Pedestrian flow rate, Vpedg (p/h) 0CCpedq Opposing queue clearing green, gq (s) Eff. ped. green consumed by opp. veh. queue, gq/gp OCCpedu Opposing flow rate, Vo (veh/h) OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion of left turns, PLT Proportion of left turns using protected phase, PLTA Left-turn adjustment, fLpb Permitted Right Turns Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Conflicting bicycle volume, Vbic (bicycles/h) Vpedg OCCpedq Effective green, g (s) Vbicg

OCCbicg								
OCCr Number	of cross.	-street	receivin	r laneg	Nrec			
Number	of turnin	ng lanes	, Nturn	y rancs,	NIEC			
ApbT		-						
Proport	ion right	t-turns,	PRT					
Proport Right t	ion rign urn adius	t-turns stment.	using pro fRph	otected	pnase, Pl	RTA		
Right c	arn aaja	Semerie ,	TUPD					
		SU	PPLEMENT	AL UNIFO	RM DELAY	WORKSHE	ET	
Curala 1	ongth C				200 0	E	BLT WBL	T NBLT SBLT
Adi. LT	vol from	m Vol Ad	justment	Workshe	200.0 et, v	sec		
v/c rat	io from (	Capacity	Workshe	et, X	,			
Protect	ed phase	effecti	ve green	interva	l, g (s)			
Opposin	g queue e ed green	interva	e green :	interval	, gq			
Red tim	e r=(C-q·	-qq-qu)	r, gu					
Arrival	rate, qa	a=v/(360	0(max[X,	1.0]))				
Protect	ed ph. de	eparture	rate, S	o=s/3600				
Permitt XDerm	ed ph. de	eparture	rate, Sa	s=s(gq+g	u)/(gu*3)	600)		
XProt								
Case								
Queue a	t beginn:	ing of g	reen arro	ow, Qa	0			
Queue a Residua	t beginn: 1 queue	ing of u Or	nsaturat	ed green	, Qu			
Uniform	Delay, d	d1						
		DELAV/	LOS WORK	знеет ит	דים דאדיד:	AI. OIIEIIE		
Appr/	Unmet	Dur. Unmet	Uniform	Delay 	Queue	Unmet	Initial Queue	Lane Group
Lane Group	Demand Q veh	Demand t hrs.	Unadj. ds	Adj. d1 sec	Param. u	Demand Q veh	Delay d3 sec	Delay d sec
Eastbou	nd							
	0.0						0.0	
	0.0						0.0	
	0.0						0.0	
Westbou	nd							
L TTT	0.0	0.00	84.5 84 5	75.1	0.00	0.0	0.0	75.9
R	0.0	0.00	49.5	30.1	0.00	0.0	0.0	30.2
Northbo	und							
1101 01120	0.0						0.0	
LT	0.0	0.00	54.5	43.4	0.00	0.0	0.0	7.9
	0.0						0.0	
Southbo	und							
шD	0.0	0 0 0	67 0	67 0	0 0 0		0.0	107 5
ΊR	0.0	0.00	67.0	67.0	0.00	25.0	0.0	127.5
	Intersect	tion Del	ay 63.5	sec/v	eh II	ntersect	ion LOS	Е
			ВАСК	OF QUEU	E WORKSHI	EET		

	Eastbound	W	estbou	und	Northbound	Southbound
LaneGroup		L	LT	R	LT	TR
Init Queue		0.0	0.0	0.0	0.0	0.0
Flow Rate		75	87	253	534	571
So		1900	1900	1900	1900	1900
No.Lanes	0 0 0	1	1	2	0 2 0	
SL		1532	1587	1370	1693	1573
LnCapacity		237	246	692	770	518
Flow Ratio		0.0	0.1	0.2	0.3	0.4
v/c Ratio		0.32	0.35	0.37	0.69	1.10
Grn Ratio		0.16	0.16	0.50	0.46	0.33
I Factor		i	1.000	C	0.479	1.000
AT or PVG		3	3	3	6	3
Pltn Ratio		1.00	1.00	1.00	2.00	1.00
PF2		1.00	1.00	1.00	0.31	1.00
Q1		3.7	4.3	8.5	7.2	31.7
kВ		0.5	0.5	0.9	0.5	0.8
Q2		0.2	0.3	0.5	1.0	11.4
Q Average		3.9	4.6	9.0	8.2	43.1
Q Spacing		25.0	25.0	25.0	25.0	25.0
Q Storage		0	0	0	0	0
Q S Ratio		İ			ĺ	i i
70th Percent	tile Output:					
fB%		1.2	1.2	1.2	1.2	1.1
BOQ		4.7	5.4	10.7	9.7	48.8
QSRatio						
85th Percent	tile Output:					
fB%		1.6	1.6	1.5	1.5	1.4
BOQ		6.1	7.1	13.8	12.6	59.1
QSRatio						
90th Percent	tile Output:					
fB%		1.7	1.7	1.7	1.7	1.4
BOQ		6.8	7.9	15.0	13.7	62.3
QSRatio						
95th Percent	tile Output:					
fB%		2.0	2.0	1.9	1.9	1.6
BOQ		7.8	9.0	16.8	15.5	67.0
QSRatio						
98th Percent	tile Output:					
fB%		2.4	2.4	2.2	2.2	1.7
BOQ		9.6	11.0	19.9	18.4	74.8
QSRatio						

_____ERROR MESSAGES_____

No errors to report.

Analyst: Agency: Date: Period: Project E/W St:	PB 6/25/2 PM Pea ID: I Harria	2010 ak Ho -290 son S	our Phas Stree	se 1 S	tudy		Int Are Ju Yea N/S	ter.: P ea Type cisd: ar : P S St: 2	Harris e: All Exist: lst Av	son Str l other ing venue	eet area	& 1st as	Ave	enue
				SI	GNALIZ	ZED I	INTERSI	ECTION	SUMMA	ARY			<u>-</u>	
		East	tbour m	ld D	Wes	stbou m	ind D		rtnboi m	und	SO	utnbo T	ound	
	-		T	IC.		T	IC.		T		Ш	T	K	
No. Lane	es	0	0	0	1 1	1	2	0	2	0	0	2	0	 
LGConfid	a	-	-	-	L L	LI	R		LT	-	-	TR	2	İ
Volume					174	48	284	322	635	ĺ		1196	213	3
Lane Wid	dth				10.0	10.0	10.0	İ	12.0	İ		10.0	)	İ
RTOR Vol	1						0						7	
 Duration	n 0	.25		Area '	Type:	All	other	areas						
					Sig	gnal	Operat	cions_						
Phase Co	ombina	tion	1	2	3	4	Ł ļ	_	5	6	7		8	
EB Left	t						NB	Left	A					
Thru	1							Thru	_ A					
RIGI	.IL ~							Deda						
WB Left	-		Δ				   SB	Left						
Thru	J		A					Thru		A				
Righ	nt		A					Right	t	A				
Peda	5						İ	Peds						
NB Righ	nt						EB	Right	t					
SB Righ	nt						WB	Right	t	A				
Green			30.0						90.0	0 65.0				
Yellow		4	4.0						4.0	4.0				
All Red		-	1.0							⊥.U nlo I.on	ath:	200	0	2022
			Ir	nterse	ction	Perf	forman	ce Sumr	narv		gun•	200.	0	5005
Appr/	Lane		 Ad	j Sat	Ra	atios	3	Lane	Group	p App	roac	 h		
Lane	Group		Flow	v Rate										
Grp	Capac	ity		(s)	v/c	ç	g∕C	Delay	y LOS	Dela	y LO	S		
Eastbour	nd													
Westbour	nd													
L	237		153	32	0.49	9 0	.16	78.8	Е					
LT	166		107	73	0.72	2 0	0.16	94.2	F	53.8	D			
R	1225		242	25	0.24	4 C	0.50	28.1	С					
Northbou	und													
LT	1471		323	34	0.68	B (	.46	7.8	A	7.8	A			
Southbou	und													
TR	991		300	)2	1.49	9 0	.33	292.0	δF	292.	6 F			
	Inte	rsect	tion	Delay	= 15	5.3 (	sec/ve	eh) :	Inter	section	LOS	= F		

I-290 Existing

Phone: Fax: E-Mail: _____OPERATIONAL ANALYSIS______OPERATIONAL ANALYSIS_____

Analyst:	
Agency/Co.:	PB
Date Performed:	6/25/2010
Analysis Time Period:	PM Peak Hour
Intersection:	Harrison Street & 1st Avenue
Area Type:	All other areas
Jurisdiction:	
Analysis Year:	Existing
Project ID: I-290 Phase 1	Study
E/W St: Harrison Street	N/S St: 1st Avenue

_____VOLUME DATA______

	Eas	tbou	nd	Wes	stbour	nd	No	rthbou	Ind	Southbound			
	L	Т	R	L	Т	R	L	Т	R	L	Т	R	
Volume				  174	48	284	322	635			1196	213	
% Heavy Veh				10	10	10	10	10			10	10	
PHF				0.95	0.95	0.95	0.95	0.95			0.95	0.95	
PK 15 Vol				46	13	75	85	167			315	56	
Hi Ln Vol				ļ			ļ						
% Grade					0			0			0		
Ideal Sat				1900	1300	1900		1900			1900		
ParkExist													
NumPark													
No. Lanes	0	0	0	1	1	2	0	2	0	0	2	0	
LGConfig				L	LT	R		LT			TR		
Lane Width				10.0	10.0	10.0		12.0			10.0		
RTOR Vol						0						7	
Adj Flow				115	119	299	ĺ	1007			1476		
%InSharedLn				37			İ					Í	
Prop LTs				ĺ	0.56	59	İ	0.33	7	ĺ	0.00	0	
Prop RTs				j 0.	.000 1	L.000	0	.000		0.	147	İ	
Peds Bikes	0			j o			İ			0		İ	
Buses				İO	0	0	ĺ	0			0	İ	
%InProtPhase	5			İ			İ						
Duration	0.25		Area 🛛	Гуре:	All d	other a	areas		ľ	I		I	

	Ea	stbou	Ind	We	stbou	nd	Nc	rthbo	und	So	und		
	L	Т	R	L	Т	R	L	Т	R	L	Т	R	Ì
Init Unmet					0 0	0 0	·	0 0		-	0 0		-
Arriv. Type				3	3	3		6			3		Ì
Unit Ext.				3.0	3.0	3.0	1	3.0		ĺ	3.0		Í
I Factor	ĺ			İ	1.00	0	İ	0.52	5	ĺ	1.00	0	İ
Lost Time				2.0	2.0	2.0	i	2.0		İ	2.0		İ
Ext of g				3.0	3.0	3.0	İ	3.0		İ	3.0		i
Ped Min g		3.2		İ	3.2		İ			İ	3.2		İ

## _____OPERATING PARAMETERS______OPERATING PARAMETERS_____

				PHA	ASE D	DATA_					
Pha	se Combination	1	2	3	4			5	6	7	8
EB	Left Thru Right Peds					NB	Left Thru Right Peds	A A			
WB	Left Thru Right Peds	A A A				SB	Left Thru Right Peds		A A		
NB	Right					EB	Right				
SB	Right					WB	Right		А		
Gre Yel All	en : low : Red :	30.0 4.0 1.0			I			90.0 4.0 1.0	65.0 4.0 1.0		

Cycle Length: 200.0 secs

		VOLU	ME ADJU	JSTME	NT A	ND SAT	URATIO	N FLO	W WORKS	SHEET_		
Volume Adju	stment											
	Eas	stbou	Ind	We	stbo	und	No	rthbo	und	Soi	ithbo	und
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume, V				<u></u>  174	48	284	322	635		 	1196	213
PHF				0.95	0.9	5 0.95	0.95	0.95			0.95	0.95
Adj flow				183	51	299	339	668			1259	217
No. Lanes	0	0	0	1	1	2	0	2	0	0	2	0
Lane group				L	L	T R		LT			TR	
Adj flow				115	119	299		1007			1476	
Prop LTs					Ο.	569		0.3	37		0.0	00
Prop RTs				0	.000	1.000	0	.000		0	.147	
Saturation	Flow R	late	(see Ez	khibi	t 16	-7 to	determ	ine tl	he adjı	ıstmeı	nt fa	ctors)
Ea	stbour	ıd	V	Vestb	ound		Nort	hbound	d	Sou	ıthbo	und
LG			L	L	Т	R		LT			TR	
So			1900	) 13	00	1900		1900			190	0
Lanes O	0	0	1	1		2	0	2	0	0	2	0
fW			0.93	33 0.	933	0.933		1.000			0.9	33
fHV			0.90	)9 0.	909	0.909		0.909			0.9	09
fG			1.00	00 1.	000	1.000		1.000			1.0	00
fP			1.00	00 1.	000	1.000		1.000			1.0	0 0
fBB			1.00	00 1.	000	1.000		1.000			1.0	0 0
fA			1.00	00 1.	000	1.000		1.000			1.0	00
fLU			1.00	00 1.	000	0.885		0.952			0.9	52
fRT				1.	000	0.850		1.000			0.9	78
fLT			0.95	50 0.	972			0.983			1.0	00
Sec.												
fLpb			1.00	00 1.	000			1.000			1.0	0 0
fRpb				1.	000	1.000		1.000			1.0	0 0
S			1532	2 10	73	2425		3234			300	2
Sec.												
			CAI	PACIT	Y AN	D LOS	WORKSH	EET				
Compariston Are	- 1		<b>T</b>	<b>7</b>	<b>a</b>							

Capacity Analysis and Lane Group Capacity

	Appr/ Mvmt	Lane Group	Flo	Adj w Rate (v)	Adj Flow (	Sat Rate s)	Flow Ratio (v/s)	Gre Rat (g/	een] cio Cap (C)	Lane Gr pacity (c)	roup v/c Ratio	
 Eas	tbound											
	Prot											
	Perm											
	Left											
	Prot											
	Perm											
	Thru											
	Right											
Wes	tbound Duct											
	Prot											
	roft	т	1	15	15	2 2	0 0 0	0	16	727	0 4 9	
	Drot	Ц	1	10	ТЭ	54	0.00	0.	10 1	231	0.49	
	Dorm											
	Thru	T.T	1	19	1 0	73	± ∩ 11	Ο	16	166	0 7 2	
	Right	R	2	 9 9	24	25	0 12	0.	50	1225	0.72	
Nor	thbound	d	2		21		J. T.	0.			J. 21	
	Prot											
	Perm											
	Left											
	Prot											
	Perm											
	Thru	LT	1	007	32	34	# 0.31	0.	46	1471	0.68	
	Right											
Sou	thboun	d										
	Prot											
	Perm											
	Left											
	Prot											
	Perm		_									
	Thru	TR	1	476	30	02	# 0.49	0.	33	991	1.49	
	Right											
	of fl	ow rati	og for		 	ne arc		·			0 91	
Tot	al los	t time	os loi per cv	cle. I	$L_{a1} = 12$	00 se	nups, ic No	. – .		5) -	0.91	
Cri	tical	flow ra	te to	capacit	v rat	io.	.c Xc	z = (Y c	c)(C)/((	C-L) =	0.97	
		Iu		<u>-</u>	ac	- /		( - (	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	,		
Con	trol D	elay an	d LOS	Determi	Inatio	n						
App	or/ R	atios	Unf	Prog	Lane	Incre	emental	Res	Lane (	Group	Appro	ach
Lan	le		Del	Adj	Grp	Facto	or Del	Del				
Grp	v/c	g/C	d1	Fact	Cap	k	d2	d3	Delay	y LOS	Delay	LOS
	+ b											
Eas	tbound											
Weg	thound											
L	0_49	0.16	77.2	1.000	237	0.11	1.6	0.0	78.8	Е		
LT	0.72	0.16	80.3	1.000	166	0.28	13.8	0.0	94.2	F	53.8	D
R	0.24	0.50	27.9	1.000	1225	0.11	0.1	0.0	28.1	C		-
Nor	thbound	d								-		
LT	0.68	0.46	43.1	0.165	1471	0.25	0.7	0.0	7.8	A	7.8	A
Sou	thboun	d										
TR	1.49	0.33	67.0	1.000	991	0.50	225.6	0.0	292.6	F	292.6	F

SUPPLEMENTAL PERMITTED LT WORKSHEET for exclusive lefts Input EΒ WB NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 200.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo 1.000 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. _SUPPLEMENTAL PERMITTED LT WORKSHEET_ for shared lefts Input EΒ WB NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 200.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s)Opposing effective green time, go (s) Number of lanes in LT lane group, N

Intersection LOS = F

Intersection delay = 155.3 (sec/veh)

Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT 0.569 0.337 0.000 Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 1.000 0.952 0.952 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min = fmin; max = 1.00)flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET Permitted Left Turns EΒ WΒ NBSB Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Pedestrian flow rate, Vpedg (p/h) 0CCpedq Opposing queue clearing green, gq (s) Eff. ped. green consumed by opp. veh. queue, gq/gp OCCpedu Opposing flow rate, Vo (veh/h) OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion of left turns, PLT Proportion of left turns using protected phase, PLTA Left-turn adjustment, fLpb Permitted Right Turns Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Conflicting bicycle volume, Vbic (bicycles/h) Vpedg OCCpedq Effective green, g (s) Vbicg

OCCbicg OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion right-turns, PRT Proportion right-turns using protected phase, PRTA Right turn adjustment, fRpb _SUPPLEMENTAL UNIFORM DELAY WORKSHEET_ EBLT WBLT NBLT SBLT Cycle length, C 200.0 sec Adj. LT vol from Vol Adjustment Worksheet, v v/c ratio from Capacity Worksheet, X Protected phase effective green interval, g (s) Opposing queue effective green interval, gq Unopposed green interval, gu Red time r=(C-g-gq-gu)Arrival rate, qa=v/(3600(max[X,1.0]))Protected ph. departure rate, Sp=s/3600 Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600) XPerm XProt Case Queue at beginning of green arrow, Qa Queue at beginning of unsaturated green, Qu Residual queue, Or Uniform Delay, d1 ___DELAY/LOS WORKSHEET WITH INITIAL QUEUE__ Uniform Delay Initial Final Initial Dur. Initial Lane Unmet Unmet Queue Unmet Oueue Group Appr/ Lane Demand Demand Unadj. Adj. Param. Demand Delay Delav t hrs. dl sec d3 sec d sec Group Q veh ds Q veh u Eastbound 0.0 0.0 0.0 0.0 0.0 0.0 Westbound 0.0 0.00 84.5 77.2 0.00 0.0 0.0 78.8 T. 0.0 0.00 84.5 80.3 0.00 0.0 0.0 94.2 LT0.00 0.00 R 0.0 49.5 27.9 0.0 0.0 28.1 Northbound 0.0 0.0 0.00 54.5 43.1 0.00 LT0.0 0.0 0.0 7.8 0.0 0.0 Southbound 0.0 0.0 0.0 0.00 0.00 ΤR 67.0 67.0 121.3 0.0 292.6 0.0 0.0 Intersection Delay 155.3 sec/veh Intersection LOS F

____BACK OF QUEUE WORKSHEET__

	Eastbound	Westbound	Northbound	Southbound
LaneGroup		L LT R	LT	TR
Init Queue		0.0 0.0 0.0	0.0	0.0
Flow Rate		115 119 168	528	775
So		1900 1300 1900	1900	1900
No.Lanes	0 0 0	1 1 2	0 2 0	0 2 0
SL		1532 1073 1370	1698	1576
LnCapacity		237 166 692	772	520
Flow Ratio		0.1 0.1 0.1	0.3	0.5
v/c Ratio		0.49 0.72 0.24	0.68	1.49
Grn Ratio		0.16 0.16 0.50	0.46	0.33
I Factor		1.000	0.525	1.000
AT or PVG		3 3 3	6	3
Pltn Ratio		1.00 1.00 1.00	2.00	1.00
PF2		1.00 1.00 1.00	0.30	1.00
Q1		5.8 6.3 5.3	7.0	43.1
kВ		0.5 0.4 0.9	0.5	0.8
Q2		0.4 0.8 0.3	1.0	34.0
Q Average		6.3 7.1 5.6	8.0	77.1
Q Spacing		25.0 25.0 25.0	25.0	25.0
Q Storage		0 0 0	0	0
Q S Ratio				
70th Percent	tile Output:			
fB%		1.2 1.2 1.2	1.2	1.1
BOQ		7.4 8.4 6.6	9.5	85.9
QSRatio				
85th Percent	cile Output:			
fB%		1.5 1.5 1.5	1.5	1.3
BOQ		9.7 10.9 8.6	12.3	102
QSRatio				
90th Percent	tile Output:			
±B%			1.7	1.4
BOQ		10.6 12.0 9.5	13.4	109
QSRatio				
95th Percent	ule Output:			
ÍB∛			1.9	
BOQ		12.1 13.6 10.8	15.1	
QSRatio				
yoth Percent	uiie Output:			
IB%			2.2	
ROÔ		14.5 16.2 13.1	18.0	
QSKatio				

_____ERROR MESSAGES_____

No errors to report.

Analyst: Agency: Date: Period: Project E/W St:	PB 6/25 AM P ID: Bata	/201( eak H I-29( an Di	) Hour ) Phas rive	se 1 St	cudy		Int Are Jur Yea N/S	er.: B a Type isd: r : E St: 1	ataan : All xisti st Av	n Drive othen ng venue	e & 1: c are:	st Ave as	≥nue	:	
				O.T.C	<b>NATA T T 17 T</b>			OT TOM	OTTNANAN	777					
				SIC	JNALIZĔ		TERSE	CTION	SUMMA	AR Y					
		Eas	uodje m		west	nuod.	a	NOT	TUDOU	Ind		μτηροι	ina		
		Ц	T	ĸ		T	ĸ		T	ĸ		T	ĸ	l	
No Iono	a														
ICConfig	ן ב ו	0	 т.т.		0	0	0		2 TD	0		2 T TT	0		
Volume		172	ы 87	21/					70/	0	266	608		ł	
Lane Wid	+h	175	12 0						11 5	0	1200	11 0			
RTOR Vol			12.0	112					11.5	0		11.0			
KIOK VOI	I							I		0	I			I	
Duration		0.25		Area 1	Type: A	11 0	ther	areas							
Dhago Cor	——— mhin	atior			Sign		perat	ions	<u>–––</u> –	6					
FR Toft		ation	1 <u>1</u> 7	2	3	4		⊺ of +	5	0	/	C	)		
EB LEIC Thru			A					Thru		δ					
Righ	+		Δ				1	Right		Δ					
Peds	C		11				1	Peds		11					
WB Left							SB	Left	Δ						
Thru								Thru	A						
Righ	t.							Right							
Peds	0						i	Peds							
NB Righ	t						   EB	Right		А					
SB Righ	t						WB	Right							
Green			30.0				1	5	90.0	65.0	C				
Yellow			4.0						4.0	4.0					
All Red			1.0						1.0	1.0					
									Сус	cle Ler	ngth:	200.0	)	sec	S
			Ir	nterseo	ction P	erfo	rmanc	e Summ	ary						
Appr/ 3	Lane		Ad	j Sat	Rat	ios		Lane	Group	o Apr	proac	h			
Lane (	Grou	р.,	Flov	v Rate			_					~			
Grp	Сара	city	(	S)	V/C	g/	C	Delay	LOS	Dela	ау LO:	S			
Eastbound	d														
T.T	259		165	72	1 06	0	16	156 5	ਸ	120	<b>ч</b> 0				
R	741		146	58	0 14	0	50	26 5	Ċ	120	.0 1				
Westbound	d it		110		0.11	0.	50	20.5	C						
neb eb e an	a														
Northbou	nd														
Norenbou	1104														
TR	106	7	323	34	0.78	0.	33	64.4	Е	64.4	4 E				
Couthber	۳ď														
Southbou	na														
LT	141	1	313	36	0.72	0.	45	8.6	A	8.6	A				
	Int	ersed	ction	Delav	= 48.5	(s	ec/ve	h) I	nters	sectior	n LOS	= D			
						, 2	-,	, -				-			

I-290 Existing

Phone: E-Mail: Fax:

_____OPERATIONAL ANALYSIS______

Analyst:	
Agency/Co.:	PB
Date Performed:	6/25/2010
Analysis Time Period:	AM Peak Hour
Intersection:	Bataan Drive & 1st Avenue
Area Type:	All other areas
Jurisdiction:	
Analysis Year:	Existing
Project ID: I-290 Phase 1	L Study
E/W St: Bataan Drive	N/S St: 1st Avenue

_____VOLUME DATA______OVOLUME DATA_____

	Eas	stbou	nd	Wes	stbou	nd	No	rthbo	und	Southbound		
	L 	Т	R	L	Т	R	Ĺ	Т	R	ļ L	Т	R
Volume	173	87	214					794	0	266	698	
% Heavy Veh	10	10	10	İ			İ	10	10	10	10	
PHF	0.95	0.95	0.95	ĺ			Ì	0.95	0.95	0.95	0.95	
PK 15 Vol	46	23	56	ĺ			Ì	209	0	70	184	
Hi Ln Vol												
% Grade		0						0			0	
Ideal Sat		1900	1900					1900			1900	
ParkExist												
NumPark												
No. Lanes	0	1	1	0	0	0	0	2	0	0	2	0
LGConfig		LT	R					TR			LT	
Lane Width		12.0	12.0					11.5			11.0	
RTOR Vol			112						0			
Adj Flow		274	107					836			1015	
%InSharedLn												
Prop LTs		0.6	64					0.0	00		0.27	б
Prop RTs	0	.000	1.000				0	.000		0	.000	
Peds Bikes	0			0			0					
Buses		0	0					0			0	
%InProtPhase	9											
Duration	0.25		Area	Type:	All	other	areas					

	Ea	stbou	nd	Westbound			Northbound			Southbound			
	L	Т	R	L	Т	R	L	Т	R	L	Т	R	
Init Unmet		0.0	0.0					0.0		-  	0.0		
Arriv. Type		3	3					3			6		
Unit Ext.		3.0	3.0					3.0			3.0		
I Factor	1.000			ĺ			Ì	1.000			0.266		
Lost Time		2.0	2.0	İ			İ	2.0		İ	2.0		
Ext of q		3.0	3.0				İ	3.0			2.0		
Ped Min g		3.2		İ	3.2			3.2					

## _____OPERATING PARAMETERS______

				PH.	ASE	DATA_						
Pha	se Combination	1	2	3	4			5	6	7	8	
EB	Left Thru Right Peds	A A A				NB	Left Thru Right Peds		A A			
WB	Left Thru Right Peds					SB	Left Thru Right Peds	A A				
NB	Right					EB	Right		A			
SB	Right					WB	Right					
Gre Yel All	en : low : Red :	30.0 4.0 1.0			I			90.0 4.0 1.0	65.0 4.0 1.0			

Cycle Length: 200.0 secs

	77	JOLUM	E ADJ	USTMEN'	r and	SAT	URATION	N FLO	WORK	SHEET_		
Volume Adjus	stment											
	Eastbound			Wes	tboun	d	Northbound			Southbound		
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume, V	  173 {	 37	214	 			_  	794	0	  266	698	 
PHF	0.95 (	0.95	0.95					0.95	0.95	0.95	0.95	
Adj flow	182 9	92	107					836	0	280	735	
No. Lanes	i o	1	1	0	0	0	0	2	0	0	2	0
Lane group	İ	LT	R	ĺ				TR		ĺ	LT	
Adj flow		274	107					836		ĺ	1015	
Prop LTs		0.66	4					0.0	00	ĺ	0.27	6
Prop RTs	0.0	000 1	.000				0	.000		ί ο.	000	
-				1			1			1		I.
Saturation H	Flow Ra	ate (	see E:	xhibit	16-7	to	determi	ine tl	he adj	ustmer	nt fac	tors)
Eas	stbound	f	1	Westbo	und		North	nbound	d -	Soı	thbou	nd
LG	LT	R						TR			LT	
So	1900	1900					1	1900			1900	
Lanes O	1	1	0	0	0		0 2	2	0	0	2	0
fW	1.000	1.00	0				(	0.983			0.96	7
fhv	0.909	0.90	9				(	0.909			0.90	9
fG	1.000	1.00	0				1	1.000			1.00	0
fP	1.000	1.00	0				1	1.000			1.00	0
fBB	1.000	1.00	0				1	1.000			1.00	0
fA	1.000	1.00	0				1	1.000			1.00	0
fLU	1.000	1.00	0				(	0.952			0.95	2
frt	1.000	0.85	0				1	1.000			1.00	0
fLT	0.968						1	1.000			0.98	6
Sec.												
fLpb	1.000						1	1.000			1.00	0
fRpb	1.000	1.00	0				1	1.000			1.00	0
S	1672	1468						3234			3136	
Sec.												
			CA	PACITY	AND	LOS	WORKSHI	EET				

Capacity Analysis and Lane Group Capacity

Ar Mv	ppr/ vmt	Lane Group	Flo	Adj w Rate (v)	Adj Flow (	Sat Rate s)	E F (	Flow Ratio (v/s)	Gre Rat (g/	en io C)	La Сара	ane G acity (c)	roup v/c Ratio	
Easth														
Pi	rot													
Pe	erm													
Le	eft													
Pi	rot													
Pe	-∵m													
 ጥነ	1r11	ŢŢŢ	2	74	16	72	#	0 16	0	16	2	59	1 06	
R-	iaht	R	1	07	14	68		0 07	0	50	7	41	0 14	
Westh	ound	10	-	0,		00		0.07	۰.	50	,		0.11	
Pi	rot													
De	-rm													
I C	≤± ≤f+													
Di	rot													
De	-rm													
ר בי ריי	2 × 11													
D -	iaht													
North	bound	4												
NOT CI	rot	1												
	2 U C													
E C T.e	≤⊥ ≤f+													
Di	rot													
	2 U C													
ድ ዓ ጥት	2 × 11	Ψ₽	g	36	30	34	#	0 26	0	22	1 (	067	0 78	
D-	iaht	II	0	50	52	JI	π	0.20	0.	55	Τ,	007	0.70	
South	bound	4												
SOULI	rot	1												
P I D 2	20C													
P C	=⊥ >.f+													
Ц¢ D-														
PI														
		тm	1	015	2.1	26	ш	0 2 2	0	4 5	1	111	0 7 0	
TT D	iru aht	Γ.Τ.	T	015	3⊥	30	Ħ	0.32	υ.	45	Τ·	411	0.72	
к. 														
Sum o	of flo	ow rati	os for	critic	cal la	ne gro	our	ps, Yc	= S	um	(v/s	) =	0.75	
Tota.	L LOSI	t time j	per cy	cle, l	_ = ⊥3	.00 se	eC	37	( 37			<b>T</b> \	0 0 0	
Crit.	ICal .	LIOW ra	le lo	Сараст	ly rat	10,		AC	= (10	)(C	)/(0.	-ц) =	0.80	
Conti	rol De	elay an	d LOS	Determ:	inatio	n								
Appr	/ Ra	atios	Unf	Prog	Lane	Incre	eme	ental	Res	Laı	ne G	roup	Appro	ach
Lane			Del	Adj	Grp	Facto	or	Del	Del					
Grp	v/c	g/C	d1	Fact	Cap	k		d2	d3	De	elay	LOS	Delay	LOS
East	oound													
тm	1 0 0	0 1 6	01 -	1 000	250	0 5 0		70 0	0 0	1 -		T.	100 0	T.
Г.I.	1.06	0.16	84.5	1.000	259 741	0.50		/2.0	0.0	150	).5 -	F'	120.0	F.
K Wootl	0.14	0.50	20.4	1.000	/4⊥	0.11		0.1	0.0	20	. ว	C		
west	Jouna													
North	nbound	£												
TR	0.78	0.33	60.5	1.000	1067	0.33		3.9	0.0	64	. 4	Е	64.4	E
South	abound	ł												
JUULI		~												
LT	0.72	0.45	44.7	0.182	1411	0.28		0.5	0.0	8.6	5	A	8.6	A

SUPPLEMENTAL PERMITTED LT WORKSHEET for exclusive lefts Input EΒ WB NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 200.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo 1.000 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. _SUPPLEMENTAL PERMITTED LT WORKSHEET_ for shared lefts Input EΒ WB NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 200.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s)Opposing effective green time, go (s) Number of lanes in LT lane group, N

Intersection LOS = D

Intersection delay = 48.5 (sec/veh)

Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) 0.664 Proportion of LT in LT lane group, PLT 0.000 0.276 Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo 1.000 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min=fmin;max=1.00)flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET Permitted Left Turns EΒ WΒ  $^{\rm NB}$ SB Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Pedestrian flow rate, Vpedg (p/h) 0CCpedq Opposing queue clearing green, gq (s) Eff. ped. green consumed by opp. veh. queue, gq/gp OCCpedu Opposing flow rate, Vo (veh/h) OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion of left turns, PLT Proportion of left turns using protected phase, PLTA Left-turn adjustment, fLpb Permitted Right Turns Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Conflicting bicycle volume, Vbic (bicycles/h) Vpedg OCCpedq Effective green, g (s) Vbicg

OCCbicg									
OCCr Number	of cross	-street	receivin	a lanes	Nrec				
Number	of turni	ng lanes	, Nturn	g tanes,	NIEC				
ApbT		-							
Proport	ion righ	t-turns,	PRT						
Proport Right t	ion rign urn adju	t-turns stment.	using pr fRpb	otected	pnase, P	RTA			
Right t	arn aaja	bemerre,	INPO						
		SU	PPLEMENT	AL UNIFC	ORM DELAY	WORKSHE	ET		
Cural o 1	anath C				200 0	E	BLT WBL	T NBLT	SBLT
Adi. LT	vol fro	m Vol Ad	iustment	Workshe	200.0 eet, v	sec			
v/c rat	io from	Capacity	Workshe	et, X	,				
Protect	ed phase	effecti	ve green	interva	1, g (s)				
Opposin Unoppos	g queue d ad green	effectiv interva	e green	interval	, gq				
Red tim	e r=(C-q	-qq-qu)	.r, gu						
Arrival	rate, q	a=v/(360	0(max[X,	1.0]))					
Protect	ed ph. d	eparture	rate, S	p=s/3600					
Permitt	ed ph. d	eparture	rate, S	s=s(gq+g	ju)/(gu*3	600)			
XProt									
Case									
Queue a	t beginn	ing of g	reen arr	ow, Qa	0				
Queue a Residua	l queue.	ng or u Or	insaturat	ed green	I, Qu				
Uniform	Delay,	d1							
		DELAY/	LOS WORK	SHEET WI	тн тмттт	AI. OIIEIIE	!		
Appr/	Unmet	Dur. Unmet Demand t hrs.	Uniform		Queue Param. u	Final Unmet	Queue	Lane Group	
Lane Group	Demand Q veh		Unadj. ds	Adj. d1 sec		Demand Q veh	Delay d3 sec	Delay d sec	
 Eastbou	 nd								
	0.0						0.0		
LT	0.0	0.00	84.5 40 F	84.5	0.00	3.8	0.0	156.5	
ĸ	0.0	0.00	49.5	20.4	0.00	0.0	0.0	20.5	
Westbou	nd								
	0.0						0.0		
	0.0						0.0		
	0.0						0.0		
Northbo	und								
mp.	0.0	0 0 0			0 00	0 0	0.0		
TR	0.0	0.00	67.0	60.5	0.00	0.0	0.0	64.4	
Southbo	und						0 0		
LT	0.0	0.00	55.0	44.7	0.00	0.0	0.0	8.6	
	0.0			•·			0.0		
	Intersec	tion Del	ay 48.5	sec/v	reh I	ntersect	ion LOS	 D	
	-		-						
			5 - 2						
			BACK	UF QUEL	WORKSH	ьвт			
	Eastbound	Westbound	Northbound	Southbound					
--------------	--------------	-----------	------------	------------					
LaneGroup	LT R		TR	LT					
Init Queue	0.0 0.0		0.0	0.0					
Flow Rate	274 107		439	533					
So	1900 1900		1900	1900					
No.Lanes	0 1 1	0 0 0	0 2 0	0 2 0					
SL	1672 1468		1698	1647					
LnCapacity	259 741		560	741					
Flow Ratio	0.2 0.1		0.3	0.3					
v/c Ratio	1.06 0.14		0.78	0.72					
Grn Ratio	0.16 0.50		0.33	0.45					
I Factor	1.000		1.000	0.266					
AT or PVG	3 3		3	6					
Pltn Ratio	1.00 1.00		1.00	2.00					
PF2	1.00 1.00		1.00	0.35					
Q1	15.2 3.2		22.0	8.4					
kB	0.5 0.9		0.8	0.2					
Q2	5.2 0.2		2.5	0.6					
Q Average	20.4 3.3		24.5	9.0					
Q Spacing	25.0 25.0		25.0	25.0					
Q Storage	0 0		0	0					
Q S Ratio									
70th Percent	cile Output:								
fB%	1.2 1.2		1.2	1.2					
BOQ	23.6 4.0		28.3	10.6					
QSRatio									
85th Percent	tile Output:								
fB%	1.5 1.6		1.4	1.5					
BOQ	29.6 5.2		35.1	13.7					
QSRatio									
90th Percent	cile Output:								
fB%	1.5 1.7		1.5	1.7					
BOQ	31.5 5.8		37.2	14.9					
QSRatio									
95th Percent	cile Output:								
fB%	1.7 2.0		1.7	1.9					
BOQ	34.5 6.7		40.5	16.8					
QSRatio									
98th Percent	tile Output:	1							
±B%	1.9 2.5		1.9	2.2					
BOQ	38.9 8.2		45.4	19.8					
QSRatio									

Analyst: Agency: 1 Date: 6 Period: 1 Project 2 E/W St: 1	PB 6/25 PM Po ID: Bata	/2010 eak H I-290 an Dr	) Iour ) Phas cive	se 1 St	udy		Int Are Jur Yea N/S	er.: B a Type isd: r : E St: 1	ataan : All xistin st Ave	Drive other ng enue	e & ls area	st Ave as	nue	
				STO	יסד דאמי	אד תק	זיידספד	OT TON	QTTMM A I	DV				
				G		-bour	ATEROF 2		+ hhow	nd	501			
		т	T T		т	שטטע. ד		I T	T T		т 500	T T T T T T T T T T T T T T T T T T T	D D	
		ш	T		Ш	T	IC.		T	IX.	ш	T	К	
No Tomo	-  - ~			 1										
NO. Lane:	8   	0	 		0	0	0			0	0	 т m	0	
LGCONIIG		1 7 2	0 4 L'L						TR	0	100	0 7 0		
volume	-  -	1/3	84	302					105	0	400	970		
Lane Wid	tn		12.0	12.0					11.5	0		11.0		
RTOR VOL	I			62				I		0				I
Duration		0.25		Area 1	Type: A	All (	other	areas						
					Sign	nal (	)perat	ions						
Phase Con	mbina	atior	1 1	2	3	4		T . C .	5	6	7	8		
EB LEIT			A				NB	Leit		7				
Thru	L.		A					Thru		A				
Right	T		А					Right		А				
Peas								Peas	-					
WB Leit							SB	Leit	A					
Thru								Thru	А					
Right	T							Right						
Peas	L.							Peas		7				
NB Right	τ							Right		А				
SB Right	T		20.0				WB	Right	<u> </u>					
Green			30.0						90.0	65.0	)			
Yellow			4.0						4.0	4.0				
All Red			1.0						1.0	U	. 1 .			
			т.					- C	Cyc.	le Ler	igtn:	200.0		secs
7			ז⊥ - ה⊲ר	itersed	CION Pot	eric	ormanc	e Summ	ary	7~~~				
Appr/	Crow	<b>~</b>	Au Elor	J Sal	Rat	2108		Lane	Group	Apt	proact	1		
Lalle (	Cana	p aitw	F I OV	v Rale		~~~~~						 ?		
GIÞ (	Capa	стсу	(	5)	v/C	9/		ретау	ПО2	Dere	ау цоз	5		
Eastbound	d													
T.T	259		165	71	1 04	Ω	16	151 Q	я	92 0	<b>ч</b>			
P	741		146	7 <u>1</u> 5 8	0 34	0.	50	191.9 29 9	C	74.7	, r			
Westhound	4 1		110	0	0.54	0.	. 50	27.7	C					
Webebouit	a													
Northbou	nd													
TR	106	7	323	34	0.77	0.	.33	63.9	E	63.9	) E			
	-													
Southbou	nd													
LT	141	0	313	33	1.02	0.	.45	60.0	Е	60.0	) E			
	Int	ersed	ction	Delay	= 67.3	3 (s	sec/ve	h) I	nters	ectior	n LOS	= E		

Phone: E-Mail: Fax:

_____OPERATIONAL ANALYSIS______

Analyst:	
Agency/Co.:	PB
Date Performed:	6/25/2010
Analysis Time Period:	PM Peak Hour
Intersection:	Bataan Drive & 1st Avenue
Area Type:	All other areas
Jurisdiction:	
Analysis Year:	Existing
Project ID: I-290 Phase 1	L Study
E/W St: Bataan Drive	N/S St: 1st Avenue

_____VOLUME DATA______OVOLUME DATA_____

	Eas	stbour	nd	We	stbou	ınd	No	rthbo	und	Sou	ıthbou	nd
	L 	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume	173	84	302					785	0	400	970	I
% Heavy Veh	10	10	10	ĺ			İ	10	10	10	10	İ
PHF	0.95	0.95	0.95					0.95	0.95	0.95	0.95	
PK 15 Vol	46	22	79					207	0	105	255	
Hi Ln Vol												
% Grade		0						0			0	
Ideal Sat		1900	1900					1900			1900	
ParkExist												
NumPark												
No. Lanes	0	1	1	0	0	0	0	2	0	0	2	0
LGConfig		LT	R					TR			LT	
Lane Width		12.0	12.0					11.5			11.0	
RTOR Vol			62						0			
Adj Flow		270	253					826			1442	
%InSharedLn												
Prop LTs		0.6	74					0.0	0 0		0.29	2
Prop RTs	0.	.000	1.000				0	.000		0	.000	
Peds Bikes	0			0			0					
Buses		0	0					0			0	
%InProtPhase	9											
Duration	0.25		Area 🗅	Гуре:	All	other	areas					

	Eas	stbou	nd	We	stbou	nd	No	rthbc	und	So	uthbo [.]	und
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
   Init Unmet		0.0	0.0	 			-   	0.0		-  	0.0	
Arriv. Type		3	3	İ			İ	3		İ	4	
Unit Ext.		3.0	3.0	İ			İ	3.0		İ	3.0	
I Factor		1.00	0	İ			İ	1.00	0	İ	0.09	0
Lost Time		2.0	2.0	İ			İ	2.0		İ	2.0	
Ext of g		3.0	3.0	İ			İ	3.0			2.0	
Ped Min g		3.2		i	3.2		i	3.2		İ		

## _____OPERATING PARAMETERS______

				PH.	ASE	data_					
Pha	se Combination	1	2	3	4			5	6	7	8
EB	Left Thru Right Peds	A A A				NB	Left Thru Right Peds		A A		
WB	Left Thru Right Peds					SB	Left Thru Right Peds	A A			
NB	Right					EB	Right		A		
SB	Right					WB	Right				
Gre Yel All	en : low : Red :	30.0 4.0 1.0			I			90.0 4.0 1.0	65.0 4.0 1.0		

Cycle Length: 200.0 secs

	7	VOLUM	E ADJ	USTMEN'	r and	SAT	URATIO	N FLO	W WORK	SHEET_		
Volume Adjus	stment											
	East	tboun	d	Wes	tboun	d	No	rthbo	und	Sou	thbou	nd
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume, V	  173 {	84	302	 			 	785	0	  400	970	 
PHF	0.95 (	0.95	0.95	İ				0.95	0.95	0.95	0.95	
Adj flow	182 8	88	253	ĺ				826	0	421	1021	
No. Lanes	i o	1	1	0	0	0	0	2	0	0	2	0
Lane group	İ	LT	R					TR		İ	LT	
Adj flow	j :	270	253					826		İ	1442	
Prop LTs	İ	0.67	4					0.0	00	İ	0.29	2
Prop RTs	j 0.0	000 1	.000	İ			0	.000		j 0.	000	İ
Saturation I Eas	Flow Ra	ate ( d	see E	xhibit Westbo	16-7 und	to	determ Nort	ine ti hbound	he adj [.] d	ustmer Soi	nt fac uthbour	tors) nd
LG	LT	R						TR			LT	
So	1900	1900						1900			1900	
Lanes O	1	1	0	0	0		0	2	0	0	2	0
fW	1.000	1.00	0					0.983			0.96	7
fHV	0.909	0.90	9					0.909			0.90	9
fG	1.000	1.00	0					1.000			1.00	0
fP	1.000	1.00	0					1.000			1.00	0
fBB	1.000	1.00	0					1.000			1.00	0
fA	1.000	1.00	0					1.000			1.00	0
fLU	1.000	1.00	0					0.952			0.95	2
frt	1.000	0.85	0					1.000			1.00	0
fLT	0.967							1.000			0.98	б
Sec.												
fLpb	1.000							1.000			1.00	0
fRpb	1.000	1.00	0					1.000			1.00	0
S	1671	1468						3234			3133	
Sec.												
			CA	PACITY	AND	LOS	WORKSH	EET				

Capacity Analysis and Lane Group Capacity

	Appr/ Mvmt	Lane Group	Flo	Adj w Rate (v)	Adj Flow (	Sat Rate s)	Flow Ratio (v/s)	Gre Rat (g/	enL io Cap C)	ane G acity (c)	roup v/c Ratio	
Eas	tbound Prot Perm Left Prot											
	Perm Thru Right	LT R	2 2	70 53	16 14	71 68	# 0.16 0.17	0. 0.	16 2 50 7	59 41	1.04 0.34	
Wes	tbound Prot Perm Left Prot Perm Thru Picht											
Nor	rthboun Prot Perm Left Prot Perm	d										
	Thru	TR	8	26	32	34	# 0.26	0.	33 1	067	0.77	
Sou	Right thboun Prot Perm Left Prot	d										
	Perm Thru Right	LT	1	442	31	33	# 0.46	0.	45 1	410	1.02	
Sum	n of fl	ow rati	os for	critic	cal la	ne gro	oups, Yo	z = S	um (v/s	) =	0.88	
Tot Cri	al los tical	t time flow ra	per cy te to	cle, I capacit	L = 13 ty rat	.00 se io,	C Xc	c = (Yc	)(C)/(C	-L) =	0.94	
Con App Lan	ntrol D pr/ R ne	elay an atios	d LOS Unf Del	Determ: Prog Adj	Lane Grp	n Incre Factc	mental or Del	Res Del	Lane G	roup	Appro	ach
Grp	v/c	g/C	dl	Fact	Cap	k	d2	d3	Delay	LOS	Delay	LOS
Eas	tbound											
LT R Wes	1.04 0.34 stbound	0.16 0.50	84.5 29.6	1.000 1.000	259 741	0.50 0.11	67.4 0.3	0.0 0.0	151.9 29.9	F C	92.9	F
Nor	thboun	d										
TR	0.77	0.33	60.3	1.000	1067	0.32	3.6	0.0	63.9	E	63.9	E
Sou	ıthboun	d										
LT	1.02	0.45	55.0	0.836	1410	0.50	14.0	0.0	60.0	E	60.0	E

SUPPLEMENTAL PERMITTED LT WORKSHEET for exclusive lefts Input EΒ WB NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 200.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo 1.000 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. _SUPPLEMENTAL PERMITTED LT WORKSHEET_ for shared lefts Input EΒ WB NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 200.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s)Opposing effective green time, go (s) Number of lanes in LT lane group, N

Intersection LOS = E

Intersection delay = 67.3 (sec/veh)

Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) 0.674 Proportion of LT in LT lane group, PLT 0.000 0.292 Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 1.000 0.952 0.952 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min=fmin;max=1.00)flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET Permitted Left Turns EΒ WΒ  $^{\rm NB}$ SB Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Pedestrian flow rate, Vpedg (p/h) 0CCpedq Opposing queue clearing green, gq (s) Eff. ped. green consumed by opp. veh. queue, gq/gp OCCpedu Opposing flow rate, Vo (veh/h) OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion of left turns, PLT Proportion of left turns using protected phase, PLTA Left-turn adjustment, fLpb Permitted Right Turns Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Conflicting bicycle volume, Vbic (bicycles/h) Vpedg OCCpedq Effective green, g (s) Vbicg

OCCbicg								
Number (	of cross	-street	receiving	g lanes,	Nrec			
Number o	of turnin	ng lanes	, Nturn					
ApbT	ion right	t-turng	DRT					
Proport	ion righ	t-turns,	using pro	otected	phase, Pl	RTA		
Right t	urn adju	stment,	fRpb		-			
		SU	PPLEMENT	AL UNIFO	RM DELAY	WORKSHE	ET	
						E	BLT WBL	T NBLT SBLT
Cycle le	ength, C				200.0	sec		
Adj. LT	vol from	m Vol Ad	justment	Workshe	et, v			
v/c rat:	10 from ( ad phage	Capacity	Workshe	et, X interva	] a (g)			
Opposing	g queue (	effectiv	e green	interval	' dd '' dd			
Unoppose	ed green	interva	l, gu					
Red time	e r=(C-g	-gq-gu)	0 (more [v])	1 01\\				
Protecte	ed ph. de	eparture	rate, S	o=s/3600				
Permitte	ed ph. de	eparture	rate, S	s=s(gq+g	u)/(gu*3	600)		
XPerm								
Case								
Queue at	t beginn:	ing of g	reen arr	ow, Qa				
Queue at	t beginn:	ing of u	nsaturat	ed green	, Qu			
Residua. Uniform	L queue, Delav (	Qr Al						
01111011	Deray,							
		DELAY/	LOS WORK	SHEET WI	TH INITI	AL QUEUE		
Appr/	Initial Unmet	Dur. Unmet	Uniform	Delay	Initial Queue	Final Unmet	Initial Queue	Lane Group
Lane Group	Demand Q veh	Demand t hrs.	Unadj. ds	Adj. dl sec	Param. u	Demand Q veh	Delay d3 sec	Delay d sec
Eastbou	 nd							
	0.0						0.0	
LT	0.0	0.00	84.5	84.5	0.00	2.8	0.0	151.9
R	0.0	0.00	49.5	29.0	0.00	0.0	0.0	29.9
Westbour	nd							
	0.0						0.0	
	0.0						0.0	
	0.0						0.0	
Northboy	und						0 0	
Ψ₽	0.0	0 0 0	67 0	60 3	0 0 0	0 0	0.0	63 9
110	0.0	0.00	07.0	00.5	0.00	0.0	0.0	
Southbo	und							
тm	0.0	0 00			0 00	0 0	0.0	60.0
LТ	0.0	0.00	55.0	55.0	0.00	8.U	0.0	6U.U
	Intersec	tion Del	ay 67.3	sec/v	eh I	ntersect	ion LOS	E
			ВАСК	OF QUEU	E WORKSH	EET		

LaneGroup       LT       R       TR       LT         Init Queue       0.0       0.0       0.0       0.0       0.0         Flow Rate       270       253       433       757         So       1900       1900       1900       1900       1900         No.Lanes       0       1       1       0       0       0       2       0       0       2       0         SL       1671       1468       1698       1645       1645       1645       1645         LnCapacity       259       741       560       740       1645       1645       1645	
Init Queue0.00.00.00.0Flow Rate270253433757So1900190019001900No.Lanes01100020SL1671146816981645LnCapacity259741560740	
Flow Rate270253433757So19001900190019001900No.Lanes0110002020SL16711468169816451645LnCapacity259741560740740	
So       1900       1900       1900       1900       1900         No.Lanes       0       1       1       0       0       0       2       0       0       2       0         SL       1671       1468       1698       1645       1645         LnCapacity       259       741       560       740	
No.Lanes         0         1         1         0         0         0         2         0         2         0           SL         1671         1468         1698         1645           LnCapacity         259         741         560         740	Ì
SL         1671 1468         1698         1645           LnCapacity         259 741         560         740	
LnCapacity 259 741 560 740	
	Ì
Flow Ratio   0.2 0.2   0.3 0.5	ĺ
v/c Ratio   1.04 0.34   0.77   1.02	
Grn Ratio   0.16 0.50   0.33   0.45	
I Factor   1.000   1.000   0.090	
AT or PVG   3 3   3   4	
Pltn Ratio   1.00 1.00   1.00   1.33	
PF2   1.00 1.00   1.00   1.00	
Q1   15.0 8.4   21.6   42.1	
kB   0.5 0.9   0.8   0.1	
Q2   4.8 0.5   2.3   4.1	
Q Average 19.8 8.9 24.0 46.1	
Q Spacing 25.0 25.0 25.0 25.0 25.0	
Q Storage 0 0 0 0 0	
Q S Ratio	
70th Percentile Output:	
fB%   1.2 1.2   1.2   1.1	ļ
BOQ 23.0 10.5 27.7 52.2	ļ
QSRatio	
85th Percentile Output:	
fB%   1.5 1.5   1.4   1.4	ļ
BOQ 28.9 13.5 34.4 62.9	ļ
QSRatio	
90th Percentile Output:	
BOQ   30.7 14.7   36.5   66.4	
QSRatio	
95th Percentile Output:	
BUQ   33./10.6   39.8   71.3	
USKatio	I
	I
BUQ   30.0 19.0   44.0   /9./	
	Ι

Analyst: Agency: Date: Period: Project	PB 6/25, AM Pe ID: 2	/2010 eak H [-290	our nPha	ase 1 S	Study		In Ar Ju Ye	ter.: ea Typ risd: ear :	CTA S e: CB Exist	Station SD or Si	& Des imilar	s Pla	aine	s Av	ven
E/W St:	CTA S	Stati	on				N/	S St:	Des P	laines	Aven	7e			
		Eas L	tbour T	SIC nd R	GNALIZ   Wes   L	ED I tbou T	NTERS nd R	ECTION	SUMM rthbo T	IARY ound R	Sou	uthbo T	ound R		
No. Lane LGConfig Volume Lane Wid	s  - 	1 L 51 L2.0	0	1 R 7 12.0 5	0	0	0	1 1 159 11.0	2 T 744 10.0	0	0	2 TH 847 12.0	 0 81 0 6		
Duration		).25		Area 5	 Гуре:	CBD	or Si	 milar			I 			I 	
					Sig	nal	Opera	tions_		C					
EB Left Thru Righ Peds	.t	ation	A	2	3	4		B Left Thru Righ Peds	A A t	6 A A	1		δ		
NB Left Thru Righ Peds NB Righ	.t .t						5E       EB	Thru Righ Peds Righ	t	A A X					
SB Righ Green Yellow All Red	.t		25.0 4.0 1.0				WE	8 Righ	t 11. 3.0 1.0 Cy	0 65.0 9 4.0 9 1.0 7cle Ler	) ngth:	115	. 0	sec	CS
			I1	ntersed	ction	Perf	orman	ice Sum	mary_						
Appr/ Lane	Lane Group	ç	Ad: Flov	j Sat w Rate	Ra 	tios	. <u> </u>	Lane	Grou	ıp Apr 	proach	1			
Grp	Capad	city	1	(s)	v/c	g	/C	Dela	y LOS	5 Dela	ay LOS	3			
Eastboun L	.d 304		134	13	0.18	0	.23	36.2	D	36.1	l d				
R Westboun	272 .d		120	)2	0.01	. 0	.23	34.5	С						
Northbou L	.nd 2.8.4		12:	2.2	0.59	0	.70	11.5	в						
Т	180	7	250	55	0.43	0	.70	7.4	A	8.1	A				
Southbou	.nd														
TR	1524	1	265	56	0.64	. 0	.57	17.4	В	17.4	4 В				
	Inte	ersec	tion	Delay	= 13.	4 (	sec/v	reh)	Inter	sectior	n LOS	= B			

Phone: Fax: E-Mail: _____OPERATIONAL ANALYSIS_____ Analyst: Agency/Co.: PB

Agency/Co..FDDate Performed:6/25/2010Analysis Time Period:AM Peak HourIntersection:CTA Station & Des Plaines AvenArea Type:CBD or SimilarJurisdiction:Analysis Year:Analysis Year:ExistingProject ID:I-290 nPhase 1 StudyE/W St: CTA StationN/S St: Des Plaines Avenve

_____VOLUME DATA______

	Eas	stbou	nd	We	stbou	ınd		Noi	rthbou	ınd	Sou	ithbo	und
	L	Т	R	L	Т	R		L	Т	R	L	Т	R
Volume	  51		7				——   	159	744		 	847	81
% Heavy Veh	10		10				ł	10	10			10	10
PHF	0.95		0.95				ľ	0.95	0.95			0.95	0.95
PK 15 Vol	13		2					42	196		ĺ	223	21
Hi Ln Vol	ĺ						j				İ		
% Grade		0					Í		0		ĺ	0	
Ideal Sat	1800		1800					1800	1800		ĺ	1800	
ParkExist													
NumPark													
No. Lanes	1	0	1	0	0	0		1	2	0	0	2	0
LGConfig	L		R					L	Т			TR	
Lane Width	12.0		12.0					11.0	10.0			12.0	
RTOR Vol			5										6
Adj Flow	54		2					167	783			971	
%InSharedLn													
Prop LTs								1.000	0.00	0		0.0	0 0
Prop RTs			1.000					0	.000		0.	.081	
Peds Bikes	0			0							30	00	C
Buses	10		10					10	10			10	
%InProtPhase	9							0.0					
Duration	0.25		Area 1	[ype:	CBD	or S	imj	llar					

## _____OPERATING PARAMETERS______OPERATING PARAMETERS_____

	Eas	Eastbound L T R 0.0 0.0 3 3.0 3.0		Westbound			No	rthbou	ınd	So	und	
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
							_			.		
Init Unmet	0.0		0.0				0.0	0.0			0.0	
Arriv. Type	3		3				3	3			3	
Unit Ext.	3.0		3.0	ĺ			3.0	3.0			3.0	Í
I Factor		1.00	0	ĺ			Ì	0.856	5	ĺ	1.00	0
Lost Time	2.0		2.0	ĺ			2.0	2.0		ĺ	2.0	Í
Ext of g	3.0		3.0	İ			2.0	3.0		İ	3.0	İ
Ped Min g		3.2		İ	3.2		İ			İ	5.8	İ

				РН.	ASE	DATA_					
Pha	se Combination	1	2	3	4			5	б	7	8
EB	Left Thru Right Peds	A A				NB	Left Thru Right Peds	A A	A A		
WB	Left Thru Right Peds					SB	Left Thru Right Peds		A A X		
NB	Right					EB	Right				
SB	Right					WB	Right				
Gre Yel All	en : low : Red :	25.0 4.0 1.0			ļ			11.0 3.0 1.0	65.0 4.0 1.0		

Cycle Length: 115.0 secs

			VOLUM	E ADJI	JSTMEN	T AND	SAT	TURATIO	ON FLOV	WORKS	SHEET_		
Volum	e Adjus	stment											
		Eas	tboun	d	Wes	tbound	d	No	orthbou	ınd	Sou	ithbo	und
		L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volum	e, V	  51		7	 			<u></u>  159	744		 	847	81
PHF		0.95		0.95				0.95	5 0.95			0.95	0.95
Adj f	low	54		2				167	783			892	79
No. La	anes	1	0	1	0	0	0	1	L 2	0	0	2	0
Lane g	group	L		R				L	Т			TR	
Adj f	low	54		2				167	783			971	
Prop 1	LTs	ĺ			ĺ			1.00	0.00	00		0.0	00
Prop 1	RTs	ĺ	1	.000	İ			(	0.000		0.	081	ĺ
Satura	ation 1	Flow R	ate (	see Ez	xhibit	16-7	to	detern	nine th	ne adju	ustmen	it fac	ctors)
та	Ed: T	schoum	u D	,	vestbo	una		TNOL	m	1	500		una
ЦG	上 1 0 0 0		R 1000					Ц 1000	1000			100	0
50	1000	0	1000	0	0	0		1000	1000	0	0	2001	0
fw	1 000	0	1 0 0	0	0	0				0	0	2 1 0/	0
LW FUV			1.00	0				0.907	0.933			1.00	00
fC	1 000		1 00	9				1 000	1 000			1 0	09
LG fD	1 000		1 00	0				1 000	1 000			1 0	00
L P f D D	1.000		1.00	0				1.000	1.000			1.0	00
f V	0.900		0.90	0				0.900	0.900			0.90	00
f t tt	1 000		1 00	0				1 000	0.900			0.9	50 52
f d m	1.000		0 85	0				1.000	1 000			0.9	22
fTT	0 950		0.05	0				0 950	1 000			1 0	00
2 P C	0.250							0 214	1.000			1.00	0.0
fLnh	1 000							0.214	1 000			1 0	0.0
fRup	1.000		1 00	0				0.911	1 000			1 O	78
d TVDD	1243		1202	0				1 2 2 2	2565			265	, <u>,</u>
Sec.	1040							1222 275	2000			2050	0
				CAI	PACITY	AND I	LOS	WORKSH	IEET				
Canac	ity Ana	alveie	and	Iane (	Iroun	Canac	itv						

