Appendix PCritical Movement Summation (CMS) How-To<br/>Guide

#### P.1 BACKGROUND

The critical movement summation (CMS) method focuses on "raw" intersection capacity, that is, the ability for an intersection to process a given traffic demand with a given lane use configuration and given phase sequence.

Traffic signal phasing is one component of the analysis, but it is important to note that most of the subtleties of traffic signal phasing and operation are not included in the analysis.

The analyst can use this simple hands-on approach to get right to the point of an intersection's ability to handle traffic demands. CMS looks at each of the "critical" movements at an intersection. It is a volume-based measure.

#### P.2 PROCESS

#### **Step 1. Gather CMS Inputs**

- Hourly Volumes Use vehicles per hour. If analyzing the peak hour, use the largest sum of 4 consecutive 15-minute periods for that intersection, e.g. 7:45 8:45 AM.
- Lane Use Configurations Determined through observation of existing geometry and operations.
- Signal Phasing Use National Electrical Manufacturers Association (NEMA) standard 8-phase operation with adjustments as needed. The top line of phasing on the CMS worksheet is intended to show existing phasing. The adjacent line below is workspace intended for conceptual improvements to phasing. See Figure P.1 for a typical NEMA phase numbering schemes.



#### P-1 Critical Movement Summation How-To Guide

### Step 2. Fill in CMS Worksheet

For each row, fill in the columns:

- Movement (describe in words, e.g. NB through, SB through, EB left, etc.)
- Phase (indicate movement number)
- Volume (in the case of a shared lane, write each volume long-hand, and then sum, e.g. 100 + 150 + 25)
- LU (Lane Use factor, see table at bottom of worksheet.)
- Lane Volume (multiply the Volume by the Lane Use Factor.)
- OL (Opposing Lefts, to be added. See description of Permissive Only Lefts below.)
- LTC (Left Turn Credit, to be subtracted. See description of Concurrent Lefts or Lead/Lead-Lag Left below.)
- Critical Lane Volume (apply OL or LTC to the Lane Volume to get this Critical Lane Volume.)

#### **Step 3. Determine Critical Movements**

In the CM column, note the highest of each movement pair (e.g. highest of NB/SB through, highest of NB left/SB left, etc.) with an asterisk\*. There should be an asterisk (\*) corresponding to each block in the top line of phasing on the CMS worksheet.

#### Step 4. Sum the Critical Movements

Fill in the "Total" by adding the movements that have asterisks\*. Assign a Level of Service (LOS) by using the Level of Service table at the bottom of the CMS worksheet.

# P.3 RULES FOR TURNING MOVEMENTS

### P.3.1 RIGHT TURNS

If right-turn is "hot" or "free" (i.e. has a dedicated, channelized deceleration and acceleration lanes) and is not signal controlled, leave out of computation.

If right-turn has a dedicated lane and is signal controlled with right-turn-on-red permitted, assume 50% of right-turn volume.

If right-turn has a dedicated lane and is signal controlled with "No right turn on red," assume 100% of right-turn volume.

If right-turn has a dedicated lane and is signal controlled for rights to move concurrently with lefts (e.g. NB rights move with WB lefts), reduce the right-turn volume in the amount of the left-turn volume.

If there is a shared through/right lane, add through and right volumes.

## P.3.2 LEFT TURNS

Left turns are to be treated as either protected (signalized left-turn arrow) or permissive (no left-turn arrow). If existing condition allows a left-turn movement to be both protected and permissive, analyze as protected (only) in CMS.

### P.3.2.1 Concurrent Lefts



Account for Left Turn Credit (LTC) as follows:

- Calculate lane volumes for left-turn moves
- Apply lane-use factor
- Calculate difference of lefts (e.g. NB/SB lefts or EB/WB lefts)
- Subtract this difference from the through movement that's in the same direction as the greater leftturn volume.

CMS may over or underestimate the impact of left turn traffic on shared left-through-right lane in situations where through opposing volume is high. Additional Analysis (such as the methods of the *Highway Capacity Manual*) may be warranted.

### P.3.2.2 Lead Left (one direction), or Lead-Lag (two directions)

Account for Left Turn Credit (LTC) as follows:

- Identify left-turn volume associated with the lead (or lag) phase.
- Apply lane-use factor.
- Subtract that left-turn volume from the through movement on the same approach.

### P.3.2.3 Permissive Only Lefts (no left-turn arrow)

Account for Opposing Lefts (OL) as follows:

- Identify left-turn volume that will be awaiting gaps in the through volume. (These lefts are considered "opposing lefts" opposing the through volume being analyzed.)
- Add that left-turn volume to the opposing through movement.
- The left turns cannot move until the opposing through movement is complete. So you must consider the total of these two movements, since they cannot move simultaneously.