Capacity Analysis and Lane Group Capacity

			Adj	Adj	Sat	F	low	Gre	en	Lane G	roup	
Appr/ Mvmt	Lane Group	Flo	w Rate (v)	Flow (s	Rate s)	R (	atio v/s)	Rat (g/	io Ca C)	pacity (c)	v/c Ratio	
Eastboun	d											
Prot												
Perm												
Left	L	5	4	134	13	#	0.04	0.	23	304	0.18	
Prot												
Perm												
Thru												
Right	R	2		120	2		0.00	0.	23	272	0.01	
Westboun	d											
Prot												
Perm												
Left												
Prot												
Perm												
Thru												
Right												
Northbou	nd											
Prot		1	17	122	22	#	0.10	0.	096	117	1.00	
Perm		5	0	275	5		0.18	0.	609	167	0.30	
Left	L	1	67					Ο.	70	284	0.59	
Prot												
Perm												
Thru	Т	7	83	256	55		0.31	Ο.	70	1807	0.43	
Right												
Southbou	nd											
Prot												
Perm												
Left												
Prot												
Perm												
Thru	TR	9	71	265	6	#	0.37	Ο.	57	1524	0.64	
Right												
Sum of f	low rati	os for			ne arc		s Yc	= S		g) =	0 50	
Total lo	st time	per cv	cle, I	= 13.	00 se	5C 5C	2, 10	5	(,,	27		
Critical	flow ra	te to	capacit	v rati	.0,		Xc	= (Yc	)(C)/(	C-L) =	0.57	
			<u>F</u>		,			( = -	, ( = , , (	/		
Control	Delay an	d LOS	Determi	nation	1							
Appr/	Ratios	Unf	Prog	Lane	Incre	eme	ntal	Res	Lane	Group	Approa	ach
Lane		Del	Adj	Grp	Facto	or	Del	Del				
Grp v/	c g/C	dl	Fact	Сар	k		d2	d3	Dela	y LOS	Delay	LOS
Eastboun	 d											
L 0.1	8 0.23	35.9	1.000	304	0.11		0.3	0.0	36.2	D		
											36.1	D
R 0.0	1 0.23	34.5	1.000	272	0.11		0.0	0.0	34.5	С		
Westboun	d											
Northbou	nd											
L 0.5	9 0.70	8.7	1.000	284	0.18		2.7	0.0	11.5	В		
T 0.4	3 0.70	7.2	1.000	1807	0.11		0.1	0.0	7.4	Ā	8.1	А
				,								
Southbou	nd											
TR 0.6	4 0.57	16.5	1.000	1524	0.22		0.9	0.0	17.4	В	17.4	В

SUPPLEMENTAL PERMITTED LT WORKSHEET		
for exclusive lefts		
IIPUL ER WR	NB	SB
Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 115.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N	80.0 70.0 66.0 1	
Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL	2 167 1.000 0.00 971 5.00	
LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)	5.33 0.952 16.29	0.952
gf=G[exp(- a * (LTC ** b))]-t1, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq <gf p=Max(ag.gf)(2,0)</gf 	0.0 1.00 0.43 19.37 50.63	
PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)] EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0)	1.00 1.00 3.38	
<pre>fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin&lt;=: or flt=[fm+0.91(N-1)]/N**</pre>	0.06 0.00 0.21 fm<=1.0	)0)
Left-turn adjustment, fLT	0.214	
<pre>For special case of single-lane approach opposed by multilane approace text. * If Pl&gt;=1 for shared left-turn lanes with N&gt;1, then assume de-fact left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes For special case of multilane approach opposed by single-lane appro or when gf&gt;gq, see text.</pre>	bach, to s, flt= bach	-fm.
SUPPLEMENTAL PERMITTED LT WORKSHEET for shared lefts		
Input	NP	<b>GB</b>
Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 115.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N	D	۵۵

```
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT
                                                                    0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
                                                                    0.952 0.952
Opposing lane util. factor, fLUo
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
qf=G[exp(-a * (LTC ** b))]-t], qf <= q
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g or fmin=2(1+Pl)/g
qdiff=max(qq-qf,0)
fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT
For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
 left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.
               SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET
Permitted Left Turns
                                                        EΒ
                                                              WΒ
                                                                          SB
                                                                    NB
Effective pedestrian green time, gp (s)
                                                                   65.0
Conflicting pedestrian volume, Vped (p/h)
                                                                   300
Pedestrian flow rate, Vpedg (p/h)
                                                                   530
0CCpedq
                                                                   0.265
Opposing queue clearing green, gq (s)
                                                                   19.37
                                                                   0.298
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
                                                                   0.226
Opposing flow rate, Vo (veh/h)
                                                                   971
                                                                   0.059
OCCr
Number of cross-street receiving lanes, Nrec
                                                                   1
Number of turning lanes, Nturn
                                                                   1
ApbT
                                                                   0.941
                                                                   1.000
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
                                                                   0.000
Left-turn adjustment, fLpb
                                                                   0.941
Permitted Right Turns
Effective pedestrian green time, gp (s)
                                                                          65.0
Conflicting pedestrian volume, Vped (p/h)
                                                                          300
Conflicting bicycle volume, Vbic (bicycles/h)
                                                                          Ω
                                                                          530
Vpedg
OCCpedq
                                                                          0.265
                                                                          66.0
Effective green, g (s)
                                                                          0
Vbicg
```

OCCbicg	0.020
OCCr	0.265
Number of cross-street receiving lanes, Nrec	1
Number of turning lanes, Nturn	1
ApbT	0.735
Proportion right-turns, PRT	0.081
Proportion right-turns using protected phase, PRTA	0.000
Right turn adjustment, fRpb	0.978

_____SUPPLEMENTAL UNIFORM DELAY WORKSHEET_____

			EBLT	WBLT	NBLT	SBLT
Cycle length, C 115.	0	sec				
Adj. LT vol from Vol Adjustment Worksheet, v					167	
v/c ratio from Capacity Worksheet, X					0.59	
Protected phase effective green interval, g (s	)				11.0	
Opposing queue effective green interval, gq					19.37	
Unopposed green interval, gu					50.63	
Red time r=(C-g-gq-gu)					34.0	
Arrival rate, $qa=v/(3600(max[X,1.0]))$					0.05	
Protected ph. departure rate, Sp=s/3600					0.339	
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*	36	00)			0.11	
XPerm					0.61	
XProt					0.56	
Case					1	
Queue at beginning of green arrow, Qa					1.58	
Queue at beginning of unsaturated green, Qu					0.90	
Residual queue, Qr					0.00	
Uniform Delay, dl					8.7	

_____DELAY/LOS WORKSHEET WITH INITIAL QUEUE______

Appr/	Initial Unmet	Dur. Unmet	Uniform	Delay	Initial Oueue	Final Unmet	Initial Oueue	Lane Group
Lane	Demand	Demand	Unadj.	Adj.	~ Param.	Demand	Delay	Delay
Group	Q veh	t hrs.	ds	dl sec	u	Q veh	d3 sec	d sec
Eastbour	nd							
L	0.0	0.00	44.5	35.9	0.00	0.0	0.0	36.2
	0.0						0.0	
R	0.0	0.00	44.5	34.5	0.00	0.0	0.0	34.5
Westbour	nd							
	0.0						0.0	
	0.0						0.0	
	0.0						0.0	
Northbou	ınd							
L	0.0	0.00		8.7	0.00	0.0	0.0	11.5
Т	0.0	0.00	17.0	7.2	0.00	0.0	0.0	7.4
	0.0						0.0	
Southbou	ınd							
	0.0						0.0	
TR	0.0	0.00	24.5	16.5	0.00	0.0	0.0	17.4
	0.0						0.0	
]	Intersect	ion Dela	ay 13.4	sec/ve	eh Ir	ntersecti	ion LOS	В

_____BACK OF QUEUE WORKSHEET_____BACK OF QUEUE WORKSHEET_____

	Eastbou	ınd	Westbou	ınd	Nor	thbound	Southbo	und
LaneGroup	L	R			L	Т	TR	
Init Queue	0.0	0.0			0.0	0.0	0.0	ĺ
Flow Rate	54	2			167	411	509	ĺ
So	1800	1800			1800	1800	1800	ĺ
No.Lanes	1 0	1 0	0	0	1	2 0	0 2	0
SL	1343	1202			404	1347	1394	
LnCapacity	304	272			284	949	800	
Flow Ratio	0.0	0.0			0.4	0.3	0.4	ĺ
v/c Ratio	0.18	0.01			0.59	0.43	0.64	
Grn Ratio	0.23	0.23			0.70	0.70	0.57	
I Factor	1.000	)				0.856	1.00	0
AT or PVG	3	3			3	3	3	
Pltn Ratio	1.00	1.00			1.00	1.00	1.00	
PF2	1.00	1.00			1.00	1.00	1.00	
Q1	1.4	0.0			1.7	5.6	10.9	
kB	0.4	0.4			0.3	0.7	0.7	
Q2	0.1	0.0			0.4	0.5	1.2	
Q Average	1.5	0.1			2.1	6.1	12.1	
Q Spacing	25.0	25.0			25.0	25.0	25.0	
Q Storage	0	80			80	0	0	
Q S Ratio		0.0			0.7			
70th Percent	cile Output	::						
fB%	1.2	1.2			1.2	1.2	1.2	
BOQ	1.8	0.1			2.5	7.2	14.2	
QSRatio		0.0			0.8			
85th Percent	cile Output	::						
fB%	1.6	1.6			1.6	1.5	1.5	
BOQ	2.3	0.1			3.3	9.4	18.2	
QSRatio		0.0			1.0			
90th Percent	cile Output	;:						
fB%	1.8	1.8			1.8	1.7	1.6	
BOQ	2.6	0.1			3.7	10.3	19.6	
QSRatio		0.0			1.2			
95th Percent	cile Output	;:						
fB%	2.1	2.1			2.0	1.9	1.8	
BOQ	3.0	0.1			4.3	11.7	21.9	
QSRatio		0.0			1.3			
98th Percent	tile Output	;:						
±B%	2.6	2.7			2.5	2.3	2.1	
BOQ	3.8	0.1			5.4	14.2	25.3	
QSRatio		0.0			1.7			

Analyst: Agency: Date: Period: Project	PB 6/25 PM P ID:	/2010 eak H I-290	iour Pha	se 1 St	Inter.: CTA Station & Des Plaines Ave Area Type: CBD or Similar Jurisd: Year : Existing tudy N/S St: Des Plaines Avenue									ven		
E/W SL· V	CIA	SLALI	011				г	G \ N.	SC. D	es pi	aines	Aven	ue			
				SIC	GNALIZ	ED I	NTEF	RSE	CTION	SUMMAI	RY					
		Eas	tbou	nd	Wes   T	tbou	nd D		Nor	thboui T	nd   b	So	uthbo T	ound ס		
		Ц	T	ĸ		T	К			T	к	Ц	T	К		
No. Lane:	s	1	0	1	0	0	0		1	2	0	0	2	0		
LGConfig	İ	L		R					L	Т	İ		TI	R		İ
Volume		63		80					157	664			985	40		
Lane Wid	th	12.0		12.0					11.0	10.0			12.	0		
RTOR Vol	I			65										0		
Duration		0.25		Area 1	Cype:	CBD	or S	Sim	ilar							
Phase Co	 mhin	ation	1	2	Sig 3	nai 4	oper	rat	lons	5	б	7		8		
EB Left		acron	A	2	5	-	1	NB	Left	A	Ā	,		0		
Thru							i		Thru	A	A					
Righ	t		А				Ì		Right							
Peds									Peds							
WB Left								SB	Leit		7					
Pich	+								Pight		A 7					
Peds	L								Peda		A X					
NB Righ	t						E	ΞB	Right							
SB Righ	t						Ī	٧В	Right							
Green			25.0							11.0	65.0					
Yellow			4.0							3.0	4.0					
All Red			1.0							1.0	1.0		11-	0		
			т	nterge	rtion	Derf	orma	anci	a Siimm	Cyc. arv	le Len	gth:	115	.0	se	CS
Appr/	 Lane		 Ad	i Sat	Ra	tios	OT IIIC	anc	Lane	Group	 qqA	roac	 h			
Lane (	Grou	р	Flo	w Rate												
Grp	Capa	city		(s)	v/c	g	/ C		Delay	LOS	Dela	y LO	S			
Eastbound	 d															
L	304		13	43	0.22	0	.23		36.6	D						
											36.3	D				
R	272		12	02	0.06	0	.23		35.0-	С						
Westbound	d															
Northbou	nd															
L	260		12	35	0.63	0	.70		14.4	В						
Т	180	7	25	65	0.39	0	.70		7.0	A	8.4	A				
Southbou	nd															
ШЪ	1	2	<u> </u>	0.4		~	F 7		10 5	F	10 -	-				
ΓK	ТЭЭ	2	21	04	0.70	U	.57		18./	В	18.7	В				
	Int	ersec	tion	Delay	= 15.	1 (	sec/	/vel	h) I	nters	ection	LOS	= B			

Analyst:

Phone: Fax: E-Mail: _____OPERATIONAL ANALYSIS_____

Agency/Co.:PBDate Performed:6/25/2010Analysis Time Period:PM Peak HourIntersection:CTA Station & Des Plaines AvenArea Type:CBD or SimilarJurisdiction:Jurisdiction:Analysis Year:ExistingProject ID:I-290 Phase 1 StudyE/W St: CTA StationN/S St: Des Plaines Avenue

_____VOLUME DATA______

	Eastbound			Wes	stbou	nd	Nor	rthbou	ınd	Southbound		
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume	63		80				  157	664		 	985	40
% Heavy Veh	10		10				10	10			10	10
PHF	0.95		0.95				0.95	0.95			0.95	0.95
PK 15 Vol	17		21				41	175			259	11
Hi Ln Vol							İ			ĺ		İ
% Grade		0					İ	0			0	İ
Ideal Sat	1800		1800				1800	1800			1800	
ParkExist												
NumPark												
No. Lanes	1	0	1	0	0	0	1	2	0	0	2	0
LGConfig	L		R				L	Т			TR	
Lane Width	12.0		12.0				11.0	10.0			12.0	
RTOR Vol			65									0
Adj Flow	66		16				165	699			1079	
%InSharedLn												
Prop LTs							1.000	0.00	0		0.00	00
Prop RTs			1.000				0	.000		0.	.039	
Peds Bikes	0			0						30	) 0 (	) (
Buses	10		10				10	10			10	
%InProtPhase	e						0.0					
Duration	0.25		Area 1	[ype:	CBD	or Sim	nilar					

## _____OPERATING PARAMETERS______OPERATING PARAMETERS_____

	Ea	Eastbound			stbou	nd	No	rthbou	und	So	uthbo	und
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
				·			_			-		
Init Unmet	0.0		0.0				0.0	0.0			0.0	
Arriv. Type	3		3				3	3			3	
Unit Ext.	3.0		3.0				3.0	3.0			3.0	
I Factor		1.00	0					0.861	1		1.00	0
Lost Time	2.0		2.0				2.0	2.0			2.0	
Ext of g	3.0		3.0				2.0	3.0			3.0	
Ped Min g		3.2			3.2						5.8	ĺ

	PHASE DATAPHASEPHASE												
Pha	se Combination	1	2	3	4			5	б	7	8		
EB	Left Thru Right Peds	A A				NB	Left Thru Right Peds	A A	A A				
WB	Left Thru Right Peds					SB	Left Thru Right Peds		A A X				
NB	Right					EB	Right						
SB	Right					WB	Right						
Gre Yel All	en : low : Red :	25.0 4.0 1.0			I			11.0 3.0 1.0	65.0 4.0 1.0				

Cycle Length: 115.0 secs

			VOLUM	E ADJI	USTMEN	T AND	SA	TURATIC	N FLO	WORKS	SHEET_			
Volume	e Adjus	stment												
		Eas	tbound	d	Wes	tboun	d	No	orthbou	und	Sou	ithbo [.]	und	
		L	Т	R	L I	Т	R	L	Т	R	L	Т	R	Ì
Volume	e, V	63		80				157	664			985	40	-
PHF		0.95		0.95				0.95	0.95			0.95	0.95	
Adj f	low	66		16				165	699			1037	42	
No. La	anes	1	0	1	0	0	0	1	. 2	0	0	2	0	
Lane g	group	L		R				L	Т			TR		
Adj f	low	66		16				165	699			1079		
Prop 1	LTs							1.00	0.00	0 0		0.0	00	
Prop H	RTs		1	.000				(	.000		0.	039		ĺ
Satura	ation H	Flow R	ate (;	see E:	xhibit	16-7	to	detern	nine th	ne adju	ıstmer	nt fa	ctors)	
	Eas	stboun	d	I	Westbo	und		Nort	hbound	f	Soi	ithbo [.]	und	
LG	L		R					L	Т			TR		
So	1800		1800					1800	1800			180	0	
Lanes	1	0	1	0	0	0		1	2	0	0	2	0	
fW	1.000		1.00	0				0.967	0.933			1.0	00	
fHV	0.909		0.90	9				0.909	0.909			0.9	09	
fG	1.000		1.00	0				1.000	1.000			1.0	00	
fP	1.000		1.00	0				1.000	1.000			1.0	00	
fBB	0.960		0.96	0				0.960	0.980			0.9	80	
fA	0.900		0.90	0				0.900	0.900			0.9	00	
fLU	1.000		1.00	0				1.000	0.952			0.9	52	
frt			0.85	0					1.000			0.9	94	
fLT	0.950							0.950	1.000			1.0	00	
Sec.								0.180						
fLpb	1.000							0.951	1.000			1.0	00	
fRpb			1.00	0					1.000			0.9	90	
S	1343		1202					1235	2565			270	4	
Sec.	_0.0							234					-	
				CA	PACITY	AND	LOS	WORKSH	IEET					
Capac	ity Ana	alysis	and i	Lane (	Group	Capac	ity							

		1	Adj	Adj	Sat	F	low	Gree	enI	lane Gi	roup	
Appr/ Mvmt	Lane Group	Flo	w Rate (v)	Flow (;	Rate s)	R (	atio v/s)	Rat: (g/0	io Cap C)	(c)	v/c Ratio	
Eastbound	1											
Prot												
Perm												
Left	L	б	6	134	43	#	0.05	0.1	23 3	304	0.22	
Prot												
Perm												
Thru												
Right	R	1	6	12	02		0.01	0.1	23 2	272	0.06	
Westbound	1											
Prot												
Perm												
Left												
Prot												
Perm												
Thru												
Right	_											
Northbour	nd										<u> </u>	
Prot		1	18	12:	35	#	0.10	0.	096 1	18	1.00	
Perm		4	7	234	4		0.20	0.	509 1	42	0.33	
Left	L	1	65					0.	70 2	260	0.63	
Prot												
Perm	_	-	~ ~									
Thru	Л.	6	99	250	65		0.27	0.	/0 1	807	0.39	
Right	-											
Southbour	la											
Prot												
Perm												
Leit												
Prot												
Perm	шЪ	1	070	27	0.4	ш	0 4 0	0	1	E E O	0 70	
Illru Diabt	IR	T	079	27	04	#	0.40	0.1	L / C	- 2 2 2	0.70	
RIGHL												
Sum of fl	low ratio	os for	critic	al la	ne gro	oup	s, Yc	= S1	um (v/s	3) =	0.54	
Total los	st time ]	per cy	cle, I	L = 13	.00 se	ec		<i>.</i>				
Critical	ilow ra	te to	capacit	ty rat:	10,		ХC	= (YC	)(C)/(C	SーL) =	0.61	
Control I	Delay and	d LOS I	Determi	Inatio	n							
Appr/ F	Ratios	Unf	Prog	Lane	Incre	eme	ntal	Res	Lane G	Group	Approa	ach
Lane		Del	Adj	Grp	Facto	or	Del	Del				
Grp v/c	c g/C	dl	Fact	Сар	k		d2	d3	Delay	/ LOS	Delay	LOS
Eastbound	1											
L 0.22	2 0.23	36.2	1.000	304	0.11		0.4	0.0	36.6	D		
											36.3	D
R 0.06	5 0.23	34.9	1.000	272	0.11		0.1	0.0	35.0-	С		
Westbound	3											
Northbour	nd											
L 0.63	3 0.70	10.0	1.000	260	0.21		4.3	0.0	14.4	В		
т 0.39	0.70	6.9	1.000	1807	0.11		0.1	0.0	7.0	A	8.4	A
Southbour	nd											
TR 0.70	0.57	17.4	1.000	1552	0.26		1.4	0.0	18.7	В	18.7	В

SUPPLEMENTAL PERMITTED LT WORKSHI	EET			
for exclusive lefts				
	EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach				
Cycle length, C 115.0 sec				
Total actual green time for LT lane group, G (s)			80.0	
Effective permitted green time for LT lane group, g(s)			70.0	
Opposing effective green time, go (s)			66.0	
Number of lanes in LT lane group, N			1	
Number of lanes in opposing approach, No			2	
Adjusted LT flow rate, VLT (veh/h)			165	
Proportion of LT in LT lane group, PLT			1.000	
Proportion of LT in opposing flow, PLTo			0.00	
Adjusted opposing flow rate, Vo (veh/h)			1079	
Lost time for LT lane group, tL			5.00	
Computation				
LT volume per cycle, LTC=VLTC/3600			5.27	
Opposing lane util. factor, fLUo			0.952	0.952
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cvc)			18.10	
gf=G[exp(- a * (LTC ** b))]-t], gf<=g			0.0	
Opposing platoon ratio. Rpo (refer Exhibit 16-11)			1 00	
Opposing Queue Ratio $gro=Max[1-Rpo(go/C) 0]$			0 43	
ag (see Exhibit C16-4 5 6 7 8)			22 52	
$g_{q}$ , (see Exhibit etc 1,5,0,7,0) $g_{u=q-qq}$ if $q_{q}>=qf$ or = $q-qf$ if $q_{q}$			47 48	
$p_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d} = g_{d$			11 26	
$\frac{1-\max(94,91)}{2,0}$			1 00	
$PIIIO = I = PIIIO$ $PII * - PI = P[1 + (N-1) \alpha / (\alpha f + \alpha n) / PI + (1 + (1 + \alpha))]$			1 00	
$\mathbb{E}\left[\frac{1}{2} - \mathbb{E}\left[\frac{1}{2} + (N^{-1})^{2}\right] + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{$			1.00 2 77	
EII (IEIEI CO EXHIDIC CIO-5) $EI 2-Max(/1, D+battan)/D] ta 1,0)$			5.77	
$f_{min-2(1+DI)/a} = f_{min-2(1+DI)/a}$			0 06	
$\frac{1}{2}\frac{1+2}{3}\frac{1+2}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}1$			0.00	
$guill = max(gq-gl,0)$ $fm = \left[ af(a] + \left[ au(a) / (1+DI(EI1-1)) - (min - fmin \cdot max - 1-00) \right] \right]$			0.00	
$f_{1} = f_{2} - [af/a] + [au/a] / [1 + pi/Ei - i/],  (min - imin/max - i.00)$	1)] (	fmin	-fm<-1	00)
cr f]+_[fm+0_01/N_1)]/N**	/ ] , (	I III II -		00)
$\int dt = [100, 91(N-1)]/N^{2}$			0 1 9 0	
Dert-turn aufustment, ini			0.100	
For special case of single-lane approach opposed by mu	ltilan	le appi	coach,	
see text.			,	
* If Pl>=1 for shared left-turn lanes with N>1, then as	ssume	de-fac	cto	
left-turn lane and redo calculations.				
** For permitted left-turns with multiple exclusive let	ft-tur	n lane	es, flt	=fm.
For special case of multilane approach opposed by sing	le-lan	le appr	roach	
or when gf>gq, see text.		- L L -		
SUPPLEMENTAL PERMITTED LT WORKSH	EET			
for shared lefts				
Input				
	EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach				
Cycle length, C 115.0 sec				
Total actual green time for LT lane group, G (s)				
Effective permitted green time for LT lane group, g(s)				
Opposing effective green time, go (s)				
Number of lanes in LT lane group, N				

```
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT
                                                                    0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
                                                                    0.952 0.952
Opposing lane util. factor, fLUo
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
qf=G[exp(-a * (LTC ** b))]-t], qf <= q
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g or fmin=2(1+Pl)/g
qdiff=max(qq-qf,0)
fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT
For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
 left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.
               SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET
Permitted Left Turns
                                                        EΒ
                                                              WΒ
                                                                          SB
                                                                    NB
Effective pedestrian green time, gp (s)
                                                                   65.0
Conflicting pedestrian volume, Vped (p/h)
                                                                   300
Pedestrian flow rate, Vpedg (p/h)
                                                                   530
                                                                   0.265
0CCpedq
                                                                   22.52
Opposing queue clearing green, gq (s)
Eff. ped. green consumed by opp. veh. queue, gq/gp
                                                                   0.346
OCCpedu
                                                                   0.219
Opposing flow rate, Vo (veh/h)
                                                                   1079
                                                                   0.049
OCCr
Number of cross-street receiving lanes, Nrec
                                                                   1
Number of turning lanes, Nturn
                                                                   1
ApbT
                                                                   0.951
                                                                   1.000
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
                                                                   0.000
Left-turn adjustment, fLpb
                                                                   0.951
Permitted Right Turns
Effective pedestrian green time, gp (s)
                                                                          65.0
Conflicting pedestrian volume, Vped (p/h)
                                                                          300
Conflicting bicycle volume, Vbic (bicycles/h)
                                                                          0
                                                                          530
Vpedg
OCCpedq
                                                                          0.265
                                                                          66.0
Effective green, g (s)
                                                                          0
Vbicg
```

OCCbicg	0.020
OCCr	0.265
Number of cross-street receiving lanes, Nrec	1
Number of turning lanes, Nturn	1
ApbT	0.735
Proportion right-turns, PRT	0.039
Proportion right-turns using protected phase, PRTA	0.000
Right turn adjustment, fRpb	0.990

_____SUPPLEMENTAL UNIFORM DELAY WORKSHEET_____

			EBLT	WBLT	NBLT	SBLT
Cycle length, C 115	. 0	sec				
Adj. LT vol from Vol Adjustment Worksheet, v					165	
v/c ratio from Capacity Worksheet, X					0.63	
Protected phase effective green interval, g (s	3)				11.0	
Opposing queue effective green interval, gq					22.52	
Unopposed green interval, gu					47.48	
Red time r=(C-g-gq-gu)					34.0	
Arrival rate, $qa=v/(3600(max[X,1.0]))$					0.05	
Protected ph. departure rate, Sp=s/3600					0.343	
Permitted ph. departure rate, Ss=s(gq+gu)/(gu?	۶36	00)			0.10	
XPerm					0.71	
XProt					0.55	
Case					1	
Queue at beginning of green arrow, Qa					1.56	
Queue at beginning of unsaturated green, Qu					1.03	
Residual queue, Qr					0.00	
Uniform Delay, dl					10.0	

_____DELAY/LOS WORKSHEET WITH INITIAL QUEUE______

Appr/	Initial Unmet	Dur. Unmet	Uniform	Delay	Initial Oueue	Final Unmet	Initial Oueue	Lane Group
Lane	Demand	Demand	Unadj.	Adj.	Param.	Demand	Delay	Delay
Group	Q veh	t hrs.	ds	d1 sec	u	Q veh	d3 sec	d sec
Eastbour	nd							
L	0.0	0.00	44.5	36.2	0.00	0.0	0.0	36.6
	0.0						0.0	
R	0.0	0.00	44.5	34.9	0.00	0.0	0.0	35.0-
Westbour	nd							
	0.0						0.0	
	0.0						0.0	
	0.0						0.0	
Northbou	und							
L	0.0	0.00		10.0	0.00	0.0	0.0	14.4
Т	0.0	0.00	17.0	6.9	0.00	0.0	0.0	7.0
	0.0						0.0	
Southbou	und							
	0.0						0.0	
TR	0.0	0.00	24.5	17.4	0.00	0.0	0.0	18.7
	0.0						0.0	
	Intersect	ion Dela	ay 15.1	sec/ve	eh Ir	ntersect	ion LOS	В

_____BACK OF QUEUE WORKSHEET_____BACK OF QUEUE WORKSHEET_____

	Eastbou	und	Westbou	und	Noi	thbound	Southbound
LaneGroup	L	r			L	Т	TR
Init Queue	0.0	0.0			0.0	0.0	0.0
Flow Rate	66	16			165	367	566
So	1800	1800			1800	1800	1800
No.Lanes	1 0	1 0	0	0	1	2 0	0 2 0
SL	1343	1202			370	1347	1420
LnCapacity	304	272			260	949	815
Flow Ratio	0.0	0.0			0.4	0.3	0.4
v/c Ratio	0.22	0.06			0.63	0.39	0.69
Grn Ratio	0.23	0.23			0.70	0.70	0.57
I Factor	1.000	) j			ĺ	0.861	1.000
AT or PVG	3	3			3	3	3
Pltn Ratio	1.00	1.00			1.00	1.00	1.00
PF2	1.00	1.00			1.00	1.00	1.00
Q1	1.7	0.4			1.7	4.8	12.8
kB	0.4	0.4			0.3	0.7	0.7
Q2	0.1	0.0			0.5	0.4	1.5
Q Average	1.8	0.4			2.2	5.2	14.3
Q Spacing	25.0	25.0			25.0	25.0	25.0
Q Storage	0	0			0	0	0
Q S Ratio							
70th Percent	tile Output	::					
fB%	1.2	1.2			1.2	1.2	1.2
BOQ	2.2	0.5			2.6	6.2	16.8
QSRatio							
85th Percent	tile Output	::					
fB%	1.6	1.6			1.6	1.6	1.5
BOQ	2.9	0.7			3.4	8.0	21.3
QSRatio							
90th Percent	tile Output	::					
fB%	1.8	1.8			1.8	1.7	1.6
BOQ	3.2	0.8			3.8	8.9	22.9
QSRatio							
95th Percent	tile Output	::					
fB%	2.0	2.1			2.0	1.9	1.8
BOQ	3.7	0.9			4.4	10.1	25.4
QSRatio							
98th Percent	tile Output	:					
fB%	2.6	2.7			2.5	2.4	2.0
BOQ	4.7	1.1			5.5	12.3	29.1
QSRatio							

Analyst: Agency: Date: Period: Project E/W St:	PB 6/25 AM P ID: Harr	/201( eak H I-29( ison	) Hour ) Phas Stree	se 1 St et	tudy	Inter.: Harrison Street & Des Plaines Area Type: CBD or Similar Jurisd: Year : Existing N/S St: Des Plaines Avenue										
				SI(	GNALI	ZED	INT	FERSE	CTION	SUMM	ARY					
		Eas	stbour	ld	We	stbo	ounc	1	Nor	thbo	ind		Soi	uthboi	und	
		Ц	.Т.	R		Т.		R		.1.	R			.Т.	R	
No Lane	g	1	1	1	0 1 0				0 2 0				1	2		 
LGConfig		т. –	т Т	R	0	T	TR	0						г Т	0	
Volume		47	71	27	26	0	1	02		817	10	112		236		
Lane Wid	th	10.0	10.5	10.0		10.	5			11.0		110	.0	10.0		
RTOR Vol	İ			0	ĺ		(	)			0	İ				
					·				·							·
Duration 0.25 Area Type: CBD or Similar Signal Operations																
EB Left			A		-		-	NB	Left	-						
Thru			А				İ		Thru		A					
Righ	t		А						Right		A					
Peds									Peds		Х					
WB Left				A				SB	Left	A						
Thru				A					Thru	A	A					
Righ	t			A					Right							
Peas	÷			X				ਰਾਜ	Peas	X	Х					
SB Right	+							ED WR	Right	•						
Green			15 0	16 0				WВ	Rigiic	60	55	0				
Yellow			4.0	4.0						3.0	4.0	)				
All Red			1.0	1.0						0.0	1.0	)				
			_			_	~		~	Сус	cle Le	engt	h:	110.	0	secs
			ר1 האת	itersed	ction	Per	rior	manc	e Summ	ary_						
Appr/	Grou	n	AU. Flor	J Sal v Pate	R	atio	5		Lane	Grou	A	pro	acı	1		
Grn (	Capa	r citv	F TOV		 V/C		a/(	- 7	Delav		 Del	av	T.O.9			
					•											
Eastbound	d					_		_		_						
L	190		130	)6	0.2	6	0.1	15	42.5	D	10	0	F			
.T.	203		139	99 50	0.3	0	0.1	15	43.6	D	43.	0	D			
K	257 2		110	00	0.1	8	0.1	- 4	42.0	D						
Westbould	a															
LTR	150		103	32	0.8	9	0.1	5	90.0	F	90.	0	F			
Northbou	nd															
TR	134	8	264	18	0.6	5	0.5	51	20.8	С	20.	8	С			
0																
Southbou	na 71		1 7 /		0 1	0	0 0			F						
ц т	/上 1 ⊑ 1	6	1 J L J L	55	U.L 0 1	0 6		20	50.9 10 0	ע ק	1 0	3	P			
Ŧ	TCT	U	200		0.1	0	0.5	כו	10.2	В	12.	5	В			
	Int	ersed	ction	Delay	= 28	.2	(se	ec/ve	h) I	nter	sectio	on L	OS	= C		

Phone: Fax: E-Mail: _____OPERATIONAL ANALYSIS_____ Analyst: Agency/Co.: PB

Agency/Co.: PB Date Performed: 6/25/2010 Analysis Time Period: AM Peak Hour Intersection: Harrison Street & Des Plaines Area Type: CBD or Similar Jurisdiction: Analysis Year: Existing Project ID: I-290 Phase 1 Study E/W St: Harrison Street N/S St: Des Plaines Avenue

_____VOLUME DATA_____

	Eas	stbour	nd	Wes	Westbound Northbound		und	Southbound				
	L	Т	R	L T R		R	L	Т	R	L	Т	R
Volume	47	71	27	26	0	102	 	817	10	12	236	
% Heavy Veh	10	10	10	10	10	10	ĺ	10	10	10	10	
PHF	0.95	0.95	0.95	0.95	0.95	0.95	ĺ	0.95	0.95	0.95	0.95	
PK 15 Vol	12	19	7	7	0	27	ĺ	215	3	3	62	
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat	1800	1800	1800		1800			1800		1800	1800	
ParkExist												
NumPark												
No. Lanes	1	1	1	0	1	0	0	2	0	1	2	0
LGConfig	L	Т	R		LTH	ર		TR		L	Т	
Lane Width	10.0	10.5	10.0		10.5			11.0		10.0	10.0	
RTOR Vol			0			0			0			
Adj Flow	49	75	28		134			871		13	248	
%InSharedLn												
Prop LTs		0.00	0 0		0.20	01		0.00	0 0		0.00	0
Prop RTs	0	.000	1.000	0	.799		0	.013		0	.000	
Peds Bikes	0			10	) 0 (	)	1	00 (	C			
Buses	0	0	0		0			10		0	10	
%InProtPhase	9											
Duration	0.25		Area 🛛	Гуре:	CBD d	or Sim:	ilar					

	Ea	stbou	nd	Westbound			Nc	rthbo	und	Southbound		
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Init Unmet	0.0	0.0	0.0	·   	0.0		-  	0.0			0.0	
Arriv. Type	3	3	3	i	3		İ	3		3	3	
Unit Ext.	3.0	3.0	3.0	i	3.0		İ	3.0		3.0	3.0	
I Factor	İ	1.00	0	İ	1.00	0	ĺ	1.00	0		1.000	)
Lost Time	2.0	2.0	2.0	i	2.0		İ	2.0		2.0	2.0	
Ext of g	3.0	3.0	2.0	İ	2.0		ĺ	3.0		2.0	3.0	
Ped Min g	İ	3.2		i	4.0		İ	4.0		İ		

## _____OPERATING PARAMETERS_____OPERATING PARAMETERS_____

				PH	ASE	DATA_					
Pha	se Combination	1	2	3	4			5	6	7	8
EB	Left Thru Right Peds	A A A				NB	Left Thru Right Peds		A A X		
WB	Left Thru Right Peds		A A A X			SB	Left Thru Right Peds	A A X	A X		
NB	Right					EB	Right				
SB	Right					WB	Right				
Gree Yel All	en low Red	15.0 4.0 1.0	16.0 4.0 1.0		I			6.0 3.0 0.0	55.0 4.0 1.0		

Cycle Length: 110.0 secs

	VOLUME ADJ	USTMENT AND SATUF	RATION FLOW WORKS	SHEET		
Volume Adj	ustment					
	Eastbound	Westbound	Northbound	Southbound		
	LTR 	LTR	LTR	L T R   		
Volume, V	47 71 27	26 0 102	817 10	12 236		
PHF	0.95 0.95 0.95	0.95 0.95 0.95	0.95 0.95	0.95 0.95		
Adj flow	49 75 28	27 0 107	860 11	13 248		
No. Lanes	1 1 1	0 1 0	0 2 0	1 2 0		
Lane group	L T R	LTR	TR	L T		
Adj flow	49 75 28	134	871	13 248		
Prop LTs	0.000	0.201	0.000	0.000		
Prop RTs	0.000 1.000	0.799	0.013	0.000		
Ea LG L So 1800 Lanes 1 fW 0.93 fW 0.93 fW 0.93 fG 1.00 fG 1.00 fP 1.00 fBB 1.00 fA 0.90 fLU 1.00 fRT fLT 0.95 Sec. fLpb 1.00 fRpb S 1306	astbound       T       R         1800       1800         1       1       0         3       0.950       0.933         9       0.909       0.909         0       1.000       1.000         0       1.000       1.000         0       1.000       1.000         0       0.900       0.900         0       1.000       1.000         1.000       0.850       0         0       1.000       1.000         1.000       1.000       1.000         1.000       1.000       1.000         1.000       1.000       1.000	Westbound LTR 1800 1 0 0 0.950 0.909 1.000 1.000 1.000 0.900 1.000 0.892 0.990 1.000 0.835 1032	Northbound TR 1800 2 0 0.967 0.909 1.000 1.000 0.980 0.900 0.952 0.998 1.000 1.000 0.999 2648	Southbound L T 1800 1800 1 2 0 0.933 0.933 0.909 0.909 1.000 1.000 1.000 1.000 1.000 0.980 0.900 0.900 1.000 0.952 1.000 0.950 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000		
Sec.						
	CA	PACITY AND LOS WO	DRKSHEET			

Capacity Analysis and Lane Group Capacity

				Adj	Adj	Sat	Fl	OW	Gre	en -	-Lane G	roup	
Ap Mv	pr/ mt	Lane Group	Flo	w Rate (v)	Flow (	Rate s)	Ra (v	tio /s)	Rat (g/	io C C)	apacity (c)	v/c Ratio	
 Eastb	ound												
Pr	ot												
Pe	rm												
Le	ft	L	4	9	13	06	0	.04	Ο.	15	190	0.26	
Pr	ot			-	-		-			-			
Pe	rm												
-с Th	r11	т	7	5	13	99	± 0	05	0	15	203	0 37	
Ri	aht	R	, 2	8	11	68	0	.02	0.	14	159	0 18	
Wooth	ound	10	4	0		00	0	.02	0.		100	0.10	
Dr													
F L	00												
Pe	сти Е н												
це	LL												
Pr	OT												
Pe	rm		_										
Th	ru	LTR	1	34	10	32	# 0	.13	0.	15	150	0.89	
Ri	ght												
North	bound	l											
Pr	ot												
Pe	rm												
Le	ft												
Pr	ot												
Pe	rm												
Th	ru	TR	8	71	26	48	# 0	.33	Ο.	51	1348	0.65	
Ri	ght												
South	bound	l											
Pr	ot												
Pe	rm												
I.e	ft	т.	1	3	13	06	# 0	01	0	05	71	0 18	
Dr	ot	-	-	5	10	00	πO		0.	0.5	7 -	0.10	
	rm												
гс Th	1 III	Ψ	2	10	25	65	0	10	0	50	1516	0 16	
тн р;	aht	T	2	τO	2 3	05	0	. 10	0.	59	1910	0.10	
Sum o	f flo	w rati	os for	critic	cal la	ne gro	oups	, Yc	= S	um (v	/s) =	0.52	
Total	lost	time	per cy	cle, I	L = 16	.00 se	ec						
Criti	cal f	low ra	te to	capacit	y rat	io,		Хc	= (Yc	:)(C)/	(C-L) =	0.61	
Contr	ol De	elay an	d LOS	Determi	Inatio	n							
Appr/	Ra	tios	Unf	Prog	Lane	Incre	emen	tal	Res	Lane	Group	Approa	ach
Lane			Del	Adj	Grp	Facto	or D	el	Del				
Grp	v/c	g/C	d1	Fact	Cap	k	d	2	d3	Del	ay LOS	Delay	LOS
Eastb	ound												
L	0.26	0.15	41.7	1.000	190	0.11	0	.7	0.0	42.5	D		
Т	0.37	0.15	42.4	1.000	203	0.11	1	.1	0.0	43.6	D	43.0	D
R	0.18	0.14	42.0	1.000	159	0.11	0	.5	0.0	42.6	D		
Westb	ound												
LTR	0.89	0.15	46.2	1.000	150	0.42	4	3.8	0.0	90.0	F	90.0	F
North	bound	l											
шЪ	0 65	0 5 1	10 0	1 000	1 2 4 0	0 00	7	1	0 0	20.0	C	20.0	a
Τĸ	0.65	0.51	тд.8	T.000	1348	0.22	T	• 1	0.0	20.8	Ċ	20.8	Ċ
0 ~ 1-	have	1											
South			10 7	1 000	71	0 1 1	7	2	0 0		Ţ		
ц m	0.10	0.05	49./ 10 0	1 000	/⊥ 1⊏1⊂	U.11	Ţ	. ∠	0.0	50.9	D D	10 0	D
T.	∪.⊥6	0.59	10.2	T.000	ΤΡΤΡ	U.II	0	• ⊥	0.0	±0.2	в	⊥∠.3	в

SUPPLEMENTAL PERMITTED LT WORKSHEET for exclusive lefts Input EΒ WB NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 110.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo 1.000 1.000 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. _SUPPLEMENTAL PERMITTED LT WORKSHEET_ for shared lefts Input EΒ WB NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 110.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s)Opposing effective green time, go (s) Number of lanes in LT lane group, N

Intersection LOS = C

Intersection delay = 28.2 (sec/veh)

Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) 0.000 0.201 0.000 0.000 Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 1.000 1.000 0.952 0.952 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) qf=G[exp(-a * (LTC ** b))]-t], qf <= qOpposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min=fmin;max=1.00)flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET Permitted Left Turns EΒ WΒ  $^{\rm NB}$ SB Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Pedestrian flow rate, Vpedg (p/h) 0CCpedq Opposing queue clearing green, gq (s) Eff. ped. green consumed by opp. veh. queue, gq/gp OCCpedu Opposing flow rate, Vo (veh/h) OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion of left turns, PLT Proportion of left turns using protected phase, PLTA Left-turn adjustment, fLpb Permitted Right Turns Effective pedestrian green time, gp (s) 16.0 55.0 Conflicting pedestrian volume, Vped (p/h) 100 100 Conflicting bicycle volume, Vbic (bicycles/h) 0 0 687 200 Vpedg 0.344 0.100 OCCpedq 16.0 56.0 Effective green, g (s) 0 0 Vbicg

OCCbicg OCCr Number	of cross	0.0 0.3 2	0.020 0.020 0.344 0.100 2 1					
Number ApbT	of turni	1 0.7	1 94 0.900					
Proport Proport Right t	0.7 0.0 0.8	0.799 0.013 0.000 0.000 0.835 0.999						
		SU	PPLEMENT	AL UNIFO	RM DELAY	WORKSHE	ET	
	_					E	BLT WBL	T NBLT SBLT
Cycle 1 Adj. LT V/c rat Protect Opposin Unoppos Red tim Arrival Protect Permitt XPerm XProt Case Queue a Queue a Residua Uniform	ength, C vol from ed phase g queue ed green e r=(C-g rate, q ed ph. d ed ph. d t beginn t beginn l queue, Delay,	m Vol Ad Capacity effectiv interva -gq-gu) a=v/(360 eparture eparture ing of g ing of u Qr dl	<pre>justment Workshee ve green e green : 1, gu 0(max[X,: rate, S] rate, S] rate, S rate, S rate, S</pre>	Workshe et, X interval 1.0])) p=s/3600 s=s(gq+g pw, Qa ed green	110.0 et, v 1, g (s) , gq u)/(gu*3 , Qu	sec		
		DELAY/	LOS WORK	SHEET WI	TH INITI.	AL QUEUE		
Appr/	Initial Unmet	Dur. Unmet	Uniform	Delay	Initial Oueue	Final Unmet	Initial Oueue	Lane Group
Lane Group	Demand Q veh	Demand t hrs.	Unadj. ds	Adj. d1 sec	Param. u	Demand Q veh	Delay d3 sec	Delay d sec
Eastbou	nd							
L	0.0	0.00	47.0	41.7	0.00	0.0	0.0	42.5
Т	0.0	0.00	47.0	42.4	0.00	0.0	0.0	43.6
R	0.0	0.00	47.5	42.0	0.00	0.0	0.0	42.6
Westbou	nd							
	0.0						0.0	
LTR	0.0 0.0	0.00	47.0	46.2	0.00	0.0	0.0 0.0	90.0
Northbo	und							
	0.0		0 - 0	1.0.0		0 0	0.0	
TR	0.0	0.00	27.0	19.8	0.00	0.0	0.0	20.8
Southbo	und							
L	0.0	0.00	52.0	49.7	0.00	0.0	0.0	50.9
Т	0.0 0.0	0.00	22.5	10.2	0.00	0.0	0.0 0.0	10.2
	Intersec	tion Del	ay 28.2	sec/v	eh I:	ntersect	ion LOS	С
			ВАСК	OF QUEU	E WORKSH	EET		
	Eastbou	und	Westbound	Northbound	Southbound			
--------------	-------------	------	-----------	------------	------------			
LaneGroup	L T	R	LTR	TR	L T			
Init Queue	0.0 0.0	0.0	0.0	0.0	0.0 0.0			
Flow Rate	49 75	28	134	457	13 130			
So	1800 1800	1800	1800	1800	1800 1800			
No.Lanes	1 1	1	0 1 0	0 2 0	1 2 0			
SL	1306 1399	1168	1032	1390	1306 1347			
LnCapacity	190 203	159	150	707	71 796			
Flow Ratio	0.0 0.1	0.0	0.1	0.3	0.0 0.1			
v/c Ratio	0.26 0.37	0.18	0.89	0.65	0.18 0.16			
Grn Ratio	0.15 0.15	0.14	0.15	0.51	0.05 0.59			
I Factor	1.000	) j	1.000	1.000	1.000			
AT or PVG	3 3	3	3	3	3 3			
Pltn Ratio	1.00 1.00	1.00	1.00	1.00	1.00 1.00			
PF2	1.00 1.00	1.00	1.00	1.00	1.00 1.00			
Q1	1.3 2.1	0.8	4.0	10.2	0.4 1.8			
kB	0.3 0.3	0.3	0.2	0.6	0.2 0.7			
Q2	0.1 0.2	0.1	1.3	1.1	0.0 0.1			
Q Average	1.4 2.2	0.8	5.3	11.3	0.4 1.9			
Q Spacing	25.0 25.0	25.0	25.0	25.0	25.0 25.0			
Q Storage	0 0	140	0	0	90 0			
Q S Ratio		0.1			0.1			
70th Percent	cile Output	t:						
fB%	1.2 1.2	1.2	1.2	1.2	1.2 1.2			
BOQ	1.7 2.7	1.0	6.3	13.3	0.5 2.3			
QSRatio		0.2			0.1			
85th Percent	tile Output	t:						
fB%	1.6 1.6	1.6	1.6	1.5	1.6 1.6			
BOQ	2.3 3.5	1.3	8.2	17.1	0.7 3.1			
QSRatio		0.2			0.2			
90th Percent	tile Output	t:						
fB%	1.8 1.8	1.8	1.7	1.6	1.8 1.8			
BOQ	2.5 3.9	1.4	9.0	18.4	0.7 3.4			
QSRatio		0.3			0.2			
95th Percent	tile Output	t:						
fB%	2.1 2.0	2.1	1.9	1.8	2.1 2.0			
BOQ	2.9 4.6	1.7	10.3	20.6	0.9 3.9			
QSRatio		0.3			0.2			
98th Percent	tile Output	t:						
fB%	2.6 2.5	2.6	2.4	2.1	2.7 2.6			
BOQ	3.7 5.7	2.1	12.5	24.0	1.1 4.9			
QSRatio		0.4			0.3			

_____ERROR MESSAGES_____

No errors to report.

Analyst: Agency: Date: Period: Project	PB 6/25, PM Pe ID: 2	/201( eak H L-29(	) Hour ) Phas	se 1 St	tudy			Int Are Jur Yea	er.: H a Type isd: r : E	arri: : CB xist	son St D or S ing	. & D imila	es Pla r	aine	es Ave
E/W St: 1	Harr	ison	Stree	et				N/S	St: D	es P	laines	Aven	ue		
	<u> </u>			SI	GNALI	ZED	INI	ERSE	CTION	SUMM	ARY				
		Eas	stbour	ıd	We	stbo	unc	1	Nor	thbo	und	So	uthbou	und	
		Ц	.Т.	R	Ц 	Т		R		.T.	R	Li 	Л.	R	
No. Lane	s	1	1	1	0	1		0	0	2	0	1	2	0	 
LGConfig	ĺ	L	Т	R		L	TR			TR		L L	Т		İ
Volume	-	122	18	132	52	0	8	31		778	29	52	581		ļ
Lane Wid	th  1	10.0	10.5	10.0		10.	5	<b>、</b>		11.0	0	10.0	10.0		
RTOR VOL	I			0	l		Ĺ	)	I		0				I
Duration	(	).25		Area '	Type:	CBD	or	Sim	ilar						
Phase Co	mbina	ation	n 1	2	S 3	giiai	4	Perat	10115	5	6	7		 3	
EB Left			A				İ	NB	Left						
Thru			A						Thru		A				
Righ	t		A						Right		A				
WB Left				Ζ				<b>GB</b>	Peas Left	δ	X				
Thru				A				Ы	Thru	A	А				
Righ	t			A			ĺ		Right						
Peds				Х			İ		Peds	Х	Х				
NB Righ	t							EB	Right						
SB Righ	t		20 0	16 0				WB	Right	10	0 51	0			
Yellow			4.0	4.0						3.0	4.0	0			
All Red			1.0	1.0						0.0	1.0				
							_			Су	cle Le	ngth:	115.0	C	secs
			IrIr	iterse	ction	Per	for	manc	e Summ	ary_					
Lane	Group	C	Flow	v Rate	R	atio	5		цапе	Grouj	p Apj	proac.	LI		
Grp	Capad	city		(s)	v/c		g/C		Delay	LOS	Dela	ay LO	S		
Eastboun	 d														
L	172		943	3	0.7	4	0.1	. 8	60.5	Е					
Т	184		101	LO	0.1	0	0.1	. 8	39.4	D	80.	7 F			
R	147		844	1	0.9	5	0.1	.7	104.8	F					
Westboun	d														
LTR	152		109	95	0.9	2	0.1	4	99.1	F	99.	1 F			
Northbou	nd														
TR	1190	)	263	31	0.7	1	0.4	15	27.6	С	27.	6 C			
Couthbarr	nd														
	114		1 7 (	)6	04	8	0 0	) 9	528	Л					
_ Т	1450	)	256	55	0.4	2	0.5	57	14.4	B	17.	б В			
	Inte	ersed	ction	Delay	= 37	.1	(se	ec/ve	h) I	nter	section	n LOS	= D		

I-290 Existing

Phone: Fax: E-Mail: _____OPERATIONAL ANALYSIS_____ Analyst: Agency/Co.: PB

Agency/Co.:FDDate Performed:6/25/2010Analysis Time Period:PM Peak HourIntersection:Harrison St. & Des Plaines AveArea Type:CBD or SimilarJurisdiction:Jurisdiction:Analysis Year:ExistingProject ID:I-290 Phase 1 StudyE/W St:Harrison StreetN/S St:Des Plaines Avenue

_____VOLUME DATA______

	Eas	stbour	nd	Wes	stbour	nd	No	rthbou	und	Sou	uthbou	nd
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume	122	18	132	52	0	81		778	29	52	581	
% Heavy Veh	10	10	10	10	10	10		10	10	10	10	
PHF	0.95	0.95	0.95	0.95	0.95	0.95		0.95	0.95	0.95	0.95	
PK 15 Vol	32	5	35	14	0	21	ĺ	205	8	14	153	
Hi Ln Vol	ĺ			ĺ			ĺ			ĺ		
% Grade		0			0			0			0	
Ideal Sat	1300	1300	1300	ĺ	1800		ĺ	1800		1800	1800	
ParkExist												
NumPark												
No. Lanes	1	1	1	0	1	0	0	2	0	1	2	0
LGConfig	L	Т	R		LTH	ર		TR		L	Т	
Lane Width	10.0	10.5	10.0		10.5			11.0		10.0	10.0	
RTOR Vol			0			0			0			
Adj Flow	128	19	139		140			850		55	612	
%InSharedLn												
Prop LTs		0.00	0 0		0.39	93		0.00	0 0		0.00	0
Prop RTs	0.	.000 1	1.000	0	.607		0	.036		0	.000	
Peds Bikes	0			10	) 0 (	)	1	00 0	C			
Buses	0	0	0		0			10		0	10	
%InProtPhase	9											
Duration	0.25		Area 🗅	Гуре:	CBD d	or Simi	ilar					

	Ea	stbou	nd	We	stbou	nd	No	rthbc	und	So	uthbou	ınd
	L	Т	R	Ĺ	Т	R	L	Т	R	L	Т	R
Init Unmet	  0.0	0.0	0.0	·   	0.0		-  	0.0		_   0.0	0.0	
Arriv. Type	3	3	3	İ	3		İ	3		3	3	
Unit Ext.	3.0	3.0	3.0	İ	3.0		İ	3.0		3.0	3.0	
I Factor	İ	1.00	0	İ	1.00	0	İ	1.00	0	İ	0.874	1
Lost Time	2.0	2.0	2.0	İ	2.0		İ	2.0		2.0	2.0	
Ext of g	3.0	3.0	2.0	Ì	2.0		Ì	3.0		2.0	3.0	
Ped Min g	ĺ	3.2		ĺ	4.1		ĺ	4.1		ĺ		

## _____OPERATING PARAMETERS_____OPERATING PARAMETERS_____

				PH2	ASE I	DATA_					
Pha	se Combination	1	2	3	4			5	6	7	8
EB	Left Thru Right Peds	A A A				NB	Left Thru Right Peds		A A X		
WB	Left Thru Right Peds		A A A X			SB	Left Thru Right Peds	A A X	A X		
NB	Right					EB	Right				
SB	Right					WB	Right				
Gre Yel All	en low Red	20.0 4.0 1.0	16.0 4.0 1.0		I			10.0 3.0 0.0	51.0 4.0 1.0		

Cycle Length: 115.0 secs

		7	∕OLUM	ie adju	USTMEN	IT ANI	SATU	RATIO	N FLOV	WORKS	SHEET_		
Volume	Adjus	stment											
		East	bour	ıd	Wes	stbour	nd	Noi	rthbou	ınd	Sou	thbour	nd
		L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume,	v	122 1	 1 8	132	  52	0	81	 	778	29	  52	581	 
PHF	İ	0.95 (	).95	0.95	0.95	0.95	0.95	İ	0.95	0.95	0.95	0.95	
Adj flo	w	128 1	19	139	55	0	85		819	31	55	612	
No. Lan	.es	1	1	1	İ O	1	0	0	2	0	İ 1	2	0
Lane gr	oup	L	Т	R	İ	LTF	ર	İ	TR		L	Т	İ
Adj flo	w	128 1	19	139	İ	140		İ	850		55	612	
Prop LT	's		0.00	0	İ	0.39	93	İ	0.00	00	İ	0.000	o İ
Prop RT	's	0.0	000 1	.000	jo.	607		0	.036		j o.	000	ĺ
													·
Saturat	ion F	'low Ra	ate (	see Ez	xhibit	: 16-7	7 to d	eterm	ine tł	ne adju	ustmen	t fact	cors)
	Eas	stbound	f	1	Vestbo	ound		North	nbound	1	Sou	thbour	nd
LG	L	Т	R		LJ	"R			TR		L	Т	
So 1	300	1300	1300	)	180	0 (		-	1800		1800	1800	
Lanes 1		1	1	0	1	0	0	4	2	0	1	2	0
fW 0	.933	0.950	0.93	3	0.9	950		(	0.967		0.933	0.93	3
fHV 0	.909	0.909	0.90	19	0.9	909		(	0.909		0.909	0.909	9
fG 1	.000	1.000	1.00	0	1.0	000		-	L.000		1.000	1.000	)
fP 1	.000	1.000	1.00	0	1.0	000		-	L.000		1.000	1.000	)
fBB 1	.000	1.000	1.00	0	1.0	000		(	0.980		1.000	0.980	)
fA 0	.900	0.900	0.90	0	0.9	00		(	0.900		0.900	0.900	)
fLU 1	.000	1.000	1.00	0	1.0	000		(	).952		1.000	0.952	2
frt		1.000	0.85	0	0.9	18		(	).995			1.000	)
flt 0	.950	1.000			0.9	81		-	L.000		0.950	1.000	)
Sec.													
fLpb 1	.000	1.000			1.0	000		-	1.000		1.000	1.000	)
fRpb		1.000	1.00	0	0.8	369		(	).996			1.000	)
S 9	43	1010	844		109	95		4	2631		1306	2565	
Sec.													
				CAI	PACITY	AND	LOS W	ORKSHI	EET				

Capacity Analysis and Lane Group Capacity

Aj Mi	ppr/	Lane	Flo	Adj w Rate	Adj Flow (	Sat Rate	Flo Rat	w io	Gre Rat	en io Ca	-Lane G apacity	roup v/c Ratio	
		GI UUP		( <b>v</b> ) 			·····						
Eastl	bound												
P:	rot												
P	erm					-	-						
L	eft	L	1	28	94	3	0.	14	0.	18	172	0.74	
P:	rot												
Pe	erm	_	-										
T	hru	Т	1	9	10	10	0.	02	0.	18	184	0.10	
R:	ight	R	T	39	84	4	# 0.	16	0.	17	147	0.95	
West	bound												
P: D	rot												
Pe	erm												
L. Б	eit												
P: D	rot												
P	erm	TED	1	10	1 0	0.5		1 2	0	1 4	1 - 0	0 0 0	
.1.1	nru 	LTR	T	40	10	95	# Ο.	13	0.	14	152	0.92	
K.	ignt	J											
NOLU	n bound wot	1											
Р. 													
E C													
л. Д	rot												
г. D/	orm												
י ב ידו	hru	ΨR	8	50	26	31	# 0	32	0	45	1190	0 71	
R.	iaht	110	0	50	20	51	π Ο.	52	0.	15	1170	0.71	
Sout	hbound	4											
DOUC!	rot	<i>x</i>											
P i	erm												
T.e	eft	т.	5	5	13	06	# 0	04	0	09	114	0 48	
P.	rot	-	5	5	10	00	п О.	01	0.	0.2	± ± ±	0.10	
P	erm												
T	hru	Т	6	12	25	65	0.	24	0.	57	1450	0.42	
R	ight												
								Va				0 66	
Tota	l lost	Jw Iaci - time	ber cv	cle I	. = 17		or Jupa,	10	- 5		5) -	0.00	
Crit	ical f	flow ra	te to	capacit	v rat	io.		Xc	= (YC	(C)/(	$(C-I_1) =$	0.77	
0220				oupuor		_ 0 /			( 2 0	/(0//	(0 2)	•••	
Cont	rol De	elay an	d LOS	Determi	natio	n							
Appr	/ Ra	atios	Unf	Prog	Lane	Incre	ement	al	Res	Lane	Group	Approa	ach
Lane			Del	Adj	Grp	Facto	or De	el	Del				
Grp	v/c	g/C	d1	Fact	Сар	k	d2	2	d3	Dela	ay LOS	Delay	LOS
East	bound												
L	0.74	0.18	44.5	1.000	172	0.30	16	5.1	0.0	60.5	Е		
т	0.10	0.18	39.2	1.000	184	0.11	0.	2	0.0	39.4	D	80.7	F
R	0.95	0.17	47.0	1.000	147	0.46	57	.9	0.0	104.8	3 F		
West	bound												
TITT	0 0 0	0 1 4	40.0	1 0 0 0	1 5 0	0 4 4	FC	$\sim$	0 0	0.0 1		0.0 1	
LTR	0.92	0.14	48.9	1.000	152	0.44	50	).2	0.0	99.1	F	99.1	F
Nort	hbound	f											
TR	0.71	0.45	25.5	1.000	1190	0.28	2 -	1	0.0	27.6	С	27.6	С
							- •				-		-
Sout	hbound	1											
L	0.48	0.09	50.0	1.000	114	0.11	2.	8	0.0	52.8	D		_
Т	0.42	0.57	14.3	1.000	1450	0.11	0.	2	0.0	14.4	В	17.6	В

SUPPLEMENTAL PERMITTED LT WORKSHEET for exclusive lefts Input EΒ WB NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 115.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo 1.000 1.000 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. _SUPPLEMENTAL PERMITTED LT WORKSHEET_ for shared lefts Input EΒ WB NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 115.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s)Opposing effective green time, go (s) Number of lanes in LT lane group, N

Intersection LOS = D

Intersection delay = 37.1 (sec/veh)

Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT 0.000 0.393 0.000 0.000 Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 1.000 1.000 0.952 0.952 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) qf=G[exp(-a * (LTC ** b))]-t], qf <= qOpposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min=fmin;max=1.00)flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET Permitted Left Turns EΒ WΒ  $^{\rm NB}$ SB Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Pedestrian flow rate, Vpedg (p/h) 0CCpedq Opposing queue clearing green, gq (s) Eff. ped. green consumed by opp. veh. queue, gq/gp OCCpedu Opposing flow rate, Vo (veh/h) OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion of left turns, PLT Proportion of left turns using protected phase, PLTA Left-turn adjustment, fLpb Permitted Right Turns Effective pedestrian green time, gp (s) 16.0 51.0 Conflicting pedestrian volume, Vped (p/h) 100 100 Conflicting bicycle volume, Vbic (bicycles/h) 0 0 718 225 Vpedg 0.359 0.113 OCCpedq 16.0 52.0 Effective green, g (s) 0 0 Vbicg

OCCbicg OCCr Number	of cross	-street	receiving	g lanes,	Nrec		0.0 0.3 2	20 0.020 59 0.113 1
Number ApbT	of turni	ng lanes	, Nturn				1 0.7	1 85 0.887
Proport Proport Right t	ion righ ion righ urn adju	t-turns, t-turns stment,	PRT using pro fRpb	otected	phase, Pi	RTA	0.6 0.0 0.8	07 0.036 00 0.000 69 0.996
		SU	PPLEMENT	AL UNIFO	RM DELAY	WORKSHE	ET	
						E	BLT WBL	T NBLT SBLT
Cycle 1 Adj. LI v/c rat Protect Opposin Unoppos Red tim Arrival Protect Permitt XPerm XProt Case Queue a Residua	ength, C vol fro io from ed phase g queue ed green er = (C-g rate, q ed ph. d ed ph. d t beginn t beginn l queue,	m Vol Ad Capacity effectiv interva -gq-gu) a=v/(360 eparture eparture ing of g ing of u Qr	justment Worksheeve green e green 1, gu 0(max[X, rate, Sp rate, Sp reen arro nsaturate	Workshe et, X interva interval 1.0])) p=s/3600 s=s(gq+g pw, Qa ed green	115.0 et, v 1, g (s) , gq u)/(gu*3 , Qu	sec 600)		
Uniform	n Delay,	dl DELAY/	LOS WORK	SHEET WI	TH INITI.	AL QUEUE		
Appr/	Initial	Dur.	Uniform	Delay	Initial	Final	Initial	Lane Group
Lane Group	Demand Q veh	Demand t hrs.	Unadj. ds	Adj. dl sec	Param. u	Demand Q veh	Delay d3 sec	Delay d sec
 Eastbou	Ind							
L	0.0	0.00	47.0	44.5	0.00	0.0	0.0	60.5
Т	0.0	0.00	47.0	39.2	0.00	0.0	0.0	39.4
R	0.0	0.00	47.5	47.0	0.00	0.0	0.0	104.8
Westbou	Ind							
	0.0						0.0	
LTR	0.0 0.0	0.00	49.5	48.9	0.00	0.0	0.0 0.0	99.1
Northbo	ound						0 0	
шЪ	0.0	0 00	01 F		0 00	0 0	0.0	
'I'R	0.0	0.00	31.5	25.5	0.00	0.0	0.0	27.6
Southbo	ound							
L	0.0	0.00	52.5	50.0	0.00	0.0	0.0	52.8
Т	0.0 0.0	0.00	25.0	14.3	0.00	0.0	0.0 0.0	14.4
	Intersec	tion Del	ay 37.1	sec/v	eh I:	ntersect	ion LOS	D
			BACK	OF QUEU	E WORKSH	EET		

	Eastbo	und	Westbound	Northbound	Southbound
LaneGroup	L T	R	LTR	TR	L T
Init Queue	0.0 0.0	0.0	0.0	0.0	0.0 0.0
Flow Rate	128 19	139	140	446	55 321
So	1300 1300	1300	1800	1800	1800 1800
No.Lanes	1 1	1	0 1 0	0 2 0	1 2 0
SL	943 1010	844	1095	1381	1306 1347
LnCapacity	172 184	147	152	624	114 761
Flow Ratio	0.1 0.0	0.2	0.1	0.3	0.0 0.2
v/c Ratio	0.74 0.10	0.95	0.92	0.71	0.48 0.42
Grn Ratio	0.18 0.18	0.17	0.14	0.45	0.09 0.57
I Factor	1.00	0 İ	1.000	1.000	0.874
AT or PVG	3 3	3	3	3	3 3
Pltn Ratio	1.00 1.00	1.00	1.00	1.00	1.00 1.00
PF2	1.00 1.00	1.00	1.00	1.00	1.00 1.00
Q1	3.9 0.5	4.4	4.4	11.5	1.7 5.9
kB	0.3 0.3	0.3	0.3	0.6	0.2 0.6
Q2	0.7 0.0	1.7	1.5	1.4	0.2 0.4
Q Average	4.6 0.5	6.0	5.9	13.0	1.8 6.3
Q Spacing	25.0 25.0	25.0	25.0	25.0	25.0 25.0
Q Storage	0 0	140	0	0	90 0
Q S Ratio		1.1			0.5
70th Percent	tile Output	t:			
fB%	1.2 1.2	1.2	1.2	1.2	1.2 1.2
BOQ	5.5 0.6	7.2	7.0	15.2	2.2 7.4
QSRatio		1.3			0.6
85th Percent	tile Output	t:			
fB%	1.6 1.6	1.5	1.5	1.5	1.6 1.5
BOQ	7.1 0.9	9.3	9.2	19.4	2.9 9.7
QSRatio		1.7			0.8
90th Percent	tile Output	t:			
fB%	1.7 1.8	1.7	1.7	1.6	1.8 1.7
BOQ	7.9 1.0	10.2	10.1	20.8	3.3 10.6
QSRatio		1.8			0.9
95th Percent	tile Output	t:			
fB%	2.0 2.1	1.9	1.9	1.8	2.0 1.9
BOQ	9.0 1.1	11.7	11.4	23.2	3.8 12.1
QSRatio		2.1			1.0
98th Percent	cile Output	t:			
±B%	2.4 2.7	2.3	2.3	2.1	2.6 2.3
BOQ	11.0 1.4	14.1	13.8	26.8	4.7 14.6
QSRatio		2.5			1.3

_____ERROR MESSAGES_____

No errors to report.

Analyst: Agency: Date: Period: Project	PB 6/25 AM P ID:	/2010 eak I-290	) Pha	se 1 S [.]	tudy			Inte Area Jur: Yea:	er.: I a Type isd: c : E	290 2: CBI CXIST	Ramps ) or S: ing	& Han imilar	rlem r	Avenı	ıe
E/W SL·	1-29	U Rail	lps					N/S	SL· F	artei	li Aveni	le			
				SI	GNALIZ	ED 1	INTE	RSE	CTION	SUMMA	ARY				
	ļ	Eas	tbou	nd	Wes	tbou	und		Nor	thbou	und	Soi	uthbo	und	
		Ц	T	R		T	R			T	R		T	ĸ	
No. Lane	es	1	0	1	   1	0	1		   1	2	1	   1	2	1	 
LGConfig	a	L	-	R	L	-		R	L _	Т	R	,   L	T	R	
Volume		283		117	164		19	5	372	732	360	457	434	311	İ
Lane Wid	lth	11.0		11.0	10.5		10	.5	11.0	10.0	10.0	11.0	10.0	10.0	)
RTOR Vol	_			62			57				60			60	
Duration	1	0.25		Area '	Гуре:	CBD	or	Sim	ilar						
	1. 1				Sig	nal	Ope	rat:	ions						
Phase Co	ombin	ation		2	3	4	±     ·	ND	⊺ of +	5	6 7	/		8	
Thru	-		A						Thru	A	A				
Righ	nt						Ì		Right		A				
Peds	5						İ		Peds		Х				
WB Left	:		A				İ	SB	Left	A	A				
Thru	1								Thru		A				
Righ	nt								Right		A				
NP Piah	3		7					гD	Peas Pight	- 7	X				
SB Righ	nt 1		A A					цр WB	Right	· A					
Green	10		30.0				I	пЪ	101 9110	30.0	50.0	C			
Yellow			4.0							4.0	4.0				
All Red			1.0							1.0	1.0				
			т	~ + ~ ~ ~ ~ ~ ~	~+ + ~ ~	Dent	Farm	~ ~ ~ ~	- C	Сус	cle Lei	ngth:	125.	0 5	secs
 Appr/	I.ane	··	⊥ 6⊿	i sat	CLION Ra	tio	LOLU Z	ance	I.ane	Grour	 זרת מ		 า		
Lane	Grou	g	Flo	w Rate	Ru		5		цапс	OLOUF	- API	prode	.1		
Grp	Capa	city		(s)	v/c		g/C		Delay	/ LOS	Dela	ay LOS	5		
Eastbour	 nd														
L	335		13	52	0.89	(	0.25		69.5	E		_			
-	2.0.0		1.0	1.0	0 1 0					-	64.2	2 E			
R	300 5		12	10	0.19	(	1.25		37.4	D					
T.	101 230		13	29	0 52		1 25		42 2	П					
-	550		10	20	0.52				12.2	D	41.9	9 D			
R	295		11	89	0.49	(	0.25		41.5	D					
Northbou	ınd														
L	467		11	14	0.84	. (	0.68		24.3	С					
Т	693		16	98	1.11	. (	0.41		106.4	F	64.	7 E			
R	502		73	0	0.63	(	1.69		13.3	В					
SOUTADOU	1110 אמנו		1 0	16	1 1 2				110 1	Ē					
ц Т	+∠0 870		⊥∠ 21	+0 37	1.13 0 52		) 41		2.8 4	. г С	57 ⁴	2 F			
R	502		73	0	0.53	(	0.69		10.6	В	57.1	- 11			
	Int	ersec	tion	Delay	= 59.	8	(sec	/veł	n) I	Inters	section	n LOS	= E		

I-290 Existing

Phone: E-Mail: Fax:

_____OPERATIONAL ANALYSIS______OPERATIONAL ANALYSIS_____

Analyst:	
Agency/Co.:	PB
Date Performed:	6/25/2010
Analysis Time Period:	AM Peak
Intersection:	I-290 Ramps & Harlem Avenue
Area Type:	CBD or Similar
Jurisdiction:	
Analysis Year:	Existing
Project ID: I-290 Phase 2	l Study
E/W St: I-290 Ramps	N/S St: Harlem Avenue

_____VOLUME DATA______

	Eas	Eastbound L T R		Westbound			Northbound		und	Sou	ıthboı	ınd
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume	  283		117	  164		195	  372	732	360	  457	434	311
% Heavy Veh	10		10	10		10	10	20	10	10	10	10
PHF	0.95		0.95	0.95		0.95	0.95	0.95	0.95	0.95	0.95	0.95
PK 15 Vol	74		31	43		51	98	193	95	120	114	82
Hi Ln Vol				ĺ			İ			İ		
% Grade	ĺ	0		ĺ	0		Ì	0		ĺ	0	
Ideal Sat	1800		1800	1800		1800	1800	1300	1800	1800	1500	1800
ParkExist												
NumPark												
No. Lanes	1	0	1	1	0	1	1	2	1	1	2	1
LGConfig	L		R	L		R	L	Т	R	L	Т	R
Lane Width	11.0		11.0	10.5		10.5	11.0	10.0	10.0	11.0	10.0	10.0
RTOR Vol			62			57			60			60
Adj Flow	298		58	173		145	392	771	316	481	457	264
%InSharedLn												
Prop LTs							1.000	0.0	0 0	1.000	0.00	00
Prop RTs			1.000			1.000	0	.000	1.000	0	.000 1	L.000
Peds Bikes	0			0			30	0 0	C	30	0 0 0	)
Buses	0		0	0		0	0	10	0	0	10	0
%InProtPhase	9						0.0		0.0	0.0		0.0
Duration	0.25		Area 🛛	Гуре:	CBD	or Sim	ilar					

## _____OPERATING PARAMETERS______OPERATING PARAMETERS_____

	Eas	stbou	ind	We	stbou	nd	No	rthbo	und	So	uthbo	und	
	L	Т	R	L	Т	R	L	Т	R	L	Т	R	
Init Unmet	0.0		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Arriv. Type	3		3	3		3	3	3	3	3	3	3	
Unit Ext.	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I Factor		1.00	0 (		1.00	0		1.00	0		1.00	0	
Lost Time	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	Ì
Ext of g	3.0		3.0	3.0		3.0	2.0	3.0	3.0	3.0	3.0	3.0	ĺ
Ped Min g	ĺ	3.2		Ì	3.2		Ì	6.0		Ì	6.0		ĺ

				PH	ASE	DATA_						
Pha	se Combination	1	2	3	4			5	б	7	8	
ΕB	Left Thru Right Peds	A				NB	Left Thru Right Peds	A	A A A X			
WB	Left Thru Right Peds	A				SB	Left Thru Right Peds	A	A A A X			
NB	Right	A			ļ	EB	Right	А				
SB	Right	A				WB	Right	A				
Gre Yel All	en low Red	30.0 4.0 1.0			I			30.0 4.0 1.0	50.0 4.0 1.0			

Cycle Length: 125.0 secs

_

			VOLUME	ADJI	JSTMEN	IT A	ND SAT	ΓUF	RATIC	N FLOW	WORKS	SHEET_		
Volume	e Adjus	stment												
		East	tbound	L	Wes	stbo	und		Nc	orthbou	ınd	Sou	thbound	d
		L	Т	R	L	Т	R		L	Т	R	L	T I	R
Volume	e, V	283	1	17	  164		195		372	732	360	457	434 3	 11
PHF		0.95	0	.95	0.95		0.95	5 İ	0.95	5 0.95	0.95	0.95	0.95 0	.95
Adj fl	Low	298	5	8	173		145	j	392	771	316	481	457 2	64
No. La	anes	1	0	1	1	0	1	j	1	. 2	1	1	2	1
Lane g	group	L		R	L L		R	j	L	Т	R	L	Т	R
Adj f]	Low	298	5	8	173		145	j	392	771	316	481	457 2	64
Prop I	p LTs   1.000 0.000   1.000 0.000											i		
Prop F	RTS		1.	000	İ		1.000	) İ	С	0.000	L.000	0.	000 1.	000
Satura	ation F	JOW R	ate (s	ee Er	xhihit	16	-7 to	de	eterm	nine tł	ne adii	ıstmen	t fact	ors)
Dacard	Eas	stbound	d 2, 232	1	Westbo	ound	,		Nort	hbound	le dajt	Sou	thboun	d
LG	L		R	L			R	Ι		Т	R	L	Т	R
So	1800		1800	1800	0		1800	18	300	1300	1800	1800	1500	1800
Lanes	1	0	1	1	0		1	1		2	1	1	2	1
fW	0.967		0.967	0.9	50		0.950	0.	967	0.933	0.933	0.967	0.933	0.933
fHV	0.909		0.909	0.9	09		0.909	0.	909	0.833	0.909	0.909	0.909	0.909
fG	1.000		1.000	1.0	0 0		1.000	1.	000	1.000	1.000	1.000	1.000	1.000
fP	1.000		1.000	1.0	0 0		1.000	1.	000	1.000	1.000	1.000	1.000	1.000
fBB	1.000		1.000	1.0	0 0		1.000	1.	000	0.980	1.000	1.000	0.980	1.000
fA	0.900		0.900	0.9	0 0		0.900	0.	900	0.900	0.900	0.900	0.900	0.900
fLU	1.000		1.000	1.0	0 0		1.000	1.	000	0.952	1.000	1.000	0.952	1.000
frt			0.850				0.850			1.000	0.850		1.000	0.850
fLT	0.950			0.9	50			0.	950	1.000		0.950	1.000	
Sec.								0.	388			0.219		
fLpb	1.000			1.00	0 0			0.	824	1.000		0.899	1.000	
fRpb			1.000				1.000			1.000	0.625		1.000	0.625
S	1352		1210	1329	9		1189	11	14	1698	730	1216	2137	730
Sec.			-	-				45	55			281		
				CAI	PACITY	AN	ID LOS	WC	ORKSE	IEET				
Capaci	ity Ana	alysis	and I	ane (	Group	Cap	acity							

				Adj	Adj	Sat	Flow	Gre	enL	ane G	roup	
	Appr/	Lane	Flo	w Rate	Flow	Rate	Ratic	Rat	io Cap	acity	v/c	
	Mvmt	Group		(v)	( :	s)	(v/s)	(g/	C)	(c)	Ratio	
Eas	thound											
Цар	Prot											
	Perm											
	Left	т.	2	98	13	52	# 0 22	0	25 3	35	0 89	
	Prot	-	-	20	10			•••	20 0	55	0.05	
	Derm											
	Thru											
	Right	R	5	8	12	10	0 05	0	25 3	0.0	0 1 9	
Weg	thound	10	5	0	<u>т</u> 2.	τU	0.05	0.	25 5	00	0.19	
neb	Prot											
	Derm											
	I.oft	т.	1	73	13	29	0 13	0	25 3	30	0 52	
	Drot		-	/ 5	± 5.		0.13	0.	25 5	50	0.52	
	Dorm											
	Thru											
	Piaht	P	1	45	11	89	0 1 2	0	25 2	95	0 49	
Nor	thhound	4	1	IJ	± ± '		0.12	0.	2.5 2		0.49	
NOL	Drot	J	2	67	11	1 /	0 24	0	240 2	67	1 0 0	
	Dorm		ے 1	07 25	15	1 T 5	0.27	0.	240 2		1.00	
	reim Ioft	т	3	2J 02	J.	5	0.27	0.		67	0.03	
	Drot	ш	J	92				0.	- 00	07	0.04	
	Down											
	Thru	m	7	71	16	0.0	0 4 5	0	<i>1</i> 1 6	0.2	1 1 1	
	Diaht	T	7	/ _ 1 G	10.	0	0.40	0.	41 0 60 E	00		
Cou	+hhour	R A	3	ΤO	15	0	0.45	0.	09 5	02	0.05	
Sou		J	2	0.0	1.0	1 C	ш о ог	0	040 0	0.0	1 0 0	
	Prot		1	02 70	14	10 1	# 0.25	0.	248 3 440 1	24	1.00	
	Perm Toft	т	1	01	20.	T	# 0.04	0.	440 I	24	⊥.44 1 1 2	
	Dret	Ц	4	8 L				υ.	09 4	20	1.13	
	Prot											
	Perm There	m	1	F 7	01	2 7	0 01	0	11 0	70	0 5 0	
	Iffru Diabt	1 D	4	5 / C /	21. 72	57 0	0.21	0.	41 0 60 E	0.2	0.52	
	RIGHU	ĸ	2	04	15	0	0.50	0.	09 5	02	0.55	
Sum	of flo	ow rati	os for	critic	al la	ne arc	ups. Y	c = S	um (v/s	) =	1.11	
Tot	al lost	t time	per cy	cle, I	_ = 8.	00 se	eC (			,		
Cri	tical :	flow ra	te to	capacit	y rat	io,	Х	c = (Yc	)(C)/(C	'-L) =	1.18	
				-	-							
Con	trol De	elay ar	d LOS	Determi	natio	n						
App	r/ Ra	atios	Unf	Prog	Lane	Incre	emental	Res	Lane G	roup	Appro	ach
Lan	.e		Del	Adj	Grp	Facto	or Del	Del				
Grp	v/c	g/C	d1	Fact	Cap	k	d2	d3	Delay	LOS	Delay	LOS
Eas	tbound											
L	0.89	0.25	45.3	1.000	335	0.41	24.1	0.0	69.5	E		
											64.2	Е
R	0.19	0.25	37.1	1.000	300	0.11	0.3	0.0	37.4	D		
Wes	tbound											
L	0.52	0.25	40.6	1.000	330	0.13	1.5	0.0	42.2	D		
											41.9	D
R	0.49	0.25	40.3	1.000	295	0.11	1.3	0.0	41.5	D		
Nor	thbound	d										
L	0.84	0.68	11.5	1.000	467	0.37	12.8	0.0	24.3	С		
Т	1.11	0.41	37.0	1.000	693	0.50	69.4	0.0	106.4	F	64.7	E
R	0.63	0.69	10.7	1.000	502	0.21	2.5	0.0	13.3	В		
Sou	thbound	d										
L	1.13	0.69	26.3	1.000	426	0.50	83.7	0.0	110.1	F		
Т	0.52	0.41	27.9	1.000	872	0.13	0.6	0.0	28.4	С	57.2	Е

Intersection delay = 59.8 (sec/veh) Intersection LOS = E

_____SUPPLEMENTAL PERMITTED LT WORKSHEET______for exclusive lefts

Input	ГB	WB	NB	<b>GB</b>
Opposed by $Single(S)$ or $Multiple(M)$ lane approach		ND	ND	5D
Cvcle length, C 125.0 sec				
Total actual green time for LT lane group, G (s)			85.0	85.0
Effective permitted green time for LT lane group, g(s)			55.0	55.0
Opposing effective green time, go (s)			51.0	51.0
Number of lanes in LT lane group, N			1	1
Number of lanes in opposing approach, No			2	2
Adjusted LT flow rate, VLT (veh/h)			392	481
Proportion of LT in LT lane group, PLT			1.000	1.000
Proportion of LT in opposing flow, PLTo			0.00	0.00
Adjusted opposing flow rate, Vo (veh/h)			457	771
Lost time for LT lane group, tL			5.00	4.00
Computation				
LT volume per cycle, LTC=VLTC/3600			13.61	16.70
Opposing lane util. factor, fLUo			0.952	0.952
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)			8.33	14.06
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g			0.0	0.0
Opposing platoon ratio, Rpo (refer Exhibit 16-11)			1.00	1.00
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]			0.59	0.59
gq, (see Exhibit C16-4,5,6,7,8)			11.39	21.48
gu=g-gq if gq>=gf, or = g-gf if gq <gf< td=""><td></td><td></td><td>43.61</td><td>33.52</td></gf<>			43.61	33.52
n=Max(gq-gf)/2,0)			5.69	10.74
PTHo=1-PLTo			1.00	1.00
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]			1.00	1.00
EL1 (refer to Exhibit C16-3)			2.04	2.78
EL2=Max((1-Ptho**n)/Plto, 1.0)				
fmin=2(1+PL)/g or fmin=2(1+Pl)/g			0.07	0.07
gdiff=max(gq-gf,0)			0.00	0.00
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)			0.39	0.22
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2)]	-1)],(f	Emin<=f	im<=1.(	)))
or flt=[fm+0.91(N-1)]/N**				
Left-turn adjustment, fLT			0.388	0.219
For special case of single-lane approach opposed by mu	ltilan@	e appro	bach,	
see text.				
* If Pl>=1 for shared left-turn lanes with N>1, then a	ssume o	de-fact	20	
left-turn lane and redo calculations.				
** For permitted left-turns with multiple exclusive le	ft-turr	n lanes	s, flt=	=fm.
For special case of multilane approach opposed by sing	le-lan@	e appro	bach	
or when gf>gq, see text.				
SUPPLEMENTAL PERMITTED LT WORKSH	EET			
for shared lefts				
Input				
	EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach				
Cycle length, C 125.0 sec				
Total actual green time for LT lane group, G (s)				
Effective permitted green time for LT lane group, $g(s)$				
upposing effective green time, go (s)				
Number of lanes in LT lane group, N				

```
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT
                                                                    0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
                                                                    0.952 0.952
Opposing lane util. factor, fLUo
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
qf=G[exp(-a * (LTC ** b))]-t], qf <= q
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g or fmin=2(1+Pl)/g
qdiff=max(qq-qf,0)
fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT
For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
 left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.
               SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET
Permitted Left Turns
                                                        EΒ
                                                              WΒ
                                                                    NB
                                                                          SB
Effective pedestrian green time, gp (s)
                                                                   50.0 50.0
Conflicting pedestrian volume, Vped (p/h)
                                                                   300
                                                                         300
Pedestrian flow rate, Vpedg (p/h)
                                                                   750
                                                                         750
                                                                   0.375 0.375
0CCpedq
                                                                   11.39 21.48
Opposing queue clearing green, gq (s)
                                                                   0.228 0.430
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
                                                                   0.332 0.294
Opposing flow rate, Vo (veh/h)
                                                                   457
                                                                         771
                                                                   0.176 0.101
OCCr
                                                                   1
Number of cross-street receiving lanes, Nrec
                                                                         1
Number of turning lanes, Nturn
                                                                   1
                                                                         1
ApbT
                                                                   0.824 0.899
Proportion of left turns, PLT
                                                                   1.000 1.000
Proportion of left turns using protected phase, PLTA
                                                                   0.000 0.000
Left-turn adjustment, fLpb
                                                                   0.824 0.899
Permitted Right Turns
Effective pedestrian green time, gp (s)
                                                                   50.0 50.0
                                                                   300
                                                                         300
Conflicting pedestrian volume, Vped (p/h)
Conflicting bicycle volume, Vbic (bicycles/h)
                                                                   0
                                                                         0
                                                                   750
                                                                         750
Vpedg
                                                                   0.375 0.375
OCCpedq
                                                                   55.0 55.0
Effective green, g (s)
Vbicg
                                                                   0
                                                                         0
```

OCCbicg	0.020	0.020
OCCr	0.375	0.375
Number of cross-street receiving lanes, Nrec	1	1
Number of turning lanes, Nturn	1	1
ApbT	0.625	0.625
Proportion right-turns, PRT	1.000	1.000
Proportion right-turns using protected phase, PRTA	0.000	0.000
Right turn adjustment, fRpb	1.000	1.000

_____SUPPLEMENTAL UNIFORM DELAY WORKSHEET_____

			EBLT	WBLT	NBLT	SBLT
Cycle length, C	125.0	sec				
Adj. LT vol from Vol Adjustment Worksheet,	v				392	481
v/c ratio from Capacity Worksheet, X					0.84	1.13
Protected phase effective green interval,	g (s)				30.0	31.0
Opposing queue effective green interval, g	q				11.39	21.48
Unopposed green interval, gu					43.61	33.52
Red time r=(C-g-gq-gu)					40.0	39.0
Arrival rate, $qa=v/(3600(max[X,1.0]))$					0.11	0.12
Protected ph. departure rate, Sp=s/3600					0.309	0.338
Permitted ph. departure rate, Ss=s(gq+gu)/	(gu*36	00)			0.16	0.13
XPerm					0.86	1.52
XProt					0.82	0.79
Case					1	3
Queue at beginning of green arrow, Qa					4.36	6.83
Queue at beginning of unsaturated green, Q	u				1.24	2.54
Residual queue, Qr					0.00	2.22
Uniform Delay, dl					11.5	26.3

_____DELAY/LOS WORKSHEET WITH INITIAL QUEUE______

Appr/	Initial Unmet	Dur. Unmet	Uniform	Delay	Initial Oueue	Final Unmet	Initial Oueue	Lane Group
Lane	Demand	Demand	Unadj.	Adj.	Param.	Demand	Delay	Delay
Group	Q veh	t hrs.	ds	d1 sec	u	Q veh	d3 sec	d sec
Eastbour	nd							
L	0.0	0.00	47.0	45.3	0.00	0.0	0.0 0.0	69.5
R	0.0	0.00	47.0	37.1	0.00	0.0	0.0	37.4
Westbour	nd							
L	0.0 0.0	0.00	47.0	40.6	0.00	0.0	0.0 0.0	42.2
R	0.0	0.00	47.0	40.3	0.00	0.0	0.0	41.5
Northbou	ind							
L	0.0	0.00		11.5	0.00	0.0	0.0	24.3
Т	0.0	0.00	37.0	37.0	0.00	19.5	0.0	106.4
R	0.0	0.00	19.5	10.7	0.00	0.0	0.0	13.3
Southbou	ınd							
L	0.0	0.00		26.3	0.00	13.7	0.0	110.1
Т	0.0	0.00	37.0	27.9	0.00	0.0	0.0	28.4
R	0.0	0.00	19.5	9.5	0.00	0.0	0.0	10.6
]	Intersect	ion Dela	ay 59.8	sec/ve	eh Ir	ntersecti	lon LOS	E

_____BACK OF QUEUE WORKSHEET_____BACK OF QUEUE WORKSHEET_____

	Eastbou	ınd	Westbou	ınd	Nor	thbou	ınd	Sou	thbou	ınd
LaneGroup	L	R	L	R	L	Т	R	L	Т	R
Init Queue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate	298	58	173	145	392	404	316	481	240	264
So	1800	1800	1800	1800	1800	1300	1800	1800	1500	1800
No.Lanes	1 0	1	1 0	1	1	2	1	1	2	1
SL	1352	1210	1329	1189	688	891	730	618	1122	730
LnCapacity	335	300	330	295	467	363	502	426	457	502
Flow Ratio	0.2	0.0	0.1	0.1	0.6	0.5	0.4	0.8	0.2	0.4
v/c Ratio	0.89	0.19	0.52	0.49	0.84	1.11	0.63	1.13	0.53	0.53
Grn Ratio	0.25	0.25	0.25	0.25	0.68	0.41	0.69	0.69	0.41	0.69
I Factor	1.000	)	1.000	)		1.000	)		1.000	) İ
AT or PVG	3	3	3	3	3	3	3	3	3	3
Pltn Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Q1	10.0	1.6	5.2	4.3	5.5	14.0	6.0	6.9	6.3	4.5
kB	0.4	0.4	0.4	0.4	0.5	0.5	0.6	0.5	0.5	0.6
Q2	2.3	0.1	0.5	0.4	2.2	8.0	0.9	9.9	0.6	0.6
Q Average	12.3	1.7	5.7	4.7	7.7	22.0	6.9	16.9	6.8	5.1
Q Spacing	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Q Storage	0	0	0	0	170	0	155	490	0	220
Q S Ratio					1.1		1.1	0.9		0.6
70th Percent	ile Output	::								
fB%	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
BOQ	14.5	2.0	6.7	5.6	9.1	25.5	8.2	19.6	8.1	6.0
QSRatio					1.3		1.3	1.0		0.7
85th Percent	ile Output	:								
fB% ∣	1.5	1.6	1.5	1.6	1.5	1.4	1.5	1.5	1.5	1.6
BOQ	18.5	2.7	8.8	7.3	11.8	31.8	10.7	24.8	10.5	7.9
QSRatio					1.7		1.7	1.3		0.9
90th Percent	ile Output	:								
fB% ∣	1.6	1.8	1.7	1.7	1.7	1.5	1.7	1.6	1.7	1.7
BOQ	19.9	3.0	9.6	8.1	12.9	33.8	11.7	26.5	11.5	8.7
QSRatio					1.9		1.9	1.4		1.0
95th Percent	ile Output	:								
fB% ∣	1.8	2.0	1.9	2.0	1.9	1.7	1.9	1.7	1.9	2.0
BOQ	22.2	3.5	11.0	9.2	14.6	36.9	13.3	29.2	13.1	9.9
QSRatio					2.1		2.1	1.5		1.1
98th Percent	ile Output	:								
1B%	2.1	2.6	2.3	2.4	2.3	1.9	2.3	2.0	2.3	2.4
BOD	25.7	4.4	13.3	11.3	117.3	41.5	15.9	33.3	15.7	12.1
QSRatio					2.6		2.6	⊥.′/		⊥.4

_____ERROR MESSAGES_____

No errors to report.

Analyst: Agency: PB Date: 6/2 Period: PM Project ID: E/W St: I-2	25/2010 Peak I-290 290 Ramp	Phas	se 1 St	cudy		In Ard Ju: Yea N/3	ter.: I ea Type risd: ar : E S St: E	-290 2: CBD Cxisti Marlen	Ramps D or Si ing n Avenu	& Hai imilai ie	clem Z	Avenu	e
			SI(	GNALIZ	ED I	NTERS:	ECTION	SUMMA	ARY				
	East	r r	10 P	wes   T.	TDOU	ina P	I NOT	rubou T	ana P	501   т.	ιτησοι Τ	una P	
		T	IC IC		T	К		Ŧ	R		T	R	ł
No. Lanes	1 1	0	1	1	0	1	1	2	1	1	2	1	-   
LGConfig	L		R	L L		R	L	Т	R	L	Т	R	İ
Volume	232		229	298		283	282	802	360	470	745	407	
Lane Width	11.0		11.0	10.5		10.5	11.0	10.0	10.0	11.0	10.0	10.0	ļ
RTOR Vol			43			60			60			60	
Duration	0.25		Area 1	Type:	CBD	or Si	milar						
Dhage Combi	nation	1	2	Sig 3	na⊥ ⊿	opera	cions	 5	6				
ER Left	IIacion	A	2	5	-	INB	Left	A	D D	/		0	
Thru						112	Thru		A				
Right						İ	Right		A				
Peds							Peds		Х				
WB Left		A				SB	Left	A	A				
Thru							Thru		A				
Right							Right		A				
NB Right		Δ				   EB	Peas Right	- D	A				
SB Right		A				MB	Right	: A					
Green		30.0				1	5	30.0	50.0	C			
Yellow	4	4.0						4.0	4.0				
All Red	-	1.0						1.0	1.0				
		т.			Deref			Сус	cle Ler	ngth:	125.	0 s	ecs
Appr/ Lar		ו⊥ ∙ ה⊿	i sat	Ction Ra	tios	orman	ce Summ Lane	lary Grour			 ว		
Lane Gro	and	Flor	w Rate	na	CIUC	,	Цанс	OLOUF		proaci	-		
Grp Cap	acity		(s)	v/c	g	l\C	Delay	/ LOS	Dela	ay LOS	5		
Eastbound													
L 33	35	13	52	0.73	C	.25	50.9	D	4.0				
ר כ	0	10	1.0	0 65	C	) ) E	47 0	П	49.3	3 D			
K 30 Westhound	10	12.	10	0.05	Ľ	0.25	4/.2	D					
	3.0	13	2.9	0.95	C	. 25	83.1	я					
_ 00				0.20			0011	-	72.4	4 E			
R 29	95	118	89	0.80	C	.25	58.2	Ε					
	Л	1.2	1 Q	0 7 2	ſ	68	21 6	C					
т 75	 56	18	52	1.12	ſ	. 41	106.6	Э F	69.0	ज (			
R 50	)2	730	- <u>-</u> 0	0.63	C	.69	13.3	B					
Southbound					-								
L 41	.3	123	33	1.20	C	.69	139.4	l F					
Т 87	2	213	37	0.90	C	.41	46.8	D	68.2	2 E			
R 50	)2	730	)	0.73	0	.69	17.4	B			_		
Ir	itersect	tion	Delay	= 67.	υ (	sec/v	en) I	nters	sectior	n LOS	= E		

I-290 Existing

Phone: E-Mail: Fax:

_____OPERATIONAL ANALYSIS______

Analyst: Agency/Co.: PB Date Performed: 6/25/2010 Analysis Time Period: PM Peak Intersection: I-290 Ramps & Harlem Avenue Area Type: CBD or Similar Jurisdiction: Analysis Year: Existing Project ID: I-290 Phase 1 Study E/W St: I-290 Ramps N/S St: Harlem Avenue

_____VOLUME DATA_____

	Eas	Eastbound   L T R			stboi	ınd	Northbound			Southbound		
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume			229	   208				802	360		7/5	407
VOLUME & Hoory Voh	2 3 2   1 0		10	1290		10	110	10	10		10	107
S HEAVY VEII												
PHF			0.95			0.95	10.95	0.95	0.95	1124	106	107
PK 15 VOL	ΙOΤ		60	/ 8		/4	/ 4	$\angle \perp \perp$	95	124	190	107
HI LN VOL		0			0			0			0	
% Grade		0			0			0			0	
Ideal Sat	1800		1800	1800		1800	1800	1300	1800	1800	1500	1800
ParkExist												
NumPark												
No. Lanes	1	0	1	1	0	1	1	2	1	1	2	1
LGConfig	L		R	L		R	L	Т	R	L	Т	R
Lane Width	11.0		11.0	10.5		10.5	11.0	10.0	10.0	11.0	10.0	10.0
RTOR Vol			43	ĺ		60	İ		60	İ		60
Adj Flow	244		196	314		235	297	844	316	495	784	365
%InSharedLn							İ			İ		
Prop LTs	ĺ			İ			1.000	0.0	0 0	1.000	0.00	00
Prop RTs			1.000	ĺ		1.000	0	.000	1.000	j 0	.000 1	L.000
Peds Bikes	İ O			İ O			30	00	0	30	00 00	)
Buses	0		0	l o		0	0	10	0	İo	10	0
%InProtPhase	5			İ			0.0		0.0	İ 0.0		0.0
Duration	0.25		Area 1	Type:	CBD	or Sim	ilar			1		

	Ea	stbou	ınd	We	stbou	nd	No	rthbo	und	So	uthbo	und
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Init Unmet	  0.0		0.0	-  <u></u>  0.0		0.0	-  <u></u>	0.0	0.0	-  <u></u>	0.0	0.0
Arriv. Type	3		3	3		3	3	3	3	3	3	3
Unit Ext.	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0
I Factor	ĺ	1.00	00	Ì	1.00	0	Ì	1.00	0	ĺ	1.00	0
Lost Time	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext of g	3.0		3.0	3.0		3.0	2.0	3.0	3.0	3.0	3.0	3.0
Ped Min g	ĺ	3.2		Ì	3.2		Ì	6.0		Ì	6.0	

## _____OPERATING PARAMETERS______OPERATING PARAMETERS_____

	PHASE DATAPHASEPHASE												
Pha	se Combination	1	2	3	4			5	б	7	8		
ΕB	Left Thru Right Peds	A				NB	Left Thru Right Peds	A	A A A X				
WB	Left Thru Right Peds	A				SB	Left Thru Right Peds	A	A A A X				
NB	Right	A			ļ	EB	Right	A					
SB	Right	A				WB	Right	A					
Gre Yel All	en low Red	30.0 4.0 1.0			I			30.0 4.0 1.0	50.0 4.0 1.0				

Cycle Length: 125.0 secs

_

			VOLUME	ADJI	JSTMEN	ТА	ND SAT	ГUF	RATIC	ON FLOW	WORKS	SHEET_		
Volume	e Adjus	stment										_		
		Eas	tbound		Wes	tbo	und		Nc	orthbou	ınd	Southbound		
		L	Т	R	L	Т	R		L	Т	R	L	Т	R
Volume	≥, V	232	2	29	298		283		282	802	360	470	745 4	 107
PHF		0.95	0	.95	0.95		0.95	5	0.95	5 0.95	0.95	0.95	0.95 (	).95
Adj fl	Low	244	1	96	314		235	Í	297	844	316	495	784 3	365
No. La	anes	1	0	1	1	0	1	ĺ	1	. 2	1	1	2	1
Lane g	group	L		R	L		R	Í	L	Т	R	L	Т	R
Adj f]	Low	244	1	96	314		235	ĺ	297	844	316	495	784 3	365
Prop I	JTs							Í	1.00	0.0	0 0	1.000	0.000	) İ
Prop F	RTs		1.	000			1.000	) İ	C	0.000	L.000	0.	000 1	.000
Satura	ation B	Flow Ra	ate (s	ee Ez	khibit	16	-7 to	de	eterm	nine th	ne adiu	ıstmen	t faci	cors)
	Eas	stbound	d	7	Vestbo	und			Nort	hbound	1	Sou	thbour	nd
LG	L		R	L			R	Ι		Т	R	L	Т	R
So	1800		1800	1800	)		1800	18	300	1300	1800	1800	1500	1800
Lanes	1	0	1	1	0		1	1		2	1	1	2	1
fW	0.967		0.967	0.95	50		0.950	0.	967	0.933	0.933	0.967	0.933	3 0.933
fHV	0.909		0.909	0.90	)9		0.909	0.	909	0.909	0.909	0.909	0.909	9 0.909
fG	1.000		1.000	1.00	00		1.000	1.	000	1.000	1.000	1.000	1.000	0 1.000
fP	1.000		1.000	1.00	00		1.000	1.	000	1.000	1.000	1.000	1.000	0 1.000
fBB	1.000		1.000	1.00	00		1.000	1.	000	0.980	1.000	1.000	0.980	0 1.000
fA	0.900		0.900	0.90	00		0.900	0.	900	0.900	0.900	0.900	0.900	0.900
fLU	1.000		1.000	1.00	00		1.000	1.	000	0.952	1.000	1.000	0.952	2 1.000
frt			0.850				0.850			1.000	0.850		1.000	0.850
fLT	0.950			0.95	50			0.	950	1.000		0.950	1.000	)
Sec.								0.	214			0.188		
fLpb	1.000			1.00	00			0.	901	1.000		0.912	1.000	)
fRpb			1.000				1.000			1.000	0.625		1.000	0.625
S	1352		1210	1329	9		1189	12	219	1852	730	1233	2137	730
Sec.				-				27	74			244		
				CAI	PACITY	AN	D LOS	WC	ORKSE	IEET				
Capaci	ity Ana	alysis	and L	ane (	Group	Cap	acity							

			Adj	Adj	Sat	Flow		Gre	en	Lane G	roup	
Appr/	Lane	Flo	w Rate	Flow	Rate	Rati	0	Rat	io Ca	pacity	v/c	
Mvmt	Group		(v)	(	S)	(v/s	)	(g/	C)	(C)	Ratio	
Eastbour	 d											
Prot	u.											
Perm												
Left	L	2	44	13	52	0.1	8	0.	25	335	0.73	
Prot	_	_					-					
Perm												
Thru												
Right	R	1	96	12	10	0 1	6	0	25	300	0 65	
Westboun	d	-			_ •	0.1	•	•••				
Prot	u.											
Perm												
Left	т.	3	14	13	29	± 0 2	4	0	25	330	0 95	
Prot	1	5	± 1	10	27	π 0.2	1	0.	23	550	0.95	
Derm												
Thru												
Pight	Ð	2	3 5	11	80	0 2	0	0	25	205	0 80	
Northbour	nd	2	55	<u>т</u> т	69	0.2	0	0.	2 J	295	0.00	
Drot	IIQ	2	0.2	1 0	10	0 2	Л	0	240	202	1 0 0	
PIOL		ے ۸	95	12	19	0.2	1 1	0.	240 440	295 101	1.00	
Perm	т	4 0	07	27	4	0.0	Т	0.	440 60		0.03	
Leit	Ц	Z	97					υ.	00	414	0.72	
Prot												
Perm	m	0	A A	1.0	г <b>о</b>	0 1	c	0	1 1	756	1 1 0	
IIIru Diadat	I D	0 2	44	10	5Z	0.4	0 2	0.	41 C 0	750	1.12	
Right	K 	3	10	/ 3	0	0.4	3	υ.	09	502	0.63	
Southbou	na	2	0.0	1.0	2.2		-	0	0.4.0	200	1 0 0	
Prot		3	06	12	33 1	# 0.Z	5	0.	248 440	306	1.00	
Perm	Ŧ	T 4	89	24	4	# 0.7	/	0.	440 C 0	107 412	1.77	
Leit	Ц	4	95					Ο.	69	413	1.20	
Prot												
Perm	-	-	0.4	0.1	2 17	0 0	-	0	4 1	0.7.0	0 00	
Thru	T	7	84	21	37	0.3	7	0.	41 50	872	0.90	
Right	R	3	65	73	0	0.5	0	0.	69	502	0.73	
Sum of f	low rati	og for			ne arc		Vc	– C			1 26	
Total lo	st time	per cv	cle I	. = 8	nc gro nn ge	odpo,	10	- 0	uiii (v)	5/ -	1.20	
Critical	flow ra	te to	capacit	v rat	io.		Хc	= (YC	)(C)/(	$(C-T_1) =$	1 35	
01101001	1100 10	00 00	oupdoid	., 1ac	10,			(10	/(0//(	0 1/	1.35	
Control	Delay an	d LOS	Determi	natio	n							
Appr/	Ratios	Unf	Prog	Lane	Incre	ementa	1	Res	Lane	Group	Approa	ach
Lane		Del	Adj	Grp	Facto	or Del		Del				
Grp v/	c g/C	d1	Fact	Cap	k	d2		d3	Dela	y LOS	Delay	LOS
Eastboun	d											
L 0.7	3 0.25	43.1	1.000	335	0.29	7.8		0.0	50.9	D		
											49.3	D
R 0.6	5 0.25	42.2	1.000	300	0.23	5.0		0.0	47.2	D		
Westboun	d											
L 0.9	5 0.25	46.3	1.000	330	0.46	36.	8	0.0	83.1	F		
											72.4	Е
R 0.8	0 0.25	44.0	1.000	295	0.34	14.	1	0.0	58.2	Е		
Northbou	nd											
L 0.7	2 0.68	15.7	1.000	414	0.28	5.9		0.0	21.6	С		
т 1.1	2 0.41	37.0	1.000	756	0.50	69.	б	0.0	106.6	F	69.0	Е
R 0.6	3 0.69	10.7	1.000	502	0.21	2.5		0.0	13.3	В		
Southbou	nd											
L 1.2	0 0.69	28.8	1.000	413	0.50	110	.6	0.0	139.4	F		
т 0.9	0 0.41	34.6	1.000	872	0.42	12.	2	0.0	46.8	D	68.2	Е

Intersection delay = 67.0 (sec/veh) Intersection LOS = E

_____SUPPLEMENTAL PERMITTED LT WORKSHEET______for exclusive lefts

Input	τD	WD	ND	CD
Opposed by $Single(S)$ or $Multiple(M)$ lane approach	C C		NБ	90
Cycle length C 125 0 sec				
Total actual green time for LT lane group G (g)			85 0	85 0
Effective permitted green time for $IT$ lane group, $g(g)$			55 0	55 0
$\begin{array}{c} \text{Effective permitted green time for first and group, g(s)} \\ \text{Opposing effective green time go (s)} \end{array}$			51.0	55.0
Number of lange in LT lang group N			51.U 1	51.U 1
Number of lance in opposing approach. No			2 T	1 1
Adjusted IT flow rate MIT (web/b)			2 207	2 105
Augusted Di 110W fate, VDI (Ven/II)			1 0 0 0	495
Proportion of LT in arraging flow DITE			1.000	1.000
Adjusted empering flow water Mar (web/h)			0.00	0.00
Adjusted opposing flow rate, vo (ven/n)			/84	844
Lost time for LT lane group, th			5.00	4.00
Computation			10 01	1 1 1 0
LT Volume per cycle, LTC=VLTC/3600			10.31	1/.19
Opposing lane util. factor, fLUo			0.952	0.952
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)			14.30	15.39
gi=G[exp(- a * (LTC ** b))]-t1, gi<=g			0.0	0.0
Opposing platoon ratio, Rpo (refer Exhibit 16-11)			1.00	1.00
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]			0.59	0.59
gq, (see Exhibit C16-4,5,6,7,8)			21.95	24.18
gu=g-gq if gq>=gf, or = g-gf if gq <gf< td=""><td></td><td></td><td>33.05</td><td>30.82</td></gf<>			33.05	30.82
n=Max(gq-gf)/2,0)			10.97	12.09
PTHO=1-PLTO			1.00	1.00
PL*=PLT[1+(N-1)g/(gt+gu/EL1+4.24)]			1.00	1.00
ELL (refer to Exhibit C16-3)			2.81	2.98
EL2=Max((1-Ptho**n)/Plto, 1.0)				
fmin=2(1+PL)/g or $fmin=2(1+PL)/g$			0.07	0.07
gdiff=max(gq-gf,0)			0.00	0.00
<pre>fm=[gf/g]+[gu/g]/[I+PL(ELI-I)], (min=fmin;max=1.00)</pre>	<b>1 ) ]</b> ( )		0.21	0.19
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-	-1)],(t	:mın<=1	m<=1.(	)())
or flt=[fm+0.91(N-1)]/N**			0 014	0 1 0 0
Left-turn adjustment, fLT			0.214	0.188
For special case of single-lane approach opposed by mul	ltilane	appro	ach,	
see text.				
* If Pl>=1 for shared left-turn lanes with N>1, then as	ssume d	le-fact	0	
left-turn lane and redo calculations.				
** For permitted left-turns with multiple exclusive left	it-turr	lanes	s, flt=	=fm.
For special case of multilane approach opposed by sing	le-lane	appro	ach	
or when gf>gq, see text.				
SUDDI.FMFNTAI. DFPMTTTFD I.T WOPKSHI	ידי			
SOFFLEMENTAL FERMITTED IT WORKSIN	ын т			
Input				
	EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach				
Cycle length, C 125.0 sec				
Total actual green time for LT lane group, G (s)				
Effective permitted green time for LT lane group, g(s)				
Opposing effective green time, go (s)				
Number of lanes in LT lane group, N				

```
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT
                                                                    0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
                                                                    0.952 0.952
Opposing lane util. factor, fLUo
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
qf=G[exp(-a * (LTC ** b))]-t], qf <= q
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g or fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT
For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
 left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.
               SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET
Permitted Left Turns
                                                        EΒ
                                                              WΒ
                                                                    NB
                                                                          SB
Effective pedestrian green time, gp (s)
                                                                   50.0 50.0
Conflicting pedestrian volume, Vped (p/h)
                                                                   300
                                                                         300
Pedestrian flow rate, Vpedg (p/h)
                                                                   750
                                                                         750
                                                                   0.375 0.375
0CCpedq
                                                                   21.95 24.18
Opposing queue clearing green, gq (s)
Eff. ped. green consumed by opp. veh. queue, gq/gp
                                                                  0.439 0.484
                                                                   0.293 0.284
OCCpedu
Opposing flow rate, Vo (veh/h)
                                                                   784
                                                                         844
                                                                   0.099 0.088
OCCr
Number of cross-street receiving lanes, Nrec
                                                                   1
                                                                         1
Number of turning lanes, Nturn
                                                                   1
                                                                         1
ApbT
                                                                   0.901 0.912
Proportion of left turns, PLT
                                                                   1.000 1.000
Proportion of left turns using protected phase, PLTA
                                                                   0.000 0.000
Left-turn adjustment, fLpb
                                                                   0.901 0.912
Permitted Right Turns
Effective pedestrian green time, gp (s)
                                                                   50.0 50.0
                                                                   300
                                                                         300
Conflicting pedestrian volume, Vped (p/h)
Conflicting bicycle volume, Vbic (bicycles/h)
                                                                   0
                                                                         0
                                                                   750
                                                                         750
Vpedg
                                                                   0.375 0.375
OCCpedq
                                                                   55.0 55.0
Effective green, g (s)
Vbicg
                                                                   0
                                                                         0
```

020
375
625
000
000
000
62 00 00 00

_____SUPPLEMENTAL UNIFORM DELAY WORKSHEET_____

		EBLT	WBLT	NBLT	SBLT
Cycle length, C 125.0 s	ec				
Adj. LT vol from Vol Adjustment Worksheet, v				297	495
v/c ratio from Capacity Worksheet, X				0.72	1.20
Protected phase effective green interval, g (s)				30.0	31.0
Opposing queue effective green interval, gq				21.95	24.18
Unopposed green interval, gu				33.05	30.82
Red time r=(C-g-gq-gu)				40.0	39.0
Arrival rate, $qa=v/(3600(max[X,1.0]))$				0.08	0.11
Protected ph. departure rate, Sp=s/3600				0.339	0.343
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600	))			0.13	0.12
XPerm				1.08	1.69
XProt				0.57	0.76
Case				3	3
Queue at beginning of green arrow, Qa				3.65	7.06
Queue at beginning of unsaturated green, Qu				1.81	2.77
Residual queue, Qr				0.35	2.58
Uniform Delay, dl				15.7	28.8

_____DELAY/LOS WORKSHEET WITH INITIAL QUEUE______

Appr/	Initial Unmet	Dur. Unmet	Uniform	Delay	Initial Oueue	Final Unmet	Initial Oueue	Lane Group
Lane	Demand	Demand	Unadj.	Adj.	Param.	Demand	Delay	Delay
Group	Q veh	t hrs.	ds	dl sec	u	Q veh	d3 sec	d sec
Eastbour	nd							
L	0.0	0.00	47.0	43.1	0.00	0.0	0.0 0.0	50.9
R	0.0	0.00	47.0	42.2	0.00	0.0	0.0	47.2
Westbour	nd							
L	0.0 0.0	0.00	47.0	46.3	0.00	0.0	0.0 0.0	83.1
R	0.0	0.00	47.0	44.0	0.00	0.0	0.0	58.2
Northbou	ınd							
L	0.0	0.00		15.7	0.00	0.0	0.0	21.6
Т	0.0	0.00	37.0	37.0	0.00	22.0	0.0	106.6
R	0.0	0.00	19.5	10.7	0.00	0.0	0.0	13.3
Southbou	ınd							
L	0.0	0.00		28.8	0.00	20.5	0.0	139.4
Т	0.0	0.00	37.0	34.6	0.00	0.0	0.0	46.8
R	0.0	0.00	19.5	12.2	0.00	0.0	0.0	17.4
]	Intersect	ion Dela	ay 67.0	sec/ve	eh Ir	ntersecti	on LOS	E

_____BACK OF QUEUE WORKSHEET_____BACK OF QUEUE WORKSHEET_____

	Eastbou	ınd	Westbou	ınd	Nor	thbou	ınd	Sou	lthbou	ınd
LaneGroup	L	R	L	R	L	Т	R	L	Т	R
Init Queue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate	244	196	314	235	297	443	316	495	411	365
So	1800	1800	1800	1800	1800	1300	1800	1800	1500	1800
No.Lanes	1 0	1	1 0	1	1	2	1	1	2	1
SL	1352	1210	1329	1189	608	972	730	600	1122	730
LnCapacity	335	300	330	295	414	397	502	413	457	502
Flow Ratio	0.2	0.2	0.2	0.2	0.5	0.5	0.4	0.8	0.4	0.5
v/c Ratio	0.73	0.65	0.95	0.80	0.72	1.12	0.63	1.20	0.90	0.73
Grn Ratio	0.25	0.25	0.25	0.25	0.68	0.41	0.69	0.69	0.41	0.69
I Factor	1.000	)	1.000	)		1.000	)		1.000	
AT or PVG	3	3	3	3	3	3	3	3	3	3
Pltn Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Q1	7.8	6.1	10.7	7.6	4.0	15.4	6.0	7.1	13.3	7.9
kB	0.4	0.4	0.4	0.4	0.5	0.5	0.6	0.5	0.5	0.6
Q2	1.1	0.7	3.2	1.3	1.2	8.8	0.9	12.7	3.1	1.4
Q Average	8.8	6.8	14.0	9.0	5.1	24.2	6.9	19.8	16.4	9.3
Q Spacing	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Q Storage	0	0	0	0	170	0	155	490	0	220
Q S Ratio					0.8		1.1	1.0		1.1
70th Percent	ile Output	:								
fB%	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
BOQ	10.4	8.1	16.3	10.6	6.1	27.9	8.2	23.0	19.1	10.9
QSRatio					0.9		1.3	1.2		1.2
85th Percent	ile Output	::								
fB% ∣	1.5	1.5	1.5	1.5	1.6	1.4	1.5	1.5	1.5	1.5
BOQ	13.5	10.5	20.8	13.7	8.0	34.7	10.7	28.8	24.2	14.1
QSRatio					1.2		1.7	1.5		1.6
90th Percent	ile Output	:								
ÍB% ∣	1.7	1.7	1.6	1.7	1.7	1.5	1.7	1.5	1.6	1.7
BOQ	14.7	11.5	22.3	14.9	8.8	36.7	11.7	30.7	25.9	15.3
QSRatio					1.3		1.9	1.6		1.7
95th Percent	ile Output	;:								
ÍB% ∣	1.9	1.9	1.8	1.9	2.0	1.7	1.9	1.7	1.7	1.9
BOQ	16.5	13.1	24.8	16.8	10.0	40.0	13.3	33.6	28.6	17.3
QSRatio					1.5		2.1	1.7		2.0
98th Percent	ule Output	;:								o o '
1B%	2.2	2.3	2.0	2.2	2.4	1.9	2.3	⊥.9	2.0	2.2
BOD	19.5	15.7	28.5	19.8	12.2	44.9	15.9	38.0	32.5	20.3
QSRat10					1.8		2.6	1.9		2.3

_____ERROR MESSAGES_____

No errors to report.