### P.3.2.4 Split Phasing

- Left-turn credit (LTC) does not apply.
- Opposing lefts (OL) do not apply.

# P.4 SIGNAL TIMING

CMS can be used as a prerequisite to signal timings. The following steps follow CMS to determine cycle length and required green and clearance (yellow and all red) time:

- Step 1. Transfer phasing and Critical Lane Volume (CLV) Inputs from CMS worksheet onto the Traffic Signal Timing Worksheet (see Figure P-2)
- **Step 2.** Determine number of vehicles per cycle per phase. The table included in the Traffic Signal Timing Worksheet can be used to determine the number of cycles in an hour (or simply divide 3600 seconds by the cycle length).
- **Step 3.** Determine green time required from Greenshield's model (see Figure P-3)
- Step 4. Determine clearance and pedestrian timings.
- Step 5. Determine total time required and compare to cycle length.

# P.5 CMS SAMPLE EXERCISE PROBLEMS

See Figures P-5 through P-14 for CMS sample exercise problems.

# P.6 SIGNAL TIMING SAMPLE EXERCISE PROBLEM

See Figure P-16 for a sample signal timing exercise problem.

# DelDOT Standards and Regulations for Subdivision Streets and State Highway Access

# Figure P-2 Traffic Signal Timing Worksheet

Location:		Date:	
Cycle Length:	Cycles per Hour:	Prepared by:	

Time of Day:

Phases	Movement	Critical lane Volume (CLV)	Vehicles per Cycle	Green Time Required (see Greenshield Figure P-3)	Clearance (Red + Yellow)	Walk + Don't Walk

Total Green		
Total Clearance		
Total Time Required		

Cycle	Cycles per
Length	Hour
45	80
60	60
75	48
90	40
100	36
120	30
150	24
180	20
210	17
240	15

Vehicles per Cycle per lane	Seconds per Vehicle	Cumulative seconds	Vehicles per Cycle per lane	Seconds per Vehicle	Cumulative seconds
1	3.8	3.8	24	2.1	54.1
2	3.1	6.9	25	2.1	56.2
3	2.7	9.6	26	2.1	58.3
4	2.4	12.0	27	2.1	60.4
5	2.2	14.2	28	2.1	62.5
6	2.1	16.3	29	2.1	64.6
7	2.1	18.4	30	2.1	66.7
8	2.1	20.5	31	2.1	68.8
9	2.1	22.6	32	2.1	70.9
10	2.1	24.7	33	2.1	73.0
11	2.1	26.8	34	2.1	75.1
12	2.1	28.9	35	2.1	77.2
13	2.1	31.0	36	2.1	79.3
14	2.1	33.1	37	2.1	81.4
15	2.1	35.2	38	2.1	83.5
16	2.1	37.3	39	2.1	85.6
17	2.1	39.4	40	2.1	87.7
18	2.1	41.5	41	2.1	89.8
19	2.1	43.6	42	2.1	91.9
20	2.1	45.7	43	2.1	94.0
21	2.1	47.8	44	2.1	96.1
22	2.1	49.9	45	2.1	98.2
23	2.1	52.0	46	2.1	100.3

Figure P-3 Traffic Signal Green Time Requirements (Greenshield's Model)

						0-7-76						
					Loca	tion:						
	De De	elDOT 📃			Coun	t Date	:					
					Scena	ario:						
CF	RITICAI	L LANE MO	VEMENT SU	MMATION	Com	puted l	By:			Date	e:	
٨N	ND LEV	EL OF SERV	VICE		Chec	ked By	y:			Date	e:	
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										koa. Vam		
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Sig	gnal Phas	ing ( <b>Φ)</b>										
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	N		37.1					Lane	OT (A 11)	LTC	Critical	СМ
Ψ	M	ovement	von	ime				Volume	OL (Add)	(Subtract)	Volume	(*)
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						_					ļ	
L												
Re	marks:		I						ΤΟΤΑΙ·		1	1
							F	T DT	IOIAL.			
								LEVEL OF	SERVICE:			
I I	Level	Critical N	lovement		No. of La	nes	Lar	ne Use factor		L	EGEND	
	A Less than 1,000 yeb/hr			1			(LU) 1.00	┥ ┝─	01 - 0	osing Laffa		
	A Less than 1,000 veh/hr		2			0.55		UL = Upp TC = Leff	USING LEITS			
	B         1,000 to 1,150 veh/hr           C         1 151 to 1 300 veh/hr		3			0.40						
	D	1,301 to 1,	450 veh/hr	F	4			0.30	-1			
	Е	1,451 to 1,	600 veh/hr	L			•					
	F	More than 1	.600 veh/hr									