Analyst: Agency: PB Date: 6/2 Period: AM Project ID:	25/2010 Peak I-290 Ph	ase 1 St	tudy	Int Are Jur Yea	er.: I a Type isd: r : E	-290 : CBD xisti	Ramps or Si ng	& Au imila	stin 1 r	3oule	vard
E/W St: I-2	90 Ramps		-	N/S	St: A	ustin	Boule	evard			
		SIC	GNALIZED	INTERSE	CTION	SUMMA	RY				
	Eastbo	und	Westb	ound	Nor	thbou	nd	So	uthbou	und	
	L T	R	L Т	R	L	Т	R	L	Т	R	
					.						_
No. Lanes	1 0	1	1	0 1	1	2	1	1	2	1	
LGConfig		R		R		Т	R	L	LT	R	
Volume	109	73	487	401	350	479	632	548	481	181	
Lane Width	110.0	10.0	10.5	11.0	11.0	10.5	10.0	10.0	10.0	10.0	
RTOR VOL		57		60			1/			54	
Duration	0.25	Area 1	Type: CB	D or Sim	ilar						
Dhago Combi			Signa	1 Operat	lons	E	6				
	.nation 1	Z	3	4     ND	Toft	С Л	0	/	(	5	
вв цегс Thru	A				Thru	A D					
Right					Right	A					
Peds					Peds	X					
WB Left	A			SB	Left		A				
Thru					Thru		A				
Right					Right		A				
Peds					Peds		Х				
NB Right	A			EB	Right	A					
SB Right	A			WB	Right		A				
Green	50.	0				30.0	30.0	)			
Yellow	4.0					4.0	4.0				
All Red	1.0						1.U	ath.	125 (	0	0.9.9
		Intersed	stion De	rformanc	e Summ	arv	те пег	Iguii	125.0	JSt	ecs
Appr/ Lar	A	di Sat	Rati	05	Lane	Group	 Apr	proac	 h		
Lane Gro	oup Fl	ow Rate									
Grp Cap	pacity	(s)	v/c	g/C	Delay	LOS	Dela	ay LO	S		
Eastbound											
L 55	58 1	368	0.21	0.41	24.1	С	25 6				
P 30	1 1	224	0 06	0 25	35 9	Л	25.0				
Westbound		221	0.00	0.25	55.7	D					
L 56	8 1	392	0.90	0.41	52.5	D					
	-					_	89.5	5 F			
R 31	.4 1	268	1.14	0.25	142.4	F					
Northbound											
ь 35	51 1	417	1.05	0.25	108.3	F					
т 49	0 1	975	1.03	0.25	95.2	F	84.0	) F			
R 63	92	18	1.02	0.69	61.5	Ε					
Southbound		2 6 0	0 0 5	0 0-		_					
Ц 33	1	368	0.90	0.25	71.7	E	000	c -			
цт 47	13 1 11 7	907 14	⊥.64 0.27	0.25	345.6	ד, בי	239.	.ю F			
к 45	/ /	14 n Delarr	U.Z/ - 122 0	U.09 (000/110	/.ð .h) T	A	eation		- 5		
11	ILEISECLIO.	п ретау		(Sec/Ve	ш) 1	ncers	CULTON	с ПОР	— г		

I-290 Existing

Phone: E-Mail: Fax:

_____OPERATIONAL ANALYSIS______

Apolyat:	
Allalyst.	
Agency/Co.:	PB
Date Performed:	6/25/2010
Analysis Time Period:	AM Peak
Intersection:	I-290 Ramps & Austin Boulevard
Area Type:	CBD or Similar
Jurisdiction:	
Analysis Year:	Existing
Project ID: I-290 Phase 2	l Study
E/W St: I-290 Ramps	N/S St: Austin Boulevard

_____VOLUME DATA______

	Eas	Eastbound			stbou	und	No:	rthbou	und	Southbound		
	L	Т	R	L	Т	R	L	Т	R	Ĺ	Т	R
Volume	  109		73	   487		401	350	479	632	548	4.8.1	181
& Hoarry Voh			5	= 0 /			1220		5	1240	701 5	тот Б
% neavy ven											0 0 5	
PHF 15 Vol			10	1120		106		126	166		107	10.95
PK 15 VOL	29		19	1 2 0 		100	92	TZO	100	1 <del>4 4</del>		40
HI LII VOI		0			0			0			0	
<pre>% Grade</pre>		0	1000		0	1000		0	1000		0	1000
Ideal Sat	11800		T800	11800		T800	11800	1300	T800	11800	1300	1800
ParkExist							ļ					
NumPark												
No. Lanes	1	0	1	1	0	1	1	2	1	1	2	1
LGConfig	L		R	L		R	L	Т	R	L	LT	R
Lane Width	10.0		10.0	10.5		11.0	11.0	10.5	10.0	10.0	10.0	10.0
RTOR Vol			57			60			17			54
Adj Flow	115		17	513		359	368	504	647	306	777	134
%InSharedLn	ĺ						Ì			47		
Prop LTs	ĺ						Ì	0.00	0 0	ĺ	0.34	19
Prop RTs	İ		1.000	İ		1.000	0	.000	1.000	j 0	.000 1	L.000
Peds Bikes	j o			j o			2	00	C	20	00 0	)
Buses	0		0	0		0	0	10	0	İo	10	0
%InProtPhase	5						İ		0.0	İ		0.0
Duration	0.25		Area '	Type:	CBD	or Sim	ilar					

	Eas	stbou	ind	We	stbou	nd	No	rthbo	und	So	uthbo	und
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Init Unmet	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arriv. Type	3		3	3		3	3	3	3	3	3	3
Unit Ext.	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0
I Factor		1.00	0		1.00	0		1.00	0		1.00	0
Lost Time	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext of g	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped Min g		3.2		İ	3.2		İ	5.1		İ	5.1	

## _____OPERATING PARAMETERS______OPERATING PARAMETERS_____

				PH	IASE	DATA_						
Pha	se Combination	1	2	3	4			5	6	7	8	
EB	Left Thru Right Peds	A				NB	Left Thru Right Peds	A A A X				
WB	Left Thru Right Peds	A				SB	Left Thru Right Peds		A A A X			
NB	Right	A			ļ	EB	Right	А				
SB	Right	A				WB	Right		A			
Gre Yel All	en low Red	50.0 4.0 1.0			I			30.0 4.0 1.0	30.0 4.0 1.0			

Cycle Length: 125.0 secs

		77	JOLUME	ADJU	JSTMEN	TA	ND SAT	ruf	RATIC	N FLOV	WORKS	SHEET_		
Volume	e Adjus	stment												
		East	cbound		Wes	tbo	und		No	orthbou	ınd	Sou	thboun	d
		L	T I	ર	L	Т	R		L	Т	R	L	Т	R
Volume, V   109 73				  487		401	 	350	479	632	548	481 1	 81	
PHF		0.95	0	.95	0.95		0.95	5 İ	0.95	0.95	0.95	0.95	0.95 0	.95
Adj flow		115	1'	7	513		359	j	368	504	647	577	506 1	34
No. La	anes	1	0	1	1	0	1	İ	1	. 2	1	1	2	1
Lane g	group	L		R	L		R	ĺ	L	Т	R	L	LT	R
Adj fl	OW	115	1	7	513		359		368	504	647	306	777 1	34
Prop L	JTs									0.00	0		0.349	ĺ
Prop R	RTs		1.0	000			1.000	)	0	.000 1	.000	0.	000 1.	000
Satura	ation H	Flow Ra	ate (se	ee Ez	khibit	16	-7 to	de	eterm	nine th	ne adju	ıstmen	t fact	ors)
	Eas	stbound	f	V	Vestbo	und			Nort	hbound	1	Sou	thboun	d
LG	L		R	L			R	I	_	Т	R	L	LT	R
So	1800		1800	1800	)		1800	18	300	1300	1800	1800	1300	1800
Lanes	1	0	1	1	0		1	1		2	1	1	2	1
fW	0.933		0.933	0.95	50		0.967	0.	967	0.950	0.933	0.933	0.933	0.933
fHV	0.952		0.952	0.95	52		0.952	0.	952	0.952	0.952	0.952	0.952	0.952
fG	1.000		1.000	1.00	00		1.000	1.	000	1.000	1.000	1.000	1.000	1.000
fP	1.000		1.000	1.00	00		1.000	1.	000	1.000	1.000	1.000	1.000	1.000
fBB	1.000		1.000	1.00	00		1.000	1.	000	0.980	1.000	1.000	0.980	1.000
ÍA	0.900		0.900	0.90	00		0.900	0.	900	0.900	0.900	0.900	0.900	0.900
fLU	1.000		1.000	1.00	00		1.000	1.	000	0.952	1.000	1.000	0.952	1.000
fRT			0.850				0.850	_		1.000	0.850		1.000	0.850
fLT	0.950			0.95	50			0.	950	1.000		0.950	0.983	
Sec.														
fLpb	1.000			1.00	00			1.	000	1.000		1.000	1.000	
1Rpb			1.000		_		1.000			1.000	0.750		1.000	0.583
S	1368		1224	1392	2		1268	14	117	1975	918	1368	1907	714
Sec.				<b>a</b>										
				CAI	ACITY	AN	D LOS	ŴС	URKSH	LEET				

Capacity Analysis and Lane Group Capacity

			Adj	Adj	Sat	Flow	Gre	enL	ane Gi	roup	
Appr/	Lane	Flo	w Rate	Flow	Rate	Ratio	Rat	io Cap	acity	v/c	
Mvmt	Group		(v)	(	s)	(v/s)	(g/	C )	(C)	Ratio	
Eastbound	 1										
Prot											
Perm											
Left	L	1	15	13	68	0.08	0.	41 5	58	0.21	
Prot											
Perm											
Thru											
Right	R	1	7	12	2.4	0 01	0	25 3	04	0 06	
Westhound	4	-	1	± 2	21	0.01	0.	25 5	01	0.00	
Drot											
Derm											
Perm Toft	т	F	12	1 0	0.2	0 27	0	<u>л</u> 1 Б	69	0 90	
Dert	Ц	5	13	т э	92	0.37	0.	41 5	00	0.90	
Prou											
Perm											
Thru	-	~	F 0	1 0		0 00	~	0.5 0	7 4	1 1 4	
Right	ĸ	3	59	12	68	0.28	Ο.	25 3	⊥4	⊥.⊥4	
Northbour	nd										
Prot											
Perm										<u> </u>	
Left	L	3	68	14	17	0.26	0.	25 3	51	1.05	
Prot											
Perm											
Thru	Т	5	04	19	75	0.26	0.	25 4	90	1.03	
Right	R	6	47	91	.8	# 0.70	0.	69 6	32	1.02	
Southbour	nd										
Prot											
Perm											
Left	L	3	06	13	68	0.22	Ο.	25 3	39	0.90	
Prot											
Perm											
Thru	T.T	7	77	19	07	# 0 41	0	25 4	73	1 64	
Right	B	, 1	24		4	0 19	0.	69 4	91	0 27	
		ـــــــــــــــــــــــــــــــــــــ		· ·							
Sum of f	low rati	os for	criti	cal la	ne gro	ups, Yc	= S	um (v/s	) =	1.11	
Total los	st time	per cy	cle, 1	L = 8.	00 se	C					
Critical	flow ra	te to	capacit	ty rat	io,	Xc	= (Yc	)(C)/(C	-L) =	1.19	
_	_	_									
Control I	Delay an	d LOS	Determ	inatic	n						
Appr/ H	Ratios	Unf	Prog	Lane	Incre	mental	Res	Lane G	roup	Approa	ach
Lane		Del	Adj	Grp	Facto	r Del	Del				
Grp v/d	c g/C	d1	Fact	Cap	k	d2	d3	Delay	LOS	Delay	LOS
Eastbound	f										
L 0.21	1 0.41	23.9	1.000	558	0.11	0.2	0.0	24.1	С		
										25.6	С
R 0.06	5 0.25	35.8	1.000	304	0.11	0.1	0.0	35.9	D		
Westbound	f										
L 0.90	0.41	34.7	1.000	568	0.42	17.8	0.0	52.5	D		
										89.5	F
R 1.14	4 0.25	47.0	1.000	314	0.50	95.4	0.0	142.4	F		
Northbour	nd										
L 1.05	5 0.25	47.0	1.000	351	0.50	61.3	0.0	108.3	F		
T 1.03	3 0.25	47.0	1.000	490	0.50	48.2	0.0	95.2	F	84.0	F
R 1 02	2 0.69	19.5	1.000	632	0.50	42.0	0.0	61.5	Ē	•	-
Southbour	nd of of	_/.5				12.0			-		
	1 0 25	45 5	1 000	220	0 4 2	26 1	0 0	71 7	F		
	1 0 2 J	43.5 47 0	1 000	172	0.72	20.1 200 c	0.0	715 K	Б Б	230 K	F
шт т.04	1 0.20	ч/.О	T.000	т/3	0.50	490.0	0.0	0.C±C	т.	499.0	т.

Intersection delay = 133.8 (sec/veh) Intersection LOS = FSUPPLEMENTAL PERMITTED LT WORKSHEET for exclusive lefts Input EΒ WΒ NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 125.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/ggdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. _SUPPLEMENTAL PERMITTED LT WORKSHEET_ for shared lefts Input EΒ WΒ NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 125.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s)Opposing effective green time, go (s) Number of lanes in LT lane group, N

R

0.27 0.69 7.5

1.000 491

0.11

0.3

0.0

7.8

Α

Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT 0.000 0.349 Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 0.952 0.952 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min=fmin;max=1.00)flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET Permitted Left Turns EΒ WΒ  $^{\rm NB}$ SB Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Pedestrian flow rate, Vpedg (p/h) 0CCpedq Opposing queue clearing green, gq (s) Eff. ped. green consumed by opp. veh. queue, gq/gp OCCpedu Opposing flow rate, Vo (veh/h) OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion of left turns, PLT Proportion of left turns using protected phase, PLTA Left-turn adjustment, fLpb Permitted Right Turns Effective pedestrian green time, gp (s) 30.0 30.0 200 Conflicting pedestrian volume, Vped (p/h) 200 Conflicting bicycle volume, Vbic (bicycles/h) 0 Ω 833 833 Vpedg 0.417 0.417 OCCpedq 0.0 0.0 Effective green, g (s) 0 0 Vbicg

Number Number ApbT	of cross of turnin	-street	receivin										
ApbT	Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT												
	ion wight	- turned	שתת					$0.750 \ 0.583$					
Proport Proport Right t	ion right urn adjus	t-turns, t-turns stment,	using pro	otected	phase, Pi	RTA		0.000	0.000				
		SU	PPLEMENT	AL UNIFO	RM DELAY	WORKSHE	ET						
						E	BLT WBL'	T NBLT	SBLT				
Cycle l Adj. LT v/c rat Protect	ength, C vol from io from ( ed phase	n Vol Ad Capacity	justment Workshe	Workshe et, X	125.0 et, v	Sec							
Opposin Unoppos Red tim	g queue e ed green e r=(C-g·	effectiv interva -gq-gu)	e green . 1, gu	interval	, 3d								
Arrival Protect Permitt XPerm XProt Case	rate, qa ed ph. da ed ph. da	a=v/(360 eparture eparture	0(max[X, rate, S rate, S	1.0])) p=s/3600 s=s(gq+g	u)/(gu*3	600)							
Queue a Queue a Residua Uniform	t beginn: t beginn: l queue, Delay, o	ing of g ing of u Qr dl	reen arro	ow, Qa ed green	, Qu								
		DELAY/	LOS WORK	SHEET WI	TH INITI.	AL QUEUE							
Appr/	Initial Unmet	Dur. Unmet	Uniform	Delay	Initial Queue	Final Unmet	Initial Queue	Lane Group					
Lane Group	Demand Q veh	Demand t hrs.	Unadj. ds	Adj. d1 sec	Param. u	Demand Q veh	Delay d3 sec	Delay d sec					
Eastbou	 nd												
L	0.0	0.00	37.0	23.9	0.00	0.0	0.0	24.1					
R	0.0	0.00	47.0	35.8	0.00	0.0	0.0	35.9					
Westbou	nd												
L	0.0	0.00	37.0	34.7	0.00	0.0	0.0	52.5					
R	0.0 0.0	0.00	47.0	47.0	0.00	11.3	0.0 0.0	142.4					
Northbo	und												
L	0.0	0.00	47.0	47.0	0.00	4.3	0.0	108.3					
Т	0.0	0.00	47.0	47.0	0.00	3.5	0.0	95.2					
R	0.0	0.00	19.5	19.5	0.00	3.8	0.0	61.5					
Southbo	und				_	_							
L	0.0	0.00	47.0	45.5	0.00	0.0	0.0	71.7					
R	0.0	0.00	47.0 19.5	47.0 7.5	0.00	0.0	0.0	345.6 7.8					
							<u> </u>						

_____BACK OF QUEUE WORKSHEET____
	Eastbou	ınd	Westbou	ınd	Nor	thbou	ınd	Sou	thbou	ınd
LaneGroup	L	R	L	R	L	Т	R	L	LT	R
Init Queue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate	115	17	513	359	368	264	647	306	408	134
So	1800	1800	1800	1800	1800	1300	1800	1800	1300	1800
No.Lanes	1 0	1	1 0	1	1	2	1	1	2	1
SL	1368	1224	1392	1268	1417	1037	918	1368	1001	714
LnCapacity	558	304	568	314	351	257	632	339	248	491
Flow Ratio	0.1	0.0	0.4	0.3	0.3	0.3	0.7	0.2	0.4	0.2
v/c Ratio	0.21	0.06	0.90	1.14	1.05	1.03	1.02	0.90	1.65	0.27
Grn Ratio	0.41	0.25	0.41	0.25	0.25	0.25	0.69	0.25	0.25	0.69
I Factor	1.000	)	1.000			1.000			1.000	
AT or PVG	3	3	3	3	3	3	3	3	3	3
Pltn Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Q1	2.6	0.5	16.7	12.5	12.8	9.2	22.5	10.3	14.2	1.8
kB	0.6	0.4	0.6	0.4	0.4	0.4	0.6	0.4	0.4	0.5
Q2	0.2	0.0	3.6	8.0	5.7	4.0	8.2	2.5	20.9	0.2
Q Average	2.7	0.5	20.3	20.4	18.5	13.1	30.6	12.8	35.1	2.0
Q Spacing	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Q Storage	0	185	530	0	150	0	200	165	0	160
Q S Ratio		0.1	1.0		3.1		3.8	1.9		0.3
70th Percent	ile Output	:								
fB%	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.2	1.1	1.2
BOQ	3.3	0.6	23.6	23.7	21.5	15.4	35.1	15.0	40.0	2.4
QSRatio		0.1	1.1		3.6		4.4	2.3		0.4
85th Percent	ile Output	:								
fB%	1.6	1.6	1.5	1.5	1.5	1.5	1.4	1.5	1.4	1.6
BOQ	4.3	0.8	29.5	29.7	27.1	19.6	43.1	19.2	48.8	3.1
QSRatio		0.1	1.4		4.5		5.4	2.9		0.5
90th Percent	ile Output	:								
fB% ∣	1.7	1.8	1.5	1.5	1.6	1.6	1.5	1.6	1.5	1.8
BOQ	4.8	0.8	31.4	31.6	28.8	21.1	45.6	20.6	51.5	3.5
QSRatio		0.1	1.5		4.8		5.7	3.1		0.5
95th Percent	ile Output	:								
fB% ∣	2.0	2.1	1.7	1.7	1.7	1.8	1.6	1.8	1.6	2.0
BOQ	5.5	1.0	34.5	34.6	31.7	23.5	49.3	23.0	55.6	4.1
QSRatio		0.1	1.6		5.3		6.2	3.5		0.6
98th Percent	ile Output	:				_ ·				
±B% ∣	2.5	2.7	1.9	1.9	1.9	2.1	1.8	2.1	1.8	2.6
BOQ	6.9	1.3	38.8	39.0	35.9	27.1	55.0	26.6	62.0	5.1
QSRatio		0.2	1.8		6.0		6.9	4.0		0.8

_____ERROR MESSAGES_____

No errors to report.

Analyst: Agency: PB Date: 6/2 Period: PM Project ID:	halyst:Inter.: I-290 Ramps & Austin Boulevardgency: PBArea Type: CBD or Similarate: 6/25/2010Jurisd:eriod: PM PeakYear : Existingcoject ID: I-290 Phase 1 StudyN/S St: Austin Boulevard										
E/W St: I-2	90 Ramps		N/S	St: Au	ıstin	Boule	evard				
	S	IGNALIZED	INTERSE	CTION S	SUMMAR	Y					
	Eastbound	Westb	ound	Nort	hboun	nd	Soi	uthbou	ind		
			R	Ц 	Л.	R	Ц	.Т.	R		
No. Lanes	1 0 1	_	 0 1	   1	2.	 1	1	2.	1	-   	
LGConfig	L R		R	L	T	R	L –	LT	R	l	
Volume	160 301	767	333	295 4	179 1	.95	767	306	175		
Lane Width	10.0 10.0	10.5	11.0	111.0 1	L0.5 1	0.0	10.0	10.0	10.0	Ì	
RTOR Vol	60		60		4				63		
Duration	0.25 Area	Type: CB	D or Sim	ilar							
Dhago Combi		Signa	1 Operat	lons		6	 7				
ER Left		5	4     NB	Left	Δ	0	/	C	2		
Thru	п			Thru	A						
Right				Right	A						
Peds			i	Peds	Х						
WB Left	A		SB	Left		A					
Thru				Thru		A					
Right				Right		A					
Peas NB Pight	λ		 	Peas Pight	7	X					
SB Right	A			Right	A	Δ					
Green	50.0		1 112		30.0	30.0	)				
Yellow	4.0				4.0	4.0					
All Red	1.0				1.0	1.0			_		
	Inters	ection Pe	rformanc	e Summa	Cycl	.e Ler	igth:	125.0	) se	ecs	
Appr/ Lan	e Adj Sat	Ratio	os	Lane G	froup	App	proacl	 1			
Lane Gro	up Flow Rat	e									
Grp Cap	acity (s)	v/c	g/C	Delay	LOS	Dela	ay LOS	5			
Eastbound											
L 55	8 1368	0.30	0.41	25.3	С	17 7	ת י				
R 30	4 1224	0.84	0.25	62.6	Е	ч/./	D				
Westbound		0.01	0120	02.0	-						
ь 56	8 1392	1.42	0.41	236.5	F						
ר ס	1 1069	0 01	0.25	75 5	Ţ.	194.	3 F				
Northbound	4 1200	0.91	0.25	15.5	E						
L 35	1 1417	0.89	0.25	68.0	Е						
т 49	0 1975	1.03	0.25	95.2	F	69.6	5 E				
R 63	2 918	0.32	0.69	8.1	A						
Southbound	<b>^</b>		o		_						
L 33	9 1368	1.19	0.25	158.8	F		o –				
ыт 46 в 40	δ 1888 1 711	1.55	0.25	304.5 7 5	Ъ. Ъ	229.	∠ F'				
-1. 49 Tn	tersection Dela	v = 155 9	(sec/ve	,., h) Тr	nterse	ection	1 I'UZ	ਜ =			
	200000000000000000000000000000000000000		,	, 1				-			

I-290 Existing

Phone: E-Mail: Fax:

_____OPERATIONAL ANALYSIS______

Analyst: Agency/Co.: PB Date Performed: 6/25/2010 Analysis Time Period: PM Peak Intersection: I-290 Ramps & Austin Boulevard Area Type: CBD or Similar Jurisdiction: Analysis Year: Existing Project ID: I-290 Phase 1 Study E/W St: I-290 Ramps N/S St: Austin Boulevard

_____VOLUME DATA______

	Eas	Eastbound		Wes	stbou	und	No:	rthbou	und	Soi	uthboi	und
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume	  160		301	  767		333	295	479	 195	  767	306	175
% Heavy Veh	5		5	5		5	5	5	5	5	5	5
PHF	0.95		0.95	0.95		0.95	0.95	0.95	0.95	0.95	0.95	0.95
PK 15 Vol	42		79	202		88	78	126	51	202	81	46
Hi Ln Vol	Ì			ĺ			ĺ			İ		
% Grade	ĺ	0			0		Ì	0		Ì	0	
Ideal Sat	1800		1800	1800		1800	1800	1300	1800	1800	1300	1800
ParkExist												
NumPark												
No. Lanes	1	0	1	1	0	1	1	2	1	1	2	1
LGConfig	L		R	L		R	L	Т	R	L	LT	R
Lane Width	10.0		10.0	10.5		11.0	11.0	10.5	10.0	10.0	10.0	10.0
RTOR Vol			60			60			4			63
Adj Flow	168		254	807		287	311	504	201	404	725	118
%InSharedLn										50		
Prop LTs								0.00	0 0		0.55	57
Prop RTs			1.000			1.000	0	.000	1.000	0	.000 1	L.000
Peds Bikes	0			0			2	0 0	0	2	00 (	)
Buses	0		0	0		0	0	10	0	0	10	0
%InProtPhase	e								0.0			0.0
Duration	0.25		Area 1	Гуре:	CBD	or Sim	ilar					

	Ea	Eastbound		We	stbou	nd	No	rthbo	und	So	uthbo	und
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Init Unmet	  0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arriv. Type	3		3	3		3	3	3	3	3	3	3
Unit Ext.	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0
I Factor	ĺ	1.00	0	Ì	1.00	0	ĺ	1.00	0	ĺ	1.00	0
Lost Time	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext of g	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped Min g	ĺ	3.2		İ	3.2		Ì	5.1		İ	5.1	

## _____OPERATING PARAMETERS______

				PH	ASE	DATA_						
Pha	se Combination	1	2	3	4			5	6	7	8	
EB	Left Thru Right Peds	A				NB	Left Thru Right Peds	A A A X				
WB	Left Thru Right Peds	A				SB	Left Thru Right Peds		A A A X			
NB	Right	A				EB	Right	А				
SB	Right	A				WB	Right		A			
Gre Yel All	en low Red	50.0 4.0 1.0			ļ			30.0 4.0 1.0	30.0 4.0 1.0			

Cycle Length: 125.0 secs

	VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET													
Volume	Adjus	stment												
		East	bound		Wes	tbo	und		No	orthbou	ınd	Sou	thbour	nd
		L	T i	R	L	Т	R		L	Т	R	L	Т	R
Volume	, v	160	3	01	  767		333		295	479	195	  767	306 1	.75
PHF		0.95	0	.95	0.95		0.95	5	0.95	0.95	0.95	0.95	0.95 (	).95
Adj flo	ow	168	2	54	807		287		311	504	201	807	322 1	.18
No. Lar	nes	1	0	1	1	0	1		1	. 2	1	1	2	1
Lane gr	roup	L		R	L		R		L	Т	R	L	LT	R
Adj flo	ow	168	2	54	807		287		311	504	201	404	725 1	.18
Prop L1	ſs									0.00	00		0.557	7
Prop RT	ſs		1.	000			1.000	)	0	.000 1	L.000	0.	000 1.	000
Saturat	tion H	'low Ra	ate (s	ee Ez	khibit	16	-7 to	de	eterm	nine th	ne adju	ıstmen	t fact	cors)
	Eas	stbound	1	V	Vestbo	und	l		Nort	hbound	1	Sou	thbour	ıd
LG	L		R	L			R	I		Т	R	L	LT	R
So 1	1800		1800	1800	)		1800	18	300	1300	1800	1800	1300	1800
Lanes 1	1	0	1	1	0		1	1		2	1	1	2	1
fW (	0.933		0.933	0.95	50		0.967	0.	.967	0.950	0.933	0.933	0.933	8 0.933
fHV (	0.952		0.952	0.95	52		0.952	0.	.952	0.952	0.952	0.952	0.952	2 0.952
fG 1	1.000		1.000	1.00	0 0		1.000	1.	.000	1.000	1.000	1.000	1.000	1.000
fP 1	1.000		1.000	1.00	0 0		1.000	1.	.000	1.000	1.000	1.000	1.000	1.000
fBB 1	1.000		1.000	1.00	00		1.000	1.	.000	0.980	1.000	1.000	0.980	1.000
fA (	0.900		0.900	0.90	00		0.900	0.	.900	0.900	0.900	0.900	0.900	0.900
fLU 1	1.000		1.000	1.00	00		1.000	1.	.000	0.952	1.000	1.000	0.952	2 1.000
fRT			0.850				0.850			1.000	0.850		1.000	0.850
fLT (	0.950			0.95	50			0.	.950	1.000		0.950	0.973	3
Sec.														
fLpb 1	1.000			1.00	00			1.	.000	1.000		1.000	1.000	)
fRpb			1.000				1.000			1.000	0.750		1.000	0.583
S 1	1368		1224	1392	2		1268	14	<b>1</b> 17	1975	918	1368	1888	714
Sec.														
				CAI	PACITY	AN	ID LOS	MC	DRKSH	IEET				

Capacity Analysis and Lane Group Capacity

				Adj	Adj	Sat	F.	low	Gre	en1	Lane G	roup	
App	pr/	Lane	Flo	w Rate	Flow	Rate	Ra	atio	Rat	io Car	pacity	v/c	
Mvn	nt	Group		(v)	( :	5)	7)	v/s)	(g/	C )	(с)	Ratio	
Eastbo	ound												
Pro	ot												
Per	rm												
Lef	Et	L	1	68	13	68	(	0.12	0.	41 5	558	0.30	
Pro	ot												
Per	rm												
Thr	ru												
Ric	r n t	R	2	54	12	2.4	(	0 21	0	2.5	304	0 84	
Westho	Jund		-	51					•••			0.01	
Dro	st st												
Der	rm .												
rei Tof	∟ F +-	т	0	07	1 2	<b>a</b> 2	# (		0	/1 [	569	1 1 2	
Бег	LL	Ц	0	07	13	92	# (	1.20	0.	41 3	000	1.42	
Pro	JL												
Per	cm												
'ſ'nr	ru	-	-	0 1		<b>C</b> O			-	0.5		0 01	
Rig	ght	ĸ	2	8.1	12	68	(	J.23	0.	25	3⊥4	0.91	
Northk	oound	i.											
Pro	ot												
Per	cm												
Lef	Et	L	3	11	14	17	(	0.22	0.	25 3	351	0.89	
Pro	ot												
Per	rm												
Thr	ru	Т	5	04	19	75	# (	0.26	Ο.	25 4	190	1.03	
Ric	ght	R	2	01	91	8	(	0.22	Ο.	69 6	532	0.32	
South	ound	1											
Pro	ot												
Per	rm												
Lef	 F+	т.	4	04	13	68	(	1 30	0	25	229	1 1 9	
Dro	nt	-	-	01	10	00	,		0.	25 .		1.12	
Der	rm .												
rei Thr	_ 111 // 11	тт	7	25	10	0 0	# (	1 20	0	25	160	1 55	
	∟u ~b+	л	1	40 10	10 ⁻	о о л	# (	J. 30 1 1 7	0.	20 - CO	101	1.55	
RIG	JIIL	ĸ	Т	10	/ 1 ·	+	(	J. 1 /	0.	09 2	±91	0.24	
Sum of	E flo	w rati	os for	critic	cal la	ne gro	oups	s, Yc	= S	um (v/s	s) =	1.22	
Total	lost	time	per cy	cle, I	5 = 12	.00 se	ec						
Critic	cal f	low ra	te to	capacit	y rat	io,		Хc	= (Yc	)(C)/(0	C-L) =	1.35	
	_	-	-		-			-					
Contro	ol De	elay an	d LOS	Determi	inatio	n							
Appr/	Ra	atios	Unf	Prog	Lane	Incre	emer	ntal	Res	Lane (	Froup	Approa	ach
Lane			Del	Adj	Grp	Facto	or I	Del	Del				
Grp	v/c	g/C	d1	Fact	Cap	k	C	d2	d3	Delay	/ LOS	Delay	LOS
Eastbo	ound												
L C	0.30	0.41	25.0	1.000	558	0.11	(	0.3	0.0	25.3	С		
												47.7	D
r C	0.84	0.25	44.6	1.000	304	0.37	-	18.0	0.0	62.6	Е		
Westbo	ound												
ь 1	1.42	0.41	37.0	1.000	568	0.50	-	199.5	0.0	236.5	F		
	4		- / • •				-				-	194.3	F
R (	),91	0 25	45 7	1,000	314	0 43		298	0.0	75 5	ज		-
C Northr	⊥ ⊃∩າາກຕ່	1	10.1		<u> </u>	J. 1J	4	_~.0		, , , , ,	-		
	) on	• ∩ ⊃⊑	15 0	1 000	2 ⊑ 1	0 / 1		ר ככ	0 0	60 0	ъ.		
ы ( т 1	עס.נ 1 חי		43.3 A7 0	1 000	700 20T	0.41	4	44.1 10 0	0.0	00.U 0F 0	ь г	60 6	r.
	L.UJ	0.25	4/.U	1 000	490 620	0.50	4	±0.∠ n 2	0.0	ンフ・ム 0 1	בי א	09.0	L
	J.34	U.09	1.0	T.000	032	0.11	(	J.3	0.0	0.⊥	А		
South		1 0 0	10 0	1 000	220	0 5 0	-	111 0	0 0	1 - 0 - 0	-		
ь 1	1.19	0.25	47.0	1.000	339	0.50	-	111.8	0.0	158.8	F.	0.0.0 -	_
LT 1	L.55	0.25	47.0	1.000	468	0.50	2	257.5	0.0	304.5	F	229.2	F

Intersection delay = 155.9 (sec/veh) Intersection LOS = FSUPPLEMENTAL PERMITTED LT WORKSHEET for exclusive lefts Input EΒ WΒ NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 125.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/ggdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. _SUPPLEMENTAL PERMITTED LT WORKSHEET_ for shared lefts Input EΒ WΒ NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 125.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s)Opposing effective green time, go (s) Number of lanes in LT lane group, N

R

0.24 0.69 7.3

1.000 491

0.11

0.3

0.0

7.5

Α

Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT 0.000 0.557 Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 0.952 0.952 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min=fmin;max=1.00)flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET Permitted Left Turns EΒ WΒ  $^{\rm NB}$ SB Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Pedestrian flow rate, Vpedg (p/h) 0CCpedq Opposing queue clearing green, gq (s) Eff. ped. green consumed by opp. veh. queue, gq/gp OCCpedu Opposing flow rate, Vo (veh/h) OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion of left turns, PLT Proportion of left turns using protected phase, PLTA Left-turn adjustment, fLpb Permitted Right Turns Effective pedestrian green time, gp (s) 30.0 30.0 200 Conflicting pedestrian volume, Vped (p/h) 200 Conflicting bicycle volume, Vbic (bicycles/h) 0 Ω 833 833 Vpedg 0.417 0.417 OCCpedq 0.0 0.0 Effective green, g (s) 0 0 Vbicg

OCCbicg OCCr Number Number		0.020 0.417 2 1 0.750	0.020 0.417 1 1						
Proport Proport Right t	ion right ion right urn adjus	t-turns, t-turns stment,	PRT using pro fRpb	otected	phase, Pl	RTA		1.000 0.000 1.000	1.000 0.000 1.000
		SU	PPLEMENT	AL UNIFO	RM DELAY	WORKSHE	ET		
						E	BLT WBL'	I NBLT	SBLT
Cycle l Adj. LT v/c rat Protect	ength, C vol from io from ( ed phase	n Vol Ad Capacity effecti	justment Workshe ve green	Workshe et, X interva	125.0 et, v l, g (s)	sec			
Opposing Unoppose Red time	g queue e ed green e r=(C-g	effectiv interva -gq-gu)	e green . 1, gu	interval	' 3d				
Arrival Protect Permitt XPerm XProt Case	rate, qa ed ph. de ed ph. de	a=v/(360 eparture eparture	0(max[X, rate, S] rate, S	1.0])) p=s/3600 s=s(gq+g	u)/(gu*3	600)			
Queue a Queue a Residua Uniform	t beginn: t beginn: l queue, Delay, o	ing of g ing of u Qr dl	reen arro	ow, Qa ed green	, Qu				
		DELAY/	LOS WORK	SHEEL WI	TH INITI.	AL QUEUE			
Appr/	Initial Unmet	Dur. Unmet	Uniform	Delay 	lnitial Queue	Final Unmet	lnitial Queue	Lane Group	
Lane Group	Demand Q veh	Demand t hrs.	Unadj. ds	Adj. d1 sec	Param. u	Demand Q veh	Delay d3 sec	Delay d sec	
Eastbou	 nd								
L	0.0	0.00	37.0	25.0	0.00	0.0	0.0	25.3	
R	0.0	0.00	47.0	44.6	0.00	0.0	0.0	62.6	
Westbou	nd								
L	0.0	0.00	37.0	37.0	0.00	59.8	0.0	236.5	
R	0.0	0.00	47.0	45.7	0.00	0.0	0.0	75.5	
Northbo	und								
L	0.0	0.00	47.0	45.3	0.00	0.0	0.0	68.0	
Т	0.0	0.00	47.0	47.0	0.00	3.5	0.0	95.2	
R	0.0	0.00	19.5	7.8	0.00	0.0	0.0	8.1	
Southbo	und								
L	0.0	0.00	47.0	47.0	0.00	16.2	0.0	158.8	
LT	0.0	0.00	47.0	47.0	0.00	64.3	0.0	304.5	
	Intersect	tion Del	ay 155.	9 sec/v	eh I:	ntersect	ion LOS	,  F	
				•					

_____BACK OF QUEUE WORKSHEET____

	Eastbou	ınd	Westbou	ınd	Nor	thbou	ınd	Sou	thbou	ınd
LaneGroup	L	R	L	R	L	Т	R	L	LT	R
Init Queue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate	168	254	807	287	311	264	201	404	380	118
So	1800	1800	1800	1800	1800	1300	1800	1800	1300	1800
No.Lanes	1 0	1	1 0	1	1	2	1	1	2	1
SL	1368	1224	1392	1268	1417	1037	918	1368	991	714
LnCapacity	558	304	568	314	351	257	632	339	245	491
Flow Ratio	0.1	0.2	0.6	0.2	0.2	0.3	0.2	0.3	0.4	0.2
v/c Ratio	0.30	0.84	1.42	0.91	0.89	1.03	0.32	1.19	1.55	0.24
Grn Ratio	0.41	0.25	0.41	0.25	0.25	0.25	0.69	0.25	0.25	0.69
I Factor	1.000	)	1.000	)		1.000	)		1.000	
AT or PVG	3	3	3	3	3	3	3	3	3	3
Pltn Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Q1	3.9	8.4	28.0	9.7	10.4	9.2	2.8	14.0	13.2	1.5
kB	0.6	0.4	0.6	0.4	0.4	0.4	0.6	0.4	0.4	0.5
Q2	0.3	1.7	31.8	2.5	2.4	4.0	0.3	10.3	17.8	0.2
Q Average	4.2	10.0	59.8	12.2	12.8	13.1	3.1	24.3	31.0	1.7
Q Spacing	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Q Storage	0	185	530	0	150	0	200	165	0	160
Q S Ratio		1.4	2.8		2.1		0.4	3.7		0.3
70th Percent	ile Output	:								
fB%	1.2	1.2	1.1	1.2	1.2	1.2	1.2	1.2	1.1	1.2
BOQ	5.0	11.8	67.1	14.4	15.0	15.4	3.7	28.1	35.6	2.0
QSRatio		1.6	3.2		2.5		0.5	4.3		0.3
85th Percent	ile Output	:								
fB%	1.6	1.5	1.3	1.5	1.5	1.5	1.6	1.4	1.4	1.6
BOQ	6.5	15.2	80.2	18.3	19.1	19.6	4.8	34.8	43.7	2.7
QSRatio		2.1	3.8		3.2		0.6	5.3		0.4
90th Percent	ile Output	::								
fB%	1.7	1.6	1.4	1.6	1.6	1.6	1.7	1.5	1.5	1.8
BOQ	7.2	16.5	84.9	19.8	20.6	21.1	5.4	36.9	46.1	3.0
QSRatio		2.2	4.0		3.4		0.7	5.6		0.5
95th Percent	ile Output	::								
fB%	2.0	1.8	1.5	1.8	1.8	1.8	2.0	1.7	1.6	2.0
BOQ	8.3	18.5	91.0	22.1	22.9	23.5	6.2	40.2	49.9	3.5
QSRatio		2.5	4.3		3.8		0.8	6.1		0.5
98th Percent	ile Output	:								
±B%	2.4	2.2	1.7	2.1	2.1	2.1	2.5	1.9	1.8	2.6
BOQ	10.2	21.7	102	25.6	26.5	27.1	7.7	45.1	55.6	4.4
QSRatio		2.9	4.8		4.4		1.0	6.8		0.7

_____ERROR MESSAGES_____

No errors to report.

Analyst: Agency: PB Date: 6/25 Period: AM E Project ID: E/W St: Flou	5/2010 Peak I-290 Phase 1 St arnoy Street	tudy	Int Are Jur Yea: N/S	er.: Fi a Type isd: r : E: St: C0	lournc : All xistin entral	oy Stre other g Avenu	e & ( area ue	Centra as	l Ave	nue
	SIC	GNALIZED	INTERSE	CTION S	SUMMAR	Y				
	Eastbound	Westb	ound	Nor	thboun	ıd	Sou	uthbou	ind	
	L T R	јь т Г	R	ļ Ц	Л.	K	Г	.L.	R	
No Laneg	0 0 0	   1		   1	2	- ∩		2		.   
LGConfig	0 0 0	і <u> </u>	T'LE E	і <u> </u>	ъ Т		0	2 T	ъ Т	1
Volume		163 55	232	287	288			512	154	
Lane Width		10.0 10	.0 10.5	10.0	12.0	İ		12.0	12.0	Ì
RTOR Vol		İ	178	İ		İ			88	İ
 Duration	0.25 Area 5	Tvpe: Al	l other	areas						
		Signa	l Operat	ions						
Phase Combir	nation 1 2	3	4		5	6	7	8		
EB Left			NB	Left	А	A				
Thru				Thru	A	A				
Right				Right						
Peds	7			Peds	Х	Х				
WB LEIL Thru	A N			цетс Трхи	7					
Right	Δ		I	Right	Δ					
Peds	X			Peds	x					
NB Right			EB	Right						
SB Right			WB	Right						
Green	23.0				40.0	16.0				
Yellow	3.0				3.0	3.0				
All Red	1.0				0.0	1.0	~+b•	00 0	~ ~	~ ~
	Interse	rtion De	rformanc	o Summ:	erv erv	е цепе	JLII•	90.0	se	CS
Appr/ Lane	Adi Sat	Rati	os	Lane (	Group	 נממA	roach	 1		
Lane Grou	ip Flow Rate	110101	02	20110	01 0 MF			-		
Grp Capa	acity (s)	v/c	g/C	Delay	LOS	Delay	y LOS	3		
 Eastbound										
Westbound										
L 409	1532	0.38	0.27	27.5	С					
LTR 412	2 1545	0.23	0.27	26.1	C	26.7	С			
R 372	2 1395	0.10	0.27	25.0	C					
	1 1520	0 49	0 66	12 9	R					
T 219	3289	0.14	0.67	$\frac{12.9}{2.1}$	A	7.5	A			
				. –						
Southbound										
T 149	3289	0.36	0.46	16.1	В	15.9	В			
R 669	9 1468	0.10	0.46	14.1	В		_			
Int	ersection Delay	= 14.6	(sec/ve	h) Iı	nterse	ection	LOS	= B		

I-290 Existing

Phone: Fax: E-Mail: _____OPERATIONAL ANALYSIS_____

Analyst: Agency/Co.: PB Date Performed: 6/25/2010 Analysis Time Period: AM Peak Intersection: Flournoy Stre & Central Avenue Area Type: All other areas Jurisdiction: Analysis Year: Existing Project ID: I-290 Phase 1 Study E/W St: Flournoy Street N/S St: Central Avenue

_____VOLUME DATA_____

	Eastbound			Wes	stbour	nd	Noi	rthbou	Ind	Sou	uthbou	ind
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume				163	55	232	287	288			512	154
% Heavy Veh				10	10	10	10	10			10	10
PHF				0.95	0.95	0.95	0.95	0.95			0.95	0.95
PK 15 Vol				43	14	61	76	76			135	41
Hi Ln Vol	ĺ			İ			İ					İ
% Grade	ĺ			ĺ	0		ĺ	0			0	ĺ
Ideal Sat				1900	1900	1900	1900	1900			1900	1900
ParkExist				ĺ			ĺ					Í
NumPark				ĺ			İ					ĺ
No. Lanes	0	0	0	1	1	1	1	2	0	0	2	1
LGConfig				L	LTH	RR	L	Т			Т	R
Lane Width				10.0	10.0	10.5	10.0	12.0			12.0	12.0
RTOR Vol				ĺ		178	İ					88
Adj Flow				155	96	36	302	303			539	69
%InSharedLn	ĺ			10		37	İ					İ
Prop LTs	ĺ			ĺ	0.1	79	1.000	0.00	0		0.00	0 0
Prop RTs				0	.220	1.000	0	.000		0	.000 1	L.000
Peds Bikes	0			0	(	C				0	(	)
Buses				0	0	0	0	0			0	0
%InProtPhase	9						0.0					ĺ
Duration	0.25		Area 🗄	Гуре:	All d	other	areas					

## _____OPERATING PARAMETERS______OPERATING PARAMETERS_____

	Eastbound			We	stbou:	nd	No	rthbound	S	outhbo	und
	L	Т	R	L	Т	R	L	T R	L	Т	R
							-				
Init Unmet				0.0	0.0	0.0	0.0	0.0		0.0	0.0
Arriv. Type				3	3	3	4	4		3	3
Unit Ext.				3.0	3.0	3.0	3.0	3.0		3.0	3.0
I Factor					1.00	0		0.818		1.00	0
Lost Time				2.0	2.0	2.0	2.0	2.0		2.0	2.0
Ext of g				3.0	3.0	3.0	2.0	3.0		3.0	3.0
Ped Min g		3.2			3.2					3.2	

				PH	ASE	DATA_					
Pha	se Combination	1	2	3	4			5	6	7	8
EΒ	Left Thru Right Peds					NB	Left Thru Right Peds	A A X	A A X		
WB	Left Thru Right Peds	A A A X				SB	Left Thru Right Peds	A A X			
NB	Right				ļ	EB	Right				
SB	Right					WB	Right				
Gre Yel All	en low Red	23.0 3.0 1.0						40.0 3.0 0.0	16.0 3.0 1.0		

Cycle Length: 90.0 secs

		VOLU	ME ADJU	JSTME	NT A	AND SAT	FURATI	ON FLO	W WOR	KSHEET	ſ	
Volume Adju	stment		- 1		_	_			_			
	Eas	stbou	nd	We	stbo	ound	N	orthbo	und	Sc	outhboun	d
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume, V	 		 	163	55	232	<u></u>  287	288		 	512 1	54
PHF				0.95	0.9	95 0.95	5  0.9	5 0.95			0.95 0	.95
Adj flow	ĺ		ĺ	172	58	57	302	303		Ì	539 6	9
No. Lanes	0	0	0	1	-	1 1	j	1 2	0	(	) 2	1
Lane group	ĺ		ĺ	L	I	LTR R	L	Т		Ì	Т	R
Adj flow	İ		ĺ	155	96	36	302	303		İ	539 6	9
Prop LTs	İ		ĺ		0	.179	1.0	00 0.0	00	İ	0.000	İ
Prop RTs	İ		İ	0	.220	0 1.000	) j	0.000		(	0.000 1.	000
Saturation 1	Flow F	late	(see Ex	hibi	t 10	5-7 to	deter	mine t	he ad	ljustme	ent fact	ors)
Eas	stbour	nd	ν	lestb	ound	ł	Nor	thboun	d	Sc	outhboun	d
LG			L	L	TR	R	L	Т			Т	R
So			1900	) 19	00	1900	1900	1900			1900	1900
Lanes O	0	0	1	1		1	1	2	0	0	2	1
fW			0.93	330.	933	0.950	0.933	1.000			1.000	1.000
fHV			0.90	)9 0.	909	0.909	0.909	0.909			0.909	0.909
fG			1.00	00 1.	000	1.000	1.000	1.000			1.000	1.000
fP			1.00	00 1.	000	1.000	1.000	1.000			1.000	1.000
fBB			1.00	00 1.	000	1.000	1.000	1.000			1.000	1.000
fA			1.00	00 1.	000	1.000	1.000	1.000			1.000	1.000
fLU			1.00	00 1.	000	1.000	1.000	0.952			0.952	1.000
fRT				Ο.	967	0.850		1.000			1.000	0.850
fLT			0.95	50 0.	991		0.950	1.000			1.000	
Sec.							0.392					
fLpb			1.00	00 1.	000		1.000	1.000			1.000	
fRpb				1.	000	1.000		1.000			1.000	1.000
S			1532	2 15	45	1395	1532	3289			3289	1468
Sec.							632					
			CAE	PACIT	Y AI	ND LOS	WORKS	HEET				
Capacity Ana	alysis	and	Lane G	Group	Car	pacity						

Appr Mvmt	/ La: Gro	ne oup	A Flow (	Adj 7 Rate 7 V)	Adj Flow (;	Sat Rate s)	E F (	Flow Ratio (v/s)	Gre Rat (g/	en io C)	La Capa	ane Gr acity (c)	roup v/c Ratio	
Eastbou	nd													
Prot														
Perm														
Left														
Prot														
Perm														
Thru														
Right	t ,													
Westbour	nd													
Prot														
Perm	т		1 0	E	1 5	2.0	#	0 1 0	0	27	10	0	0 20	
Drot	Ц		10	00	C L	52	Ħ	0.10	0.	27	4(	19	0.38	
Prot														
Thru	יידי ד	5	0.6		15	15		0 06	0	27	1-	1.2	0 22	
Pight	ь р 111	τ.	36	) -	13	4 D 0 F		0.00	0.	27	4- 2'	L Z 7 O	0.23	
Northbo	und		30	)	тэ.	95		0.03	0.	27	5	12	0.10	
Drot	una		20	ł	1 5	30	#	0 0 2	Ω	<b>ว</b> วว	2/	10	0 0 8	
FIUL Derm			20	, 74	κς Τ.Ο.	2	₩ #	0.02	0.	422 422	ン つ	74	1 00	
I.eft	т.		27	12	0.5	2	#	0.45	0.	455 66	61	14	0 49	
Prot	ш.		50	12					0.	00	0-		0.17	
Derm														
Thru	т		3(	) 3	32	89		0 09	0	67	2.1	93	0 1 4	
Right	t		50		52			0.05	•••	0,			0.11	
Southbo	und													
Prot														
Perm														
Left														
Prot														
Perm														
Thru	Т		53	39	32	89		0.16	0.	46	14	198	0.36	
Right	t R		69	)	14	68		0.05	0.	46	66	59	0.10	
Sum of :	flow :	ratios	for	critic	al la	ne gro	ur	ps, Yc	= S	um (	v/s)	) =	0.55	
Total lo	ost t	ime pe	er cyc	le, I	= 7.	00 se	C							
Critica	l flo	w rate	e to c	apacit	y rat	io,		Xc	= (Yc	)(C)	/ ( C-	-L) =	0.60	
_	_	_												
Control	Dela	y and	LOS I	)etermi	natio	n								
Appr/	Ratio	os U	Inf	Prog	Lane	Incre	m€	ental	Res	Lar	ie Gi	roup	Approa	ach
Lane		D	)el	Adj	Grp	Facto	r	Del	Del					
Grp v	/C 9	g/C d	ί⊥	Fact	Сар	ĸ		d2	d3	De	elay	LOS	Delay	LOS
LastDou	liu													
Westboun	nd													
L 0.	38 0	.27 2	6.9	1.000	409	0.11		0.6	0.0	27.	5	С		
LTR 0.1	23 0	.27 2	15.8	1.000	412	0.11		0.3	0.0	26.	1	С	26.7	С
R 0.1	10 0	.27 2	4.8	1.000	372	0.11		0.1	0.0	25.	0	С		-
Northbo	und	_			-						-	-		
L 0.4	49 0	.66 1	2.4	1.000	614	0.11		0.5	0.0	12.	9	В		
т 0.1	14 0	.67 5	.5	0.383	2193	0.11		0.0	0.0	2.1		A	7.5	A
	2	-			-									
Southboy	und													
т 0.1	36 0	.46 1	6.0	1.000	1498	0.11		0.1	0.0	16.	1	В	15.9	В

Intersection delay = 14.6 (sec/veh) Intersection LOS = B

SUPPLEMENTAL PERMITTED LT WORKSHEET for exclusive lefts Input ΕB WΒ NBSB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 90.0 sec Total actual green time for LT lane group, G (s) 59.0 Effective permitted green time for LT lane group, g(s) 39.0 Opposing effective green time, go (s) 41.0 Number of lanes in LT lane group, N 1 Number of lanes in opposing approach, No 2 Adjusted LT flow rate, VLT (veh/h) 302 Proportion of LT in LT lane group, PLT 1.000 Proportion of LT in opposing flow, PLTo 0.00 Adjusted opposing flow rate, Vo (veh/h) 539 Lost time for LT lane group, tL 4.00 Computation LT volume per cycle, LTC=VLTC/3600 7.55 Opposing lane util. factor, fLUo 1.000 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) 7.08 gf=G[exp(- a * (LTC ** b))]-tl, gf<=g 0.0 Opposing platoon ratio, Rpo (refer Exhibit 16-11) 1.00 Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] 0.54 qq, (see Exhibit C16-4,5,6,7,8) 5.14 gu=g-gq if gq>=gf, or = g-gf if gq<gf 33.86 2.57 n=Max(gq-gf)/2,0)PTHo=1-PLTo 1.00 PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]1.00 EL1 (refer to Exhibit C16-3) 2.21 EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g 0.10 0.00 gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) 0.39 flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT 0.392 For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. _SUPPLEMENTAL PERMITTED LT WORKSHEET_ for shared lefts Input EΒ WΒ NB SB Opposed by Single(S) or Multiple(M) lane approach

Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 90.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N

```
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT
                                                              0.179 0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo
                                                        1.000 0.952 0.952
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
qf=G[exp(-a * (LTC ** b))]-t], qf <= q
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g or fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT
For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
 left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.
               SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET
Permitted Left Turns
                                                        EΒ
                                                                    NB
                                                                          SB
                                                              WΒ
Effective pedestrian green time, gp (s)
                                                                   40.0
Conflicting pedestrian volume, Vped (p/h)
                                                                   0
Pedestrian flow rate, Vpedg (p/h)
                                                                   0
                                                                   0.000
0CCpedq
Opposing queue clearing green, gq (s)
                                                                   5.14
                                                                   0.129
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
                                                                   0.000
Opposing flow rate, Vo (veh/h)
                                                                   539
                                                                   0.000
OCCr
Number of cross-street receiving lanes, Nrec
                                                                   1
Number of turning lanes, Nturn
                                                                   1
                                                                   1.000
ApbT
                                                                   1.000
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
                                                                   0.000
Left-turn adjustment, fLpb
                                                                   1.000
Permitted Right Turns
Effective pedestrian green time, gp (s)
                                                            23.0
                                                                         40.0
Conflicting pedestrian volume, Vped (p/h)
                                                                         0
                                                             0
                                                                         0
Conflicting bicycle volume, Vbic (bicycles/h)
                                                             0
                                                             0
                                                                         0
Vpedg
OCCpedq
                                                             0.000
                                                                        0.000
                                                                         41.0
Effective green, g (s)
                                                             24.0
                                                             0
                                                                         0
Vbicg
```

OCCbicg	0.020	0.020
OCCr	0.000	0.000
Number of cross-street receiving lanes, Nrec	2	1
Number of turning lanes, Nturn	2	1
ApbT	1.000	1.000
Proportion right-turns, PRT	1.000	1.000
Proportion right-turns using protected phase, PRTA	0.000	0.000
Right turn adjustment, fRpb	1.000	

_____SUPPLEMENTAL UNIFORM DELAY WORKSHEET______

			EBLT	WBLT	NBLT	SBLT
Cycle length, C	90.0	sec				
Adj. LT vol from Vol Adjustment Worksheet,	v				302	
v/c ratio from Capacity Worksheet, X					0.49	
Protected phase effective green interval,	g (s)				20.0	
Opposing queue effective green interval, g	ld				5.14	
Unopposed green interval, gu					33.86	
Red time r=(C-g-gq-gu)					31.0	
Arrival rate, $qa=v/(3600(max[X,1.0]))$					0.08	
Protected ph. departure rate, Sp=s/3600					0.426	
Permitted ph. departure rate, Ss=s(gq+gu)/	(gu*360	00)			0.20	
XPerm					0.86	
XProt						
Case					4	
Queue at beginning of green arrow, Qa					0.00	
Queue at beginning of unsaturated green, Q	)u				3.03	
Residual queue, Qr					0.00	
Uniform Delay, dl					12.4	

_____DELAY/LOS WORKSHEET WITH INITIAL QUEUE_____

Appr/	Initial Unmet	Dur. Unmet	Uniform	Delay	Initial Queue	Final Unmet	Initial Oueue	Lane Group
Lane	Demand	Demand	Unadi.	Adi.	Param.	Demand	Delav	Delav
Group	Q veh	t hrs.	ds	dl sec	u	Q veh	d3 sec	d sec
Eastbour	nd							
	0.0						0.0	
	0.0						0.0	
	0.0						0.0	
Westbour	nd							
L	0.0	0.00	33.0	26.9	0.00	0.0	0.0	27.5
LTR	0.0	0.00	33.0	25.8	0.00	0.0	0.0	26.1
R	0.0	0.00	33.0	24.8	0.00	0.0	0.0	25.0
Northbou	ınd							
L	0.0	0.00		12.4	0.00	0.0	0.0	12.9
Т	0.0	0.00	15.0	5.5	0.00	0.0	0.0	2.1
	0.0						0.0	
Southbou	ınd							
	0.0						0.0	
Т	0.0	0.00	24.5	16.0	0.00	0.0	0.0	16.1
R	0.0	0.00	24.5	14.0	0.00	0.0	0.0	14.1
]	Intersect	ion Dela	ay 14.6	sec/ve	eh Ir	ntersecti	on LOS	В

_____BACK OF QUEUE WORKSHEET_____BACK OF QUEUE WORKSHEET_____

	Eastbound	We	estbou	und	Noi	rthbound	So	uthbou	und	
LaneGroup		L	LTR	R	L	Т		Т	R	
Init Queue		0.0	0.0	0.0	0.0	0.0		0.0	0.0	İ
Flow Rate		155	96	36	302	159		283	69	İ
So		1900	1900	1900	1900	1900		1900	1900	İ
No.Lanes	0 0	1	1	1	1	2 0	0	2	1	İ
SL		1532	1545	1395	937	1727		1727	1468	İ
LnCapacity		409	412	372	614	1151		786	669	İ
Flow Ratio		0.1	0.1	0.0	0.3	0.1		0.2	0.0	İ
v/c Ratio		0.38	0.23	0.10	0.49	0.14		0.36	0.10	İ
Grn Ratio		0.27	0.27	0.27	0.66	0.67		0.46	0.46	İ
I Factor		İ	1.000	C	İ	0.818		1.000	C	İ
AT or PVG		3	3	3	4	4		3	3	Í
Pltn Ratio		1.00	1.00	1.00	1.33	1.33		1.00	1.00	İ
PF2		1.00	1.00	1.00	0.43	0.34		1.00	1.00	Ì
Q1		3.2	1.9	0.7	1.3	0.5		4.6	1.0	İ
kB		0.4	0.4	0.4	0.4	0.6		0.6	0.5	Ì
Q2		0.2	0.1	0.0	0.4	0.1		0.3	0.1	Ì
Q Average		3.4	2.0	0.7	1.7	0.6		4.9	1.0	Ì
Q Spacing		25.0	25.0	25.0	25.0	25.0		25.0	25.0	
Q Storage		0	0	0	0	0		0	0	
Q S Ratio										
70th Percent	tile Output:									
fB%		1.2	1.2	1.2	1.2	1.2		1.2	1.2	
BOQ		4.1	2.4	0.9	2.0	0.7		5.9	1.3	
QSRatio										
85th Percent	tile Output:									
fB%		1.6	1.6	1.6	1.6	1.6		1.6	1.6	
BOQ		5.3	3.2	1.1	2.6	1.0		7.7	1.7	
QSRatio										
90th Percent	tile Output:									
fB%		1.7	1.8	1.8	1.8	1.8		1.7	1.8	
BOQ		5.9	3.5	1.3	3.0	1.1		8.5	1.9	
QSRatio										
95th Percent	tile Output:									
fB%		2.0	2.0	2.1	2.0	2.1		2.0	2.1	
BOQ		6.8	4.1	1.5	3.4	1.3		9.7	2.2	
QSRatio										
98th Percent	tile Output:									
fB%		2.5	2.6	2.6	2.6	2.7		2.4	2.6	
BOQ		8.4	5.1	1.9	4.3	1.6		11.8	2.7	ļ
QSRatio										

_____ERROR MESSAGES_____

No errors to report.

Analyst: Agency: 1 Date: 9 Period: 1 Project 1 E/W St: 1	PB 6/25/2010 PM Peak ID: I-290 Flournoy	) ) Phase 1 St Street	udy	Int Are Jur Yea N/S	er.: F a Type isd: r : E St: C	lournc : All xistir entral	by Str other ng Aven	e & ( area ue	Centra as	al Ave	enue
		SIG	NALIZED	INTERSE	CTION	SUMMAF	εΥ				
	Eas	stbound	Westb	ound	Nor	thbour	nd	Soi	1thboi	und	
	ļ Ц	'I' R	ь т	R		T	R	Ь	.Т.	R	
No Iono	~	 			-		·				-
ICConfig	5   0		T T			ъ Т	0	0	2 T	Ъ	
Volume			126 13	8 181	2.67	 665			879	258	
Lane Widt	th		10.0 10	.0 10.5	10.0	12.0	ļ		12.0	12.0	
RTOR Vol				148			İ			147	ļ
					·		·				·
Duration	0.25	Area I	'ype: Al	l other	areas						
Dhago Cor			Signa	1 Operat	lons		6				
			3	4     ND	T of t	С 7	0	/		5	
EB LEIU Thru					Thru	A A	A A				
Right	t			ł	Right						
Peds	-			i	Peds	Х	Х				
WB Left		A		SB	Left						
Thru		A		İ	Thru	A					
Right	t	A			Right	A					
Peds		Х			Peds	Х					
NB Right	t			EB	Right						
SB Right	t	0.2 0		WB	Rıght	10 0	1 6 0				
Green		23.0				40.0	16.0				
IELLOW		3.0				3.0	3.0				
AII Keu		1.0				Cvcl	e Len	ath:	90.0	se	CS
		Intersec	tion Pe	rformanc	e Summa	ary		9011	20.0		
Appr/	Lane	Adj Sat	Rati	os	Lane	Group	App	roach	 า		
Lane (	Group	Flow Rate									
Grp (	Capacity	(s)	v/c	g/C	Delay	LOS	Dela	y LOS	5		
Eastbound	a										
Westbound	d										
L	409	1532	0.29	0.27	26.7	С					
LTR	425	1595	0.39	0.27	27.6	С	27.0	С			
R	372	1395	0.08	0.27	24.8	С					
Northbou	nd										
Ĺ	478	1532	0.59	0.66	23.1	С	0 1	_			
.Т.	2193	3289	0.32	0.67	2.5	A	8.4	A			
Southbour	nd										
т	1498	3289	0.62	0.46	193	в	18 R	R			
- R	669	1468	0.17	0.46	14.6	B	_0.0				
	Intersed	ction Delay	= 15.5	(sec/ve	h) I	nterse	ection	LOS	= B		
		-									

I-290 Existing

Phone: Fax: E-Mail: _____OPERATIONAL ANALYSIS_____

Analyst: Agency/Co.: PB Date Performed: 6/25/2010 Analysis Time Period: PM Peak Intersection: Flournoy Stre & Central Avenue Area Type: All other areas Jurisdiction: Analysis Year: Existing Project ID: I-290 Phase 1 Study E/W St: Flournoy Street N/S St: Central Avenue

_____VOLUME DATA______

	Eas	stbou	nd	Wes	stbour	nd	Noi	rthbou	ınd	Sou	ıthboı	ind
	L	Т	R	L L	Т	R	L	Т	R	L	Т	R
17.0 ]					120	101					070	
volume				126	138	181	267	665			8/9	258
% Heavy Veh				10	10	10	10	10			10	10
PHF				0.95	0.95	0.95	0.95	0.95			0.95	0.95
PK 15 Vol				33	36	48	70	175			231	68
Hi Ln Vol												
% Grade	ĺ			ĺ	0		İ	0		ĺ	0	ĺ
Ideal Sat	ĺ			1900	1900	1900	1900	1900			1900	1900
ParkExist	İ			ĺ			İ			ĺ		İ
NumPark	İ			İ			İ			İ		j
No. Lanes	0	0	0	1	1	1	1	2	0	0	2	1
LGConfig	ĺ			L	LTI	RR	L	Т			Т	R
Lane Width	İ			10.0	10.0	10.5	10.0	12.0		ĺ	12.0	12.0
RTOR Vol	ĺ			ĺ		148	İ					147
Adj Flow	İ			120	165	28	281	700			925	117
%InSharedLn	İ			10		21	İ			ĺ		İ
Prop LTs	ĺ			ĺ	0.08	31	1.000	0.00	0	ĺ	0.00	0 0
Prop RTs				0	.045	1.000	0	.000		0	.000 1	L.000
Peds Bikes	0			0	(	C	İ			0	(	)
Buses	ĺ			0	0	0	0	0		ĺ	0	0
%InProtPhase	2						0.0					İ
Duration	0.25		Area 🛛	Гуре:	All d	other	areas					

## _____OPERATING PARAMETERS______OPERATING PARAMETERS_____

	Eas	stbou	nd	We	stbour	nd	No:	rthbou	ind	Sou	uthbo [.]	und
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Init Unmet				0.0	0.0	0.0	0.0	0.0			0.0	0.0
Arriv. Type				3	3	3	4	4			3	3
Unit Ext.				3.0	3.0	3.0	3.0	3.0			3.0	3.0
I Factor					1.000	)	Ì	0.575	Í		1.00	0
Lost Time				2.0	2.0	2.0	2.0	2.0			2.0	2.0
Ext of g				3.0	3.0	3.0	2.0	3.0			3.0	3.0
Ped Min g		3.2		ĺ	3.2		ĺ		İ		3.2	İ

				PH	ASE	DATA_						
Pha	se Combination	1	2	3	4			5	б	7	8	
EΒ	Left Thru Right					NB	Left Thru Right	A A	A A			
	Peds				I		Peas	Х	X			
WB	Left Thru Right Peds	A A A X				SB	Left Thru Right Peds	A A X				
NB	Right					EB	Right					
SB	Right					WB	Right					
Gre Yel All	en low Red	23.0 3.0 1.0			ļ			40.0 3.0 0.0	16.0 3.0 1.0			

Cycle Length: 90.0 secs

		VOLU	ME ADJU	JSTMENT	AND SAT	TURATI (	ON FLOV	WORK:	SHEET_		
Volume Adjus	stment										
	Eas	tbou	nd	Westh	ound	No	orthbou	ınd	Soi	uthbound	d
	L	Т	R	ь т	R	L	Т	R	ļЬ	T I	R
Volume, V	 			126 13	8 181		665		 	879 2	 58
PHF				0.95 0.	95 0.95	5 0.9	5 0.95		1	0.95 0	.95
Adi flow				133 14	5 35	2.81	700		1	925 1	17
No. Lanes	0	0	0	1	1 1		1 2	0	l o	2	1
Lane group		Ũ	J. J. J. J. J. J. J. J. J. J. J. J. J. J	— — Т.	I'LL K	I T.	 Т	Ū		T	R
Adi flow				_   1 2 0 1 F	5 2.8	281	700		1	925 1	17
Prop LTs	1				0.81	1 0		0	1	0 000	± /   
Prop RTs	1				5 1 000				i o	000 1	
	I					- 1			1 -		
Saturation H	Flow R	ate	(see Ez	khibit 1	6-7 to	deter	mine th	ne adju	ustmei	nt fact	ors)
Eas	stboun	d	V	Vestbour	ıd	Nor	thbound	1	Soi	uthbound	d /
LG			$\mathbf{L}$	LTR	R	L	Т			Т	R
So			1900	) 1900	1900	1900	1900			1900	1900
Lanes O	0	0	1	1	1	1	2	0	0	2	1
fW			0.93	33 0.933	0.950	0.933	1.000			1.000	1.000
fHV			0.90	0.909	0.909	0.909	0.909			0.909	0.909
fG			1.00	0 1.000	1.000	1.000	1.000			1.000	1.000
fP			1.00	0 1.000	1.000	1.000	1.000			1.000	1.000
fBB			1.00	0 1.000	1.000	1.000	1.000			1.000	1.000
fA			1.00	0 1.000	1.000	1.000	1.000			1.000	1.000
fLU			1.00	0 1.000	1.000	1.000	0.952			0.952	1.000
frt				0.993	0.850		1.000			1.000	0.850
fLT			0.95	50 0.996		0.950	1.000			1.000	
Sec.						0.197					
fLpb			1.00	0 1.000		1.000	1.000			1.000	
fRpb				1.000	1.000		1.000			1.000	1.000
S			1532	2 1595	1395	1532	3289			3289	1468
Sec.						318					
			CAI	PACITY A	ND LOS	WORKSI	HEET				
Capacity Ana	alysis	and	Lane (	Group Ca	pacity						

Ap Mv	opr/ vmt	Lane Group	Flo	Adj w Rate (v)	Adj Flow (	Sat Rate s)	I H	Flow Ratio (v/s)	Gre Rat (g/	een tio (C)	La Capa	ane Gr acity (c)	roup v/c Ratio	
Easth	ound													
Pr	rot													
Pe	erm													
Le	eft													
Pr	rot													
Pe	erm													
Th	ıru													
Ri	lght ,													
West	bound													
PI	TOT													
Pe	erm Sfr	-	1	2.0	1 6	2 2		0 00	0	07	1 (	20	0 20	
Це Ди		Ц	T	20	τэ	32		0.08	0.	21	40	19	0.29	
Pr														
Pe mb		TTD	1	65	1 5	0 5	#	0 1 0	0	27	۸ ۱	) E	0 20	
וו קים	aht	р ТТК	1 2	8	⊥⊃ 1 ⊃	95	Ħ	0.10	0.	27	4. 2'	20 70	0.39	
KI North	hour	4	2	0	13			0.02	υ.	<u> </u>	د	14	0.00	
			1	43	1 ⊑	30	#	0 00	Ω	<b></b>	2.	10	0 4 2	
	orm		1	78 70	1 D 2 1	2 <u>2</u> 8	# #	0.09	0.	422	، د ۱ ٬	28	1 00	
ге Т.с	> ± > f +	т.	1 2	81	51	0	#	0.13	0.	66	т. Д'	78	1.00 0 59	
ЦС Dv	rot	-	2	0 <b>T</b>					0.	00	ч	, 0	0.57	
F I De	rm													
т с т Р	) 12 III	т	7	0.0	32	89		0 21	0	67	2	193	0 32	
Ri	aht	-	,	00	52	0,0		0.21	0.	07	2.		0.52	
South	bound	3												
Pr	rot	A												
Pe	rm													
I e	eft.													
Pr	not.													
Pe	rm													
Th	iru	Т	9	25	32	89		0.28	0.	46	14	498	0.62	
Ri	ght	R	1	17	14	68		0.08	0.	46	66	59	0.17	
Sum c	of flo	ow rati	os for	critic	cal la	ne gro	oup	ps, Yc	= 5	Sum	(v/s	) =	0.63	
Total	l lost	t time	per cy	cle, I	<b>_</b> = 7.	00 se	C							
Criti	lcal f	Elow ra	te to	capacit	y rat	io,		Xc	= (Yc	c)(C	) / ( C·	-L) =	0.68	
Contr	col De	elay an	d LOS	Determi	natio	n								
Appr/	/ Ra	atios	Unf	Prog	Lane	Incre	eme	ental	Res	Laı	ne Gi	roup	Approa	ach
Lane			Del	Adj	Grp	Facto	r	Del	Del					
Grp	v/c	g/C	d1	Fact	Cap	k		d2	d3	De	elay	LOS	Delay	LOS
Eastr	ouna													
Weath	baund													
west	Jouna	0 27	26.2	1 000	100	0 1 1		0 4	0 0	26	7	C		
L T TTD	0.29	0.27	20.3	1 000	409	0.11		0.4	0.0	20	. /	C	27 0	C
D IK	0.39	0.27	∠/.U 2/ 7	1 000	443 270	0.11		0.0	0.0	∠/ ე/	. U Q	C	21.0	C
K	0.08	J.Z/	24./	1.000	312	0.11		0.1	0.0	24	. 0	C		
TUOLU	U E O IDO UIC	1 0 66	<u>,,,</u> ,	1 000	170	0 10		1 1	0 0	າາ	1	C		
ц т	0.59	0.00	22.U 6 1	1.000 0.202	4/0 2102	U.⊥Ծ 0 11		1.1 0 0	0.0	∠ວ ວ່	•⊥ 5		Q /I	λ
T	0.32	0.0/	0.4	0.383	2173	0.11		0.0	0.0	4.5	ر	А	0.4	А
9011+4	hours	3												
SOULI	inonito	L												
т	0.62	046	18 6	1 000	1498	0 20		08	0 0	19	3	в	18 8	в
÷	0.04	J. I.				0.20		<b></b>	<b></b>	エノ		-		-

Intersection delay = 15.5 (sec/veh) Intersection LOS = B

SUPPLEMENTAL PERMITTED LT WORKSHEET for exclusive lefts Input ΕB WΒ NBSB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 90.0 sec Total actual green time for LT lane group, G (s) 59.0 Effective permitted green time for LT lane group, g(s) 39.0 Opposing effective green time, go (s) 41.0 Number of lanes in LT lane group, N 1 Number of lanes in opposing approach, No 2 Adjusted LT flow rate, VLT (veh/h) 281 Proportion of LT in LT lane group, PLT 1.000 Proportion of LT in opposing flow, PLTo 0.00 Adjusted opposing flow rate, Vo (veh/h) 925 Lost time for LT lane group, tL 4.00 Computation LT volume per cycle, LTC=VLTC/3600 7.03 Opposing lane util. factor, fLUo 1.000 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) 12.15 gf=G[exp(- a * (LTC ** b))]-tl, gf<=g 0.0 Opposing platoon ratio, Rpo (refer Exhibit 16-11) 1.00 Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] 0.54 qq, (see Exhibit C16-4,5,6,7,8) 14.11 gu=g-gq if gq>=gf, or = g-gf if gq<gf 24.89 n=Max(gq-gf)/2,0)7.06 PTHo=1-PLTo 1.00 PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]1.00 EL1 (refer to Exhibit C16-3) 3.23 EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g 0.10 0.00 gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) 0.20 flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT 0.197 For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. _SUPPLEMENTAL PERMITTED LT WORKSHEET_ for shared lefts Input EΒ WΒ NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 90.0 sec Total actual green time for LT lane group, G (s)

Effective permitted green time for LT lane group, g(s)

Opposing effective green time, go (s)

Number of lanes in LT lane group, N

```
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT
                                                              0.081 0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo
                                                        1.000 0.952 0.952
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
qf=G[exp(-a * (LTC ** b))]-t], qf <= q
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g or fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT
For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
 left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.
               SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET
Permitted Left Turns
                                                        EΒ
                                                                    NB
                                                                          SB
                                                              WΒ
Effective pedestrian green time, gp (s)
                                                                   40.0
Conflicting pedestrian volume, Vped (p/h)
                                                                   0
Pedestrian flow rate, Vpedg (p/h)
                                                                   0
                                                                   0.000
0CCpedq
                                                                   14.11
Opposing queue clearing green, gq (s)
                                                                   0.353
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
                                                                   0.000
Opposing flow rate, Vo (veh/h)
                                                                   925
                                                                   0.000
OCCr
Number of cross-street receiving lanes, Nrec
                                                                   1
Number of turning lanes, Nturn
                                                                   1
                                                                   1.000
ApbT
                                                                   1.000
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
                                                                   0.000
Left-turn adjustment, fLpb
                                                                   1.000
Permitted Right Turns
Effective pedestrian green time, gp (s)
                                                            23.0
                                                                         40.0
Conflicting pedestrian volume, Vped (p/h)
                                                                         0
                                                             0
                                                                         0
Conflicting bicycle volume, Vbic (bicycles/h)
                                                             0
                                                             0
                                                                         0
Vpedg
OCCpedq
                                                             0.000
                                                                        0.000
                                                                         41.0
Effective green, g (s)
                                                             24.0
                                                             0
                                                                         0
Vbicg
```

OCCbicg	0.020	0.020
OCCr	0.000	0.000
Number of cross-street receiving lanes, Nrec	2	1
Number of turning lanes, Nturn	2	1
ApbT	1.000	1.000
Proportion right-turns, PRT	1.000	1.000
Proportion right-turns using protected phase, PRTA	0.000	0.000
Right turn adjustment, fRpb	1.000	

_____SUPPLEMENTAL UNIFORM DELAY WORKSHEET______

		EBLT	WBLT	NBLT	SBLT
Cycle length, C 90.0 s	sec				
Adj. LT vol from Vol Adjustment Worksheet, v				281	
v/c ratio from Capacity Worksheet, X				0.59	
Protected phase effective green interval, g (s)				20.0	
Opposing queue effective green interval, gq				14.11	
Unopposed green interval, gu				24.89	
Red time r=(C-g-gq-gu)				31.0	
Arrival rate, $qa=v/(3600(max[X,1.0]))$				0.08	
Protected ph. departure rate, Sp=s/3600				0.426	
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*360)	0)			0.14	
XPerm				1.59	
XProt					
Case				5	
Queue at beginning of green arrow, Qa				2.02	
Queue at beginning of unsaturated green, Qu				3.52	
Residual queue, Qr				0.00	
Uniform Delay, dl				22.0	

_____DELAY/LOS WORKSHEET WITH INITIAL QUEUE_____

Appr/	Initial Unmet	Dur. Unmet	Uniform	Delay	Initial Oueue	Final Unmet	Initial Oueue	Lane Group
Lane	Demand	Demand	Unadi.	Adi.	Param.	Demand	Delav	Delav
Group	Q veh	t hrs.	ds	dl sec	u	Q veh	d3 sec	d sec
Eastbour	nd							
	0.0						0.0	
	0.0						0.0	
	0.0						0.0	
Westbour	nd							
L	0.0	0.00	33.0	26.3	0.00	0.0	0.0	26.7
LTR	0.0	0.00	33.0	27.0	0.00	0.0	0.0	27.6
R	0.0	0.00	33.0	24.7	0.00	0.0	0.0	24.8
Northbou	ınd							
L	0.0	0.00		22.0	0.00	0.0	0.0	23.1
Т	0.0	0.00	15.0	6.4	0.00	0.0	0.0	2.5
	0.0						0.0	
Southbou	ınd							
	0.0						0.0	
Т	0.0	0.00	24.5	18.6	0.00	0.0	0.0	19.3
R	0.0	0.00	24.5	14.5	0.00	0.0	0.0	14.6
]	Intersect	ion Dela	ay 15.5	sec/ve	eh Ir	ntersecti	on LOS	В

_____BACK OF QUEUE WORKSHEET_____BACK OF QUEUE WORKSHEET_____

	Eastbo	und	We	estbou	ınd	Noi	thbou	ınd	Sou	ıthboı	ınd	
LaneGroup			L	LTR	R	L	Т			Т	R	
Init Queue	ĺ		0.0	0.0	0.0	0.0	0.0			0.0	0.0	
Flow Rate	ĺ		120	165	28	281	367		ĺ	485	117 İ	
So	ĺ		1900	1900	1900	1900	1900		ĺ	1900	1900 İ	
No.Lanes	jo o	0	1	1	1	1	2	0	0	2	1 İ	
SL			1532	1595	1395	730	1727		ĺ	1727	1468	
LnCapacity			409	425	372	478	1151		ĺ	786	669	
Flow Ratio			0.1	0.1	0.0	0.4	0.2			0.3	0.1	
v/c Ratio			0.29	0.39	0.08	0.59	0.32		ĺ	0.62	0.17	
Grn Ratio			0.27	0.27	0.27	0.66	0.67		ĺ	0.46	0.46	
I Factor				1.000	)	ĺ	0.575	5		1.000	)	
AT or PVG			3	3	3	4	4		ĺ	3	3	
Pltn Ratio			1.00	1.00	1.00	1.33	1.33		ĺ	1.00	1.00	
PF2			1.00	1.00	1.00	0.46	0.37		ĺ	1.00	1.00	
Q1			2.4	3.4	0.5	1.3	1.4		ĺ	9.2	1.7	
kВ			0.4	0.4	0.4	0.3	0.4		ĺ	0.6	0.5	
Q2			0.2	0.3	0.0	0.4	0.2		ĺ	0.9	0.1	
Q Average			2.6	3.6	0.6	1.6	1.6		ĺ	10.1	1.8	
Q Spacing			25.0	25.0	25.0	25.0	25.0		ĺ	25.0	25.0	
Q Storage			0	0	0	0	0			0	0	
Q S Ratio			ĺ			İ					ĺ	
70th Percent	tile Output	t:	-									
fB%			1.2	1.2	1.2	1.2	1.2			1.2	1.2	
BOQ			3.0	4.3	0.7	2.0	1.9		ĺ	11.9	2.2	
QSRatio						ĺ			ĺ		ĺ	
85th Percent	tile Output	t:										
fB%			1.6	1.6	1.6	1.6	1.6			1.5	1.6	
BOQ			4.0	5.7	0.9	2.6	2.6			15.3	2.9	
QSRatio												
90th Percent	tile Output	t:										
fB%			1.8	1.7	1.8	1.8	1.8			1.6	1.8	
BOQ			4.5	6.3	1.0	2.9	2.9			16.6	3.3	
QSRatio												
95th Percent	tile Output	t:										
fB%			2.0	2.0	2.1	2.0	2.0			1.8	2.0	
BOQ			5.2	7.2	1.2	3.4	3.3			18.6	3.8	
QSRatio												
98th Percent	tile Output	t:										
fB%			2.5	2.5	2.7	2.6	2.6			2.2	2.6	
BOQ			6.4	8.9	1.5	4.2	4.2			21.9	4.7	
QSRatio												

_____ERROR MESSAGES_____

No errors to report.

Analyst: Inter.: Eastbound Ramp & Central Avenu Agency: AM Peak Area Type: All other areas Date: 6/25/2010 Jurisd: Period: AM Peak Year : Existing Project ID: I-290 Phase 1 Study E/W St: Eastbound Ramp N/S St: Central Avenue ___SIGNALIZED INTERSECTION SUMMARY__ Eastbound Westbound Northbound Southbound Т L т L L Т Т T. R R R L R No. Lanes 0 1 1 0 0 0 0 2 0 2 2 0 LGConfig LT R ΤR L Т 282 353 Volume 128 0 447 183 341 Lane Width 10.0 10.0 12.0 10.0 12.0 RTOR Vol 143 130 Duration 0.25 Area Type: All other areas ___Signal Operations__ 2 Phase Combination 1 3 5 7 8 4 б EB Left А NB Left Thru Α Thru Α Right Α Right A Peds Peds Х WB Left SB Left Α Thru Thru А Α Right Riqht Peds Peds Х Х NB Right EΒ Right SB Right WΒ Right 23.0 35.0 20.0 Green Yellow 3.0 3.0 3.0 All Red 1.0 1.0 1.0 Cycle Length: 90.0 secs __Intersection Performance Summary__ Adj Sat Ratios Lane Lane Group Approach Appr/ Flow Rate Lane Group Grp Capacity (s) v/c g/C Delay LOS Delay LOS Eastbound LT392 0.34 0.26 27.9 С 27.4 C 1535 350 1370 0.12 0.26 25.9 R С Westbound Northbound ΤR 1252 3131 0.55 0.40 21.3 C 21.3 C Southbound 2974 0.45 0.22 L 661 30.7 С т 2193 3289 0.17 0.67 2.2 Α 14.9 В Intersection Delay = 19.2 (sec/veh) Intersection LOS = B

I-290 Existing

Phone: Fax: E-Mail: _____OPERATIONAL ANALYSIS______ Analyst:

—		
Agency/Co.:	AM Peak	
Date Performed:	6/25/2010	
Analysis Time Period:	AM Peak	
Intersection:	Eastbound	Ramp & Central Avenu
Area Type:	All other	areas
Jurisdiction:		
Analysis Year:	Existing	
Project ID: I-290 Phase	1 Study	
E/W St: Eastbound Ramp		N/S St: Central Avenue

_____VOLUME DATA______

	Eas	stboui	nd	Wes	stbou	nd	No	rthbou	und	Sou	ıthbou	nd
	L 	Т	R	L 	Т	R	L	Т	R	L	Т	R
Volume	128	0	183					447	341	282	353	
% Heavy Veh	10	10	10	ĺ			Ì	10	10	10	10	
PHF	0.95	0.95	0.95	ĺ			ĺ	0.95	0.95	0.95	0.95	
PK 15 Vol	34	0	48	ĺ			ĺ	118	90	74	93	
Hi Ln Vol												
% Grade		0						0			0	
Ideal Sat		1900	1900					1900		1900	1900	
ParkExist												
NumPark												
No. Lanes	0	1	1	0	0	0	0	2	0	2	2	0
LGConfig		LT	R					TR		L	Т	
Lane Width		10.0	10.0					12.0		10.0	12.0	
RTOR Vol			143						130			
Adj Flow		135	42					693		297	372	
%InSharedLn												
Prop LTs		1.00	00					0.00	0 0		0.00	0
Prop RTs	0.	.000 1	1.000				0	.320		0	.000	
Peds Bikes	0			0			0	(	C			
Buses		0	0					0		0	0	
%InProtPhase	9											
Duration	0.25		Area 🗅	Гуре:	All	other	areas					

	Eastbound			Westbound			No	orthbo	und	Southbound		
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Init Unmet		0.0	0.0	.   			-  	0.0		_   0.0	0.0	
Arriv. Type		3	3	İ				3		3	4	
Unit Ext.		3.0	3.0	İ				3.0		3.0	3.0	
I Factor		1.00	0	i			j	1.00	0	ĺ	0.943	
Lost Time		2.0	2.0	İ				2.0		2.0	2.0	
Ext of g		2.0	2.0	İ				3.0		2.0	3.0	
Ped Min g		3.2		İ	3.2		İ	3.2		İ		

## _____OPERATING PARAMETERS______

				PF	IASE	DATA_					
Pha	se Combination	1	2	3	4			5	6	7	8
EB	Left Thru Right Peds	A A A				NB	Left Thru Right Peds	A A X			
WB	Left Thru Right Peds					SB	Left Thru Right Peds	A X	A A X		
NB	Right					EB	Right				
SB	Right					WB	Right				
Gree Yel All	en : low : Red :	23.0 3.0 1.0			I			35.0 3.0 1.0	20.0 3.0 1.0		

Cycle Length: 90.0 secs

	7	VOLUME	ADJU	STMEN	r and	SAT	rur	ATIO	N FLO	W WORK	SHEET_		
Volume Adju	stment												
	East	tbound		West	tboun	d		No	rthbo	und	Sou	thbou	ind
	L	T I	r	L	Т	R	Ì	L	Т	R	L	Т	R
Volume, V PHF Adi flow	128 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.95 (0.	0 1 0.95 0 0 4	83   .95   2				     		447 0.95 471	341 0.95 222	  282  0.95  297	353 0.95 372	   
No. Lanes	0	1	1	0	0	0		0	2	0	2	2	0
Lane group		LT 135 4	R   2	Ū	Ū	U		Ū	- TR 693	Ū	L   297	– T 372	
Prop LTs Prop RTs	0.0	1.000 000 1.	000					0	0.0	0 0	0.	0.00	00
Saturation Ea	Flow Ra stbound	ate (s d	ee E> V	hibit Vestbou	16-7 und	to	de	term: Nortl	ine t hboun	he adj d	ustmen Sou	t fac thbou	tors)
LG	LT	R							TR		L	Т	
So	1900	1900							1900		1900	1900	)
Lanes 0 fW fHV fG fP	1 0.933 0.909 1.000 1.000	1 0.933 0.909 1.000 1.000	0	0	0		0	-	2 1.000 0.909 1.000 1.000	0	2 0.933 0.909 1.000 1.000	2 1.00 0.90 1.00 1.00	0 00 09 00
1 BB	1.000	1.000						-	1.000		1.000	1.00	0
ÍA fLU fRT fLT	1.000 1.000 1.000 0.952	1.000 1.000 0.850							1.000 0.952 0.952 1.000		1.000 0.971 0.950	1.00 0.95 1.00 1.00	0 52 00 00
Sec.								-					-
fLpb fRpb S	1.000 1.000 1535	1.000 1370						-	1.000 1.000 3131		1.000 2974	1.00 1.00 3289	)
Sec.													

_____CAPACITY AND LOS WORKSHEET___

Capacity Analysis and Lane Group Capacity

A	Appr/ Ivmt	Lane Group	Flo	Adj w Rate (v)	Adj Flow (	Sat Rate s)	편 귀 (	Flow Ratio [v/s)	Gre Rat (g/	enL io Cap C)	ane G acity (c)	roup v/c Ratio	
East	bound Prot												
P	Perm												
L	⊿eft												
P	rot												
P	Perm												
Т	hru	LT	1	35	15	35	#	0.09	0.	26 3	92	0.34	
R	Right	R	4	2	13	70		0.03	0.	26 3	50	0.12	
West	bound												
P	rot												
P	Perm												
L	⊿eft												
P	rot												
P	Perm												
Т	hru												
R	Right												
Nort	hboun	d											
P	rot												
P	Perm												
L	⊿eft												
P	rot												
P	Perm												
Т	hru	TR	6	93	31	31	#	0.22	0.	40 1	252	0.55	
R	Right	_											
Sout	hboun	d											
P	rot												
P	Perm												
I	∟eft	L	2	97	29	74	#	0.10	0.	22 6	61	0.45	
P	rot												
P	Perm								-				
I	'hru	Т	3	72	32	89		0.11	0.	67 2	193	0.17	
R	light												
Sum	of fl	ow rati	os for	critic	cal la	ne gro	oup	os, Yc	= S	um (v/s	) =	0.41	
Tota	al los	t time	per cy	cle, I	L = 11	.00 se	ec						
Crit	ical	ilow ra	te to	capacit	ty rat	10,		XC	= (YC	e)(C)/(C	-L) =	0.47	
Cont	rol D	elav an	20.1 b	Determ	inatio	n							
Appr	$\sim / R$	atios	Unf	Prog	Lane	Incre	- <u>-</u> _	ntal	Res	Lane G	roup	Approz	ach
Lane	,		Del	Adi	Grp	Facto	or	Del	Del		10 MP		
Grp	v/c	a/C	d1	Fact	Cap	k	-	d2	d3	Delav	LOS	Delav	LOS
East	bound	_	_		_		_	_	_	_	_		_
тт		0 26	07 0	1 000	202	0 1 1		0 5	0 0	27 0	C	07 /	C
Ъ	0.34	0.20 0.26	47.3 25 7	1 000	394 350	0.11		0.5	0.0	41.9 25 Q	C	4/.4	C
Wogt	bound	0.20	23.7	1.000	550	0.11		0.2	0.0	23.9	C		
WCBC	bound												
Nort	hboun	d											
чт		0 40	20 Q	1 000	1250	0 1 5		0 5	0 0	21 2	C	21 2	C
T 1/	0.00	5.10	20.0	1.000		0.10		5.5	0.0	د J	<u> </u>	21 · J	<u> </u>
Sout	hboun	d											
L	0.45	0.22	30.2	1.000	661	0.11		0.5	0.0	30.7	С		
Т	0.17	0.67	5.6	0.383	2193	0.11		0.0	0.0	2.2	А	14.9	В

SUPPLEMENTAL PERMITTED LT WORKSHEET for exclusive lefts Input EΒ WB NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 90.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo 1.000 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. _SUPPLEMENTAL PERMITTED LT WORKSHEET_ for shared lefts Input EΒ WB NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 90.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s)Opposing effective green time, go (s) Number of lanes in LT lane group, N

Intersection LOS = B

Intersection delay = 19.2 (sec/veh)

Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) 1.000 Proportion of LT in LT lane group, PLT 0.000 0.000 Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo 1.000 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min=fmin;max=1.00)flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET Permitted Left Turns EΒ WΒ  $^{\rm NB}$ SB Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Pedestrian flow rate, Vpedg (p/h) 0CCpedq Opposing queue clearing green, gq (s) Eff. ped. green consumed by opp. veh. queue, gq/gp OCCpedu Opposing flow rate, Vo (veh/h) OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion of left turns, PLT Proportion of left turns using protected phase, PLTA Left-turn adjustment, fLpb Permitted Right Turns Effective pedestrian green time, gp (s) 35.0 Conflicting pedestrian volume, Vped (p/h) 0 0 Conflicting bicycle volume, Vbic (bicycles/h) 0 Vpedg 0.000 OCCpedq 36.0 Effective green, g (s) Vbicg 0

Mamber Of Curning Tarles, North         1.000           Proportion right-turns using protected phase, PRTA         0.000           Right turn adjustment, fRpb         1.000	OCCbicg OCCr Number c	of cross-	-street	receiving	g lanes,	Nrec			0.020 0.000 2		
Proportion right-turns using protected phase, PRTA         0.320           Right turn adjustment, fRpb         0.000           Right turn adjustment, fRpb         1.000	ApbT		ig lanes	, NCUIII					1.000		
SUPPLEMENTAL UNIFORM DELAY WORKSHEET	Proporti Proporti Right tu	on right on right Irn adjus	t-turns, t-turns stment,	PRT using pro fRpb	otected p	phase, Pl	RTA		0.320 0.000 1.000		
EELT WELT NELT SI           Cycle length, C         90.0 sec           Adj. LT vol from Vol Adjustment Worksheet, v         90.0 sec           V/c ratio from Capacity Worksheet, X         Protected phase effective green interval, g (s)           Opposing queue effective green interval, g         Unopposed green interval, gu           Red time r=(C-g-g-gui)         Arrival rate, ga=v/(3600(max[X,1.0]))           Protected ph. departure rate, Ss=s(gq+gu)/(gu*3600)         XPerm           XProt         Case           Queue at beginning of green arrow, Qa         Queue at beginning of unsaturated green, Qu           Residual gueue, Qr         Uniform Delay           Uniform Delay, dl			SU	PPLEMENTA	AL UNIFO	RM DELAY	WORKSHE	ET			
Cycle length, C       90.0 sec         Adj. LT vol from Vol Adjustment Worksheet, v       vv         v/c ratio from Capacity Worksheet, X       Protected phase effective green interval, g(s)         Opposing queue effective green interval, gq       Unopposed green interval, gu         Red time r=(C-g-gq-gu)       Arrival rate, qae-v()3600(max[X,1.0]))         Protected ph. departure rate, Sp=s/3600       Permitted ph. departure rate, Sp=s/3600         Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)       XPerm         XProt       Case         Queue at beginning of green arrow, Qa       Queue at beginning of unsaturated green, Qu         Residual queue, Qr       Difform Delay         Uniform Delay, d1							E	BLT WBL	T NBLT SBLT		
	Cycle le Adj. LT v/c rati Protecte Opposing Unoppose Red time Arrival Protecte Permitte XPerm XProt Case Queue at Queue at Residual Uniform	ength, C vol from o from ( ed phase g queue e ed green e r=(C-g- rate, qa ed ph. de ed ph. de ed ph. de beginn: beginn: queue, Delay, o	n Vol Ad Capacity effectiv interva -gq-gu) a=v/(360 eparture eparture ing of g ing of u Qr	justment Workshee ve green e green : 1, gu 0(max[X,: rate, S; rate, S; reen arro nsaturate	Workshee et, X interval interval 1.0])) p=s/3600 s=s(gq+gn pw, Qa ed green	90.0 et, v 1, g (s) , gq u)/(gu*3 , Qu	sec				
Initial Dur. Appr/Unmet         Uniform Delay Demand         Initial Queue         Final Unmet Demand         Initial Queue         Initial Demand         Initial Queue         Initial Demand         Lane Queue         Group Delay           Eastbound         0.0         1.00         33.5         27.3         0.00         0.0         27.9           R         0.0         0.00         33.5         25.7         0.00         0.0         25.9           Westbound         0.0         0.0         0.0         0.0         0.0         0.0           Northbound         0.0         27.0         20.8         0.00         0.0         21.3           Southbound         0.0         0.00         35.0         30.2         0.00         0.0         2.2           Southbound         0.0         0.00         15.0         5.6         0.00         0.0         30.7	OIIIIOIM	Deray, (	DELAY/	LOS WORKS	SHEET WI	TH INITI	AL QUEUE				
Appl/       Differ       Differ       Differ       Differ       Other       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer       Offer	Appr/	Initial	Dur.	Uniform	Delay	Initial	Final	Initial	Lane		
Eastbound       0.0       0.0       0.0       0.0         LT       0.0       0.00       33.5       27.3       0.00       0.0       27.9         R       0.0       0.00       33.5       25.7       0.00       0.0       25.9         Westbound       0.0       0.0       0.0       0.0       0.0       25.9         Northbound       0.0       0.0       0.0       0.0       0.0       0.0         TR       0.0       0.00       27.0       20.8       0.00       0.0       21.3         Southbound       1       0.0       0.00       35.0       30.2       0.00       0.0       0.0       21.3         Southbound       1       0.0       0.00       35.0       30.2       0.00       0.0       2.2         0.0       0.00       15.0       5.6       0.00       0.0       2.2	Lane Group	Demand Q veh	Demand t hrs.	Unadj. ds	Adj. d1 sec	Param. u	Demand Q veh	Delay d3 sec	Delay d sec		
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Eastbour	nd									
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		0.0						0.0			
Westbound $0.0$ $0.0$ $0.0$ $0.0$ $0.0$ $0.0$ $0.0$ $0.0$ $0.0$ $0.0$ $0.0$ Northbound $0.0$ $0.00$ $27.0$ $20.8$ $0.00$ $0.0$ TR $0.0$ $0.00$ $27.0$ $20.8$ $0.00$ $0.0$ $21.3$ Southbound $1.0$ $0.00$ $35.0$ $30.2$ $0.00$ $0.0$ $21.3$ $1.0$ $0.00$ $35.0$ $30.2$ $0.00$ $0.0$ $30.7$ $T$ $0.0$ $0.00$ $15.0$ $5.6$ $0.00$ $0.0$ $2.2$	LT R	0.0 0.0	0.00 0.00	33.5 33.5	27.3 25.7	0.00 0.00	0.0 0.0	0.0 0.0	27.9 25.9		
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Westbour	nd									
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		0.0						0.0			
Northbound       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       0.0       21.3       0.0       0.0       21.3       0.0       0.0       2.2       0.0       0.0       0.0       2.2       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0 <td></td> <td>0.0 0.0</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>0.0 0.0</td> <td></td>		0.0 0.0						0.0 0.0			
TR $0.0\\ 0.0\\ 0.0$ $0.00$ $27.0$ $20.8$ $0.00$ $0.0$ $0.0\\ 0.0$ $21.3$ SouthboundL $0.0$ $0.00$ $35.0$ $30.2$ $0.00$ $0.0$ $30.7$ T $0.0$ $0.00$ $15.0$ $5.6$ $0.00$ $0.0$ $2.2$	Northbou	ınd									
TR       0.0       0.00       27.0       20.8       0.00       0.0       21.3         Southbound       0.0       0.00       35.0       30.2       0.00       0.0       30.7         T       0.0       0.00       15.0       5.6       0.00       0.0       2.2		0.0						0.0			
Southbound L 0.0 0.00 35.0 30.2 0.00 0.0 0.0 30.7 T 0.0 0.00 15.0 5.6 0.00 0.0 0.0 2.2	TR	0.0 0.0	0.00	27.0	20.8	0.00	0.0	0.0 0.0	21.3		
L 0.0 0.00 35.0 30.2 0.00 0.0 0.0 30.7 T 0.0 0.00 15.0 5.6 0.00 0.0 0.0 2.2	Southbou	ınd									
T 0.0 0.00 15.0 5.6 0.00 0.0 0.0 2.2	L	0.0	0.00	35.0	30.2	0.00	0.0	0.0	30.7		
0.0 0.0	Т	0.0 0.0	0.00	15.0	5.6	0.00	0.0	0.0 0.0	2.2		
Intersection Delay 19.2 sec/veh Intersection LOS B	I	Intersect	cion Del	ay 19.2	sec/ve	eh Ii	ntersect	ion LOS	В		
LaneGroup  LT  R  TR  L  T    Init Queue  0.0  0.0  0.0  0.0  0.0  0.0    Flow Rate  135  42  363  152  195    So  1900  1900  1900  1900  1900  1900    No.Lanes  0  1  1  0  0  0  2  2  0    SL  1535  1370  1644  1531  1727  1    LnCapacity  392  350  657  340  1151    Flow Ratio  0.1  0.0  0.2  0.1  0.1    V/c Ratio  0.34  0.12  0.55  0.45  0.17    Grn Ratio  0.26  0.26  0.40  0.22  0.67    I Factor  1.000  1.000  0.943  1.00  1.00  1.33    PF2  1.00  1.00  1.00  1.00  1.33  0.6  1.00    Q1  2.8  0.8  7.0  3.3  0.6  1.00    Q2 <t< th=""><th></th><th>Eastbo</th><th>und</th><th>V</th><th>lestbou</th><th>ınd</th><th>Nor</th><th>thbound</th><th>Sou</th><th>thbou</th><th>nd</th></t<>		Eastbo	und	V	lestbou	ınd	Nor	thbound	Sou	thbou	nd
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------	------------	------------	---	---------	-----	-----	-------------	------	------------	----
Init Queue  0.0  0.0  0.0  0.0  0.0  0.0    Flow Rate  135  42  363  152  195    So  1900  1900  1900  1900  1900  1900    No.Lanes  0  1  1  0  0  0  2  0  2  2  0    SL  1535  1370  1644  1531  1727  1    LnCapacity  392  350  657  340  1151    Flow Ratio  0.1  0.0  0.2  0.1  0.1    V/c Ratio  0.34  0.12  0.55  0.45  0.17    Grn Ratio  0.26  0.26  0.40  0.22  0.67    I Factor  1.000  1.000  0.943  3  4    Pltn Ratio  1.00  1.00  1.00  1.33  1    PF2  1.00  1.00  1.00  1.33  0.6  1    Q1  2.8  0.8  7.0  3.3  0.6  1    Q Average <t< td=""><td>LaneGroup</td><td>LT</td><td>R</td><td></td><td></td><td></td><td></td><td>TR</td><td>L</td><td>Т</td><td></td></t<>	LaneGroup	LT	R					TR	L	Т	
Flow Rate  135  42  363  152  195    So  1900  1900  1900  1900  1900  1900    No.Lanes  0  1  1  0  0  0  2  0  2  2  0    SL  1535  1370  1644  1531  1727  1644  1531  1727    LnCapacity  392  350  657  340  1151  10  10  10  10  11  10  10  11  10  10  11  10  11  10  11  10  10  11  10  10  11  10  11  10  11  10  11  10  11  10  11  10  11  11  11  11  11  11  11  11  11  11  11  11  11  11  11  11  11  11  11  11  11  11  11  11  11  11  11  11  11  11  11  11  11  1	Init Queue	0.0	0.0	ĺ				0.0	0.0	0.0	Í
So  1900 1900  1900  1900  1900  1900    No.Lanes  0  1  1  0  0  0  2  0  2  0    SL  1535 1370  1644  1531 1727  1644  1531 1727    LnCapacity  392 350  657  340 1151  0.2  0.1 0.1    V/c Ratio  0.34 0.12  0.55  0.45 0.17  0.943    Grn Ratio  0.26 0.26  0.40  0.22 0.67  1.000    I Factor  1.000  0.943  3  4    Pltn Ratio  1.00 1.00  1.00  0.943    PF2  1.00 1.00  1.00  1.00 1.33    Q1  2.8 0.8  7.0  3.3 0.6    KB  0.4 0.4  0.5  0.3 0.7    Q2  0.2 0.1  0.7  0.3 0.1  25.0    Q Average  3.0 0.9  7.6  3.6 0.8  25.0    Q Storage  0  0  0  0  0	Flow Rate	135	42	ĺ				363	152	195	ĺ
No.Lanes  0  1  1  0  0  0  2  0  2  0    SL  1535  1370  1644  1531  1727    LnCapacity  392  350  657  340  1151    Flow Ratio  0.1  0.0  0.2  0.1  0.1    V/c Ratio  0.34  0.12  0.55  0.45  0.17    Grn Ratio  0.26  0.26  0.40  0.22  0.67    I Factor  1.000  1.000  0.943  0.943    AT or PVG  3  3  3  4    Pltn Ratio  1.00  1.00  1.00  1.00    Q1  2.8  0.8  7.0  3.3  0.6    KB  0.4  0.4  0.5  0.3  0.7    Q2  0.2  0.1  0.7  0.3  0.1    Q Average  3.0  0.9  7.6  3.6  0.8    Q Spacing  25.0  25.0  25.0  25.0  25.0  25.0    Q Storage  0	So	1900	1900	ĺ				1900	1900	1900	İ
SL1535 137016441531 1727LnCapacity392 350657340 1151Flow Ratio0.1 0.00.20.1 0.1v/c Ratio0.34 0.120.550.45 0.17Grn Ratio0.26 0.260.400.22 0.67I Factor1.0001.0000.943AT or PVG333PItn Ratio1.00 1.001.001.00 1.33PF21.00 1.001.001.001.00 0.35Q12.8 0.87.03.3 0.6kB0.4 0.40.50.3 0.7Q20.2 0.10.70.3 0.1Q Average3.0 0.97.63.6 0.8Q Spacing25.0 25.025.0 25.00Q S Ratio0000	No.Lanes	0 1	1	0	0	0	0	2 0	2	2	0
LnCapacity3923506573401151Flow Ratio0.10.00.20.10.1v/c Ratio0.340.120.550.450.17Grn Ratio0.260.260.400.220.67I Factor1.0001.0000.943AT or PVG3334Pltn Ratio1.001.001.001.33PF21.001.001.000.35Q12.80.87.03.30.6kB0.40.40.50.30.7Q20.20.10.70.30.1Q Average3.00.97.63.60.8Q Spacing25.025.025.025.025.0Q Storage000000	SL	1535	1370	ĺ				1644	1531	1727	ĺ
Flow Ratio0.10.00.20.10.1v/c Ratio0.340.120.550.450.17Grn Ratio0.260.260.400.220.67I Factor1.0001.0000.943AT or PVG3334Pltn Ratio1.001.001.001.33PF21.001.001.001.000.35Q12.80.87.03.30.6kB0.40.40.50.30.7Q20.20.10.70.30.1Q Average3.00.97.63.60.8Q Spacing25.025.025.025.025.0Q Storage00000	LnCapacity	392	350	ĺ				657	340	1151	ĺ
v/c Ratio0.34 0.120.550.45 0.17Grn Ratio0.26 0.260.400.22 0.67I Factor1.0001.0000.943AT or PVG3333Pltn Ratio1.00 1.001.001.00 1.33PF21.00 1.001.001.00 0.35Q12.8 0.87.03.3 0.6kB0.4 0.40.50.3 0.7Q20.2 0.10.70.3 0.1Q Average3.0 0.97.63.6 0.8Q Spacing25.0 25.025.0 25.025.0 25.0Q Storage0000	Flow Ratio	0.1	0.0					0.2	0.1	0.1	Í
Grn Ratio0.26 0.260.400.22 0.67I Factor1.0001.0000.943AT or PVG3334Pltn Ratio1.00 1.001.001.00 1.33PF21.00 1.001.001.00 0.35Q12.8 0.87.03.3 0.6kB0.4 0.40.50.3 0.7Q20.2 0.10.70.3 0.1Q Average3.0 0.97.63.6 0.8Q Spacing25.0 25.025.0 25.025.0 25.0Q Storage0000	v/c Ratio	0.34	0.12					0.55	0.45	0.17	
I Factor1.0001.0000.943AT or PVG3334Pltn Ratio1.001.001.001.00PF21.001.001.001.000.35Q12.80.87.03.30.6kB0.40.40.50.30.7Q20.20.10.70.30.1Q Average3.00.97.63.60.8Q Spacing25.025.025.025.025.0Q S Ratio000000	Grn Ratio	0.26	0.26					0.40	0.22	0.67	
AT or PVG3334Pltn Ratio1.001.001.001.001.33PF21.001.001.001.000.35Q12.80.87.03.30.6kB0.40.40.50.30.7Q20.20.10.70.30.1Q Average3.00.97.63.60.8Q Spacing25.025.025.025.025.0Q Storage000000	I Factor	1.00	0					1.000		0.943	
Pltn Ratio1.001.001.001.001.33PF21.001.001.001.000.35Q12.80.87.03.30.6kB0.40.40.50.30.7Q20.20.10.70.30.1Q Average3.00.97.63.60.8Q Spacing25.025.025.025.025.0Q Storage000000	AT or PVG	3	3					3	3	4	
PF2  1.00 1.00  1.00 0.35    Q1  2.8 0.8  7.0 3.3 0.6    kB  0.4 0.4  0.5 0.3 0.7    Q2  0.2 0.1  0.7 0.3 0.1    Q Average  3.0 0.9  7.6 3.6 0.8    Q Spacing  25.0 25.0  25.0 25.0    Q Storage  0  0    Q S Ratio  0  0	Pltn Ratio	1.00	1.00					1.00	1.00	1.33	
Q1  2.8  0.8  7.0  3.3  0.6    kB  0.4  0.4  0.5  0.3  0.7    Q2  0.2  0.1  0.7  0.3  0.1    Q Average  3.0  0.9  7.6  3.6  0.8    Q Spacing  25.0  25.0  25.0  25.0  25.0    Q Storage  0  0  0  0  0	PF2	1.00	1.00					1.00	1.00	0.35	
kB  0.4  0.4  0.5  0.3  0.7    Q2  0.2  0.1  0.7  0.3  0.1    Q Average  3.0  0.9  7.6  3.6  0.8    Q Spacing  25.0  25.0  25.0  25.0  25.0    Q Storage  0  0  0  0  0	Q1	2.8	0.8					7.0	3.3	0.6	
Q2  0.2  0.1  0.7  0.3  0.1    Q Average  3.0  0.9  7.6  3.6  0.8    Q Spacing  25.0  25.0  25.0  25.0  25.0    Q Storage  0  0  0  0  0    Q S Ratio	kB	0.4	0.4					0.5	0.3	0.7	
Q Average  3.0  0.9  7.6  3.6  0.8    Q Spacing  25.0  25.0  25.0  25.0  25.0  25.0    Q Storage  0  0  0  0  0  0  0    Q S Ratio  3.6  0.8  0  0  0  0  0  0	Q2	0.2	0.1					0.7	0.3	0.1	
Q Spacing  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0  25.0	Q Average	3.0	0.9					7.6	3.6	0.8	
Q Storage 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Q Spacing	25.0	25.0					25.0	25.0	25.0	
Q S Ratio	Q Storage	0	0					0	0	0	
	Q S Ratio										
70th Percentile Output:	70th Percent	ile Outpu	t:								
fB%   1.2 1.2   1.2   1.2   1.2	fB%	1.2	1.2					1.2	1.2	1.2	
BOQ 3.5 1.0 9.0 4.2 0.9	BOQ	3.5	1.0					9.0	4.2	0.9	
QSRatio	QSRatio										
85th Percentile Output:	85th Percent	ile Outpu	t:								
fB% 1.6 1.6 1.6 1.6 1.6	fB% ∣	1.6	1.6					1.5	1.6	1.6	
BOQ 4.7 1.4 11.7 5.6 1.2	BOQ	4.7	1.4					11.7	5.6	1.2	
QSRatio	QSRatio										
90th Percentile Output:	90th Percent	ile Outpu	t:								
IB%   1.7 1.8     1.7  1.7 1.8	IB%	1.7	1.8					1.7	1.7	1.8	
BOQ   5.2 1.5   12.8   6.2 1.4	BOQ	5.2	1.5					12.8	6.2	1.4	
QSRatio	QSRatio					l					
95th Percentile Output:	95th Percent	cile Outpu		ı				1 0		0 1	1
$1B_{8}$   2.0 2.1   1.9   2.0 2.1	IB%	2.0	2.1					1.9	2.0	2.1	
BOQ   5.9 1.8   14.5  7.1 1.6	BOQ	5.9	1.8					14.5	7.⊥	1.6	
USKatlo	USKATIO		L •			l					
	yoth Percent	Lite Outpu		I				<b>1</b> 1		2 C	I
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	TR4	2.5	∠.0 0.0					4.3 17 0		2.0 0 1	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		/.4	4.3					11.2	Ö. /	∠.⊥	
	Voracio			I		I			l		I

_____ERROR MESSAGES_____

No errors to report.

Analyst: Agency: Date: Period: Project	PB 6/25/ PM Pe ID: ]	2010 eak 2-290	Phas	se 1 St	cudy			Int Are Jur Yea	er.: E a Type isd: r : E	astbo : Ali xist:	ound Ra l other ing	amp & c area	Centr as	ral	Ave	enu
E/W St: 1	Eastk	bound	Ramp	)				N/S	St: C	entra	al Aver	nue				
				SIG	SNALI.	ZED	INT	CERSE	CTION	SUMM	ARY	 S 01				
		L	T	R	L	T T	June	R	L	T	R	L	T	R		
	j_														İ	
No. Lane	s	0	1	1	0	(	C	0	0	2	0	2	2	0		
Volume		289	0 L.L.	292						642	278	上 322	-1- 683			
Lane Wid	th	100	10.0	10.0						12.0	270	10.0	12.0			
RTOR Vol				187							41				ļ	
 Duration	(	).25		Area 1	Type:	 Al]	l ot	her	areas							
					Si	gnal	l Or	perat	ions							
Phase Con	mbina	ation	1	2	3		4		Tof+	5	6	7	8	3		
Thru			A					ИД	Thru	А						
Righ	t				ļ		Right	A								
Peds							ĺ		Peds	Х						
WB Left							ļ	SB	Left	_	A					
Thru Bigh	+								Thru Bight	A	A					
Peds	L								Peds	x	x					
NB Righ	t						İ	EB	Right							
SB Righ	t						İ	WB	Right							
Green			23.0							35.0	20.0	)				
Yellow			3.0							3.0	3.0					
AII KEU			1.0							L.U Cyc	cle Ler	ngth:	90.0		sec	cs
			Ir	ntersed	ction	Per	for	rmanc	e Summ	ary_						
Appr/	Lane	_	Ad	j Sat	Ra	atio	S		Lane	Grou	p App	proach	n			
Grp	Capac	, citv	FIOW (	s)	 v/c		a/0	-	Delav	LOS	 Dela	av LOS	 5			
mascoouli	u															
LT	392		153	35	0.7	8	0.2	26	40.5	D	37.1	L D				
R	350		137	70	0.3	2	0.2	26	27.7	С						
Westbound	d															
Northbou	nd															
TR	1262	2	315	56	0.7	3	0.4	10	25.2	С	25.2	2 C				
Southbou	nd															
L	661		297	74	0.5	1	0.2	22	31.3	С						
Т	2193	3	328	39	0.3	3	0.6	57	1.0	A	10.7	7 B				
	Inte	ersec	tion	Delay	= 20	.9	(se	ec/ve	h) I	nter	sectior	n LOS	= C			

I-290 Existing

Analyst:

Phone: Fax: E-Mail: _____OPERATIONAL ANALYSIS_____

Agency/Co.:PBDate Performed:6/25/2010Analysis Time Period:PM PeakIntersection:Eastbound Ramp & Central AvenuArea Type:All other areasJurisdiction:Jurisdiction:Analysis Year:ExistingProject ID:I-290 Phase 1 StudyE/W St:Eastbound RampN/S St:Central Avenue

_____VOLUME DATA______

	Eas	stbour	nd	We	stbou	ind	No	rthbo	und	Sou	uthbou	nd
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume	289	0	292					642	278	322	683	
% Heavy Veh	10	10	10	ĺ			Ì	10	10	10	10	ĺ
PHF	0.95	0.95	0.95				1 I	0.95	0.95	0.95	0.95	Í
PK 15 Vol	76	0	77					169	73	85	180	ĺ
Hi Ln Vol												
% Grade		0						0			0	
Ideal Sat		1900	1900					1900		1900	1900	
ParkExist												
NumPark												
No. Lanes	0	1	1	0	0	0	0	2	0	2	2	0
LGConfig		LT	R					TR		L	Т	
Lane Width		10.0	10.0					12.0		10.0	12.0	
RTOR Vol			187						41			
Adj Flow		304	111					925		339	719	
%InSharedLn												
Prop LTs		1.00	00					0.0	00		0.00	0
Prop RTs	0.	.000 1	1.000				0	.269		0	.000	
Peds Bikes	0			0			0		0			
Buses		0	0					0		0	0	
%InProtPhase	9											
Duration	0.25		Area 🗅	Гуре:	All	other	areas					

	Eastbou	ınd	We	stbou	nd	No	rthbo	und	So	uthbound	
	L T	R	L	Т	R	Ĺ	Т	R	L	T R	İ
Init Unmet	0.0	0.0				-  	0.0		_  <u></u>  0.0	0.0	 
Arriv. Type	3	3	İ				3		4	5	İ
Unit Ext.	3.0	3.0	İ				3.0		3.0	3.0	i
I Factor	1.00	0	İ			ĺ	1.00	0	ĺ	0.819	i
Lost Time	2.0	2.0	İ				2.0		2.0	2.0	İ
Ext of g	2.0	2.0	İ				3.0		2.0	3.0	İ
Ped Min g	3.2		İ	3.2		İ	3.2		İ		İ

## _____OPERATING PARAMETERS______OPERATING PARAMETERS_____

				PF	IASE	DATA_					
Pha	se Combination	1	2	3	4			5	6	7	8
EB	Left Thru Right Peds	A A A				NB	Left Thru Right Peds	A A X			
WB	Left Thru Right Peds					SB	Left Thru Right Peds	A X	A A X		
NB	Right					EB	Right				
SB	Right					WB	Right				
Gree Yel All	en : low : Red :	23.0 3.0 1.0			I			35.0 3.0 1.0	20.0 3.0 1.0		

Cycle Length: 90.0 secs

		VOLUN	IE ADJ	JUSTMEN	T AND	SAT	rur <i>i</i>	ATION	I FLO	WORK	SHEET		
Volume Adju	stment												
	East	tbour	nd	Wes	tboun	d		Nor	thbo	ınd	So	uthbou	nd
	L	Т	R	L	Т	R		L	Т	R	L	Т	R
Volume, V	289	0	292	-   					642	278	322	683	 
PHF	0.95	0.95	0.95	İ			İ		0.95	0.95	0.95	0.95	İ
Adj flow	304	0	111	İ			İ		676	249	339	719	İ
No. Lanes	j o	1	1	0	0	0	İ	0	2	0	2	2	0
Lane group	İ	LT	R	İ			i		TR		L	Т	j
Adj flow	j :	304	111	İ			i		925		339	719	j
Prop LTs	İ	1.00	00	İ			i		0.0	0 0	İ	0.00	0
Prop RTs	0.	000 1	L.000	İ			İ	0.	269		j o	.000	İ
LG So Lanes 0 fW fHV fG fP fBB fA fLU fRT fLT Sec. fLpb fRpb	LT 1900 1 0.933 0.909 1.000 1.000 1.000 1.000 1.000 1.000 0.952 1.000	R 1900 1 0.93 0.90 1.00 1.00 1.00 1.00 0.85	) 0 3 3 3 9 9 9 9 9 9 9 9 9 9 9 9 9	0	0		0	1 2 1 1 1 1 1 1 2 0 1 1 1 1 0 0 0 1 1	TR .900 .000 .000 .000 .000 .000 .000 .952 .960 .000	0	L 1900 2 0.93 0.90 1.00 1.00 1.00 1.00 0.97 0.95 1.00	T 1900 2 3 1.00 9 0.90 0 1.00 0 1.00 0 1.00 1 0.95 1.00 0 1.00 0 1.00 0 1.00	0 9 0 0 0 0 0 2 0 0 0
садит	1535	1370	0					1	156		2971	1.00 7.00	U
Sec	LJJJ	т э / С	,					5	110		2214	5205	
			0.1			тоа	T.T.O.T						

_____CAPACITY AND LOS WORKSHEET____

Capacity Analysis and Lane Group Capacity

	Appr/ Mvmt	Lane Group	Flo	Adj w Rate (v)	Adj Flow (	Sat Rate s)	F R (	low atio v/s)	Gre Rat (g/	enI io Ca <u>r</u> C)	Lane G Dacity (c)	roup v/c Ratio	
Eas	tbound Prot Perm Left												
	Prot Perm Thru	LT	3	04	15	35	#	0.20	0.	26 3	392	0.78	
Wes	Right tbound Prot Perm Left Prot Perm Thru	R	1	11	13	70		0.08	0.	26 3	350	0.32	
Nor	Right thboun Prot Perm Left Prot	d											
	Perm Thru	TR	9	25	31	56	#	0.29	0.	40 1	262	0.73	
Sou	Right thboun Prot	d											
	Perm Left Prot	L	3	39	29	74	#	0.11	0.	22 6	561	0.51	
	Perm Thru Right	Т	7	19	32	89		0.22	0.	67 2	2193	0.33	
Sum Tot	n of fl al los	ow rati t time	os for per cy	critic cle, I	cal la L = 11	ne gro .00 se	oup ec	s, Yc	= S	um (v/s	s) =	0.61	
Con	trol D	elav an		Determ.	inatio	10, n		AC	- (10	)(C)/(C	) _	0.09	
App Lan	or/ R	atios	Unf Del	Prog Adj	Lane Grp	Incre Facto	eme: or :	ntal Del	Res Del	Lane (	Group	Appro	ach
Grp	v/c	g/C	d1	Fact	Cap	k	(	d2	d3	Delay	/ LOS	Delay	LOS
Eas	stbound												
LT R Wes	0.78 0.32 tbound	0.26 0.26	31.1 27.1	1.000 1.000	392 350	0.32 0.11		9.4 0.5	0.0	40.5 27.7	D C	37.1	D
Nor	thboun	d											
TR	0.73	0.40	22.9	1.000	1262	0.29		2.2	0.0	25.2	С	25.2	С
Sou L	thboun 0.51	d 0.22	30.7	1.000	661	0.12		0.6	0.0	31.3	С		
Т	0.33	0.67	6.4	0.150	2193	0.11		0.1	0.0	1.0	A	10.7	В

SUPPLEMENTAL PERMITTED LT WORKSHEET for exclusive lefts Input EΒ WB NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 90.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo 1.000 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. _SUPPLEMENTAL PERMITTED LT WORKSHEET_ for shared lefts Input EΒ WB NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 90.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s)Opposing effective green time, go (s) Number of lanes in LT lane group, N

Intersection LOS = C

Intersection delay = 20.9 (sec/veh)

Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) 1.000 Proportion of LT in LT lane group, PLT 0.000 0.000 Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo 1.000 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min=fmin;max=1.00)flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET Permitted Left Turns EΒ WΒ  $^{\rm NB}$ SB Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Pedestrian flow rate, Vpedg (p/h) 0CCpedq Opposing queue clearing green, gq (s) Eff. ped. green consumed by opp. veh. queue, gq/gp OCCpedu Opposing flow rate, Vo (veh/h) OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion of left turns, PLT Proportion of left turns using protected phase, PLTA Left-turn adjustment, fLpb Permitted Right Turns Effective pedestrian green time, gp (s) 35.0 Conflicting pedestrian volume, Vped (p/h) 0 0 Conflicting bicycle volume, Vbic (bicycles/h) 0 Vpedg 0.000 OCCpedq 36.0 Effective green, g (s) Vbicg 0

OCCbicg OCCr Number Number	of cross of turni	-street ng lanes	receivin	g lanes,	Nrec			0.020 0.000 2 1
ApbT	01 041111	ing railed	, nearn					1.000
Proport Proport Right t	ion righ ion righ urn adju	t-turns, t-turns stment,	PRT using pr fRpb	otected	phase, P	RTA		0.269 0.000 1.000
		SU	PPLEMENT.	AL UNIFO	RM DELAY	WORKSHE	ET	
						E	BLT WBL	T NBLT SBLT
Cycle 1 Adj. LT v/c rat Protect Opposir Unoppos Red tim Arrival Protect Permitt XPerm XProt Case Queue a Queue a Residua Uniform	ength, C vol fro io from ed phase gqueue sed green he r=(C-g rate, q ed ph. d ed ph. d ed ph. d	m Vol Ad Capacity effectiv interva -gq-gu) a=v/(360 eparture eparture ing of g ing of u Qr d1	Justment Worksheve green e green 1, gu 0(max[X, rate, S rate, S reen arr nsaturat	Workshe et, X interval 1.0])) p=s/3600 s=s(gq+g ow, Qa ed green	90.0 et, v 1, g (s) , gq w)/(gu*3	sec		
		DELAY/	LOS WORK	SHEET WI	TH INITI	AL QUEUE		
Appro /	Initial	Dur.	Uniform	Delay	Initial	Final	Initial	Lane
Lane Group	Demand Q veh	Demand t hrs.	Unadj. ds	Adj. d1 sec	Param. u	Demand Q veh	Delay d3 sec	Delay d sec
Eastbou								
	0.0						0.0	
LT R	0.0 0.0	0.00 0.00	33.5 33.5	31.1 27.1	0.00 0.00	0.0 0.0	0.0 0.0	40.5 27.7
Westbou	ind							
	0.0						0.0	
	0.0 0.0						0.0 0.0	
Northbo	ound							
	0.0	0 0 0	0 7 0	00.0	0 0 0	0 0	0.0	05 0
'I'R	0.0	0.00	27.0	22.9	0.00	0.0	0.0	25.2
Southbo	ound							
L	0.0	0.00	35.0	30.7	0.00	0.0	0.0	31.3
Т	0.0 0.0	0.00	15.0	6.4	0.00	0.0	0.0 0.0	1.0
	Intersec	tion Del	ay 20.9	sec/v	eh I	ntersect	ion LOS	C
			BACK	OF QUEU	E WORKSH	EET		

	Eastbou	ınd	Wes	tbou	nd	Nor	thbound	Sou	thbou	nd
LaneGroup	LT	R					TR	L	Т	
Init Queue	0.0	0.0			ĺ		0.0	0.0	0.0	ĺ
Flow Rate	304	111			ĺ		485	174	377	ĺ
So	1900	1900			ĺ		1900	1900	1900	ĺ
No.Lanes	0 1	1 0	) 0		0	0	2 0	2	2	0
SL	1535	1370					1657	1531	1727	
LnCapacity	392	350			ĺ		662	340	1151	ĺ
Flow Ratio	0.2	0.1			ĺ		0.3	0.1	0.2	ĺ
v/c Ratio	0.78	0.32					0.73	0.51	0.33	
Grn Ratio	0.26	0.26					0.40	0.22	0.67	
I Factor	1.000	) [			ĺ		1.000		0.819	ĺ
AT or PVG	3	3					3	4	5	
Pltn Ratio	1.00	1.00					1.00	1.33	1.42	
PF2	1.00	1.00					1.00	0.95	0.17	
Q1	7.1	2.2			ĺ		10.3	3.6	0.7	ĺ
kB	0.4	0.4					0.5	0.3	0.6	
Q2	1.2	0.2					1.4	0.3	0.3	
Q Average	8.3	2.4					11.7	3.9	1.0	
Q Spacing	25.0	25.0					25.0	25.0	25.0	
Q Storage	0	0					0	0	0	
Q S Ratio										
70th Percent	cile Output	:								
fB%	1.2	1.2					1.2	1.2	1.2	
BOQ	9.8	2.9					13.7	4.7	1.2	
QSRatio										
85th Percent	ile Output	:								
fB%	1.5	1.6					1.5	1.6	1.6	
BOQ	12.6	3.8					17.6	6.1	1.6	
QSRatio										
90th Percent	ile Output	:								
fB%	1.7	1.8					1.6	1.7	1.8	
BOQ	13.8	4.2					19.0	6.8	1.7	
QSRatio										
95th Percent	ile Output	:								
fB%	1.9	2.0					1.8	2.0	2.1	
BOQ	15.6	4.9					21.2	7.8	2.0	
QSRatio										
98th Percent	ile Output	:						_ ·		
±B%	2.2	2.5					2.1	2.4	2.6	
BOQ	18.5	6.1					24.6	9.5	2.6	
QSRatio										

_____ERROR MESSAGES_____

No errors to report.

Analyst: Agency: Date: Period: Project E/W St:	PB 6/25/20 AM Peał ID: I-2 Flourno	010 c 290 Phase 1 by Street	Study	Int Are Jur Yea N/S	er.: F a Type isd: r : E St: L	lourno : CBD xistin aramie	oy Stre or Sim ng e Avenu	et & ilan	k Lara	amie	e Aven
			SIGNALIZED	INTERSE	CTION	SUMMAR	RY				
	I	Eastbound	Westb	ound	Nor	thbour	nd	Sou	lthbo	und	
	ĹГ	TR		R	L	Т	R	L	Т	R	İ
	_										l
No Lane	, g	0 0 0	   1	2 1	0	2		0	2	0	 
LCConfic		0 0 0	т. —	ק קידיו		- Т.Т	ů l	Ŭ	- TP	Ŭ	I
Volumo				200	1 1 0	122			601	10	
VOLUME	1+b			0 10 0		11 0				10	
Lane wid			110.0 10	.0 10.0		11.0			11.0	F	
RIOR VOI	-			80						5	
Duration	n 0.2	25 Are	а Туре: СВ	D or Sim	ilar						
			Signa	l Operat	ions						
Phase Co	mbinat	ion 1 2	3	4		5	6	7	1	8	
EB Left	:			NB	Left	A	A				
Thru	1				Thru	A	A				
Righ	nt				Right						
Peds	3				Peds	Х	Х				
WB Left		A		SB	Left						
Thru	1	A			Thru		A				
Righ	nt	A		Í	Right		A				
Peds	5	Х		İ	Peds		Х				
NB Righ	nt			EB	Right						
SB Righ	nt			WB	Right						
Green		20.0		·	-	10.0	47.0				
Yellow		3.0				0.0	3.0				
All Red		1.0				0.0	1.0				
						Cyc	le Leng	th:	85.0		secs
. <u> </u>		Inter	section Pe	rformanc	e Summ	ary					
Appr/	Lane	Adj Sa	t Rati	os	Lane	Group	Appr	oach	n		
Lane	Group	Flow Ra	te								
Grp	Capacit	cy (s)	v/c	g/C	Delay	LOS	Delay	LOS	5		
Eastbour	ıd										
Westboun	ıd										
L	316	1280	0.56	0.25	30.2	С					
LTR	516	2089	0.56	0.25	29.4	С	32.3	С			
R	227	920	0.72	0.25	39.7	D					
Northbou	ınd										
LT	1303	2663	0.15	0.68	4.8	A	4.8	A			
Southbou	ınd										
200000											
TR	1500	2657	0.51	0.56	11.6	В	11.6	В			
	Inters	section Dela	ay = 19.0	(sec/ve	h) I	nterse	ection	LOS	= B		

I-290 Existing

Phone: Fax: E-Mail: _____OPERATIONAL ANALYSIS_____ Analyst: Agency/Co.: PB Date Performed: 6/25/2010 Analysis Time Period: AM Peak Intersection: Flournoy Street & Laramie Aven Area Type: CBD or Similar Jurisdiction: Analysis Year: Existing Project ID: I-290 Phase 1 Study E/W St: Flournoy Street N/S St: Laramie Avenue

_____VOLUME DATA______

	Ea	stbou	nd	Wes	stbour	nd	No	rthbou	Ind	Sou	ithbou	ınd
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume	 			234	57	389	48	133		<u></u>	694	40
% Heavy Veh	ĺ			10	10	10	10	10		ĺ	10	10
PHF	ĺ			0.95	0.95	0.95	0.95	0.95		ĺ	0.95	0.95
PK 15 Vol				62	15	102	13	35			183	11
Hi Ln Vol												
% Grade					0			0			0	
Ideal Sat				1800	1800	1800		1800			1800	
ParkExist												
NumPark												
No. Lanes	0	0	0	1	2	1	0	2	0	0	2	0
LGConfig				L	LTI	R R		LT			TR	
Lane Width				10.0	10.0	10.0		11.0			11.0	
RTOR Vol						80						5
Adj Flow				177	291	163		191			768	
%InSharedLn				28		50						
Prop LTs					0.23	37		0.26	7		0.00	0 0
Prop RTs				0	.558	1.000	0	.000		0.	048	
Peds Bikes	0			10	00 (	0				10	) 0 (	C
Buses				5	0	0		0			5	
%InProtPhase	2						0.0					
Duration	0.25		Area 🗄	Гуре:	CBD o	or Sim	ilar					

	Ea	stbou	nd	We	stbou	nd	No	rthbo	und	So	uthbo	und
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Init Unmet					0.0	0.0	-   	0.0		·	0.0	 
Arriv. Type				3	3	3	İ	3		i	3	
Unit Ext.				3.0	3.0	3.0		3.0			3.0	
I Factor					1.00	0		0.96	6		1.00	0
Lost Time	ĺ			2.0	2.0	2.0	ĺ	2.0		İ	2.0	İ
Ext of g	ĺ			3.0	3.0	3.0	ĺ	3.0		İ	3.0	İ
Ped Min g		3.2		İ	3.8		İ			İ	3.8	İ

## _____OPERATING PARAMETERS______OPERATING PARAMETERS_____

				PH2	ASE	DATA_					
Pha	se Combination	1	2	3	4			5	6	7	8
EB	Left Thru Right					NB	Left Thru Right	A A	A A		
	Peds						Peds	Х	Х		
WB	Left Thru Right Peds	A A A X				SB	Left Thru Right Peds		A A X		
NB	Right					EB	Right				
SB	Right					WB	Right				
Gre Yel All	en low Red	20.0 3.0 1.0						10.0 0.0 0.0	47.0 3.0 1.0		

Cycle Length: 85.0 secs

		_VOLU	JME ADJU	JSTME	NT A	AND SAT	UF	RATION	J FLOV	WORK	SHEET_		
Volume Adju	stmen	t											
	Ea	stbou	ınd	We	stbo	ound		Noi	rthbou	ınd	Sou	lthbo	und
	L	Т	R	L	Т	R		L	Т	R	L	Т	R
Volume, V				234	57	389	 	48	133			694	40
PHF				0.95	0.9	95 0.95	5	0.95	0.95			0.95	0.95
Adj flow	ĺ			246	60	325	ĺ	51	140		ĺ	731	37
No. Lanes	0	0	0	1	. 2	2 1		0	2	0	0	2	0
Lane group				L	1	LTR R			LT			TR	
Adj flow				177	291	1 163			191			768	
Prop LTs	ĺ				0	.237	ĺ		0.26	57	ĺ	0.0	00
Prop RTs				C	.558	3 1.000	)	0.	.000		0	.048	ĺ
Saturation	Flow	Rate	(see Ez	khibi	t 10	5-7 to	de	etermi	ine th	ne adj	ustmei	nt fa	ctors)
Ea	stbou	nd	, I	Vestb	ound	f		North	ibound	ł	Soi	uthbo	und
LG			L	I	TR	R			LT			TR	
So			1800	) 18	00	1800		1	L800			180	0
Lanes O	0	0	1	2		1	0		2	0	0	2	0
fW			0.93	33 0.	933	0.933		(	).967			0.9	67
fHV			0.90	)9 0.	909	0.909		(	).909			0.9	09
fG			1.00	00 1.	000	1.000		1	L.000			1.0	00
fP			1.00	00 1.	000	1.000		1	L.000			1.0	00
fBB			0.98	30 1.	000	1.000		1	L.000			0.9	90
fA			0.90	000.	900	0.900		(	0.900			0.9	00
fLU			1.00	000.	952	1.000		(	).952			0.9	52
fRT				Ο.	916	0.850		1	L.000			0.9	93
fLT			0.95	50 0.	988			(	).987			1.0	00
Sec.								(	0.670				
fLpb			1.00	00 1.	000			(	).996			1.0	0 0
fRpb				0.	881	0.788		1	L.000			0.9	97
S			1280	20	89	920		2	2663			265	7
Sec.								1	L807				
			CAI	PACIT	'Y Al	ND LOS	WC	RKSH	EET				
<b>A</b>	- 1			N	~								

Capacity Analysis and Lane Group Capacity

Aj Mi	ppr/ vmt	Lane Group	Flo	Adj w Rate (v)	Adj Flow (	Sat Rate s)	] J	Flow Ratio (v/s)	Gre Rat (g/	en - cio Ca (C)	-Lane G apacity (c)	roup v/c Ratio	
 Eastl	bound												
P	rot												
P	erm												
L	eft												
P	rot												
P	erm												
 T	hru												
Ð	iaht												
Wogtl	hound												
ים משויים איים איים איים איים איים איים איים	bound wot												
P.													
P	erm	-	1		1.0	~ ~		0 1 4	0	0.5	216	0 5 6	
上。 —	eit	Ь	T	//	12	80		0.14	Ο.	25	316	0.56	
P:	rot												
P	erm												
T	hru	LTR	2	91	20	89		0.14	0.	25	516	0.56	
R	ight	R	1	63	92	0	#	0.18	0.	25	227	0.72	
Nort	hbound	1											
P	rot												
P	erm												
L	eft												
P	rot		1	91	26	63	#	0.07	0.	082	219	0.87	
P	erm		0		18	07		0.00	0.	600	1084	0.00	
T	hru	LT	1	91	_0				0	68	1303	0.15	
R	ight		-										
Sout1	hbound	3											
DOUC! D'	rot	A Contraction of the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second se											
г. D/	orm												
E C													
л. Л	ert												
P:	rot												
Pe	erm		_	<b>C O</b>	0.0				0		1 - 0 0	0 51	
.1.1	nru	TR	1	68	26	57	Ħ	0.29	0.	56	1500	0.51	
R	ight												
Sum (	of flo	ow rati	os for	critic	cal la	ne gro	buj	ps, Yc	= 5	Sum (v	/s) =	0.54	
Tota	l lost	t time	per cy	cle, I	<b>_</b> = 9.	00 se	ЗC						
Crit	ical f	Elow ra	te to	capacit	ly rat	io,		Хc	= (Yc	c)(C)/	(C-L) =	0.60	
a .	1 5	-	1	<b>D</b>									
Cont:	roi de	elay an	a LOS	Determ	Inatio	n						7~~~~	
rebr.	/ Ka	ALIOS		Prog	цапе	THOLE	= 1116		RES	цапе	Group	Abbr.o	acii
Lane			Del	Aaj	Grp	Facto	br	Del	Del				
Jrp	V/C	g/C	aı	Fact	Сар	К		a۷	α3	Del	ау LOS	Delay	LOS
 Eastl	bound												
Woati	hourd												
west! T		0 25	20 0	1 000	21 <i>6</i>	0 16		0 0	0 0	20 0	C		
ᆸ	0.50	0.25	∠0.U	1 000	510 E1C	0.10		∠.3 1 4	0.0	SU.∠		20.2	C
цт.К	0.56	0.25	∠8.U	1.000	976 976	0.16		105	0.0	29.4	C D	34.3	Ċ
к. 	0./2	∪.∠5	29.3	T.000	221	0.28		T0.2	0.0	39.1	D		
Nort	nbound	1											
LT	0.15	0.68	4.8	1.000	1303	0.11		0.1	0.0	4.8	А	4.8	A
													-
Sout	hbound	ł											
TD	0 51	0 5 5	11 0	1 0 0 0	1 - 0 0	0 1 0		0 0	0 0	11 -	-	11 6	P
л.К	0.51	0.56	⊥⊥.3	T.000	T200	0.12		0.3	υ.υ	⊥⊥.6	В	⊥⊥.6	В

SUPPLEMENTAL PERMITTED LT WORKSHEET for exclusive lefts Input EΒ WB NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 85.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo 0.952 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. _SUPPLEMENTAL PERMITTED LT WORKSHEET_ for shared lefts Input EΒ WB NBSB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 85.0 sec Total actual green time for LT lane group, G (s) 57.0 Effective permitted green time for LT lane group, g(s)51.0 48.0 Opposing effective green time, go (s) Number of lanes in LT lane group, N 2

Intersection LOS = B

Intersection delay = 19.0 (sec/veh)

Number of lanes in opposing approach, No 2 Adjusted LT flow rate, VLT (veh/h) 51 Proportion of LT in LT lane group, PLT 0.237 0.267 0.000 Proportion of LT in opposing flow, PLTo 0.00 Adjusted opposing flow rate, Vo (veh/h) 768 Lost time for LT lane group, tL 3.00 Computation LT volume per cycle, LTC=VLTC/3600 1.20 Opposing lane util. factor, fLUo 0.952 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) 9.52 qf=G[exp(-a * (LTC ** b))]-t1, qf <= q7.2 Opposing platoon ratio, Rpo (refer Exhibit 16-11) 1.00 Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] 0.44 gq, (see Exhibit C16-4,5,6,7,8) 10.69 40.31 gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)1.76 PTHo=1-PLTo 1.00 PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]0.83 EL1 (refer to Exhibit C16-3) 3.10 EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g 0.07 qdiff=max(qq-qf,0) 0.00 fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min = fmin; max = 1.00)0.43 flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT 0.670 For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET Permitted Left Turns EΒ WΒ NB SB Effective pedestrian green time, gp (s) 47.0 100 Conflicting pedestrian volume, Vped (p/h) Pedestrian flow rate, Vpedg (p/h) 180 0.090 0CCpedq Opposing queue clearing green, gq (s) 10.69 0.227 Eff. ped. green consumed by opp. veh. queue, gq/gp 0.080 OCCpedu Opposing flow rate, Vo (veh/h) 768 0.027 OCCr 2 Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn 1 ApbT 0.984 Proportion of left turns, PLT 0.267 Proportion of left turns using protected phase, PLTA 0.000 Left-turn adjustment, fLpb 0.996 Permitted Right Turns Effective pedestrian green time, gp (s) 20.0 47.0 Conflicting pedestrian volume, Vped (p/h) 100 100 Conflicting bicycle volume, Vbic (bicycles/h) 0 0 Vpedg 425 180 OCCpedq 0.213 0.090 Effective green, g (s) 21.0 48.0 Vbicg 0 0

OCCbicg OCCr Number Number	of cross of turnin	-street ng lanes	0.02	20 13	0.020 0.090 2 1								
OCCDig    0.020    0.020      OCCCr    0.213    0.090      Number of cross-street receiving lanes, Nrec    2    2      Number of turning lanes, Nturn    2    1      ApbT    0.788    0.946      Proportion right-turns using protected phase, PRTA    1.000    0.048      Proportion right-turns using protected phase, PRTA    0.000    0.000      Right turn adjustment, fRpb    1.000    0.997													
		SU	PPLEMENTA	AL UNIFO	RM DELAY	WORKSHE	ET						
Cycle 1 Adj. LT V/c rat. Protect Opposing Unoppos Red time Arrival Protect Permitt XPerm XProt Case Queue a Queue a Residua Uniform	ength, C vol from o from ( ed phase g queue e ed green e r=(C-g- rate, qa ed ph. de ed ph. de t beginn: t beginn: l queue, Delay, (	n Vol Ad Capacity effectiv interva -gq-gu) a=v/(360 eparture eparture ing of g ing of u Qr d1	justment Workshee ve green e green : 1, gu 0(max[X,: rate, Sp rate, Ss reen arro nsaturate	Workshe et, X interva interval 1.0])) p=s/3600 s=s(gq+g ow, Qa ed green	85.0 et, v 1, g (s) , gq u)/(gu*3) , Qu	E sec	BLT WBL'	r nblt	SBLT				
	Initial	Dur.	Uniform	Delay	Initial	Final	Initial	Lane					
Appr/ Lane Group	Demand Q veh	Demand t hrs.	Unadj. ds	Adj. d1 sec	Param. u	Demand Q veh	Delay d3 sec	Delay d sec					
Eastbou	nd												
	0.0 0.0 0.0						0.0 0.0 0.0						
Westbour	nd												
L I TTD	0.0	0.00	32.0	28.0	0.00	0.0	0.0	30.2					
R	0.0	0.00	32.0	29.3	0.00	0.0	0.0	39.7					
Northbo	und						0 0						
LT	0.0 0.0 0.0	0.00	13.5	4.8	0.00	0.0	0.0 0.0 0.0	4.8					
Southbo	und 0 0						0 0						
TR	0.0	0.00	18.5	11.3	0.00	0.0	0.0	11.6					

_____BACK OF QUEUE WORKSHEET____

	Eastbound	Westbound	Northbound	Southbound
LaneGroup		L LTR R	LT	TR
Init Queue		0.0 0.0 0.0	0.0	0.0
Flow Rate		177 152 163	100	403
So		1800 1800 1800	1800	1800
No.Lanes	0 0 0	1 2 1	0 2 0	
SL		1280 1097 920	1003	1395
LnCapacity		316 271 227	684	787
Flow Ratio		0.1 0.1 0.2	0.1	0.3
v/c Ratio		0.56 0.56 0.72	0.15	0.51
Grn Ratio		0.25 0.25 0.25	0.68	0.56
I Factor		1.000	0.966	1.000
AT or PVG		3 3 3	3	3
Pltn Ratio		1.00 1.00 1.00	1.00	1.00
PF2		1.00 1.00 1.00	1.00	1.00
Q1		3.7 3.1 3.5	0.8	5.8
kB		0.3 0.3 0.3	0.5	0.6
Q2		0.4 0.4 0.6	0.1	0.6
Q Average		4.1 3.5 4.2	0.8	6.4
Q Spacing		25.0 25.0 25.0	25.0	25.0
Q Storage		0 0 0	0	0
Q S Ratio		İ	İ	i i
70th Percent	tile Output:			
fB%		1.2 1.2 1.2	1.2	1.2
BOQ		4.8 4.2 5.0	1.0	7.6
QSRatio				
85th Percent	tile Output:			
fB%		1.6 1.6 1.6	1.6	1.5
BOQ		6.4 5.5 6.5	1.3	9.9
QSRatio				
90th Percent	tile Output:			
fB%		1.7 1.7 1.7	1.8	1.7
BOQ		7.0 6.1 7.2	1.5	10.9
QSRatio				
95th Percent	tile Output:			
fB%		2.0 2.0 2.0	2.1	1.9
BOQ		8.0 7.0 8.2	1.8	12.3
QSRatio				
98th Percent	tile Output:			
fB%		2.4 2.5 2.4	2.6	2.3
BOQ		9.9 8.7 10.1	2.2	14.8
QSRatio				

_____ERROR MESSAGES_____

No errors to report.

Analyst: Agency: PB Date: 6/25/201 Period: PM Peak Project ID: I-29 E/W St: Flournoy	0 0 Phase 1 St Street	Inter.: Flournoy Street & Laramie Area Type: CBD or Similar Jurisd: Year : Existing tudy N/S St: Laramie Avenue								e Aven
	SIC	GNALIZEI	) INTERSE	CTION	SUMMAR	RY				
Ea	stbound	Westh	ound	Nor	thbour	nd	Soi	uthbo	und	
L	TR	L I	R	L	Т	R	L	Т	R	ĺ
No. Lanes   0	0 0	1	2 1	0	2	0	0	2	0	
LGConfig		L	LTR R		LT			TR		
Volume		251 26	360	59	319			503	30	
Lane Width		10.0 10	0.0 10.0		11.0			11.0		
RTOR Vol			80						5	
Duration 0.25	Area 1	Type: CE	BD or Sim	ilar						
		Signa	al Operat	ions						
Phase Combinatio	n 1 2	3	4		5	6	7		8	
EB Left			NB	Left	A	A				
Thru				Thru	A	A				
Right				Right						
Peds				Peds	Х	Х				
WB Left	A		SB	Left						
Thru	A			Thru		A				
Right	A			Right		A				
Peas	Х			Peas		Х				
NB Right				Right						
SB Right	24 0		WB	Right	7 0	26 0				
Green	34.0				7.0	36.0				
IEIIOW	3.0				0.0	3.0				
AII KEU	1.0					L.U La Lanc	rth:	85 0		abaa
	Intersec	rtion Pe	rformanc	e Summ	arv		j CII •	05.0		5005
Appr/ Lane	Adi Sat	Rati	05	Lane	Group	 וממA	roact	 า		
Lane Group	Flow Rate							-		
Grp Capacity	(s)	v/c	g/C	Delay	LOS	Delay	Z LOS	5		
 Eastbound										
Waathound										
	1280	0 31	0 / 1	17 0	D					
L 907	2202	0.31	0.41	17.2	B	17 2	R			
R 421	1022	0.30	0.41	17.0	B	11.2	D			
Northbound	1022	0.55	0.11	± / • /	D					
LT 1062	2678	0.37	0.52	12.5	В	12.5	В			
Southbound										
TR 1156	2656	0.48	0.44	17.4	В	17.4	В			
Interce	ction Delav	= 16.1	.1 (sec/veh) Intersection LOS = B							

I-290 Existing

Phone: Fax: E-Mail: _____OPERATIONAL ANALYSIS_____ Analyst: Agency/Co.: PB Date Performed: 6/25/2010 Analysis Time Period: PM Peak Intersection: Flournoy Street & Laramie Aven CPD or Similar

Area Type:CBD or SimilarJurisdiction:Analysis Year:Project ID:I-290 Phase 1 StudyE/W St: Flournoy StreetN/S St: Laramie Avenue

_____VOLUME DATA_____

	Eas	stbou	nd	Westbound			Northbound			Southbound		ind
	L	Т	R	L L	Т	R	L	Т	R	L	Т	R
				0.51		260		210				
Volume				251	26	360	59	319			503	30
% Heavy Veh				10	10	10	10	10			10	10
PHF				0.95	0.95	0.95	0.95	0.95			0.95	0.95
PK 15 Vol				66	7	95	16	84			132	8
Hi Ln Vol				ĺ			İ			ĺ		İ
% Grade				İ	0			0			0	
Ideal Sat	ĺ			1800	1800	1800	İ	1800			1800	İ
ParkExist							İ					
NumPark	ĺ						İ					
No. Lanes	j o	0	0	1	2	1	0	2	0	0	2	0
LGConfig				L	LTH	R R	ĺ	LT			TR	ĺ
Lane Width	ĺ			10.0	10.0	10.0	İ	11.0			11.0	İ
RTOR Vol				ĺ		80	İ					5
Adj Flow				166	272	148	ĺ	398			555	ĺ
%InSharedLn	ĺ			37		50	İ					İ
Prop LTs				ĺ	0.35	59	İ	0.15	6	ĺ	0.00	) OC
Prop RTs				0	.542 1	1.000	0	.000		0	.047	İ
Peds Bikes	0			10	0 0 0	C				10	0 0 0	) j
Buses				5	0	0	Ì	0			5	İ
%InProtPhase	2						0.0					İ
Duration	0.25		Area 🗄	Гуре:	CBD d	or Sim	ilar					

	Eastbound			We	stbou	nd	No	rthbo	und	Southbound		
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Init Unmot	 						·					
					0.0	0.0		0.0			0.0	
Arriv. Type				3	3	3		3			3	
Unit Ext.				3.0	3.0	3.0		3.0			3.0	
I Factor					1.00	0		0.88	8		1.00	0
Lost Time				2.0	2.0	2.0		2.0			2.0	
Ext of g				3.0	3.0	3.0		3.0			3.0	
Ped Min g		3.2			3.8						3.8	

## _____OPERATING PARAMETERS______OPERATING PARAMETERS_____

				PH2	ASE	DATA_					
Pha	se Combination	1	2	3	4			5	6	7	8
EB	Left Thru Right Peds					NB	Left Thru Right Peds	A A X	A A X		
WB	Left Thru Right Peds	A A A X				SB	Left Thru Right Peds		A A X		
NB	Right					EB	Right				
SB	Right					WB	Right				
Gre Yel All	en low Red	34.0 3.0 1.0						7.0 0.0 0.0	36.0 3.0 1.0		

Cycle Length: 85.0 secs

		_VOLU	ME ADJU	JSTME	NT A	AND SAT	UF	RATION	J FLOW	WORK	SHEET		
Volume Adju	stment	t											
	Eas	stbou	nd	We	stbo	ound		Noi	rthbou	ınd	So	uthbo	und
	L	Т	R	L	Т	AND SATURATION FLOW WORKSHEET  Southbound  Southbound $R$ L  T  R  L  T $R$ L  T  R  L  T $G$ 360  59  319  503 $95$ 0.95  0.95  0.95 $2$ 1  0  2  0  2 $2$ 1  0  2  0  2 $2$ 1  0  2  0  2 $2$ 1  0  2  0  0  2 $2$ 1  0  2  0  0  2 $2$ 148  398  555  0.00  0 $2$ 148  398  555  0.00 $3$ 0.900  0.000  0.0047  0 $6$ 0.000  0.000  0.0047  0 $6$ 0.000  1800  1800  1800 $1$ 0  2  0  0  0 $0$ 0.900  0.900  <		R					
Volume, V				251	26	360		59	319			503	30
PHF				0.95	0.9	95 0.95	5	0.95	0.95			0.95	0.95
Adj flow				264	27	295		62	336			529	26
No. Lanes	0	0	0	1	. 2	2 1		0	2	0	0	2	0
Lane group				L	I	JTR R			LT			TR	
Adj flow				166	272	2 148			398			555	
Prop LTs					0.	359			0.15	56		0.0	00
Prop RTs				0	.542	2 1.000	)	0.	.000		0	.047	
Saturation : Ea	Flow H stbour	Rate nd	(see Ez	khibi Vestb	t 16 ound	5-7 to 1	de	etermi North	ine th nbound	ne adj [.] 1	ustme: So [:]	nt fa uthbo	ctors) und
LG			L	L	TR	R			LT			TR	
So			1800	) 18	00	1800		1	L800			180	0
Lanes O	0	0	1	2		1	0	2	2	0	0	2	0
fW			0.93	33 0.	933	0.933		(	).967			0.9	67
fHV			0.90	)9 0.	909	0.909		(	).909			0.9	09
fG			1.00	00 1.	000	1.000		1	L.000			1.0	00
fP			1.00	00 1.	000	1.000		1	L.000			1.0	00
fBB			0.98	30 1.	000	1.000		1	L.000			0.9	90
fA			0.90	0 0.	900	0.900		(	0.900			0.9	00
fLU			1.00	0 0.	952	1.000		(	).952			0.9	52
fRT				Ο.	919	0.850		1	L.000			0.9	93
fLT			0.95	50 0.	982			(	).992			1.0	00
Sec.								(	).737				
fLpb			1.00	00 1.	000			(	).996			1.0	00
fRpb				Ο.	932	0.875		1	L.000			0.9	97
S			1280	) 22	02	1022		4	2678			265	б
Sec.								1	L990				
			CAI	PACIT	'Y AN	ID LOS	WC	RKSH	CET				
Concaity An		~		1									

Capacity Analysis and Lane Group Capacity

A M	ppr/ vmt	Lane Group	Flo	Adj w Rate (v)	Adj Flow (s	Sat Rate s)	F (	Flow Ratio (v/s)	Gre Rat (g/	en - io C C)	-Lane G apacity (c)	roup v/c Ratio	
 East	bound												
P	rot												
P	erm												
L	eft												
P	rot												
P	erm												
- T	'hru												
т Р	iaht												
Woat	hound												
ncbc D	rot												
г D	IUL												
P	erm	Ŧ	1	cc	1 0 0			0 1 2	0	4 1	F 0 7	0 21	
ட் –	eit	Ц	T	66	128	30		0.13	υ.	4⊥	527	0.31	
P	rot												
P	erm												
Т	hru	LTR	2	72	220	2		0.12	0.	41	907	0.30	
R	ight	R	1	48	102	22	#	0.14	0.	41	421	0.35	
Nort	hbound	b											
P	rot												
P	erm												
т.	eft												
ц Ц	rot		1	26	265	18	#	0 05	Ο	047	126	1 00	
r D			1 2	20	207	0	#	0.05	0.	0 <del>1</del> / 1 <del>7</del> 1	120	1.00	
P	erm	- m	2	12	199	0		0.14	0.	4/1	936	0.29	
.T.	nru	Г.Т.	3	98					Ο.	52	1062	0.37	
R	ight	_											
Sout	hbound	b											
P	rot												
P	erm												
$\mathbf{L}$	eft												
P	rot												
P	erm												
Т	hru	TR	5	55	265	6	#	0.21	0.	44	1156	0.48	
R	ight												
 S11m	of fl		os for	criti		e aro					(g) =	0 40	
Tota		t time	per cv	rcle. 1	= 9  (	10 gro	° C	907 10	-	Jam (V	/ 0 /	0.10	
Cri+	ical	flow ra	te to	capacit	v rati	0.	-	Хc	= (Yc	;)(C)/	$(C - T_{1}) =$	0.45	
	ICUI .	LIOW IA		capacit	ly raci	,		210	- (10	./(C//	(С Ц) –	0.15	
Cont	rol De	elay an	d LOS	Determ:	ination	1							
Appr	/ Ra	atios	Unf	Prog	Lane	Incre	eme	ental	Res	Lane	Group	Appro	ach
Lane			Del	Adj	Grp	Facto	r	Del	Del	_			
Grp	v/c	a/C	d1	Fact	Сар	k		d2	d3	Del	av LOS	Delav	LOS
- <u> </u>													
East	bound												
Vest	bound												
с <u>,</u> Г	0 31	0 41	16 9	1 000	527	0.11		0.3	0 0	17 2	R		
_ 	0 20	0 41	16 8	1 000	907	0 11		0 2	0 0	17 0	R	17 2	в
2	0.25	0 41	17 0	1 000	421	0 11		0 5	0 0	17 7	B	т, <b>.</b> Д	
Nor+	hhour	4	± / • 4	1.000	1 4 1	J. II		5.5	0.0	±/•/	L L		
JIUV	incound	L											
r m	0 27	0 50	10 0	1 000	1060	0 1 1		0 2	0 0	10 F	п	10 F	Ð
цТ.	0.3/	0.52	12.3	T.000	TUDZ	0.11		0.2	0.0	12.5	В	12.5	в
<b>a</b> :		-											
Sout	nbound	d											
TR	0.48	0.44	17.1	1.000	1156	0.11		0.3	0.0	17.4	В	17.4	В

SUPPLEMENTAL PERMITTED LT WORKSHEET for exclusive lefts Input EΒ WB NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 85.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo 0.952 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. _SUPPLEMENTAL PERMITTED LT WORKSHEET_ for shared lefts Input EΒ WB NBSB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 85.0 sec Total actual green time for LT lane group, G (s) 43.0 Effective permitted green time for LT lane group, g(s)40.0 37.0 Opposing effective green time, go (s) Number of lanes in LT lane group, N 2

Intersection LOS = B

Intersection delay = 16.1 (sec/veh)

Number of lanes in opposing approach, No 2 Adjusted LT flow rate, VLT (veh/h) 62 Proportion of LT in LT lane group, PLT 0.359 0.156 0.000 Proportion of LT in opposing flow, PLTo 0.00 Adjusted opposing flow rate, Vo (veh/h) 555 Lost time for LT lane group, tL 3.00 Computation LT volume per cycle, LTC=VLTC/3600 1.46 Opposing lane util. factor, fLUo 0.952 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) 6.88 qf=G[exp(-a * (LTC ** b))]-t1, qf <= q4.3 Opposing platoon ratio, Rpo (refer Exhibit 16-11) 1.00 Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] 0.56 gq, (see Exhibit C16-4,5,6,7,8) 9.28 gu=g-gq if gq>=gf, or = g-gf if gq<gf 30.72 n=Max(gq-gf)/2,0)2.49 PTHo=1-PLTo 1.00 PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]0.45 EL1 (refer to Exhibit C16-3) 2.50 EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g 0.07 qdiff=max(qq-qf,0) 0.00 fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min = fmin; max = 1.00)0.56 flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT 0.737 For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET Permitted Left Turns EΒ WΒ NB SB Effective pedestrian green time, gp (s) 36.0 Conflicting pedestrian volume, Vped (p/h) 100 Pedestrian flow rate, Vpedg (p/h) 236 0.118 0CCpedq Opposing queue clearing green, gq (s) 9.28 0.258 Eff. ped. green consumed by opp. veh. queue, gq/gp OCCpedu 0.103 Opposing flow rate, Vo (veh/h) 555 0.048 OCCr 2 Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn 1 ApbT 0.971 Proportion of left turns, PLT 0.156 Proportion of left turns using protected phase, PLTA 0.000 Left-turn adjustment, fLpb 0.996 Permitted Right Turns Effective pedestrian green time, gp (s) 34.0 36.0 Conflicting pedestrian volume, Vped (p/h) 100 100 Conflicting bicycle volume, Vbic (bicycles/h) 0 0 Vpedg 250 236 OCCpedq 0.125 0.118 35.0 37.0 Effective green, g (s) Vbicg 0 0

OCCbicg OCCr							0.02	20 25	0.020 0.118
Number Number	of cross of turnin	-street ng lanes	receiving , Nturn	g lanes,	Nrec		2 2		2 1
ApbT Proport	ion right	t-turns.	PRT				0.8	75 00	0.929
OCCDig    0.020    0.020      OCCT    0.125    0.118      Number of cross-street receiving lanes, Nrec    2    2      Number of turning lanes, Nturn    2    1      ApbT    0.875    0.929      Proportion right-turns using protected phase, PRTA    0.000    0.001      Right turn adjustment, FRpb    1.000    0.047								0.000	
		SU	PPLEMENT	AL UNIFO	RM DELAY	WORKSHE	ET		
						E	BLT WBL'	T NBLT	SBLT
Adj. LT	vol from	n Vol Ad	justment	Workshe	85.0 et, v	sec			
v/c rat Protect	io from ( ed phase	Capacity effecti	Workshe ve green	et, X interva	1. a (s)				
Opposin	g queue e	effectiv	e green :	interval	, gq				
Unoppos Red tim	ed green e r=(C-q·	interva -qq-qu)	l, gu						
Arrival	rate, qa	a = v / (360)	0(max[X,	1.0]))					
Protect Permitt	ed ph. de ed ph. de	eparture eparture	rate, Si rate, Si	o=s/3600 s=s(gq+g	u)/(gu*3	600)			
XPerm	_	_			-				
Case									
Queue a Queue a Residua Uniform	t beginn: t beginn: l queue, Delav, o	ing of g ing of u Qr dl	reen arro nsaturato	ow, Qa ed green	, Qu				
	, i i i i i i i i i i i i i i i i i i i								
		ДЕЦАУ/	LUS WORK	SHEEL WI	TH INTIT.	AL QUEUE			
Appr/	Initial Unmet	Dur. Unmet	Uniform	Delay	Initial Queue	Final Unmet	Initial Queue	Lane Group	
Lane Group	Demand Q veh	Demand t hrs.	Unadj. ds	Adj. dl sec	Param. u	Demand Q veh	Delay d3 sec	Delay d sec	
Eastbou	nd								
	0.0						0.0		
	0.0						0.0		
Westbou	nd								
L L.TR	0.0	0.00	25.0 25.0	16.9 16.8	0.00	0.0	0.0	17.2 17.0	
R	0.0	0.00	25.0	17.2	0.00	0.0	0.0	17.7	
Northbo	und								
T.T	0.0	0.00	20.5	12.3	0.00	0.0	0.0	12.5	
	0.0	0.00	20.3	12.3	0.00	0.0	0.0	12.3	
Southbo	und						0 0		
TR	0.0	0.00	24.0	17.1	0.00	0.0	0.0	17.4	
	0.0						0.0		
	Intersect	tion Del	ay 16.1	sec/v	eh I:	ntersect	ion LOS	В	

_____BACK OF QUEUE WORKSHEET____

	Eastbound	Westbou	nd No	orthbound	Southbound
LaneGroup		L LTR	R	LT	TR
Init Queue		0.0 0.0	0.0	0.0	0.0
Flow Rate		166 142	148	209	291
So		1800 1800	1800	1800	1800
No.Lanes	0 0 0	1 2	1 0	2 0	0 2 0
SL		1280 1156	1022	1078	1394
LnCapacity		527 476	421	557	607
Flow Ratio		0.1 0.1	0.1	0.2	0.2
v/c Ratio		0.31 0.30	0.35	0.38	0.48
Grn Ratio		0.41 0.41	0.41	0.52	0.44
I Factor		1.000	İ	0.888	1.000
AT or PVG		3 3	3	3	3
Pltn Ratio		1.00 1.00	1.00	1.00	1.00
PF2		1.00 1.00	1.00	1.00	1.00
Q1		2.6 2.2	2.4	2.4	4.9
kВ		0.5 0.4	0.4	0.4	0.5
Q2		0.2 0.2	0.2	0.2	0.4
Q Average		2.9 2.4	2.6	2.7	5.4
Q Spacing		25.0 25.0	25.0	25.0	25.0
Q Storage		0 0	0	0	0
Q S Ratio		İ	ĺ		İ
70th Percent	tile Output:		·	·	
fB%		1.2 1.2	1.2	1.2	1.2
BOQ		3.4 2.9	3.1	3.2	6.4
QSRatio					
85th Percent	tile Output:				
fB%		1.6 1.6	1.6	1.6	1.6
BOQ		4.5 3.8	4.1	4.2	8.3
QSRatio					
90th Percent	tile Output:				
fB%		1.7 1.8	1.8	1.7	1.7
BOQ		5.0 4.3	4.6	4.7	9.1
QSRatio					
95th Percent	tile Output:				
fB%		2.0 2.0	2.0	2.0	1.9
BOQ		5.7 4.9	5.3	5.4	10.4
QSRatio					
98th Percent	tile Output:				
fB%		2.5 2.5	2.5	2.5	2.4
BOQ		7.2 6.1	6.6	6.7	12.6
QSRatio					

_____ERROR MESSAGES_____

No errors to report.

Analyst: Agency: Date: Period: Project	PB 6/25/20 AM Peak ID: I-2	Inter.: Lexington Street & Laramie Ave Area Type: CBD or Similar Jurisd: Year : Existing						Ave				
E/W St:	Lexingt	on Street			N/S	St: La	arami	e Aver	iue			
		SIC	GNALIZED	INT	ERSE	CTION S	SUMMAI	RY				
		astbound	Westb	ound		Nor	thboui	nd	Soi	uthbo [.]	und	
	Ц Ц	T R	Г. Т		R	Ц 	Л.	R	Ц	Т	R	
No. Lane	s	0 1 0	0	0	0	0	2	0	1	2	1	-¦
LGConfig		LTR	-	-	-		LTR	-	L	LT	R	i
Volume	25	11 3				17 1	155 2	182	234	582	50	İ
Lane Wid	th	12.0				:	11.5		11.0	11.0	11.0	
RTOR Vol		3					5	80			17	
Duration	0.2	5 Area 1	Гуре: СЕ	D or	Sim	ilar						
C			Signa	l Op	erat	ions						
Phase Co	mpinati	on L Z	3	4	ND	⊺ of+	5	6 7	/		8	
Thru		A				Thru		A				
Righ	t	A		ļ		Right		A				
Peds		Х		İ		Peds		Х				
WB Left					SB	Left	А	A				
Thru						Thru	A	A				
Righ	t					Right	A	A				
NB Righ	VE Right FR Right											
SB Righ	t				WB	Right						
Green	-	20.0		I		5	20.0	34.0	)			
Yellow		3.0					3.0	3.0				
All Red		1.0					0.0	1.0				
		Intersec	rtion Pe	rfor	manc	e Summa	Cyc. arv	le Ler	igth:	85.0	S	ecs
Appr/	Lane	Adj Sat	Rati	os	marro	Lane (	Group	 Apr	proach			
Lane	Group	Flow Rate										
Grp	Capacit	y (s)	v/c	g/C		Delay	LOS	Dela	ay LOS	5		
Eastboun	d											
LTR	352	1424	0.11	0.2	5	24.9	С	24.9	) C			
Westboun	d											
Northbou	nd											
LTR	940	2283	0.31	0.4	1	17.0	В	17.0	) В			
Southbour	nd											
L	590	1247	0.28	0.6	8	6.4	A					
LT	1573	2645	0.44	0.6	8	15.1	В	13.3	в В			
R	764	1120	0.05	0.6	8	10.8	В					
	Inters	ection Delay	= 14.5	(se	c/vel	h) II	nterse	ectior	1 LOS	= B		

I-290 Existing

Phone: Fax: E-Mail: _____OPERATIONAL ANALYSIS_____ Analyst: Agency/Co.: PB

Date Performed:	6/25/2010	
Analysis Time Period:	AM Peak	
Intersection:	Lexington Stre	eet & Laramie Ave
Area Type:	CBD or Similar	<u>c</u>
Jurisdiction:		
Analysis Year:	Existing	
Project ID: I-290 Phase	l Study	
E/W St: Lexington Street		N/S St: Laramie Avenue

_____VOLUME DATA______

	Eas	stbour	nd	Wes	stbour	nd	No	rthbou	und	Southbound		
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volumo	   25	11					   1 7	155	100	224		
			3					10	102	234	202	50
% Heavy Ven	110	ΤÜ	10				110	10	10	Ι I Ο	10	TO
PHF	0.95	0.95	0.95				0.95	0.95	0.95	0.95	0.95	0.95
PK 15 Vol	7	3	1				5	41	48	62	153	13
Hi Ln Vol												
% Grade		0					Ì	0		ĺ	0	ĺ
Ideal Sat		1800						1800		1800	1800	1800
ParkExist	ĺ						İ			İ		İ
NumPark	ĺ						Ì			ĺ		ĺ
No. Lanes	0	1	0	0	0	0	0	2	0	1	2	1
LGConfig		LTI	R					LTH	ર	L	LT	R
Lane Width		12.0						11.5		11.0	11.0	11.0
RTOR Vol			3						80			17
Adj Flow		38						288		167	692	35
%InSharedLn	ĺ						İ			32		İ
Prop LTs	ĺ	0.68	84				Ì	0.00	53	1.000	0.11	L4
Prop RTs	0.	.000					0	.372		0	.000 1	L.000
Peds Bikes	10	00	0	0			10	0 0	C	10	0 0 0	)
Buses		0						0		0	5	0
%InProtPhase	2									0.0		İ
Duration	0.25		Area 1	Гуре:	CBD d	or Sim:	ilar					

	Ea	Eastbound			Westbound			Northbound			Southbound		
	L	Т	R	L	Т	R	L	Т	R	L	Т	R	
Init Unmet		0.0		 			 	0.0			0.0	0.0	
Arriv. Type	ĺ	3		Ì			İ	3		1	1	1	
Unit Ext.		3.0		ĺ				3.0		3.0	3.0	3.0	
I Factor		1.00	0					1.00	0		0.89	7	
Lost Time		2.0						2.0		2.0	2.0	2.0	
Ext of g		3.0		ĺ			ĺ	3.0		2.0	3.0	3.0	
Ped Min g		3.8			3.2			3.8			3.8		

## _____OPERATING PARAMETERS______

	PHASE DATAPHASEPHASE											
Pha	se Combination	1	2	3	4			5	6	7	8	
EB	Left Thru Right Peds	A A A X				NB	Left Thru Right Peds		A A A X			
WB	Left Thru Right Peds					SB	Left Thru Right Peds	A A A X	A A A X			
NB	Right					EB	Right					
SB	Right					WB	Right					
Gre Yel All	en low Red	20.0 3.0 1.0			I			20.0 3.0 0.0	34.0 3.0 1.0			

Cycle Length: 85.0 secs

	VOLUME ADJ	USTMENT AND SATU	JRATION FLOW WORK	SHEET				
Volume Adju	stment							
	Eastbound	Westbound	Northbound	Southbound				
	LTR	LTR	LTR	LTR				
Volume, V	  25 11 3	-   	_  <u></u>  17	234 582 50				
PHF	0.95 0.95 0.95	i	0.95 0.95 0.95	0.95 0.95 0.95				
Adj flow	26 12 0		18 163 107	246 613 35				
No. Lanes	0 1 0	0 0 0	0 2 0					
Lane group	LTR		LTR	L LT R				
Adj flow	38		288	167 692 35				
Prop LTs	0.684		0.063	1.000 0.114				
Prop RTs	0.000		0.372	0.000 1.000				
Saturation	Flow Rate (see F	xhibit 16-7 to c	determine the adi	ustment factors)				
Ea	stbound	Westbound	Northbound	Southbound				
LG	LTR		LTR	L LT R				
So	1800		1800	1800 1800 1800				
Lanes 0	1 0 0	0 0 0	0 2 0	1 2 1				
fW	1.000		0.983	0.967 0.967 0.967				
fhV	0.909		0.909	0.909 0.909 0.909				
fG	1.000		1.000	1.000 1.000 1.000				
fP	1.000		1.000	1.000 1.000 1.000				
fBB	1.000		1.000	1.000 0.990 1.000				
fA	0.900		0.900	0.900 0.900 0.900				
fLU	1.000		0.952	1.000 0.952 1.000				
frt	1.000		0.944	1.000 0.850				
fLT	0.967		0.905	0.950 0.994				
Sec.				0.506 0.800				
fLpb	1.000		0.997	0.922 0.991				
fRpb	1.000		0.972	1.000 0.925				
S	1424		2283 1247 2645 1120					
Sec.				664 2127				
	CA	PACITY AND LOS W	WORKSHEET					
<b>A</b>		and a second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second sec						

Capacity Analysis and Lane Group Capacity

				Adj	Adj	Sat	F	'low	Gr	een	La	ane Gi	roup	
A	ppr/	Lane	Flo	w Rate	Flow	Rate	R	atio	Ra	tio	Capa	acity	v/c	
M	vmt	Group		(v)	( s	)	(	V/S)	(g	/C)		(C)	Ratio	
East	bound													
P	rot													
P	erm													
L	eft													
Р	rot													
P	erm													
- T	bru	T.TR	2	8	142	4	Ħ	0 03	0	25	ζı	52	0 1 1	
P	iaht		5	0	± 12	1	Π	0.05	0	. 25	5.	52	0.11	
Wogt	hound													
WESL.	bound													
P	rot													
Р -	erm													
Ц	eit													
P	rot													
P	erm													
Т	hru													
R	ight													
Nort	hbound	d												
P	rot													
P	erm													
L	eft													
P	rot													
Р	erm													
- T	hru	I.TR	2	88	228	3	#	0 13	0	41	94	40	0 31	
P	iaht	LI III	4	00	220	5	п	0.10	Ū	• • •	_	10	0.51	
Cout	hhound	4												
SOUL		J	1	<b>C D</b>	104	7		0 1 2	0	0 D F	20	<b>.</b>		
P	rot		Ţ	67	124	/		0.13	0	. 235	25	23	0.57	
P	erm	_	0		664			0.00	0	.447	29	97	0.00	
L	eit	L	1	67					0	.68	59	90	0.28	
P	rot		6	22	264	5	#	0.24	0	.235	62	22	1.00	
P	erm		7	0	212	7		0.03	0	.447	95	51	0.07	
T	hru	LT	6	92					0	.68	15	573	0.44	
R	ight	R	3	5	112	0		0.03	0	.68	76	54	0.05	
 Sum	of flo	ow rati	os for	critic	cal lan	e aro	 au	s, Yc	=	 Sum (	v/s	) =	0.39	
Tota	l lost	t time	per cy	cle, I	. = 9.0	0 se	ec							
Crit	ical :	flow ra	te to	capacit	y rati	ο,		Хc	= (Y	c)(C)	/ ( C-	-L) =	0.43	
				-	-					, , ,				
Cont	rol De	elay an	d LOS	Determi	Ination									
Appr -	/ Ra	atios	Unt	Prog	Lane	⊥ncre	eme	ental	Kes	Lan	e Gi	coup	Appro	ach
Lane			Del	Adj	Grp	Facto	r	Del	Del					
Grp	v/c	g/C	d1	Fact	Cap	k		d2	d3	De	lay	LOS	Delay	LOS
East	bound													
	0 1 1	0 05	04 0	1 000	250	0 1 1		0 1	0 0	0.4	0	a	24 0	a
глК	U.II	0.25	24.8	T.000	352	0.11		υ.⊥	0.0	24.	9	C	24.9	C
West	bound													
Nort	hbound	d												
	0 01	0.15	1.6	1 0 0 0	0.4.0	0 1 1		0 0	0 0		0	-		-
LTR	0.31	0.41	16.8	1.000	940	0.11		0.2	0.0	17.	U	В	17.0	В
Sout	hbound	d												
L	0.28	0.68	5.1	1.205	590	0.11		0.2	0.0	б.4		A		
LT	0.44	0.68	6.1	2.432	1573	0.11		0.2	0.0	15.	1	В	13.3	В

Intersection delay = 14.5 (sec/veh) Intersection LOS = B

SUPPLEMENTAL PERMITTED LT WORKSHEET for exclusive lefts Input ΕB WΒ NB SB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 85.0 sec Total actual green time for LT lane group, G (s) 57.0 Effective permitted green time for LT lane group, g(s) 38.0 Opposing effective green time, go (s) 35.0 Number of lanes in LT lane group, N 1 Number of lanes in opposing approach, No 2 Adjusted LT flow rate, VLT (veh/h) 167 Proportion of LT in LT lane group, PLT 1.000 Proportion of LT in opposing flow, PLTo 0.06 Adjusted opposing flow rate, Vo (veh/h) 288 Lost time for LT lane group, tL 4.00 Computation LT volume per cycle, LTC=VLTC/3600 3.94 Opposing lane util. factor, fLUo 1.000 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) 3.57 gf=G[exp(- a * (LTC ** b))]-tl, gf<=g 0.0 Opposing platoon ratio, Rpo (refer Exhibit 16-11) 1.00 Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] 0.59 qq, (see Exhibit C16-4,5,6,7,8) 4.59 gu=g-gq if gq>=gf, or = g-gf if gq<gf 33.41 n=Max(gq-gf)/2,0)2.29 PTHo=1-PLTo 0.94 PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]1.00 EL1 (refer to Exhibit C16-3) 1.74 EL2=Max((1-Ptho**n)/Plto, 1.0) 2.20 fmin=2(1+PL)/g or fmin=2(1+Pl)/g 0.11 gdiff=max(gq-gf,0) 4.59 fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) 0.51 flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** 0.506 Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. ____SUPPLEMENTAL PERMITTED LT WORKSHEET___ for shared lefts Input

		EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach					
Cycle length, C 85.0	sec				
Total actual green time for LT lane group, G (s)				34.0	57.0
Effective permitted green time for LT lane group,	g(s)			35.0	38.0
Opposing effective green time, go (s)				58.0	35.0
Number of lanes in LT lane group, N				2	2

2 2 Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) 18 78 0.684 Proportion of LT in LT lane group, PLT 0.063 0.114 Proportion of LT in opposing flow, PLTo 0.11 0.06 288 Adjusted opposing flow rate, Vo (veh/h) 692 Lost time for LT lane group, tL 3.00 3.00 Computation LT volume per cycle, LTC=VLTC/3600 0.43 1.84 1.000 0.952 0.952 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) 8.58 3.57 qf=G[exp(-a * (LTC ** b))]-t1, qf <= q18.1 0.0 Opposing platoon ratio, Rpo (refer Exhibit 16-11) 0.33 1.00 0.77 0.59 Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) 0.00 4.59 16.91 33.41 gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)0.00 2.29 PTHo=1-PLTo 0.89 0.94 0.14 0.31 PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]EL1 (refer to Exhibit C16-3) 2.87 1.89 EL2=Max((1-Ptho**n)/Plto, 1.0) 1.00 2.20 fmin=2(1+PL)/g or fmin=2(1+Pl)/g 0.07 0.07 qdiff=max(qq-qf,0) 0.00 4.59 fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min = fmin; max = 1.00)0.90 0.69 flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT 0.905 0.800 For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET Permitted Left Turns EΒ WΒ NB SB Effective pedestrian green time, gp (s) 34.0 34.0 Conflicting pedestrian volume, Vped (p/h) 100 100 Pedestrian flow rate, Vpedg (p/h) 250 250 0.125 0.125 0CCpedq Opposing queue clearing green, gq (s) 0.00 4.59 0.000 0.135 Eff. ped. green consumed by opp. veh. queue, gq/gp 0.125 0.117 OCCpedu Opposing flow rate, Vo (veh/h) 692 288 0.048 0.078 OCCr 2 Number of cross-street receiving lanes, Nrec 1 Number of turning lanes, Nturn 1 2 ApbT 0.952 0.922 Proportion of left turns, PLT 0.063 1.000 Proportion of left turns using protected phase, PLTA 0.000 0.000 Left-turn adjustment, fLpb 0.997 0.922 Permitted Right Turns 20.0 Effective pedestrian green time, gp (s) 34.0 57.0 Conflicting pedestrian volume, Vped (p/h) 100 100 100 Conflicting bicycle volume, Vbic (bicycles/h) 0 0 0 425 250 149 Vpedg 0.125 0.075 OCCpedq 0.213 35.0 58.0 Effective green, g (s) 21.0 Vbicg 0 0 0

OCCbicg	0.020	0.020	0.020
OCCr	0.213	0.125	0.075
Number of cross-street receiving lanes, Nrec	2	2	1
Number of turning lanes, Nturn	1	1	1
ApbT	0.873	0.925	0.925
Proportion right-turns, PRT	0.000	0.372	1.000
Proportion right-turns using protected phase, PRTA	0.000	0.000	0.000
Right turn adjustment, fRpb	1.000	0.972	1.000

_____SUPPLEMENTAL UNIFORM DELAY WORKSHEET_____

			EBLT	WBLT	NBLT	SBLT
Cycle length, C 85.	. 0	sec				
Adj. LT vol from Vol Adjustment Worksheet, v						167
v/c ratio from Capacity Worksheet, X						0.28
Protected phase effective green interval, g (	(s)					20.0
Opposing queue effective green interval, gq						4.59
Unopposed green interval, gu						33.41
Red time r=(C-g-gq-gu)						27.0
Arrival rate, $qa=v/(3600(max[X,1.0]))$						0.05
Protected ph. departure rate, Sp=s/3600						0.346
Permitted ph. departure rate, Ss=s(gq+gu)/(gu	1*36(	) ( 0				0.21
XPerm						0.25
XProt						0.31
Case						1
Queue at beginning of green arrow, Qa						1.25
Queue at beginning of unsaturated green, Qu						0.21
Residual queue, Qr						0.00
Uniform Delay, dl						5.1

_____DELAY/LOS WORKSHEET WITH INITIAL QUEUE______

In Appr/ Un	Initial Unmet	Dur. Unmet	Uniform	Delay	Initial Oueue	Final Unmet	Initial Oueue	Lane Group
Lane	Demand	Demand	Unadj.	Adi.	Param.	Demand	Delay	Delay
Group	Q veh	t hrs.	ds	d1 sec	u	Q veh	d3 sec	d sec
Eastbour	nd							
	0.0						0.0	
LTR	0.0	0.00	32.0	24.8	0.00	0.0	0.0	24.9
	0.0						0.0	
Westbour	nd							
	0.0						0.0	
	0.0						0.0	
	0.0						0.0	
Northbou	und							
	0.0						0.0	
LTR	0.0	0.00	25.0	16.8	0.00	0.0	0.0	17.0
	0.0						0.0	
Southbou	und							
L	0.0	0.00		5.1	0.00	0.0	0.0	6.4
LT	0.0	0.00	13.5	6.1	0.00	0.0	0.0	15.1
R	0.0	0.00	13.5	4.4	0.00	0.0	0.0	10.8
	Intersect	ion Dela	ay 14.5	sec/ve	eh Ir	ntersecti	ion LOS	В

_____BACK OF QUEUE WORKSHEET_____BACK OF QUEUE WORKSHEET_____
	Eastb	ound	T	Westbo	und	Nor	thbou	nd	Sou	thbou	ınd
LaneGroup	LTR						LTR		L	LT	R
Init Queue	0.0		Ì			ĺ	0.0	ĺ	0.0	0.0	0.0
Flow Rate	38						151		167	363	35
So	180	0	ĺ				1800	ĺ	1800	1800	1800
No.Lanes	0 1	0	0	0	0	0	2	0	1	2	1
SL	142	4	ĺ			ĺ	1199	ĺ	865	1210	1120
LnCapacity	352		Ì			ĺ	493	ĺ	590	826	764
Flow Ratio	0.0		İ			İ	0.1	ĺ	0.2	0.3	0.0
v/c Ratio	0.1	1	Ì			ĺ	0.31	ĺ	0.28	0.44	0.05
Grn Ratio	0.2	5	Ì			ĺ	0.41	ĺ	0.68	0.68	0.68
I Factor	1.0	00	İ			İ	1.000	ĺ		0.897	/
AT or PVG	3		Ì			ĺ	3	ĺ	1	1	1
Pltn Ratio	1.0	0	Ì			ĺ	1.00	ĺ	0.33	0.33	0.33
PF2	1.0	0	Ì			ĺ	1.00	ĺ	2.10	1.89	2.38
Q1	0.7		İ			İ	2.4	j	2.8	5.7	0.6
kB	0.4		Ì			ĺ	0.4	ĺ	0.4	0.5	0.5
Q2	0.0		İ			İ	0.2	j	0.2	0.4	0.0
Q Average	0.7		İ			İ	2.6	j	3.0	6.2	0.7
Q Spacing	25.	0	İ			İ	25.0	j	25.0	25.0	25.0
Q Storage	j o		Ì			ĺ	0	ĺ	0	0	0
Q S Ratio	ĺ		Ì			ĺ		ĺ	ĺ		İ
70th Percent	tile Outp	ut:									·
fB%	1.2						1.2		1.2	1.2	1.2
BOQ	0.9						3.1		3.6	7.3	0.8
QSRatio											
85th Percent	tile Outp	ut:									
fB%	1.6						1.6		1.6	1.5	1.6
BOQ	1.2						4.1		4.7	9.5	1.1
QSRatio											
90th Percent	tile Outp	ut:									
fB%	1.8						1.8		1.7	1.7	1.8
BOQ	1.3						4.5		5.2	10.4	1.2
QSRatio											
95th Percent	tile Outp	ut:									
fB%	2.1						2.0		2.0	1.9	2.1
BOQ	1.5						5.2		6.0	11.9	1.4
QSRatio								ĺ			ĺ
98th Percent	tile Outp	ut:									·
fB%	2.6						2.5		2.5	2.3	2.6
BOQ	1.9						6.5	ĺ	7.4	14.3	1.8
QSRatio								İ			ĺ

_____ERROR MESSAGES_____

Analyst: Agency: Date: Period: Project E/W St:	PB 6/25/20 PM Peak ID: I-2 W. Lexi	)10 c 290 Phase 1 St Ington Street	cudy	Inter.: W. Lexington Street & Laramie Area Type: CBD or Similar Jurisd: Year : Existing N/S St: Laramie Avenue							
		STO	NALTZED	TNTER	SECTION	SUMMA	RY				
	   E	Sit	Westb	ound	Nor	thbou	nd	Soi		und	
	L	T R	Ь Т	R	ļ Г	Т	R	L	т	R	İ
	İ				İ						_i
No. Lane	s	0 1 0	0	0 0	0	2	0	1	2	1	
LGConfig		LTR				LTR		L	LT	R	
Volume	119	98 111			62	262	101	360	328	65	
Lane Wid	.th	12.0				11.5	07	11.0	11.0	11.0	
RIOR VOL		19			I		21			26	I
Duration	0.2	25 Area 2	Type: CB	D or S	imilar						
Phase Co	mbinati	on 1 2	3	4	acrons	5	б	7	 {	 3	
EB Left		A	U	-     N	B Left	U	A			-	
Thru		А		İ	Thru		A				
Righ	.t	A		İ	Right		A				
Peds		Х			Peds		Х				
WB Left				S	B Left	A	A				
Thru				ļ	Thru	A	A				
Rign	.t				Right	A	A				
NB Righ	+			 	Peas B Right	X	X				
SB Righ	t.			I W	B Right						
Green	-	24.0		1		7.0	43.0	)			
Yellow		3.0				3.0	3.0				
All Red		1.0				0.0	1.0				
						Сус	le Ler	igth:	85.0	S	ecs
		Intersed	ction Pe	rforma	nce Summ	ary					
Appr/	Lane	Adj Sat	Rati	os	Lane	Group	App	roaci	ו		
Grn	Capacit	riow Rale		a/C	Delav		Dela				
								.у <u>но</u> .			
Eastboun	d										
LTR	395	1343	0.82	0.29	41.1	D	41.1	. D			
Westboun	.d										
Northbou	.nd										
LTR	1118	2159	0.37	0.52	12.5	В	12.5	б В			
Southbou	nd										
L	439	1283	0.52	0.64	8.6	А					
LT	1188	2602	0.42	0.64	16.9	В	14.2	2 В			
R	707	1113	0.06	0.64	12.7	В					
	Inters	section Delay	= 19.5	(sec/	veh) I	nters	ection	1 LOS	= B		

I-290 Existing

Phone: E-Mail: Fax:

_____OPERATIONAL ANALYSIS______

Analyst: Agency/Co.: PB Date Performed: 6/25/2010 Analysis Time Period: PM Peak Intersection: W. Lexington Street & Laramie Area Type: CBD or Similar Jurisdiction: Analysis Year: Existing Project ID: I-290 Phase 1 Study E/W St: W. Lexington Street N/S St: Laramie Avenue

_____VOLUME DATA_____

	Eastbound		Wes	stbou	nd	Northbound			Southbound			
	L 	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume	119	98	111				62	262	101	360	328	65
% Heavy Veh	10	10	10				10	10	10	10	10	10
PHF	0.95	0.95	0.95				0.95	0.95	0.95	0.95	0.95	0.95
PK 15 Vol	31	26	29				16	69	27	95	86	17
Hi Ln Vol												
% Grade		0						0			0	
Ideal Sat		1800						1800		1800	1800	1800
ParkExist												
NumPark												
No. Lanes	0	1	0	0	0	0	0	2	0	1	2	1
LGConfig		LTI	R					LTI	Я.	L	LT	R
Lane Width		12.0						11.5		11.0	11.0	11.0
RTOR Vol			19						27			26
Adj Flow		325						419		227	497	41
%InSharedLn										40		
Prop LTs		0.38	85					0.1	55	1.000	0.30	)5
Prop RTs	0	.298					0	.186		0	.000 1	L.000
Peds Bikes	10	00	C	0			10	00 (	C	10	00 0	)
Buses		0						0		0	5	0
%InProtPhase	9									0.0		
Duration	0.25		Area 1	Type:	CBD	or Sim	ilar					

	Ea	Eastbound		We	Westbound			Northbound			Southbound		
	L	Т	R	L	Т	R	L	Т	R	L	Т	R	
Init Unmet	<u></u>	0.0		-   			_	0.0		_	0.0	0.0	
Arriv. Type		3						3		1	1	1	
Unit Ext.	İ	3.0		İ			İ	3.0		3.0	3.0	3.0	
I Factor	ĺ	1.00	0	Ì			Ì	1.00	0	ĺ	0.95	5	
Lost Time	ĺ	2.0		Ì			Ì	2.0		2.0	2.0	2.0	
Ext of g	ĺ	3.0		Ì			Ì	3.0		2.0	3.0	3.0	
Ped Min g		3.8			3.2			3.8			3.8		

#### _____OPERATING PARAMETERS______OPERATING PARAMETERS_____

				PH.	ASE :	DATA_					
Pha	se Combination	1	2	3	4			5	б	7	8
EB	Left Thru Right Peds	A A A X				NB	Left Thru Right Peds		A A A X		
WB	Left Thru Right Peds					SB	Left Thru Right Peds	A A A X	A A X		
NB	Right					EB	Right				
SB	Right					WB	Right				
Gre Yel All	en low Red	24.0 3.0 1.0			I			7.0 3.0 0.0	43.0 3.0 1.0		

		VOLUN	ME ADJU	JSTMEN	T AND	SAT	URATIO	N FLO	W WORK	SHEET_		
Volume Adju	stment		_			_				1 .		
	Eas	tbour	nd	Wes	tboun	.d	No	rthbo	und	Sou	thbound	d
	L 	Т	R	L 	Т	R		Т	R	L 	T I	R
Volume, V	119	98	111	 			62	262	101	360	328 6	 5
PHF	0.95	0.95	0.95				0.95	0.95	0.95	0.95	0.95 0	.95
Adj flow	125	103	97	ĺ			65	276	78	379	345 43	1
No. Lanes	0	1	0	0	0	0	0	2	0	1	2	1
Lane group	ĺ	LTI	R	ĺ			Ì	LT	R	L	LT	R
Adj flow	j :	325		ĺ			Ì	419		227	497 43	1
Prop LTs	ĺ	0.38	85	ĺ			Ì	0.1	55	1.000	0.305	
Prop RTs	0.1	298		İ			j 0	.186		0.	000 1.	000
Saturation	Flow P	at 0	(	vhihit	16-7	to	dotorm	ing t	he adi	ustmon	t fact	arg)
Ea	stbound	d		Westbo	und ,	20	Nort	hboun	d	Sou	thbound	d
LG	LTR							LTR		L	LT	R
So	1800							1800		1800	1800	1800
Lanes O	1	0	0	0	0		0	2	0	1	2	1
fW	1.000							0.983		0.967	0.967	0.967
fHV	0.909							0.909		0.909	0.909	0.909
fG	1.000							1.000		1.000	1.000	1.000
fP	1.000							1.000		1.000	1.000	1.000
fBB	1.000							1.000		1.000	0.990	1.000
fA	0.900							0.900		0.900	0.900	0.900
fLU	1.000							0.952		1.000	0.952	1.000
frt	0.960							0.972			1.000	0.850
fLT	0.981							0.821		0.950	0.985	
Sec.										0.446	0.667	
fLpb	1.000							0.992		0.949	0.984	
fRpb	0.968							0.989			1.000	0.920
S	1343							2159		1283	2602	1113
Sec.										602	1761	
~			CAI	PACITY	AND	LOS	WORKSH	EET				
Capacity An	a⊥ysıs	and	Lane (	Jroup	Capac	ıty						

				Adj	Adj	Sat	E	Flow	Gre	een	La	ane Gi	roup	
Ar M-	ppr/	Lane	Flo	w Rate	Flow	Rate	F	Ratio	Rat	cio	Capa	acity	v/c	
M1	/mt	Group		(	(	s) 		(V/S) 	(g/	· (· )		(C)	Ratio	
East	oound													
Pı	rot													
Pe	erm													
Le	eft													
Pı	rot													
Pe	erm													
Tł	nru	LTR	3	25	13	43	#	0.24	0.	.29	39	95	0.82	
Ri	ight													
Westk	oound													
Pı	rot													
Pe	erm													
Le	eft													
Pı	rot													
Pe	erm													
Tł	nru													
R	ight													
North	nbound	f												
Pı	rot													
Pe	erm													
Le	eft													
Pi	rot													
Pe	-rm													
י ב דו	1r11	T'LL	4	19	21	59		0 19	0	52	1 -	118	0 37	
Ri	iaht	<b>D I I I</b>	-	17		55		0.19	0.			110	0.07	
South	hound	4												
Douci	rot	4	1	06	1 2	83	#	0 08	0	082	1 (	าค	1 0 0	
	2 U L		1	21	12 60	2 2	# #	0.00	0.	553	3.	22	1.00	
E C	5 ± 111 5 € +	т	- - -	21 27	00	2	π	0.20	0.	61	1	20	0.50	
	rot	Ш	2	27 17	26	0.2		0 00	0.	.01	т. О ^г	1 /	1 00	
P1 Dc			2	1 <del>1</del> 0 0	20	02 61		0.00	0.	.00Z	ے کے م	14 7/	1.00	
Pt ml		тт	ے ۸	03	Τ /	01		0.10	0.	61	9 1 -	100	0.29	
11 D -	liru Sabt	л	4	97 1	1 1	1 0		0 0 1	0.	.04 64	1 - 7 (	100 17	0.42	
K.	Igni	ĸ	4	T	ΤΤ	13		0.04	0.	.04	70	JI	0.06	
Sum o	of flo	ow rati	os for	critic	cal la	ne gro	our	ps, Yc	= 5	Sum (	v/s	) =	0.53	
Tota	L lost	t time	per cy	cle, I	<b>_</b> = 7.	00 se	ЭC							
Criti	ical i	Elow ra	te to	capacit	cy rat	io,		Хc	= (Yo	2)(C)	/ ( C-	-L) =	0.57	
	_	_	_											
Conti	rol De	elay an	d LOS	Determi	Inatio	n								
Appr	/ Ra	atios	Unf	Prog	Lane	Incre	eme	ental	Res	Lar	ne Gi	roup	Approa	ach
Lane			Del	Adj	Grp	Facto	or	Del	Del					
Grp	v/c	g/C	d1	Fact	Cap	k		d2	d3	De	elay	LOS	Delay	LOS
 Eastk	oound													
	0 0 0	0.55	0	1 0		0 5 -		10 -	0		-	_	4.7	_
ĿľR	0.82	0.29	27.9	1.000	395	0.36		13.1	0.0	41.	T	ט	41.1	D
Westk	oound													
North	nbound	đ												
LTR	0.37	0.52	12.3	1.000	1118	0.11		0.2	0.0	12.	5	В	12.5	в
											-			
South	nbound	b b									_			
L	0.52	0.64	7.2	1.060	439	0.12		1.0	0.0	8.6	)	A		
LT	0.42	0.64	7.7	2.161	1188	0.11		0.2	0.0	16.	9	В	14.2	В

Intersection delay = 19.5 (sec/veh) Intersection LOS = B

SUPPLEMENTAL PERMITTED LT WORKSHEET for exclusive lefts Input EΒ WΒ NBSB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 85.0 sec Total actual green time for LT lane group, G (s) 53.0 Effective permitted green time for LT lane group, g(s) 47.0 Opposing effective green time, go (s) 44.0 Number of lanes in LT lane group, N 1 Number of lanes in opposing approach, No 2 Adjusted LT flow rate, VLT (veh/h) 227 Proportion of LT in LT lane group, PLT 1.000 Proportion of LT in opposing flow, PLTo 0.16 Adjusted opposing flow rate, Vo (veh/h) 419 Lost time for LT lane group, tL 4.00 Computation LT volume per cycle, LTC=VLTC/3600 5.36 Opposing lane util. factor, fLUo 1.000 0.952 0.952 Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) 5.20 gf=G[exp(- a * (LTC ** b))]-tl, gf<=g 0.0 Opposing platoon ratio, Rpo (refer Exhibit 16-11) 1.00 Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] 0.48 qq, (see Exhibit C16-4,5,6,7,8) 5.71 gu=g-gq if gq>=gf, or = g-gf if gq<gf 41.29 n=Max(gq-gf)/2,0)2.86 PTHo=1-PLTo 0.84 PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]1.00 EL1 (refer to Exhibit C16-3) 1.97 EL2=Max((1-Ptho**n)/Plto, 1.0) 2.46 fmin=2(1+PL)/g or fmin=2(1+Pl)/g 0.09 gdiff=max(gq-gf,0) 5.71 fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) 0.45 flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** 0.446 Left-turn adjustment, fLT For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. 

SUPPLEMENTAL PERMITTED LT WORKS	ЧЕЕЛ. ^{———}											
for shared lefts												
Input												
	EB	WB	NB	SB								
Opposed by Single(S) or Multiple(M) lane approach												
Cycle length, C 85.0 sec												
Total actual green time for LT lane group, G (s)			43.0	53.0								
Effective permitted green time for LT lane group, g(s	)		44.0	47.0								
Opposing effective green time, go (s)			54.0	44.0								
Number of lanes in LT lane group, N			2	2								

2 2 Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) 65 151 0.385 Proportion of LT in LT lane group, PLT 0.155 0.305 Proportion of LT in opposing flow, PLTo 0.31 0.16 Adjusted opposing flow rate, Vo (veh/h) 497 419 Lost time for LT lane group, tL 3.00 3.00 Computation LT volume per cycle, LTC=VLTC/3600 1.53 3.57 1.000 0.952 0.952 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) 6.16 5.20 qf=G[exp(-a * (LTC ** b))]-t1, qf <= q10.0 0.0 Opposing platoon ratio, Rpo (refer Exhibit 16-11) 0.33 1.00 0.79 0.48 Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) 0.00 5.71 34.04 41.29 gu=g-gq if gq>=gf, or = g-gf if gq<gf n=Max(gq-gf)/2,0)0.00 2.86 0.69 0.84 PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]0.39 0.92 EL1 (refer to Exhibit C16-3) 2.35 2.17 EL2=Max((1-Ptho**n)/Plto, 1.0) 1.00 2.46 fmin=2(1+PL)/g or fmin=2(1+Pl)/g 0.06 0.08 qdiff=max(qq-qf,0) 0.00 5.71 fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min = fmin; max = 1.00)0.73 0.42 flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT 0.821 0.667 For special case of single-lane approach opposed by multilane approach, see text. * If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text. SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET Permitted Left Turns EΒ WΒ NBSB Effective pedestrian green time, gp (s) 43.0 43.0 Conflicting pedestrian volume, Vped (p/h) 100 100 Pedestrian flow rate, Vpedg (p/h) 197 197 0.099 0.099 0CCpedq Opposing queue clearing green, gq (s) 0.00 5.71 0.000 0.133 Eff. ped. green consumed by opp. veh. queue, gq/gp 0.099 0.092 OCCpedu Opposing flow rate, Vo (veh/h) 497 419 0.049 0.051 OCCr 2 Number of cross-street receiving lanes, Nrec 1 Number of turning lanes, Nturn 1 2 ApbT 0.951 0.949 Proportion of left turns, PLT 0.155 1.000 Proportion of left turns using protected phase, PLTA 0.000 0.000 Left-turn adjustment, fLpb 0.992 0.949 Permitted Right Turns 24.0 Effective pedestrian green time, gp (s) 43.0 53.0 Conflicting pedestrian volume, Vped (p/h) 100 100 100 Conflicting bicycle volume, Vbic (bicycles/h) 0 0 0 354 197 160 Vpedg 0.099 0.080 OCCpedq 0.177 Effective green, g (s) 44.0 54.0 25.0 Vbicg 0 0 0

OCCbicg	0.020	0.020	0.020
OCCr	0.177	0.099	0.080
Number of cross-street receiving lanes, Nrec	2	2	1
Number of turning lanes, Nturn	1	1	1
ApbT	0.894	0.941	0.920
Proportion right-turns, PRT	0.298	0.186	1.000
Proportion right-turns using protected phase, PRTA	0.000	0.000	0.000
Right turn adjustment, fRpb	0.968	0.989	1.000

_____SUPPLEMENTAL UNIFORM DELAY WORKSHEET_____

		EBLT	WBLT	NBLT	SBLT
Cycle length, C 85.0	sec				
Adj. LT vol from Vol Adjustment Worksheet, v					227
v/c ratio from Capacity Worksheet, X					0.52
Protected phase effective green interval, g $(s)$					7.0
Opposing queue effective green interval, gq					5.71
Unopposed green interval, gu					41.29
Red time r=(C-g-gq-gu)					31.0
Arrival rate, $qa=v/(3600(max[X,1.0]))$					0.06
Protected ph. departure rate, Sp=s/3600					0.356
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3	600)				0.19
XPerm					0.38
XProt					0.96
Case					1
Queue at beginning of green arrow, Qa					1.95
Queue at beginning of unsaturated green, Qu					0.36
Residual queue, Qr					0.00
Uniform Delay, dl					7.2

_____DELAY/LOS WORKSHEET WITH INITIAL QUEUE______

Appr/	Initial Unmet	Dur. Unmet	Uniform	Delay	Initial Oueue	Final Unmet	Initial Oueue	Lane Group
Lane	Demand	Demand	Unadj.	Adj.	Param.	Demand	Delay	Delay
Group	Q veh	t hrs.	ds	d1 sec	u	Q veh	d3 sec	d sec
Eastbour	nd							
	0.0						0.0	
LTR	0.0	0.00	30.0	27.9	0.00	0.0	0.0	41.1
	0.0						0.0	
Westbour	nd							
	0.0						0.0	
	0.0						0.0	
	0.0						0.0	
Northbou	und							
	0.0						0.0	
LTR	0.0	0.00	20.5	12.3	0.00	0.0	0.0	12.5
	0.0						0.0	
Southbou	und							
L	0.0	0.00		7.2	0.00	0.0	0.0	8.6
LT	0.0	0.00	15.5	7.7	0.00	0.0	0.0	16.9
R	0.0	0.00	15.5	5.9	0.00	0.0	0.0	12.7
	Intersect	ion Dela	ay 19.5	sec/ve	eh Ir	ntersecti	ion LOS	В

_____BACK OF QUEUE WORKSHEET_____BACK OF QUEUE WORKSHEET_____

LameGroup       LTR       LTR       LTR       L LT       R         Init Queue       0.0       0.0       0.0       0.0       0.0       0.0         Flow Rate       325       220       227       261       41         So       1800       1800       1800       1800       1800       1800         No.Lanes       0       1       0       0       0       2       0       1       2       1         SL       1343       1133       690       982       1113       13       690       982       1113         LnCapacity       395       587       439       623       707       0.52       0.42       0.06         Grn Ratio       0.29       0.37       0.52       0.42       0.06         J Factor       1.000       1.000       0.55       0.4       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64		Eastbound	Westbou	ind	Northbound	Southbour	nd
Init Queue       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0	LaneGroup	LTR			LTR	L LT I	r.
Flow Rate       325       220       227       261       41         So       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800 <td< td=""><td>Init Queue</td><td>0.0</td><td></td><td>Ì</td><td>0.0</td><td>0.0 0.0</td><td>0.0</td></td<>	Init Queue	0.0		Ì	0.0	0.0 0.0	0.0
So       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       1800       <	Flow Rate	325		Ì	220	227 261	41
No.Lanes       0       1       0       0       0       2       0       1       2       1         SL       1343       1133       690       982       1113         LnCapacity       395       587       439       623       707         Flow Ratio       0.2       0.3       0.3       0.0       0.2       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.64       0.955       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1 </td <td>So</td> <td>1800</td> <td></td> <td>ĺ</td> <td>1800</td> <td>1800 1800 1</td> <td>1800  </td>	So	1800		ĺ	1800	1800 1800 1	1800
SL       1343       1133       690       982       1113         LnCapacity       395       587       439       623       707         Flow Ratio       0.2       0.2       0.3       0.0       0         v/c Ratio       0.82       0.37       0.52       0.42       0.06         Grn Ratio       0.29       0.52       0.64       0.64       0.64         I Factor       1.000       1.000       0.955       0.33       0.33       0.30       0.35         AT or PVG       3       1       1       1       1       1       1       1         Q1       7.1       3.1       3.3       4.1       0.8       0.4       0.5       0.4       0.5       0.5       0.2       0.0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0 <td>No.Lanes</td> <td>0 1 0</td> <td>0 0</td> <td>0</td> <td>0 2 0</td> <td>1 2 3</td> <td>1  </td>	No.Lanes	0 1 0	0 0	0	0 2 0	1 2 3	1
LnCapacity       395       587       439       623       707         Flow Ratio       0.2       0.3       0.3       0.0       0.0         Grn Ratio       0.29       0.52       0.64       0.64       0.64         I Factor       1.000       0.955       0.95       0.955       0.955         AT or PVG       3       1       1       1       1         Q1       7.1       3.1       3.3       1.3       1.3         Q2       1.5       0.3       0.4       0.5       0.4       0.5         Q2       1.5       0.3       0.4       0.5       0.4       0.5       0.4       0.5       0.4       0.5       0.4       0.5       0.4       0.5       0.4       0.5       0.4       0.5       0.5       0.2       0.5       0.2       0.5       0.2       0.5       0.2       0.5       0.2       0.5       0.5       0.5       0.2       0.5       0.2       0.5       0.2       0.5       0.2       0.5       0.2       0.2       0.2       0.5       0.5       0.5       0.5       0.5       0.5       0.5       0.5       0.5       0.5       0.5       0.5 <td>SL</td> <td>1343</td> <td></td> <td>Ì</td> <td>1133</td> <td>690 982 3</td> <td>1113  </td>	SL	1343		Ì	1133	690 982 3	1113
Flow Ratio       0.2       0.3       0.3       0.0         v/c Ratio       0.82       0.37       0.52       0.42       0.64         I Factor       1.000       0.52       0.64       0.64       0.64         I Factor       1.000       0.33       0.33       0.33       0.52         AT or PVG       3       1       1       1       1         Pltn Ratio       1.00       0.33       0.33       0.33       0.33         PF2       1.00       1.00       1.63       1.74       2.11         Q1       7.1       3.1       3.3       4.1       0.8         Q2       1.5       0.3       0.4       0.5       0.5       0.4       0.5         Q2       1.5       0.3       0.4       0.5       0.4       0.8       0.0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0<	LnCapacity	395		ĺ	587	439 623 '	707
v/c Ratio       0.82       0.37       0.52       0.42       0.06         Grn Ratio       0.29       0.64       0.64       0.64       0.64         AT or PVG       3       1       1       1       1         Pltn Ratio       1.00       0.33       0.33       0.33       0.33         PF2       1.00       1.00       1.63       1.74       2.11         Q1       7.1       3.1       3.3       4.1       0.8         KB       0.4       0.5       0.4       0.5       0.5         Q2       1.5       0.3       0.4       0.5       0.5         Q2       1.5       0.3       0.4       0.5       0.5         Q2       1.5       0.3       0.4       0.5       0.5         Q2       1.5       0.3       0.4       0.5       0.5         Q2       1.5       0.3       0.4       0.5       0.5       0.0         Q Storage       0       0       0       0       0       0       0         QStorage       0       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       <	Flow Ratio	0.2		ĺ	0.2	0.3 0.3	0.0
Grn Ratio       0.29       0.52       0.64 0.64 0.64         I Factor       1.000       0.955         AT or PVG       3       1       1         Pltn Ratio       1.00       0.33 0.33 0.33       0.33         PF2       1.00       1.00       1.63 1.74 2.11         Ql       7.1       3.1       3.3       4.1 0.8         KB       0.4       0.5       0.4 0.5       0.5         Q2       1.5       0.3       0.4 0.5       0.5         Q2       1.5       0.3       0.4 0.5       0.5         Q2       2.5.0       2.0       2.5.0       2.5.0       2.5.0         Q Storage       0       0       0       0       0       0         Q Storage       0       0       0       0       0       0       0         QStardo       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2 <td>v/c Ratio</td> <td>0.82</td> <td></td> <td>Ì</td> <td>0.37</td> <td>0.52 0.42</td> <td>0.06</td>	v/c Ratio	0.82		Ì	0.37	0.52 0.42	0.06
I Factor       1.000       0.955         AT or PVG       3       1       1         Pltn Ratio       1.00       0.33       0.33       0.33         PF2       1.00       1.00       1.63       1.74       2.11         Ql       7.1       3.1       3.3       4.1       0.8         KB       0.4       0.5       0.4       0.5       0.5       0.2         Q2       1.5       0.3       0.3       0.3       0.0       0       0         Q Average       8.7       3.4       3.7       4.4       0.8       0.2       0.3       0.4       0.3       0.0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0	Grn Ratio	0.29		ĺ	0.52	0.64 0.64	0.64
AT or PVG       3       1       1       1         Pltn Ratio       1.00       0.33       0.33       0.33         PF2       1.00       1.00       1.63       1.74       2.11         Q1       7.1       3.1       3.3       4.1       0.8         kB       0.4       0.5       0.4       0.5       0.5         Q2       1.5       0.3       0.4       0.5       0.5         Q Average       8.7       3.4       3.7       4.4       0.8         Q Spacing       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0	I Factor	1.000		İ	1.000	0.955	İ
Pltn Ratio       1.00       1.00       0.33 0.33 0.33         PF2       1.00       1.00       1.63 1.74 2.11         Q1       7.1       3.1       3.3 4.1 0.8         KB       0.4       0.5       0.4 0.3 0.01         Q2       1.5       0.3       0.4 0.3 0.0         Q Average       8.7       3.4       3.7 4.4 0.8         Q Spacing       25.0       25.0 25.0 25.0 25.0 25.0       25.0         Q Storage       0       0       0       0         Q Statio       1.2       1.2 1.2 1.2 1.2       1.2         70th Percentile Output:       1.2       1.2 1.2 1.2       1.2         RSRatio       1.6       1.6 1.6 1.6 1.6       1.6         BOQ       13.2       5.3 5.8 6.9 1.3       3         QSRatio       1.7       1.7 1.7 1.7 1.8       3         BOQ       14.4       5.9       6.5 7.6 1.4         QSRatio       1.7       1.7 1.7 1.7 1.8       1.4         BOQ       16.2       6.8       7.4 8.7 1.7         95th Percentile Output:       6.8       7.4 8.7 1.7       1.7         IB%       1.9       2.0       2.0 2.0 2.1       2.1         BOQ	AT or PVG	3		Ì	3	1 1 :	1
PF2       1.00       1.00       1.63       1.74       2.11         Q1       7.1       3.1       3.3       4.1       0.8         kB       0.4       0.5       0.4       0.5       0.5         Q2       1.5       0.3       0.4       0.3       0.4       0.8         Q Average       8.7       3.4       3.7       4.4       0.8         Q Storage       0       0       0       0       0       0         Q Storage       0       0       0       0       0       0       0       0         Q Storage       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0 </td <td>Pltn Ratio</td> <td>1.00</td> <td></td> <td>ĺ</td> <td>1.00</td> <td>0.33 0.33</td> <td>0.33</td>	Pltn Ratio	1.00		ĺ	1.00	0.33 0.33	0.33
Q1       7.1       3.1       3.3       4.1       0.8         kB       0.4       0.5       0.4       0.5       0.5         Q2       1.5       0.3       0.4       0.5       0.5         Q Average       8.7       0.3       0.4       0.5       0.5         Q Spacing       25.0       25.0       25.0       25.0       25.0       25.0         Q Storage       0       0       0       0       0       0       0         Q Storage       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0	PF2	1.00		ĺ	1.00	1.63 1.74	2.11
kB       0.4       0.5       0.4       0.5       0.5       0.4       0.5       0.5         Q2       1.5       0.3       0.4       0.3       0.0       0         Q Average       8.7       3.4       3.7       4.4       0.8       0         Q Spacing       25.0       25.0       25.0       25.0       25.0       0       0       0       0       0         Q Storage       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0	Q1	7.1	İ	j	3.1	3.3 4.1	0.8
Q2       1.5       0.3       0.4       0.3       0.0         Q Average       8.7       3.4       3.7       4.4       0.8         Q Spacing       25.0       25.0       25.0       25.0       25.0       25.0         Q Storage       0       0       0       0       0       0       0       0         Q Storage       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0 <t< td=""><td>kB</td><td>0.4</td><td></td><td>ĺ</td><td>0.5</td><td>0.4 0.5</td><td>0.5</td></t<>	kB	0.4		ĺ	0.5	0.4 0.5	0.5
Q Average       8.7       3.4       3.7       4.4       0.8         Q Spacing       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0	Q2	1.5		ĺ	0.3	0.4 0.3	0.0
Q Spacing       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0       25.0	Q Average	8.7		ĺ	3.4	3.7 4.4	0.8
Q Storage       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0	Q Spacing	25.0		ĺ	25.0	25.0 25.0 2	25.0
Q S Ratio	Q Storage	0		Ì	0	0 0	0
70th Percentile Output:         fB%       1.2         BOQ       10.2         QSRatio         85th Percentile Output:         fB%       1.5         BOQ       13.2         QSRatio         90th Percentile Output:         fB%       1.6         90th Percentile Output:         fB%       1.7         BOQ       14.4         90th Percentile Output:         fB%       1.7         BOQ       14.4         QSRatio         95th Percentile Output:         fB%       1.9         BOQ       16.2         QSRatio         98th Percentile Output:         fB%       2.0         98th Percentile Output:         fB%       2.2         98th Percentile Output:         fB%       2.2         900       19.2	Q S Ratio			Ì			ĺ
fB%       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.2       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1.0       1	70th Percent	tile Output:					
BOQ       10.2       4.0       4.4       5.2       1.0         QSRatio       85th Percentile Output:       1.6       1.6       1.6       1.6       1.6         BOQ       13.2       5.3       5.8       6.9       1.3       90th Percentile Output:       1.7       1.7       1.7       1.8       90th Percentile Output:       1.8       90th Percentile Output:       1.7       1.7       1.7       1.8       1.4       90th Percentile Output:       1.8       1.4       90th Percentile Output:       1.7       1.7       1.7       1.4       1.4       90th Percentile Output:       1.4       1.9       1.7       1.7       1.7       1.8       1.4       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.7       1.7       1.7       1.7       1.7       1.7       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1.9 <td>fB%</td> <td>1.2</td> <td></td> <td></td> <td>1.2</td> <td>1.2 1.2</td> <td>1.2  </td>	fB%	1.2			1.2	1.2 1.2	1.2
QSRatio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 </td <td>BOQ</td> <td>10.2</td> <td></td> <td></td> <td>4.0</td> <td>4.4 5.2</td> <td>1.0  </td>	BOQ	10.2			4.0	4.4 5.2	1.0
85th Percentile Output:         fB%       1.5         BOQ       13.2         QSRatio       5.3         90th Percentile Output:         fB%       1.7         BOQ       14.4         QSRatio       5.9         95th Percentile Output:         fB%       1.9         SQ       16.2         QSRatio       6.8         98th Percentile Output:         fB%       2.2         80Q       19.2	QSRatio						
fB%       1.5       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.6       1.7       1.7       1.7       1.7       1.7       1.7       1.8       1.8       1.9       1.6       1.4       1.6       1.4       1.6       1.4       1.9       1.6       1.4       1.6       1.4       1.6       1.4       1.6       1.4       1.7       1.8       1.7       1.8       1.7       1.9       1.9       1.0       1.9       1.9       1.6       2.0       2.0       2.1       1.9       1.6       1.7       1.9       1.9       1.9       1.9       1.9       1.9       1.9       1	85th Percent	tile Output:					
BOQ       13.2       5.3       5.8       6.9       1.3         QSRatio       90th Percentile Output:         fB%       1.7       1.7       1.7       1.8         BOQ       14.4       5.9       6.5       7.6       1.4         QSRatio       95th Percentile Output:       1.9       2.0       2.0       2.1         BOQ       16.2       6.8       7.4       8.7       1.7         QSRatio       98th Percentile Output:       2.5       2.5       2.4       2.6         BOQ       19.2       8.4       9.1       10.6       2.1	fB%	1.5			1.6	1.6 1.6 1	1.6
QSRatio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 </td <td>BOQ</td> <td>13.2</td> <td></td> <td></td> <td>5.3</td> <td>5.8 6.9</td> <td>1.3  </td>	BOQ	13.2			5.3	5.8 6.9	1.3
90th Percentile Output:         fB%       1.7         BOQ       14.4         QSRatio       6.5         95th Percentile Output:         fB%       1.9         BOQ       16.2         QSRatio       6.8         98th Percentile Output:         fB%       2.2         BOQ       19.2	QSRatio						
fB%       1.7       1.7       1.7       1.7       1.8         BOQ       14.4       5.9       6.5       7.6       1.4         QSRatio       95th Percentile Output:       2.0       2.0       2.1       1.7         BOQ       16.2       6.8       7.4       8.7       1.7       1.7         QSRatio       98th Percentile Output:       2.5       2.5       2.4       2.6         BOQ       19.2       8.4       9.1       10.6       2.1	90th Percent	tile Output:					
BOQ       14.4       5.9       6.5       7.6       1.4         QSRatio       95th Percentile Output:       2.0       2.0       2.1         fB%       1.9       2.0       2.0       2.1         BOQ       16.2       6.8       7.4       8.7       1.7         QSRatio       98th Percentile Output:       2.5       2.5       2.4       2.6         BOQ       19.2       8.4       9.1       10.6       2.1	fB%	1.7			1.7	1.7 1.7 1	1.8
QSRatio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 </td <td>BOQ</td> <td>14.4</td> <td></td> <td></td> <td>5.9</td> <td>6.5 7.6</td> <td>1.4  </td>	BOQ	14.4			5.9	6.5 7.6	1.4
95th Percentile Output:         fB%       1.9         BOQ       16.2         QSRatio       6.8         98th Percentile Output:         fB%       2.2         BOQ       19.2	QSRatio						
fB%       1.9       2.0       2.0       2.1         BOQ       16.2       6.8       7.4       8.7       1.7         QSRatio       98th Percentile Output:       2.5       2.5       2.4       2.6         BOQ       19.2       8.4       9.1       10.6       2.1	95th Percent	tile Output:					
BOQ       16.2       6.8       7.4       8.7       1.7       98th         QSRatio       98th Percentile Output:       2.5       2.5       2.4       2.6       8.4         BOQ       19.2       8.4       9.1       10.6       2.1       10.6       10.6	fB%	1.9			2.0	2.0 2.0 2	2.1
QSRatio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 </td <td>BOQ</td> <td>16.2</td> <td></td> <td></td> <td>6.8</td> <td>7.4 8.7</td> <td>1.7  </td>	BOQ	16.2			6.8	7.4 8.7	1.7
98th Percentile Output:         fB%       2.2         BOQ       19.2         8.4       9.1         10.6       2.1	QSRatio						
fB%       2.2       2.5       2.5       2.4       2.6         BOQ       19.2       8.4       9.1       10.6       2.1	98th Percent	tile Output:					
BOQ 19.2 8.4 9.1 10.6 2.1	fB%	2.2			2.5	2.5 2.4	2.6
	BOQ	19.2			8.4	9.1 10.6	2.1
QSRatio	QSRatio						

_____ERROR MESSAGES_____

2001 I-290 AM Cicero_Flournoy 0716.txt HCS+: Signalized Intersections Release 5.4

Anal yst: Inter.: Flournoy Street & Cicero Avenu Agency: PB Area Type: CBD or Similar 6/25/2010 Date: Juri sd. Period: AM Peak Year : Existing Project ID: I-290 Phase 1 Study E/W St: Flournoy Street N/S St: Cicero Avenue SIGNALIZED INTERSECTION SUMMARY Eastbound Southbound Westbound Northbound R L Т R L Т L Т R L Т R No. Lanes 0 0 0 1 2 0 2 2 0 0 2 1 LGConfi g Т Т R L L Т 8 361 1401 602 304 Vol ume 4 Lane Width 11.0 12.0 12.0 11.0 11.0 11.0 **RTOR Vol** 120 **Duration** 0.25 Area Type: CBD or Similar Signal Operations 3 4 | Phase Combination 1 2 5 7 8 6 EB Left NB Left А А Thru Thru А А Ri ght Ri ght Peds Peds Х Х WB Left А SB Left А Thru Thru А Ri ght Ri ght А Х Peds Х Peds Ri ght NB FB Ri ght SB Ri <u>ğ</u>ht WB Ri <u>ğ</u>ht 23.0 43.0 Green 8.0 3.0 Yellow 3.0 3.0 ALL Red 1.0 0.0 1.0 Cycle Length: 85.0 secs Intersection Performance Summary Appr/ Lane Adj Sat Ratios Lane Group Approach Flow Rate Lane Group g/C Grp Capaci ty (s) v/c Delay LOS Del ay LOS Eastbound Westbound C C 1399 0.01 0.25 L 346 24.2 Т 0.01 0.25 24.2 24.2 С 693 2804 Northbound 588 2421 0.65 0.61 22.0 С L Т 1169 1911 1.26 139.8 F 115.7 F 0.61 Southbound 1911 Т 922 0.69 0.48 18.9 В 17.9 В 0.38 0.48 В R 515 1067 14.3 Intersection Delay = 85.2(sec/veh) Intersection LOS = F

HCS+: Signalized Intersections Release 5.4

I-290 Existing

Phone: E-Mail:

Anal yst: Agency/Co. :	РВ
Date Performed:	6/25/2010
Analysis Time Period:	AM Peak
Intersection:	Flournov Street & Cicero Avenu
Area Type:	CBD or Šimilar
Jurisdiction:	
Analysis Year:	Existing
Project ID: I-290 Phase	1 Study
E/W St: Flournoy Street	N/S St: Cicero Avenue

### _VOLUME DATA_

	Eas   L	tboui T	nd R	Wes L	stbound T	d R	Nor L	rthboui T	nd   R	South L T	bound R
Volume % Heavy Veh PHF PK 15 Vol Hi In Vol				4 10 0. 95 1	8 10 0. 95 2		361 10 0. 95 95	1401 10 0. 95 369		60 10 0. 15	2 304 10 95 0.95 8 80
% Grade I deal Sat ParkExist NumPark				1800	0 1800		1800	0 1300		0 13	00 1800
No. Lanes LGConfig Lane Width RTOR Vol	0	0	0	1 L 12. 0	2 T 12. 0	0	2 L 11. 0	2 T 11. 0	0	0 11	2 1 T R .0 11.0 120
Adj Flow %InSharedLn				4	8		380	1475		63	4 194
Prop LTs Prop RTs Peds Bikes	0			0.	0.000 000	)	1. 000 0.	0.00 000	0	0 0.00 200	. 000 0 1. 000 0
Buses %InProtPhase				0	0		0 0. 0	12		12	0
Duration	0. 25		Area	Гуре:	CBD or	^ Simi	lar		ľ		I
				OPEF	RATI NG	PARA	<b>IETERS</b>	5			

		East L	boun T	d R	We   L	stbound T	d R	Nor   L	rthbo T	ound R	So   L	uthbo T	ound   R	
Ini Arri Uni I Fa Los Ext Ped	t Unmet v. Type t Ext. actor t Time of g Min g	3	3. 2		0.0 3 3.0 2.0 0.0	0.0 3 3.0 1.000 2.0 0.0		0.0 3 3.0 2.0 0.0	0.0 3 3.0 0.77 2.0 0.0	/5	-	0.0 3 3.0 0.87 2.0 0.0 4.5	0.0 3 3.0 2 2.0 0.0	
						_PHASE	DATA_							
Phas	se Combir	nation	1	2	3	4			5	6	7		8	
EB	Left Thru Right						NB	Left Thru Ri ght	A A	A A				
	Peds							Peds	Х	Х				
WB	Left Thru Right Peds		A A X				SB	Left Thru Right Peds	A A X					

EB Right

WB Right Page 2

NB Right SB Right

Green	23.0	43.0	8.0
Yellow	3.0	3.0	3.0
AII Red	1.0	0.0	1.0

<b></b>	VOLI	JME ADJUSTN	IENT AND S	SATUF	RATIO	ON FLOW WO	RKSHEET	
Volume Adj	ustment							
	Eastbo	und   M	lest <u>b</u> ound	_	l No	orthbound	Sout	hbound
		RL	1 1	۲		I R	L	і к
Volume, V PHF Adj flow No. Lanes Lane group Adj flow Prop LTs Prop RTs	0 0	0 4 0 4 4	8 5 0.95 8 1 2 ( T 8 0.000 0.000	)	361 0.95 380 2 L 380 1.00	1401 5 0. 95 1475 2 2 0 T 1475 00 0. 000 0. 000	6 0 6 0 6 0.0	02 304 . 95 0. 95 34 194 2 1 T R 34 194 0. 000 00 1. 000
Saturation	Flow Rate	(see Exhib	bit 16-7	to de	etern	nine the a	djustment Sout	factors)
IG	astbound		T	1	NOT	T	5001	T R
So Lanes 0 fW fHV fG fP fBB fA fLU fRT fLT Sec. fLpb fRph	0 0	1800 1 1 2 1.000 1 0.909 0 1.000 1 1.000 1 1.000 1 0.900 0 1.000 0 1.000 1 0.950 1	800 . 000 . 909 . 000 . 000 . 000 . 900 . 900 . 900 . 000 . 000 . 000	18 2 0. 1. 1. 1. 0. 0. 0. 0.	967 909 000 000 900 900 971 950 205 922	1300 2 0 0.967 0.909 1.000 1.000 0.976 0.900 0.952 1.000 1.000 1.000 1.000	0	1300       1800         2       1         0.967       0.967         0.909       0.909         1.000       1.000         1.000       1.000         0.976       1.000         0.900       0.900         0.902       1.000         1.000       0.850         1.000       1.000         1.000       0.882
s s		1399 2	2804	24	121	1911		1.000 0.862
Sec		10// 2	004	52	721	1711		1711 1007
		CAPACI	TY AND LO	DS WO	DRKSH	IEET		
Capacity A	nalysis and	d Lane Grou	ip Capaci ¹	ty				
		Adj	Adj Sat	FIC	W	Green	Lane Gr	oup
Appr/	Lane Fi			Rai		Ratio (		V/C Dotio
WIVIIIL	Group	$(\mathbf{v})$	(5)	(\/	(5)	(g/C)	$(\mathcal{C})$	Ratio
Eastbound Prot Perm Left Prot Perm Thru Right								
Westbound								
Prot Perm Left Prot	L	4	1399	# O.	00	0. 25	346	0. 01
Thru Right	Т	8	2804	0.	00	0.25	693	0. 01
Northbound		10.4	0.401	~	<b>o</b> (		0.46	0.00
Prot		134	2421	0.	06 47	0.141	342	0.39
Perm   oft	I	∠40 380	522	υ.	4/	0.471 0.61	240 588	0.65
Prot	-	000				0.01	550	0.00
Perm Thru	Т	1475	1911	# 0.	77	0. 61	1169	1.26

Ri South Pr Ee Pr Pe Th Ri	ght bound ot erm eft ot erm nru ght	T R	6 1	200 34 94	191 192 106	90 AM Ci 11 57	cero_F 0. 33 0. 18	0. 4 0. 4	y 0716. 48 9: 48 5:	. txt 22 15	0. 69 0. 38	
Sum c Total Criti	of flo lost cal f	w rati time low ra	os for per cy te to	critic cle, l capacit	cal lar _ = 12. ty rati	ne group 00 sec o,	os, Yc Xc	= Su = (Yc)	um (v/s) )(C)/(C	) = -L) =	0. 77 0. 90	
Contr Appr/ Lane Grp	rol De ⁄ Ra <u>v/c</u>	lay and tios g/C	d LOS Unf Del d1	Determi Prog Adj Fact	natior Lane Grp Cap	lncreme Factor k	ental Del d2	Res Del d3	Lane G	roup	Approa Del ay	ach LOS
Eastb	ound											
Westb L T	ound 0. 01 0. 01	0. 25 0. 25	24.2 24.2	1.000 1.000	346 693	0. 11 0. 11	0. 0 0. 0	0. 0 0. 0	24.2 24.2	C C	24.2	С
North L T	1bound 0. 65 1. 26	0. 61 0. 61	20. 1 16. 5	1. 000 1. 000	588 1169	0. 22 0. 50	1. 9 123. 3	0. 0 0. 0	22. 0 139. 8	C F	115.7	F
South T	nbound 0. 69	0. 48	17.0	1.000	922	0. 26	1.9	0.0	18. 9	В	17.9	В
R	0.38	0. 48	13.9	1.000	515	0. 11	0.4	0.0	14.3	В		
	I	nterse	ction	del ay =	= 85.2	(sec/\	/eh)	Inters	section	LOS =	= F	
				SUPPLEN	IENTAL	PERMI TI	FED LT	WORKSI	IEET			
Input	t				for e	excl usi \	/e left	ts		WD	ND	<b>CD</b>
Oppos Cycle Total Effec Oppos Numbe Adjus Propo Adjus Lost Compu LT vo Oppos Oppos	sed by actu actu sing e er of sted L ortion sted o time utatio olume sing l	Single th, C al gree permit ffecti lanes lanes lanes T flow of LT of LT pposing for LT n per cyo ane ut low, V	e(S) o en tim ted grev in LT in opporte in LT in opporte g flow lane cle, L il. fac olc=Voo	r Multi e for L een time lane gr osing a VLT ( lane g posing rate, group, TC=VLT( ctor, f C/[3600	ple(M) T lane ne for oup, N approac veh/h) group, flow, Vo (ve tL C/3600 LUo D(No)fl	) Iane a e group, LT Iane (s) N ch, No PLT PLTo eh/h)	approad 85.0 G (s) group	ch sec b, g(s)	0. 952		54. 0 40. 0 41. 0 2 380 1. 000 0. 00 634 6. 00 8. 97 0. 952 7. 86	0. 952
gf=G[ Oppos gq, ( gu=g- n=Max PTHo= PL*=F EL1 ( EL2=M	pipposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)7.86 $f=G[exp(-a * (LTC ** b))]-tl, gf<=g$											

2001 I-290 AM Cicero_Flourno fmin=2(1+PL)/g or fmin=2(1+PI)/g gdiff=max(gg-gf_0)	y 0716.	txt	0.20	
<pre>fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (mi n=fmi n; max=1.00) fl t=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdi ff/g]/[1+PL(EL2 or fl t=[fm+0.91(N-1)]/N** Laft turn adjustment fl T</pre>	-1)], (1	fmin<=	0.20 fm<=1.0	00)
Lett-turn adjustment, TLI			0.205	
For special case of single-lane approach opposed by mu see text. * If PL>=1 for shared left-turn lanes with N>1. then a	ltilane ssume o	e appr de-fac	oach, to	
<pre>left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive le For special case of multilane approach opposed by sing or when gf&gt;gq, see text.</pre>	ft-turi le-lane	n Lane e appr	s, flt: oach	=fm.
SUPPLEMENTAL PERMITTED LT WORKSH	EET			
Input				
Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 85.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate VLT (ver /b)	EB	WB	NB	SB
Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation		0.000	0.000	0.000
Li volume per cycle, LIC=VLIC/3600 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b)]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C), 0] gq, (see Exhibit C16-4, 5, 6, 7, 8) gu=g-gq if gq>=gf, or = g-gf if gq <gf n=Max(gq-gf)/2, 0) PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)] EL1 (refer to Exhibit C16-3)</gf 	0. 952		0. 952	0. 952
EL2=Max((1-Ptho**n)/Plto, 1.0) fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin; max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2 or flt=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT	-1)], (1	fmi n<=	fm<=1.(	00)
For special case of single-lane approach opposed by mu see text.	ltilane	e appr	oach,	
<pre>* If PI&gt;=1 for shared left-turn lanes with N&gt;1, then a left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive le For special case of multilane approach opposed by sing or when gf&gt;gq, see text.</pre>	ssume ( ft-turn le-lane	de-fac n Lane e appr	to s, flt: oach	=fm.
SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS Permitted Left Turns	WORKSI	HEET		
Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Pedestrian flow rate, Vpedg (p/h) OCCpedg Opposing queue clearing green, gq (s) Eff. ped. green consumed by opp. veh. queue, gq/gp OCCpedu	EB	WB	NB 43.0 200 395 0.198 3.99 0.093 0.188	SB

Opposing flow rate, Vo (veh/h) OCCr Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn ApbT Proportion of left turns, PLT Proportion of left turns using protected phase, PLTA Left-turn adjustment, fLpb Permitted Right Turns Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Conflicting bicycle volume, Vbic (bicycles/h) Vpedg OCCpedg Effective green, g (s) Vbicg OCCbicg OCC									43.0 200 0 395 0.198 41.0
Vbicg OCCbicg OCCr Number o Number o ApbT Proporti	of cross of turnin	-street ng Lanes	receivin , Nturn PRT	g Lanes,	Nrec				0 0.020 0.198 2 1 0.882 1.000
Proportion right-turns, PRT Proportion right-turns using protected phase, PRTA Right turn adjustment, fRpb									0.000
		SU	PPLEMENT	AL UNIFO	RM DELAY	WORKSHE	EI		
Cycle le Adj. LT v/c rati Protecte Opposing Unoppose Red time Arrival Protecte Permitte XPerm	ength, C vol from ed phase g queue ed green e r=(C-g rate, q ed ph. do ed ph. do	n Vol Adj Capacity effective interval -gq-gu) a=v/(3600 eparture eparture	justment Workshev ve green e green I, gu O(max[X, rate, S rate, S	Workshe et, X interva interval 1.0])) p=s/3600 s=s(gq+g	85.0 et, v I, g (s) , gq u)/(gu*3	E sec 600)	BLT WBLT	<ul> <li>NBLT</li> <li>380</li> <li>0.65</li> <li>12.0</li> <li>3.99</li> <li>36.01</li> <li>33.0</li> <li>0.11</li> <li>0.673</li> <li>0.16</li> <li>1.33</li> </ul>	SBLT
XProt Case5Queue at beginning of green arrow, Qa1.Queue at beginning of unsaturated green, Qu3.Residual queue, Qr0.Uniform Delay, d120								5 1. 91 3. 90 0. 00 20. 1	
		DELAY/	LOS WORK	SHEET WI	TH INITI.	AL QUEUE			
Appr/ Lane Group	lnitial Unmet Demand Qveh	Dur. Unmet Demand t hrs.	Uni form Unadj. ds	Del ay Adj . d1 sec	lnitial Queue Param. u	Final Unmet Demand Q veh	l ni ti al Queue Del ay d3 sec	Lane Group Del ay d sec	

•								
Eastbou	und							
	0.0						0.0	
	0.0						0.0	
	0.0						0.0	
Westbou	und							
L	0.0	0.00	32.0	24.2	0.00	0.0	0.0	24.2
Т	0.0	0.00	32.0	24.2	0.00	0.0	0.0	24.2
	0.0						0.0	
Northbo	ound							
L	0.0	0.00		20. 1	0.00	0.0	0.0	22.0
Т	0.0	0.00	16.5	16.5	0.00	76.5	0.0	139.8
	0.0						0.0	
Southbo	hund							
Southou							0 0	
	0.0				_		0.0	

			2001 I	-290 AM	Ci cero_F	lournoy	0716. txt	t
Т	0.0	0.00	22.0	17.0	0.00	0.0	0.0	18.9
R	0.0	0.00	22.0	13.9	0.00	0.0	0.0	14.3

Intersection Delay 85.2 sec/veh Intersection LOS F

		BACK OF QUEUE	WORKSHEET	
	Eastbound	Westbound	Northbound	Southbound
LaneGroup Init Queue Flow Rate So	0 0 0	L T 0.0 0.0 4 4 1800 1800	L T 0.0 0.0 195 774 1800 1300	T R 0.0 0.0 332 194 1300 1800
No. Lanes SL LnCapacity Flow Ratio v/c Ratio Grn Ratio I Factor AT or PVG Pltn Ratio PF2 Q1 kB Q2 Q Average Q Spacing Q Storage Q S Ratio 70th Percon		$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
fB% BOQ QSRatio 85th Percent		1.2 1.2 0.1 0.1 0.0	1.2 1.1 2.9 45.6 0.5	1.2 1.2 8.1 3.7 0.9
fB% BOQ QSRatio 90th Percent	tile Output:	1.6 1.6 0.1 0.1 0.0	1.6 1.4 3.8 55.3 0.6	1.5 1.6 10.5 4.9 1.2
fB% BOQ QSRatio 95th Percent	tile Output:	1.8 1.8 0.1 0.1 0.0	1.8 1.5 4.2 58.3 0.7	1.7 1.7 11.5 5.5 1.4
fB% BOQ QSRatio 98th Percent		2.1 2.1 0.2 0.2 0.0	2.0 1.6 4.9 62.8 0.8	1.9 2.0 13.1 6.3 1.6
fB% BOQ QSRatio		2.7 2.7 0.2 0.2 0.1	2.5 1.7 6.1 70.0 1.0	2.3 2.5 15.7 7.8 1.9

_____ERROR MESSAGES_____

2001 I-290 PM Cicero_Flournoy 0716.txt HCS+: Signalized Intersections Release 5.4

Anal yst: Inter.: Flournoy Street & Cicero Avenu Agency: PB Area Type: CBD or Similar 6/25/2010 Date: Juri sd. Period: PM Peak Year : Existing Project ID: I-290 Phase 1 Study E/W St: Flournoy Street N/S St: Cicero Avenue SIGNALIZED INTERSECTION SUMMARY Eastbound Southbound Westbound Northbound R L Т R L Т L Т R L Т R No. Lanes 0 0 0 1 2 0 2 2 0 0 2 1 LGConfi g Т т R L L Т 367 8 1287 1060 325 Vol ume 5 Lane Width 12.0 12.0 11.0 11.0 11.0 11.0 **RTOR Vol** 114 **Duration** 0.25 Area Type: CBD or Similar Signal Operations 3 4 | Phase Combination 1 2 5 7 8 6 EB Left NB Left А А Thru Thru А А Ri ght Ri ght Peds Peds Х Х WB Left А SB Left А Thru Thru А Ri ght Ri ght А Х Peds Х Peds Ri ght NB FB Ri ght SB Ri ğht WB Right 23.0 43.0 Green 8.0 3.0 Yellow 3.0 3.0 ALL Red 1.0 0.0 1.0 Cycle Length: 85.0 secs Intersection Performance Summary Appr/ Lane Adj Sat Ratios Lane Group Approach Flow Rate Lane Group g/C Grp Capaci ty (s) v/c Delay LOS Del ay LOS Eastbound Westbound 1399 0.01 0.25 C C L 346 24.2 Т 0.01 0.25 24.2 24.2 С 693 2804 Northbound C F 721 2536 0.54 0.61 20.5 L 96.5 Т 1911 1.16 79.6 Ε 1169 0.61 Southbound 1911 F Т 922 1.21 0.48 123.2 105.2 F 0.48 В R 515 1067 0.43 14.7 Intersection Delay = 90.5(sec/veh) Intersection LOS = F

HCS+: Signalized Intersections Release 5.4

I-290 Existing

Phone: E-Mail: Anal yst:Agency/Co.:PBDate Performed:6/25/2010Anal ysi s Time Period:PM PeakIntersection:Flournoy Street & Cicero AvenuArea Type:CBD or SimilarJuri sdiction:Anal ysi s Year:Anal ysi s Year:ExistingProject ID:I-290 Phase 1 StudyE/W St:Flournoy StreetN/S St:Cicero Avenue

#### _____VOLUME DATA___

	Eas L	tbou T	nd R	Wes   L	stboun T	d R	Nor L	T T	ind R	Sou ⁻   L	thbou T	nd R
Volume % Heavy Veh PHF PK 15 Vol Hi Ln Vol				5 10 0. 95 2	8 10 0. 95 2		367 10 0. 95 97	1287 10 0. 95 339			1060 10 0. 95 279	325 10 0.95 86
% Grade Ideal Sat ParkExist NumPark				1800	0 1800		1800	0 1300			) 1300	1800
No. Lanes LGConfig Lane Width RTOR Vol	0	0	0	1   L  12.0	2 T 12. 0	0	2 L 11. 0	2 T 11. 0	0	0	2 T 11. 0	1 R 11.0 114
Adj Flow %InSharedLn Prop LTs Prop RTs				5	8 0.00 000	0	386 1.000 0.	1355 ) 0.00 000	00	0.0	1116 0.00 000 1	222
Peds Bikes Buses %InProtPhase	0			0	0		0.0	12		200	) C 12	0
Duration	0. 25		Area	Type: 0PEI	CBD O RATING	r Simi PARAM	lar METERS	6				
	Eas L	tbou T	nd R	   Wes   L	stboun T	d R	Nor L	-thbou T	ind R	Sou ⁻ L	thbou T	ind R
Init Unmet				0.0	0.0		0.0	0.0		(	D. 0	0.0

		L .	1	IX I		I	N		I	N		1	K	
Ini Arr Uni IF Los Ext Ped	t Unmet iv. Type t Ext. actor t Time of g Min g		3.2		0.0 3 3.0 2.0 0.0	0.0 3 3.0 1.000 2.0 0.0		0.0 3 3.0 2.0 0.0	0. 0 3 3. 0 0. 836 2. 0 0. 0			0.0 3 3.0 0.622 2.0 0.0 4.5	0.0 3 3.0 2 2.0 0.0	
						_PHASE	DATA							
Pha	se Combir	natio	n 1	2	3	4			5	6	7	8	3	
EB	Left Thru Right Peds						NB	Left Thru Right Peds	A A X	A A X				
WB	Left Thru Right Peds		A A X				SB	Left Thru Right Peds	A A X					
NB	Ri ght						EB	Ri ght						
SB	Right						WB	Ri ght						

Page 2

Green	23.0	43.0	8.0
Yellow	3.0	3.0	3.0
AII Red	1.0	0.0	1.0

	VOLU	JME ADJUSTN	MENT AND S	SATURA	ATI ON	FLOW WO	RKSHEET	
Volume Adju	stment							
-	Eastbou	und   V R   L	Vestbound T F	2	Nort L	thbound T R	Sout	hbound T R
Volume, V PHF Adj flow No. Lanes Lane group Adj flow Prop LTs Prop RTs	0 0	0 L 5	95 0.95 8 1 2 0 T 8 0.000 0.000		367 1 0.95 ( 386 1 2 L 386 1 1.000 0.(	1287 ). 95 1355 2 0 T 1355 0. 000 )00	1 0 1 0 1 0.0	060 325 . 95 0. 95 116 222 2 1 T R 116 222 0. 000 00 1. 000
Saturation Ea	Flow Rate	(see Exhik West	oit 16-7 t tbound	to det	termir Northb	ne the a	idjustment Sout	factors) hbound
LG So Lanes 0 fW fHV fG fP fBB fA fLU fRT fLT Sec. fLpb fRpb S Sec.	0 0	L 1800 1 1.000 0.909 (1.000 1.000 1.000 0.950 1.000 1.000 1.000 1.000 0.950 1.000 1.000 1.000 1.000 1.000	T 1800 2 0 1.000 0.909 1.000 1.000 1.000 0.952 1.000 1.000 1.000 1.000 2804	180 2 0.9 1.0 1.0 1.0 0.9 0.9 0.9 0.9 0.9 0.9 0.9 0.9 0.9 0	7 20 767 0. 2007 0. 2007 1. 2007 70 2007 1. 2007 1. 2007 1. 2007 1. 2007 1. 2007 1. 2007 1. 2007 1. 2007 1. 2007 1. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2007 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 2000 2. 20000 2. 200000000	000 967 909 000 976 900 976 900 952 000 000 000 000 000 011 T	0	T R 1300 1800 2 1 0. 967 0. 967 0. 909 0. 909 1. 000 1. 000 1. 000 1. 000 0. 976 1. 000 0. 976 1. 000 0. 952 1. 000 1. 000 0. 850 1. 000 1. 000 0. 882 1911 1067
Capacity An	alysis and ane Fl	d Lane Grou Adj ow Rate J	up Capacit Adj Sat Low Rate	ty Flov Rati	V	Green Ratio	Lane Gr	oup
Mvmt G	roup	(v)	(s)	(v/s	s)	(g/C)	(c)	Ratio
Eastbound Prot Perm Left Prot Perm Thru Right Westbound Prot Porm								
Left L Prot Perm		5	1399	# 0.0	00	0. 25	346	0. 01
Thru T Right		8	2804	0. (	00	0. 25	693	0. 01
Northbound Prot		23	2536	0 0	71	0 141	358	0.06
Perm		363	772	0.4	47	0. 471	363	1.00
Left L Prot		386				0. 61	721	0. 54
Thru T		1355	1911	# 0.7	71	0. 61	1169	1.16

	2001 I-290 PM Cicero_Flournoy 0716.txt											
Ri South Pr Pe	ght nbound rot erm											
L€ Pr	eft ot											
Pe	erm	_						-				
l r Ri	nru ght l	I R	1	116 22	191 106	57	0. 58 0. 21	0.4 0.4	48 92 48 51	22 15	1.21 0.43	
Sum o		N rati	ns for	critic	al lar			- 51	$\frac{1}{1}$ m (y/s)	) _	0.71	
Total	lost	time	per cy	cle, L	_ = 12.	00 sec	уз, те У-	- 00		-	0.71	
Criti	Cal T	low ra	τε το	сарасі і	y rati	Ο,	XC	= (YC)	)(L)/(L	-L) =	0.83	
Contr	rol Del ⁄ Rat	lay and tios	d LOS Unf	Determi Prog	nati or	lncreme	ntal	Res	Lane G	roup	Approx	ach
Lane			Del	Adj	Grp	Factor	Del	Del				
Grp	V/C	g/C	di	Fact	Сар	K	d2	d3	Del ay	LUS	Del ay	LOS
Eastk	bound											
Westbound												
L	0.01	0.25	24.2	1.000	346	0.11	0.0	0.0	24.2	C		•
I	0.01	0.25	24.2	1.000	693	0.11	0.0	0.0	24.2	C	24.2	C
North		0.61	10 Q	1 000	721	0 14	07	0 0	20 5	C		
Ť	1. 16	0.61	16.5	1.000	1169	0.50	80.0	0.0	96. 5	F	79.6	E
South	nbound											
т	1 01	0 40	<u></u>	1 000	000		101 0	0.0	100 0	г	105 0	F
R	0.43	0. 48	22.0 14.4	1.000	922 515	0.50	0.4	0.0	123. 2 14. 7	г В	105.2	Г
		nterse	ction	del av =	= 90.5	(sec/\	/eh)	Inters	section	LOS =	= F	
						(						
				SUPPLEN	TENTAL	PERMI TT	TED LT	WORKSI	HEET			
I nput	t											
Oppos	sed by	Singl	e(S) o	r Multi	ple(M)	) Lane a	approad	ch	EB	WВ	NB	SB
	e leng	th, Č	on tim	o for l	Tland	aroup	85.0	sec			54 0	
Effec	ctive j	permit	ted gr	e for L een tin	ne for	LT I ane	e group	, b, g(s)	)		40. 0	
Oppos Numbe	sing e [:]	ffecti	ve gře in LT	en time Lane gr	e, go (	(s)		0			41.0 2	
Numbe	er of	anes	in opp	osing	approad	ch, No					2	
Adj us	sted L	T flow	rate,	VLT (\	/eh/h)	DI T					386	
Propo	prtion	of LT	in op	posing	flow,	PLTo					0.00	
Adjus Lost	sted o _l time	oposing for IT	g flow Lane	rate, aroup.	Vo (ve	eh/h)					1116 6.00	
Compu	utatio	n		$\frac{9}{7}$							0.11	
	sing la	per cy ane ut	il. fa	ctor, f	73600 ELUo				0. 952		9.11 0.952	0. 952
Oppos	sing f	low, V	ol c=Vo	C/[3600	)(No)fL	_Uo] (ve	eh/In/o	cyc)			13.84	
Oppos	sing pl	latoon	ratio	, Rpo (	.r, gr∢ (refer	≲=y Exhibit	16-11	1)			1.00	
Oppos	sing Qu	ueue Ra vhihit	atio, C16-4	qro=Max	([1-Rpc	o(go/C),	0]				0.52	
gu=g-	-gqif	gq>=g	f, or	, 3, 0, 7, = g-gf	if gq∢	<gf< td=""><td></td><td></td><td></td><td></td><td>24.75</td><td></td></gf<>					24.75	
n=Max PTHo=	(gq-g ⊧1-PI Ti	r)/2,0) o	)								7.62 1.00	
PL*=F	PLT[1+	(N-1)g	/(gf+g	u/EL1+4	1.24)]						4.78	
ELI ( EL2=N	lax((1	-Ptho*	*n)/Pl	to, 1.0	))						3.91	

2001 I - 290 PM Cicero_Flourno	y 0716.	txt		
<pre>fmin=2(1+PL)/g or fmin=2(1+PI)/g gdiff=max(gq-gf, 0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin; max=1.00) fl t=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2- or fl t=[fm+0.91(N-1)]/N** Left turn adjustment fl T</pre>	-1)], (1	fmi n<=	0.29 0.00 0.29 fm<=1.0	)0)
Left-turn adjustment, TLT			0. 289	
<pre>For special case of single-lane approach opposed by mul see text. * If Pl&gt;=1 for shared left-turn lanes with N&gt;1, then as left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left For special case of multilane approach opposed by single or when gf&gt;gq, see text.</pre>	ltilane ssume o ft-turn le-lane	e appro de-fac n Lane e appro	oach, to s, flt= oach	=fm.
SUPPLEMENTAL PERMITTED LT WORKSHI	EET			
Input				
Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 85.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h)	EB	WB	NB	SB
Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL Computation		0.000	0.000	0. 000
L1 Volume per cycle, L1C=VL1C/3000 Opposing Lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/Ln/cyc) gf=G[exp(- a * (LTC ** b)]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C), 0] gq, (see Exhibit C16-4, 5, 6, 7, 8) gu=g-gq if gq>=gf, or = g-gf if gq <gf n=Max(gq-gf)/2, 0) PTHo=1-PLTo PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)] EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/PLto, 1.0) fmin=2(1+PL)/g or fmin=2(1+PL)/g gdiff=max(gq-gf, 0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin; max=1.00)</gf 	0. 952		0. 952	0. 952
fl t=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdi ff/g]/[1+PL(EL2- or fl t=[fm+0.91(N-1)]/N** Left-turn adjustment, fLT	-1)], (1	fmi n<=	fm<=1.(	)0)
<pre>For special case of single-lane approach opposed by mul see text. * If Pl&gt;=1 for shared left-turn lanes with N&gt;1, then as left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left For special case of multilane approach opposed by single</pre>	ltilane ssume o ft-turn le-lane	e appro de-fac n Lane e appro	oach, to s, flt= oach	=fm.
CIIDDI EMENITAL DEDESTDI AN DIOVOLE EFFECTS	WODVE	1664		
	EB	WB	NB	SB
Conflicting pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Pedestrian flow rate, Vpedg (p/h) OCCpedg Opposing queue clearing green, gq (s) Eff. ped. green consumed by opp. veh. queue, gq/gp OCCpedu			43.0 200 395 0.198 15.25 0.355 0.162	

2001 I-290 PM Cicero_Flournoy 0716.txt Opposing flow rate, Vo (veh/h)	1116
Number of cross-street receiving lanes, Nrec	0.034 2 2
ApbT Proportion of left turns, PLT Proportion of left turns using protected phase PLTA	0.966 1.000
Left-turn adjustment, fLpb Permitted Right Turns	0.966
Effective pedestrian green time, gp (s) Conflicting pedestrian volume, Vped (p/h) Conflicting bicycle volume, Vbic (bicycles/h) Vpedg	43.0 200 0 395
UCCpedg Effective green, g (s)	0. 198 41. 0
Vbi cg OCCbi cg	0 0. 020 0. 198
Number of cross-street receiving lanes, Nrec Number of turning lanes, Nturn AnbT	2 1 0 882
Proportion right-turns, PRT Proportion right-turns using protected phase, PRTA Right turn adjustment, fRpb	1.000 0.000
SUPPLEMENTAL UNI FORM DELAY WORKSHEET	
SUPPLEMENTAL UNIFORM DELAY WORKSHEET EBLT WBLT Cycle length, C 85.0 sec	NBLT SBLT
SUPPLEMENTAL UNIFORM DELAY WORKSHEET EBLT WBLT Cycle length, C 85.0 sec Adj. LT vol from Vol Adjustment Worksheet, v v/c ratio from Capacity Worksheet, X	NBLT SBLT 386 0.54
SUPPLEMENTAL UNIFORM DELAY WORKSHEET EBLT WBLT Cycle length, C 85.0 sec Adj. LT vol from Vol Adjustment Worksheet, v v/c ratio from Capacity Worksheet, X Protected phase effective green interval, g (s) Opposing queue effective green interval, gq	NBLT SBLT 386 0.54 12.0 15.25
SUPPLEMENTAL UNIFORM DELAY WORKSHEET EBLT WBLT Cycle length, C 85.0 sec Adj. LT vol from Vol Adjustment Worksheet, v v/c ratio from Capacity Worksheet, X Protected phase effective green interval, g (s) Opposing queue effective green interval, gq Unopposed green interval, gu Red time r=(C-g-gq-gu)	NBLT SBLT 386 0.54 12.0 15.25 24.75 33.0
SUPPLEMENTAL UNIFORM DELAY WORKSHEET EBLT WBLT Cycle length, C 85.0 sec Adj. LT vol from Vol Adjustment Worksheet, v v/c ratio from Capacity Worksheet, X Protected phase effective green interval, g (s) Opposing queue effective green interval, gq Unopposed green interval, gu Red time r=(C-g-gq-gu) Arrival rate, qa=v/(3600(max[X, 1.0])) Protected ph. departure rate, Sp=s/3600	NBLT SBLT 386 0.54 12.0 15.25 24.75 33.0 0.11 0.704
SUPPLEMENTAL UNIFORM DELAY WORKSHEET EBLT WBLT Cycle length, C 85.0 sec Adj. LT vol from Vol Adjustment Worksheet, v v/c ratio from Capacity Worksheet, X Protected phase effective green interval, g (s) Opposing queue effective green interval, gq Unopposed green interval, gu Red time r=(C-g-gq-gu) Arrival rate, qa=v/(3600(max[X, 1.0])) Protected ph. departure rate, Sp=s/3600 Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600) XPerm	NBLT SBLT 386 0.54 12.0 15.25 24.75 33.0 0.11 0.704 0.35 0.91
SUPPLEMENTAL UNIFORM DELAY WORKSHEET EBLT WBLT Cycle length, C 85.0 sec Adj. LT vol from Vol Adjustment Worksheet, v v/c ratio from Capacity Worksheet, X Protected phase effective green interval, g (s) Opposing queue effective green interval, gq Unopposed green interval, gu Red time r=(C-g-gq-gu) Arrival rate, qa=v/(3600(max[X, 1.0])) Protected ph. departure rate, Sp=s/3600 Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600) XPerm XProt Case	NBLT SBLT 386 0.54 12.0 15.25 24.75 33.0 0.11 0.704 0.35 0.91 4
SUPPLEMENTAL UNIFORM DELAY WORKSHEET EBLT WBLT Cycle length, C 85.0 sec Adj. LT vol from Vol Adjustment Worksheet, v v/c ratio from Capacity Worksheet, X Protected phase effective green interval, g (s) Opposing queue effective green interval, gq Unopposed green interval, gu Red time r=(C-g-gq-gu) Arrival rate, qa=v/(3600(max[X, 1.0])) Protected ph. departure rate, Sp=s/3600 Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600) XPerm XProt Case Queue at beginning of green arrow, Qa Queue at beginning of unsaturated green, Qu	NBLT SBLT 386 0.54 12.0 15.25 24.75 33.0 0.11 0.704 0.35 0.91 4 0.00 5.17 0.00
SUPPLEMENTAL UNIFORM DELAY WORKSHEET EBLT WBLT Cycle length, C 85.0 sec Adj. LT vol from Vol Adjustment Worksheet, v v/c ratio from Capacity Worksheet, X Protected phase effective green interval, g (s) Opposing queue effective green interval, gq Unopposed green interval, gu Red time r=(C-g-gq-gu) Arrival rate, qa=v/(3600(max[X,1.0])) Protected ph. departure rate, Sp=s/3600 Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600) XPerm XProt Case Queue at beginning of green arrow, Qa Queue at beginning of unsaturated green, Qu Residual queue, Or Uniform Delay, d1	NBLT SBLT 386 0.54 12.0 15.25 24.75 33.0 0.11 0.704 0.35 0.91 4 0.00 5.17 0.00 19.8
	NBLT SBLT 386 0.54 12.0 15.25 24.75 33.0 0.11 0.704 0.35 0.91 4 0.00 5.17 0.00 19.8

Appr/	Unmet	Unmet		beruy	Queue	Unmet	Queue	Group
Lane Group	Demand Q veh	Demand t hrs.	Unadj . ds	Adj. d1 sec	Param. u	Demand Q veh	Del ay d3 sec	Del ay d sec
Eastbour	nd						0.0	
	0.0 0.0 0.0						0.0 0.0 0.0	
Westbour	nd							
L T	0. 0 0. 0 0. 0	0.00 0.00	32. 0 32. 0	24.2 24.2	0.00 0.00	0. 0 0. 0	0. 0 0. 0 0. 0	24. 2 24. 2
Northbou	und							
L T	0.0 0.0 0.0	0.00 0.00	16. 5	19.8 16.5	0.00 0.00	0.0 46.5	0.0 0.0 0.0	20. 5 96. 5
Southbou	und							
	0.0						0.0	

			2001	1-290 PM	Ci cero_l	-l ournoy	0716. tx1	t
Т	0.0	0.00	22.0	22.0	0.00	48.5	0.0	123.2
R	0.0	0.00	22.0	14.4	0.00	0.0	0.0	14.7

Intersection Delay 90.5 sec/veh Intersection LOS F

		BACK OF QUEUE	WORKSHEET	
	Eastbound	Westbound	Northbound	Southbound
LaneGroup Init Queue Flow Rate So		L T 0.0 0.0 5 4 1800 1800	L T 0.0 0.0 198 711 1800 1300	T R 0.0 0.0 586 222 1300 1800
No. Lanes SL LnCapacity Flow Ratio v/c Ratio Grn Ratio I Factor AT or PVG Pltn Ratio PF2 Q1 kB Q2 Q Average Q Spacing Q Storage Q S Ratio		$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
70th Percent fB% BOQ QSRatio		1.2 1.2 0.1 0.1 0.0	1.2 1.1 2.8 36.1 0.4	1. 1 1. 2 32. 2 4. 3 1. 1
fB% BOQ QSRatio 90th Percent	tile Output:	1.6 1.6 0.2 0.1 0.0	1.6 1.4 3.6 44.3 0.6	1.4 1.6 39.7 5.7 1.4
fB% BOQ QSRatio 95th Percent	tile Output:	1.8 1.8 0.2 0.1 0.0	1.8 1.5 4.1 46.8 0.7	1.5 1.7 41.9 6.3 1.6
fB% BOQ QSRatio 98th Percent	tile Output	2.1 2.1 0.2 0.2 0.1	2.0 1.6 4.7 50.6 0.8	1.6 2.0 45.5 7.2 1.8
fB% BOQ QSRatio		2.7 2.7 0.3 0.2 0.1	2.5 1.8 5.9 56.4 0.9	1.8 2.5 50.8 8.9 2.2

_____ERROR MESSAGES_____

Analyst: Agency: Date: Period: Project			Int Are Jur Yea:	er.: Lo a Type isd: r : E:	exing : CBI xist:	gton St D or Si ing	reet Imila:	& Cio r	ero	> Aven					
E/W SC.	DEVII	Igcoi	I DULC	eet				N/ D	5C• C	ICEI	JAVEII	iC			
			. 1	SIC	GNALI	ZED	INT	TERSE	CTION :	SUMM	ARY				
		Eas T.	stbour T	nd R	we;   т.	Stbo T	ounc	1 R	Nor   I.	thboi T	and R	SO T.	utnboi T	ind R	
	_		T	10	<u> </u>	1				-			-	10	
No. Lane	s	1	2	1	0	(	)	0	0	3	0	1	2	0	
LGConfig		L	LTH	R R						TR	-	L	Т		
Volume   504 33			609 12 0	 					1250 11 0	5	4	559 11 0			
RTOR Vol   120			120					1			11.0	11.0			
	·														
Duration	. (	0.25		Area	Type: Si	gna]	l Or	erat	ions						
Phase Co	mbina	atior	1 1	2	3		4			5	6	7		3	
EB Left			A					NB	Left	_					
Thru	+		A A						Thru Right	A A					
Peds			X						Peds	X					
WB Left							İ	SB	Left	A	A				
Thru									Thru	A	A				
Righ	t								Right	v	v				
NB Righ	t							EB	Right	Λ	Λ				
SB Righ	t						İ	WB	Right						
Green			23.0							43.0	0.8.0				
Yellow			3.0							3.0	3.0				
AII RCu			1.0							Cyc	cle Ler	ngth:	85.0		secs
			Ir	ntersed	ction	Per	for	manc	e Summa	ary					
Appr/	Lane		Adj	j Sat	R	atio	DS		Lane (	Grou	p App	proac	h		
Grp	Capac	, city	FION	(s)	v/c		q/0	-	Delay	LOS	Dela	ay LO	 S		
Eastboun	d 200		1.24	20	0 0	Л	0 7			Ţ					
LTR	363		14	29 70	1.4	4 2	0.2	25 25	236.0	ь F	180.	.8 F			
R	195		789	9	1.3	2	0.2	25	208.5	F		-			
Westboun	d														
Northbou	nd														
TR	1839	)	382	13	0.7	2	0.4	18	18.8	В	18.8	В В			
Southbour	nd														
L	284		133	30	0.0	1	0.6	51	11.2	В					
Т	1619	)	264	46	0.3	6	0.6	51	8.4	А	8.4	A			
	Inte	ersec	ction	Delay	= 75	.3	(se	ec/ve	h) I	nter	sectior	1 LOS	= E		

I-290 Existing

Phone: Fax: E-Mail: _____OPERATIONAL ANALYSIS_____

Analyst: Agency/Co.: PB Date Performed: 6/25/2010 Analysis Time Period: AM Peak Intersection: Lexington Street & Cicero Aven Area Type: CBD or Similar Jurisdiction: Analysis Year: Existing Project ID: I-290 Phase 1 Study E/W St: Lexington Street N/S St: Cicero Avenue

_____VOLUME DATA_____

	Eas	stbou	nd	We	stbou	nd	No	rthbou	und	Sou	ıthbou	nd
	L	Т	R	L 	Т	R	L	Т	R	L	Т	R
Volume	504	33	609				-   	1250	5	4	559	
% Heavy Veh	10	10	10	ĺ			Ì	10	10	10	10	
PHF	0.95	0.95	0.95					0.95	0.95	0.95	0.95	
PK 15 Vol	133	9	160					329	2	1	147	
Hi Ln Vol												
% Grade		0						0			0	
Ideal Sat	1800	1300	1800					1800		1800	1800	
ParkExist												
NumPark												
No. Lanes	1	2	1	0	0	0	0	3	0	1	2	0
LGConfig	L	LTI	RR					TR		L	Т	
Lane Width	10.5	11.5	12.0					11.0		11.0	11.0	
RTOR Vol			120						1			
Adj Flow	308	515	258					1320		4	588	
%InSharedLn	42		50									
Prop LTs		0.4	33					0.00	0 0	1.000	0.00	0
Prop RTs	0.	500	1.000				0	.003		0	.000	
Peds Bikes	20	00	0	0			2	00	0			
Buses	0	0	0					12		0	12	
%InProtPhase	9									0.0		
Duration	0.25		Area '	Гуре:	CBD	or Sin	nilar					

	Ea	stbou	nd	We	stbou	nd	Nc	Northbound			Southbound			
	L	Т	R	Ĺ	Т	R	L	Т	R	L	Т	R		
Init Unmet	  0.0	0.0	0.0	·   			-	0.0		_   0.0	0.0			
Arriv. Type	3	3	3	Ì			i	3		3	3			
Unit Ext.	3.0	3.0	3.0	İ			İ	3.0		3.0	3.0			
I Factor	İ	1.00	0	i			İ	1.00	0	İ	0.92	8		
Lost Time	2.0	2.0	2.0	i			İ	2.0		2.0	2.0			
Ext of g	0.0	0.0	0.0	i			İ	0.0		0.0	0.0			
Ped Min g	İ	4.5		İ	3.2		İ	4.5		İ				

#### _____OPERATING PARAMETERS_____OPERATING PARAMETERS_____

	PHASE DATA											
Pha	se Combination	1	2	3	4			5	б	7	8	
EB	Left Thru Right Peds	A A A X				NB	Left Thru Right Peds	A A X				
WB	Left Thru Right Peds					SB	Left Thru Right Peds	A A X	A A X			
NB	Right				ļ	EB	Right					
SB	Right					WB	Right					
Gre Yel All	en : low : Red :	23.0 3.0 1.0			Ι			43.0 3.0 0.0	8.0 3.0 1.0			

		VOLUME	ADJU	STMEN	r and	SATU	RATIO	N FLOV	WORK	SHEET_			
Volume Adjustment													
	Eastbound			Westbound			No:	Northbound			Southbound		
	L	T R	.	L	Т	R	L	Т	R	L	Т	R	
Volume, V	504	33 60	9				 	1250	5	  4	559	 	
PHF	0.95	0.95 0.	95 İ				Ì	0.95	0.95	0.95	0.95	ĺ	
Adj flow	531	35 51	5 İ				Ì	1316	4	4	588	ĺ	
No. Lanes	1	2 1	i	0	0	0	0	3	0	1	2	0	
Lane group	5   L	LTR	r İ					TR		L	Т	i	
Adj flow	308	515 25	8					1320		4	588	i	
Prop LTs	i	0.433	i					0.00	00	1.000	0.000	i	
Prop RTs	0.	500 1.0	00				0	.003		j 0.	000	İ	
Saturation I	Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors) Eastbound Westbound Northbound Southbound												
LG L	LTR	R						TR		L	Т		
So 1800	1300	1800						1800		1800	1800		
Lanes 1	2	1	0	0	0	0		3	0	1	2	0	
fW 0.95	50 0.983	1.000						0.967		0.967	0.967		
fHV 0.90	0.909	0.909						0.909		0.909	0.909		
fG 1.00	00 1.000	1.000						1.000		1.000	1.000		
fP 1.00	00 1.000	1.000						1.000		1.000	1.000		
fBB 1.00	00 1.000	1.000						0.984		1.000	0.976		
fA 0.90	0.900	0.900						0.900		0.900	0.900		
fLU 1.00	0.952	1.000						0.908		1.000	0.952		
frt	0.925	0.850						1.000			1.000		
fLT 0.95	50 0.979							1.000		0.950	1.000		
Sec.										0.146			
fLpb 1.00	00 1.000							1.000		0.983	1.000		
fRpb	0.815	0.630						1.000			1.000		
S 1329	9 1470	789						3813		1330	2646		
Sec.										204			
			_CAP	ACITY	AND I	LOS W	ORKSH	EET					

Capacity Analysis and Lane Group Capacity

Ar Mv	opr/ vmt	Lane Group	Flo	Adj w Rate (v)	Adj Flow (	Sat Rate s)	H	Flow Ratio (v/s)	Gre Rat (g/	en io C)	La Capa	ane Gr acity (c)	roup v/c Ratio	
East	oound													
Ρı	rot													
Pe	erm													
Le	eft	L	3	08	13	29		0.23	0.	25	32	28	0.94	
Pi	rot													
Pe	erm													
Тł	nru	LTR	5	15	14	70	#	0.35	0.	25	36	53	1.42	
R	iqht	R	2	58	78	9		0.33	0.	25	19	95	1.32	
West	oound													
Pi	rot													
D 4	200 2rm													
I (	≤ ± ≤ f +													
	rot													
E 1														
11	iru talat													
RI N	ignt	-												
Norti	ibounc	1												
P1	rot													
Pe	erm													
Le	eft													
Pı	rot													
Pe	erm													
Tł	nru	TR	1	320	38	13	#	0.35	0.	48	18	339	0.72	
R	ight													
South	nbound	1												
Pı	rot		0		13	30	#	0.00	0.	141	18	88	0.00	
Pe	erm		4		20	4		0.02	0.	471	90	5	0.04	
Le	eft	L	4						0.	61	28	34	0.01	
Ρı	rot													
Pe	erm													
Тł	nru	Т	5	88	26	46		0.22	0.	61	10	519	0.36	
R	ight		-											
Sum o	of flo	ow rati	os for	critio	cal la	ne gro	bur	ps, Yc	= 5	um (	v/s	) =	0.70	
Tota	l lost	t time	per cy	cle, I	i = 11	.00 se	ЭC							
Crit	ical f	Elow ra	te to	capacit	ly rat	io,		Xc	= (Yc	:)(C)	/ ( C·	-L) =	0.80	
Conti	rol De	elay an	d LOS	Determ	inatio	n								
Appr	/ Ra	atios	Unf	Prog	Lane	Incre	eme	ental	Res	Lan	le Gi	roup	Appro	ach
Lane			Del	Adj	Grp	Facto	or	Del	Del					
Grp	v/c	g/C	d1	Fact	Cap	k		d2	d3	De	lay	LOS	Delay	LOS
East	oound													
L	0.94	0.25	31.4	1.000	328	0.45		34.1	0.0	65.	5	Е		
LTR	1.42	0.25	32.0	1.000	363	0.50		204.0	0.0	236	.0	F	180.8	F
R	1.32	0.25	32.0	1.000	195	0.50		176.5	0.0	208	.5	F		
West	oound													
North	nbound	E												
TR	0.72	0.48	17.4	1.000	1839	0.28		1.4	0.0	18.	8	В	18.8	В
C ~ · · + 1	abour	7												
JUUTI			11 1	1 000	204	0 1 1		0 0	0 0	1 1	2	П		
ц П		0.01	$\downarrow \downarrow , \downarrow$	1 000	204 1610			0.0	0.0	⊥⊥. ° 4	4	ы Л	0 1	7
Τ.	0.36	0.0⊥	ö.2	T.000	тота	U.II		υ.⊥	0.0	8.4		А	ö.4	А

SUPPLEMENTAL PERMITTED LT WORKSHEET			
for exclusive lefts			
Input	MD	ND	СЪ
EB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 85.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time, go (s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL	wВ	NB	SB 54.0 40.0 41.0 1 3 4 1.000 0.00 1320 6.00
Computation			
LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq <gf n=Max(gq-gf)/2,0) PTHo=1-PLTO PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)] EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto 1 0)</gf 	0.952	0.952	$\begin{array}{c} 0.09\\ 0.908\\ 11.44\\ 0.0\\ 1.00\\ 0.52\\ 10.21\\ 29.79\\ 5.10\\ 1.00\\ 1.00\\ 5.11 \end{array}$
<pre>fmin=2(1+PL)/g or fmin=2(1+Pl)/g gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(f)</pre>	Emin<=f	£m<=1.0	0.10 0.00 0.15 00)
or $flt=[fm+0.91(N-1)]/N**$			0 146
			0.140
<pre>For special case of single-lane approach opposed by multilane see text. * If Pl&gt;=1 for shared left-turn lanes with N&gt;1, then assume of left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn For special case of multilane approach opposed by single-lane or when gf&gt;gq, see text.</pre>	≥ appro le-fact 1 lanes ≥ appro	oach, co s, flt= oach	=fm.
SUPPLEMENTAL PERMITTED LT WORKSHEET			
Ior shared lefts			
EB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 85.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N	WB	NB	SB

```
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
                                                       0.433
Proportion of LT in LT lane group, PLT
                                                                  0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo
                                                              0.952 0.952 0.908
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
qf=G[exp(-a * (LTC ** b))]-t], qf <= q
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g or fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT
For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
 left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.
               SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET
Permitted Left Turns
                                                        EΒ
                                                                    NB
                                                              WB
                                                                          SB
Effective pedestrian green time, gp (s)
                                                                         43.0
Conflicting pedestrian volume, Vped (p/h)
                                                                         200
Pedestrian flow rate, Vpedg (p/h)
                                                                         395
0CCpedq
                                                                         0.198
Opposing queue clearing green, gq (s)
                                                                         10.21
Eff. ped. green consumed by opp. veh. queue, gq/gp
                                                                         0.237
OCCpedu
                                                                         0.174
Opposing flow rate, Vo (veh/h)
                                                                         1320
                                                                         0.028
OCCr
Number of cross-street receiving lanes, Nrec
                                                                         2
Number of turning lanes, Nturn
                                                                         1
ApbT
                                                                         0.983
Proportion of left turns, PLT
                                                                         1.000
Proportion of left turns using protected phase, PLTA
                                                                         0.000
Left-turn adjustment, fLpb
                                                                         0.983
Permitted Right Turns
Effective pedestrian green time, gp (s)
                                                       23.0
                                                                   43.0
                                                                   200
Conflicting pedestrian volume, Vped (p/h)
                                                       200
Conflicting bicycle volume, Vbic (bicycles/h)
                                                       0
                                                                   0
                                                      739
                                                                  395
Vpedg
OCCpedq
                                                       0.370
                                                                  0.198
                                                                   41.0
Effective green, g (s)
                                                       21.0
                                                       0
                                                                   0
Vbicg
```

OCCbicg	0.020	0.020
OCCr	0.370	0.198
Number of cross-street receiving lanes, Nrec	2	2
Number of turning lanes, Nturn	2	1
ApbT	0.630	0.882
Proportion right-turns, PRT	1.000	0.003
Proportion right-turns using protected phase, PRTA	0.000	0.000
Right turn adjustment, fRpb	1.000	1.000

_____SUPPLEMENTAL UNIFORM DELAY WORKSHEET_____

			EBLT	WBLT	NBLT	SBLT
Cycle length, C 85	.0	sec				
Adj. LT vol from Vol Adjustment Worksheet, v						4
v/c ratio from Capacity Worksheet, X						0.01
Protected phase effective green interval, g	(s)					12.0
Opposing queue effective green interval, gq						10.21
Unopposed green interval, gu						29.79
Red time r=(C-g-gq-gu)						33.0
Arrival rate, $qa=v/(3600(max[X,1.0]))$						0.00
Protected ph. departure rate, Sp=s/3600						0.369
Permitted ph. departure rate, Ss=s(gq+gu)/(g	u*36	00)				0.08
XPerm						0.04
XProt						
Case						4
Queue at beginning of green arrow, Qa						0.00
Queue at beginning of unsaturated green, Qu						0.05
Residual queue, Qr						0.00
Uniform Delay, dl						11.1

_____DELAY/LOS WORKSHEET WITH INITIAL QUEUE______

Appr/	Initial Unmet	Dur. Unmet	Uniform	Delay	Initial Oueue	Final Unmet	Initial Oueue	Lane Group	
Lane Group	Demand Q veh	Demand t hrs.	Unadj. ds	Adj. d1 sec	Param. u	Demand Q veh	Delay d3 sec	Delay d sec	
Eastbour	nd								
L	0.0	0.00	32.0	31.4	0.00	0.0	0.0	65.5	
LTR	0.0	0.00	32.0	32.0	0.00	38.0	0.0	236.0	
R	0.0	0.00	32.0	32.0	0.00	15.8	0.0	208.5	
Westbour	nd								
	0.0						0.0		
	0.0						0.0		
	0.0						0.0		
Northbou	und								
	0.0						0.0		
TR	0.0	0.00	22.0	17.4	0.00	0.0	0.0	18.8	
	0.0						0.0		
Southbou	und								
L	0.0	0.00		11.1	0.00	0.0	0.0	11.2	
Т	0.0	0.00	16.5	8.2	0.00	0.0	0.0	8.4	
	0.0						0.0		
	Intersect	ion Dela	ay 75.3	sec/ve	eh Ir	ntersect	ion LOS	E	

_____BACK OF QUEUE WORKSHEET_____BACK OF QUEUE WORKSHEET_____

	Eastbour	nd	Westbou	ınd	Nor	thbound	Sou	thbound
LaneGroup	L LTR F	ર				TR	L	т
Init Queue	0.0 0.0 0	).0		ĺ	(	0.0	0.0	0.0
Flow Rate	308 270 2	258		ĺ	4	484	4	308
So	1800 1300 1	L800				1800	1800	1800
No.Lanes	1 2 1	L   O	0	0	0	3 0	1	2 0
SL	1329 772 7	789				1399	464	1389
LnCapacity	328 190 1	L95		ĺ	(	675	284	850
Flow Ratio	0.2 0.3 0	).3		ĺ	(	0.3	0.0	0.2
v/c Ratio	0.94 1.42 1	1.32		ĺ	(	0.72	0.01	0.36
Grn Ratio	0.25 0.25 0	).25		ĺ	(	0.48	0.61	0.61
I Factor	1.000	İ				1.000		0.928
AT or PVG	3 3 3	3		ĺ		3	3	3
Pltn Ratio	1.00 1.00 1	L.00		ĺ		1.00	1.00	1.00
PF2	1.00 1.00 1	L.00		ĺ		1.00	1.00	1.00
Q1	7.1 6.4 6	5.1				9.0	0.0	3.6
kB	0.3 0.2 0	).2		ĺ	(	0.5	0.3	0.6
Q2	2.6 10.8 8	3.8		Í		1.3	0.0	0.3
Q Average	9.7 17.1 1	14.9		Í		10.3	0.0	3.9
Q Spacing	25.0 25.0 2	25.0			:	25.0	25.0	25.0
Q Storage	95 0 1	LOO		ĺ	(	0	50	0
Q S Ratio	2.6 3	3.7		ĺ			0.0	
70th Percent	tile Output:	:						
fB%	1.2 1.2 1	L.2				1.2	1.2	1.2
BOQ	11.4 20.0 1	L7.4				12.1	0.0	4.7
QSRatio	3.0 4	1.3					0.0	
85th Percent	ile Output:	:						
fB%	1.5 1.5 1	L.5				1.5	1.6	1.6
BOQ	14.7 25.2 2	22.1				15.6	0.1	6.2
QSRatio	3.9 5	5.5					0.0	
90th Percent	tile Output:	:						
fB%	1.6 1.6 1	L.6				1.6	1.8	1.7
BOQ	16.0 26.9 2	23.7				16.9	0.1	6.8
QSRatio	4.2 5	5.9					0.0	
95th Percent	tile Output:	:						
fB%	1.8 1.7 1	L.8				1.8	2.1	2.0
BOQ	18.0 29.7 2	26.2				19.0	0.1	7.8
QSRatio	4.7 6	5.6					0.0	
98th Percent	tile Output:	:						
fB%	2.2 2.0 2	2.0				2.2	2.7	2.4
BOQ	21.1 33.7 3	30.0				22.2	0.1	9.6
QSRatio	5.6 7	7.5		ļ		ĺ	0.1	ĺ

_____ERROR MESSAGES_____
Analyst: Agency: Date: Period: Project E/W St:	rst: y: PB 6/25/2010 d: PM Peak ct ID: I-290 Phase 1 Study t: Lexington Street							Inter.: Lexington Street & Cicero Aven Area Type: CBD or Similar Jurisd: Year : Existing N/S St: Cicero Avenue								
				STO	ινατ.τ 7	สา	тмт	ידפפדי	CTTON	STIMM	ABA					
		Eas	st.bour	5±0	Wes	stbo	und		l Nor	thbo	ind	So	Southbound			
		L	T	R	L	T	0.110	R	L	Т	R	L	T	R		
	İ											 				
No. Lane	s	1	2	1	0	0		0	0	3	0	1	2	0	i	
LGConfig	ĺ	L	LTH	RR					Ì	TR		L	Т		ĺ	
Volume		359	38	439						1295	12	12	1053			
Lane Wid	th	10.5	11.5	12.0						11.0		11.0	11.0			
RTOR Vol				120							1					
Duration		0.25		Area 1	Cype:	CBD	or	: Sim	ilar							
					Sig	gnal	OF	perat	ions							
Phase Co	mpin	atior		2	3		4	ND	⊺ o f +	5	6	/	5	5		
вы цегс Трги			A A					NВ	Thru	Δ						
Righ	t.		A						Right	A						
Peds	-		X				ļ		Peds	X						
WB Left							İ	SB	Left	A	A					
Thru							İ		Thru	А	A					
Righ	t								Right							
Peds									Peds	Х	Х					
NB Righ	t							EB	Right							
SB Righ	t		22 0					WВ	Right	12						
Green			23.0							43.	J 8.0					
All Red			1 0							0 0	1 0					
AII Rea			1.0							Cy	cle Lei	ngth:	85.0		secs	
			I1	ntersed	ction	Per	for	manc	e Summ	ary_						
Appr/	Lane		Ad	j Sat	Ra	atio	S		Lane	Grou	o Api	proacl	h			
Lane	Grou	p	Flow	w Rate				_								
Grp	Capa	city		(s)	v/c	9	g/C		Delay	LOS	Dela	ay LO	S			
 Eastboun	 d															
L	328		132	29	0.69	)	0.2	25	35.2	D						
LTR	371		150	0 0	0.97	7	0.2	25	69.8	Е	57.4	4 E				
R	195		789	9	0.86	5	0.2	25	60.9	Е						
Westboun	d															
Northbou	nd															
TR	183	б	380	)7	0.75	5	0.4	8	19.6	В	19.0	6 В				
Southbor	nð															
T.	יית סקר		12	22			0 6	51	10 1	Þ						
ы Т	270	9	13. 264	46	0.05	, }	0.0 0 6	51	11 R	R	11 9	8 R				
-	- V T	-	20	- •	5.00			-		2	±±•\					
	Int	ersec	tion	Delay	= 25.	7	(se	ec/ve	h) I	nter	section	n LOS	= C			

I-290 Existing

Phone: Fax: E-Mail: _____OPERATIONAL ANALYSIS_____

Analyst: Agency/Co.: PB Date Performed: 6/25/2010 Analysis Time Period: PM Peak Intersection: Lexington Street & Cicero Aven Area Type: CBD or Similar Jurisdiction: Analysis Year: Existing Project ID: I-290 Phase 1 Study E/W St: Lexington Street N/S St: Cicero Avenue

_____VOLUME DATA______

	Eastbound			Wes	stbou	nd	No	rthbou	und	Southbound		
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume	359	38	439	 				1295	12	  12	1053	
% Heavy Veh	10	10	10	Ì				10	10	110	10	
PHF	0.95	0.95	0.95	i				0.95	0.95	0.95	0.95	
PK 15 Vol	94	10	116					341	3	3	277	
Hi Ln Vol		-		İ				-	-			
% Grade		0		i				0			0	
Ideal Sat	1800	1300	1800	İ				1800		1800	1800	
ParkExist	İ			İ			İ			İ		
NumPark	ĺ			ĺ			ĺ			ĺ		
No. Lanes	1	2	1	0	0	0	0	3	0	1	2	0
LGConfig	L	LT	R R					TR		L	Т	
Lane Width	10.5	11.5	12.0					11.0		11.0	11.0	
RTOR Vol			120						1			
Adj Flow	227	359	168					1375		13	1108	
%InSharedLn	40		50									
Prop LTs		0.4	21					0.00	00	1.000	0.00	0
Prop RTs	0.	468	1.000				0	.009		0	.000	
Peds Bikes	20	00	0	0			2	00	0			
Buses	0	0	0	ļ				12		0	12	
%InProtPhase	9									0.0		
Duration	0.25		Area	Type:	CBD	or Sim	ilar					

	Eastbound			Wes	stboun	d	Noi	rthbou	ınd	So	Southbound			
	L	Т	R	L	Т	R	L	Т	R	L	Т	R		
Init Unmet	0.0	0.0	0.0			 		0.0		0.0	0.0		-	
Arriv. Type	3	3	3					3		3	3			
Unit Ext.	3.0	3.0	3.0			ĺ		3.0		3.0	3.0			
I Factor	ĺ	1.000				Ì		1.000	)	ĺ	0.671			
Lost Time	2.0	2.0	2.0			İ		2.0		2.0	2.0			
Ext of g	0.0	0.0	0.0			İ		0.0		0.0	0.0			
Ped Min g	İ	4.5			3.2	İ		4.5		İ				

## _____OPERATING PARAMETERS______OPERATING PARAMETERS_____

	PHASE DATA												
Pha	se Combination	1	2	З	4			5	6	7	8		
1 ma		-	2	5	- 1			5	Ũ	,	0		
EB	Left	A				NB	Left						
	Thru	A			ĺ		Thru	A					
	Right	A			İ		Right	A					
	Peds	Х			İ		Peds	Х					
WB	Left					SB	Left	A	A				
	Thru				İ		Thru	A	А				
	Right				ĺ		Right						
	Peds				Ì		Peds	Х	Х				
NB	Right					EB	Right						
SB	Right					WB	Right						
Gre	en	23.0			1			43.0	8.0				
Yel	low	3.0						3.0	3.0				
All	Red	1.0						0.0	1.0				

Cycle Length: 85.0 secs

		77	JOLUM	E ADJ	USTMEN	r and	SATU	JRATION	J FLOV	WORKS	SHEET_		
Volume Ad	djus	tment											
		East	cboun	d	West	tbound	f	Nor	thbou	und	Sou	thboun	d
		L	Т	R	L	Т	R	L	Т	R	L 	Т	R
Volume, N	v	359 3	38	439				-  	1295	12	12	1053	 
PHF		0.95 (	).95	0.95					0.95	0.95	0.95	0.95	
Adj flow		378 4	40	336					1363	12	13	1108	
No. Lanes	s	1	2	1	0	0	0	0	3	0	1	2	0
Lane grou	up	L	LTR	R	Ì				TR		L	Т	ĺ
Adj flow	ĺ	227 3	359	168	Ì				1375		13	1108	ĺ
Prop LTs 0.421					Ì				0.00	0 0	1.000	0.000	ĺ
Prop RTs	İ	0.4	468 1	.000	İ			0.	009		j 0.	000	İ
Saturatio	on F	'low Ra	ate (	see E	xhibit Westbou	16-7	to d	letermi North	ne th	ne adju N	ustmen	t fact	ors)
TC T	Eas	τ τ τ τ τ τ τ τ τ τ τ τ τ τ τ τ τ τ τ τ	D		MEBLDO	ana		NOT CI.	TDO UIIC TD		т	T T	u
So 180	0 0	1300	1800					1	800		1800	1800	
Laneg 1	00	2	1	0	0	0	(	ר ז	2000	0	1	2	0
fw 0 c	950	0 983	1 00	0	0	0	,		967	0	0 967	0 967	0
fhv 0.9	909	0.909	0.90	9				C	),909		0.909	0.909	
fG 1.0	000	1.000	1.00	0				1	.000		1.000	1.000	
fP 1.0	000	1.000	1.00	0				1	.000		1.000	1.000	
fBB 1.0	000	1.000	1.00	0				C	).984		1.000	0.976	
fA 0.9	900	0.900	0.90	0				C	.900		0.900	0.900	
fLU 1.0	000	0.952	1.00	0				C	.908		1.000	0.952	
frt		0.930	0.85	0				C	).999			1.000	
fLT 0.9	950	0.979						1	.000		0.950	1.000	
Sec.											0.133		
fLpb 1.0	000	1.000						1	.000		0.985	1.000	
fRpb		0.827	0.63	0				С	).999			1.000	
s 132	29	1500	789					3	3807		1332	2646	
Sec.											187		
				CA	PACITY	AND 1	LOS I	VORKSHF	TT.				

Capacity Analysis and Lane Group Capacity

Ar Ma	opr/ vmt	Lane Group	Flo	Adj w Rate (v)	Adj Flow (s	Sat Rate s)	Flow Ratio (v/s)	Gre Rat (g/	en - io C C)	-Lane Gr apacity (c)	roup v/c Ratio	
Easth	oound											
Pı	rot											
Pe	erm											
Le	eft	L	2	27	132	29	0.17	0.	25	328	0.69	
Pı	rot											
Pe	erm											
Tł	nru	LTR	3	59	150	0 0	# 0.24	Ο.	25	371	0.97	
R	ight	R	1	68	789	9	0.21	Ο.	25	195	0.86	
Westk	oound											
Pı	rot											
Pe	erm											
Le	eft											
Pı	rot											
Pe	erm											
 ТЪ	าทม											
Ri	iaht											
North	hound	٩										
NOT CI Da	rot	L										
Pe	=⊥ III > f +											
ле Л-												
PI												
Pe	erm	шЪ	1	275	200	די	0.20	0	10	1020	0 75	
11	iru	TR	T	3/5	380	)/	0.36	0.	48	1830	0.75	
RI Q LI	ignt	-										
Sout	ibound	1										
Pı	rot		0	•	13.	32	0.00	0.	141	188	0.00	
Pe	erm		1	3	18	7	0.07	0.	471	88	0.15	
Le	eft	L	1	3				0.	61	276	0.05	
Pı	rot											
Pe	erm											
Tł	nru	Т	1	108	264	16	# 0.42	0.	61	1619	0.68	
R	ight											
Sum c	of flo	ow rati	os for	critio	cal lar	ne gro	oups, Yc	= S [.]	um (v	/s) =	0.66	
Total	l lost	t time	per cy	cle, 1	L = 12	.00 se	C					
Criti	ical f	Elow ra	te to	capacit	ty rat:	io,	Xc	= (Yc	)(C)/	(C-L) =	0.77	
Conti	rol De	elay an	d LOS	Determ	ination	1						
Appr	/ Ra	atios	Unf	Prog	Lane	Incre	emental	Res	Lane	Group	Appro	ach
Lane			Del	Adj	Grp	Facto	or Del	Del				
Grp	v/c	g/C	d1	Fact	Cap	k	d2	d3	Del	ay LOS	Delay	LOS
East	bound									_		
L	0.69	0.25	29.1	1.000	328	0.26	6.1	0.0	35.2	D		
LTR	0.97	0.25	31.7	1.000	371	0.47	38.1	0.0	69.8	E	57.4	E
R	0.86	0.25	30.6	1.000	195	0.39	30.3	0.0	60.9	E		
Westk	oound											
North	nbound	3										
ΨP	0 75	0 10	17 0	1 000	1926	0 20	1 0	0 0	10 E	D	10 E	D
ΤĽ	0./5	0.40	1/.Ö	1.000	σεστ	0.50	1.0	0.0	ט.עו	Б	19.0	D
South	ibound	٩										
T,	0 05	0 61	12 1	1 000	276	0 11	0 0	0 0	12 1	R		
т Т	0.68	0.61	11.0	1.000	1619	0.25	0.8	0.0	11 8	B	11.8	В
-	2.00	· · · ·					5.0			-		_

SUPPLEMENTAL PERMITTED LT WORKSHEET			
for exclusive lefts			
Input	WD	ND	СЪ
EB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 85.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N Number of lanes in opposing approach, No Adjusted LT flow rate, VLT (veh/h) Proportion of LT in LT lane group, PLT Proportion of LT in opposing flow, PLTo Adjusted opposing flow rate, Vo (veh/h) Lost time for LT lane group, tL	WB	NB	SB 54.0 40.0 41.0 1 3 1.000 0.00 1375 6.00
Computation			
LT volume per cycle, LTC=VLTC/3600 Opposing lane util. factor, fLUo Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc) gf=G[exp(- a * (LTC ** b))]-tl, gf<=g Opposing platoon ratio, Rpo (refer Exhibit 16-11) Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0] gq, (see Exhibit C16-4,5,6,7,8) gu=g-gq if gq>=gf, or = g-gf if gq <gf n=Max(gq-gf)/2,0) PTHo=1-PLTO PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)] EL1 (refer to Exhibit C16-3) EL2=Max((1-Ptho**n)/Plto 1 0)</gf 	0.952	0.952	$\begin{array}{c} 0.31 \\ 0.908 \\ 11.92 \\ 0.0 \\ 1.00 \\ 0.52 \\ 11.15 \\ 28.85 \\ 5.57 \\ 1.00 \\ 1.00 \\ 5.42 \end{array}$
fmin=2(1+PL)/g or $fmin=2(1+PL)/g$			0 10
<pre>gdiff=max(gq-gf,0) fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00) flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],( or flt=[fm+0.91(N-1)]/N**</pre>	fmin<=f	Em<=1.(	0.00 0.13
Left-turn adjustment, fLT			0.133
<pre>For special case of single-lane approach opposed by multiland see text. * If Pl&gt;=1 for shared left-turn lanes with N&gt;1, then assume left-turn lane and redo calculations. ** For permitted left-turns with multiple exclusive left-turn For special case of multilane approach opposed by single-land or when gf&gt;gq, see text.</pre>	e appro de-fact n lanes e appro	oach, co s, flt= oach	=fm.
SUPPLEMENTAL PERMITTED LT WORKSHEET for shared lefts			
Input			
EB Opposed by Single(S) or Multiple(M) lane approach Cycle length, C 85.0 sec Total actual green time for LT lane group, G (s) Effective permitted green time for LT lane group, g(s) Opposing effective green time, go (s) Number of lanes in LT lane group, N	WB	NB	SB

```
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
                                                       0.421
Proportion of LT in LT lane group, PLT
                                                                  0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo
                                                              0.952 0.952 0.908
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
qf=G[exp(-a * (LTC ** b))]-t], qf <= q
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, gro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g or fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm = [qf/q] + [qu/q] / [1 + PL(EL1 - 1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT
For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
 left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.
               SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET
Permitted Left Turns
                                                        EΒ
                                                                    NB
                                                              WB
                                                                          SB
Effective pedestrian green time, gp (s)
                                                                         43.0
Conflicting pedestrian volume, Vped (p/h)
                                                                         200
Pedestrian flow rate, Vpedg (p/h)
                                                                         395
                                                                         0.198
0CCpedq
                                                                         11.15
Opposing queue clearing green, gq (s)
                                                                         0.259
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
                                                                         0.172
Opposing flow rate, Vo (veh/h)
                                                                         1375
                                                                         0.025
OCCr
                                                                         2
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
                                                                         1
ApbT
                                                                         0.985
Proportion of left turns, PLT
                                                                         1.000
Proportion of left turns using protected phase, PLTA
                                                                         0.000
Left-turn adjustment, fLpb
                                                                         0.985
Permitted Right Turns
Effective pedestrian green time, gp (s)
                                                       23.0
                                                                   43.0
                                                                   200
Conflicting pedestrian volume, Vped (p/h)
                                                       200
Conflicting bicycle volume, Vbic (bicycles/h)
                                                       0
                                                                   0
                                                      739
                                                                  395
Vpedg
OCCpedq
                                                       0.370
                                                                  0.198
                                                                   41.0
Effective green, g (s)
                                                       21.0
                                                       0
                                                                   0
Vbicg
```

OCCbicg	0.020	0.020
OCCr	0.370	0.198
Number of cross-street receiving lanes, Nrec	2	2
Number of turning lanes, Nturn	2	1
ApbT	0.630	0.882
Proportion right-turns, PRT	1.000	0.009
Proportion right-turns using protected phase, PRTA	0.000	0.000
Right turn adjustment, fRpb	1.000	0.999

_____SUPPLEMENTAL UNIFORM DELAY WORKSHEET_____

			EBLT	WBLT	NBLT	SBLT					
Cycle length, C 85.	.0	sec									
Adj. LT vol from Vol Adjustment Worksheet, v						13					
v/c ratio from Capacity Worksheet, X					0.05						
Protected phase effective green interval, g (				12.0							
Opposing queue effective green interval, gq		11.15									
Unopposed green interval, gu						28.85					
Red time r=(C-g-gq-gu)						33.0					
Arrival rate, qa=v/(3600(max[X,1.0]))											
Protected ph. departure rate, Sp=s/3600						0.370					
Permitted ph. departure rate, Ss=s(gq+gu)/(gu	a*360	00)				0.07					
XPerm						0.13					
XProt											
Case						4					
Queue at beginning of green arrow, Qa						0.00					
Queue at beginning of unsaturated green, Qu						0.16					
Residual queue, Qr						0.00					
Uniform Delay, dl						12.1					

_____DELAY/LOS WORKSHEET WITH INITIAL QUEUE______

Appr/	Initial Unmet	Dur. Unmet Demand	Uniform	Delay	Initial Oueue	Final Unmet	Initial Oueue	Lane Group
Lane	Demand	Demand	Unadj.	Adj.	~ Param.	Demand	Delay	Delay
Group	Q veh	t hrs.	ds	dl sec	u	Q veh	d3 sec	d sec
Eastbour	nd							
L	0.0	0.00	32.0	29.1	0.00	0.0	0.0	35.2
LTR	0.0	0.00	32.0	31.7	0.00	0.0	0.0	69.8
R	0.0	0.00	32.0	30.6	0.00	0.0	0.0	60.9
Westbour	nd							
	0.0						0.0	
	0.0						0.0	
	0.0						0.0	
Northbou	und							
	0.0						0.0	
TR	0.0	0.00	22.0	17.8	0.00	0.0	0.0	19.6
	0.0						0.0	
Southbou	und							
L	0.0	0.00		12.1	0.00	0.0	0.0	12.1
Т	0.0	0.00	16.5	11.0	0.00	0.0	0.0	11.8
	0.0						0.0	
	Intersect	ion Dela	ay 25.7	sec/ve	eh Ir	ntersecti	ion LOS	С

_____BACK OF QUEUE WORKSHEET_____BACK OF QUEUE WORKSHEET_____

	Eastbou	Westbound			Nor	thbound	Southbound			
LaneGroup	L LTR	R					TR	L	т	
Init Queue	0.0 0.0	0.0					0.0	0.0	0.0	
Flow Rate	227 188	168					504	13	581	
So	1800 1300	1800					1800	1800	1800	
No.Lanes	1 2	1	0	0	0	0	3 0	1	2 0	
SL	1329 787	789					1397	451	1389	
LnCapacity	328 194	195			ĺ		674	276	850	
Flow Ratio	0.2 0.2	0.2					0.4	0.0	0.4	
v/c Ratio	0.69 0.97	0.86			ĺ		0.75	0.05	0.68	
Grn Ratio	0.25 0.25	0.25					0.48	0.61	0.61	
I Factor	1.000	) į			İ		1.000	İ	0.671	
AT or PVG	3 3	3			ĺ		3	3	3	
Pltn Ratio	1.00 1.00	1.00			ĺ		1.00	1.00	1.00	
PF2	1.00 1.00	1.00			ĺ		1.00	1.00	1.00	
Q1	4.9 4.4	3.8					9.6	0.1	9.2	
kB	0.3 0.2	0.2			ĺ		0.5	0.2	0.4	
Q2	0.7 2.1	1.2			ĺ		1.5	0.0	0.9	
Q Average	5.6 6.5	5.0			ĺ		11.1	0.1	10.0	
Q Spacing	25.0 25.0	25.0					25.0	25.0	25.0	
Q Storage	95 0	100			ĺ		0	50	0	
Q S Ratio	1.5	1.2						0.1		
70th Percent	cile Output	::								
fB%	1.2 1.2	1.2					1.2	1.2	1.2	
BOQ	6.6 7.7	5.9					13.0	0.2	11.8	
QSRatio	1.7	1.5						0.1		
85th Percent	cile Output	::								
fB%	1.5 1.5	1.6					1.5	1.6	1.5	
BOQ	8.7 10.0	7.7					16.7	0.2	15.2	
QSRatio	2.3	1.9						0.1		
90th Percent	cile Output	::								
fB%	1.7 1.7	1.7					1.6	1.8	1.6	
BOQ	9.5 10.9	8.5					18.1	0.2	16.4	
QSRatio	2.5	2.1						0.1		
95th Percent	cile Output	::								
fB%	1.9 1.9	2.0					1.8	2.1	1.8	
BOQ	10.9 12.4	9.7					20.2	0.3	18.5	
QSRatio	2.9	2.4						0.1		
98th Percent	cile Output	::								
fB%	2.4 2.3	2.4					2.1	2.7	2.2	
BOQ	13.1 14.9	11.8					23.6	0.4	21.6	
QSRatio	3.5	3.0						0.2		

_____ERROR MESSAGES_____

No errors to report.