Figure P-4 CMS Blank Sheet

P-4 Critical Movement Summation How-To Guide

CR AN	RITICAI ND LEV	ELANE MOV	VEMENT SU /ICE	MMATION	Locatio Count I Scenar Compu Checke	on: Date: io: ited By: ed By:	Rt. 300 a 12/25/20 Existing ABC JHI	nnd Rt. 42 05 – Permissiv	e Lefts – Sha Date Date	ared lefts : 01 : 01	/01/06 /02/06
$\begin{array}{c c} \hline 106 \\ \hline 561 \\ \hline 110 \\ \hline 561 \\ \hline 110 \\ \hline 223 \\ \hline 712 \\ \hline 49 \\ \hline \hline 49 \\ \hline \hline \hline 712 \\ \hline 49 \\ \hline \hline \hline 712 \\ \hline 712 $				-		Rt. 300		Rt. 42			
	$2+6 \qquad 4+8 $										
Φ	М	ovement	Volı	ume		LU	Lane Volume	OL (Add)	LTC (Subtract)	Critical Lane Volume	CM (*)
2	Rt. 300	EB.	223+7	12+49	984	1.00	984	110		1094	*
6	Rt. 300	WB.	110+56	61+106	777	1.00	777	223		1000	
4	Rt. 42	SB.	117+16	64+121	402	1.00	402	20		422	*
8	Rt 42	NB	20+4	7+18	85	1.00	85	117		202	
-				,							
Re	marks:							TOTAL		1516	
itematiks.						LEVEL OF	F SERVICE:		E		
Critical Movement				La	ane Use factor	r DERVICE.					
	Level Volume		INO. Of Lane	es	(LU)	$ \perp$		IGEND			
	A Less than 1,000 veh/hr		1		1.00	┥┝,	OL = Oppo	osing Lefts			
	B 1,000 to 1,150 veh/hr		2		0.55	-  [_]	LIC = Left	Turn Credit			
	D	1,131  to  1,	450  veh/hr		<u> </u>		0.40				
D         1,301 to 1,450 veh/hr           E         1.451 to 1.600 veh/hr		Т	<u> </u>	0.50	ł						
	$\frac{1}{1,451} \text{ to } 1,600 \text{ veh/hr}$ $F \qquad \text{More than } 1,600 \text{ veh/hr}$										

Figure P-5 CMS Example 1 – Permissive Lefts – Shared Lefts

CR AN	CRITICAL LANE MOVEMENT SUMMATION AND LEVEL OF SERVICE					Location: Count Date: Scenario: Computed By: Checked By:			Rt. 300 and Rt. 42         12/25/2005         Existing – Split E-W Phasing – Shared lefts         ABC       Date:       01/01/06         JHI       Date:       01/02/06				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$					Rt.	300		Rt. 42					
518		ing ( <b>Φ)</b>	2		4+8	•	•						
				-		_			]				
Φ	M	ovement	Volu	ime		LU	,	Lane Volume	OL (Add)	LTC (Subtract)	Critical Lane Volume	CM (*)	
1	Rt. 300	EB.	223+7	12+49	984	1.00	)	984			984	*	
2	Rt. 300	WB.	110+56	1+106	777	1.00	)	777			777	*	
4	Rt. 42 S	SB.	117+16	4+121	402	1.00	)	402	20		422	*	
8	Rt. 42 1	NB.	20+47	7+18	85	1.00	)	85	117		202		
Re	marks:								TOTAL:		2183		
							Ι	LEVEL OI	F SERVICE:		F		
Ι	Level Critical Movement		No. of La	anes	Lane	Use factor	r	LF	GEND				
	A	Less than 1	000 veh/hr	=	1			1.00	┥ ┝─	OL = Oppo	osing Lefts		
	B         1,000 to 1,150 veh/hr		2			0.55		LTC = Left	Turn Credit				
	C	1,151 to 1,3	300 veh/hr		3			0.40					
	D	1,301 to 1,4	450 veh/hr	L	4			0.30					
	E F	1,451 to 1,0	500 veh/hr										

Figure P-6 CMS Example 2 – Split E-W Phasing – Shared Lefts

			_		-		D: 200	1.0. 10				
					Locati	on:	Rt. 300 and Rt. 42					
	De De	eidu i $\equiv$			Count	Date:	12/25/20	05	N · ~~	17.0		
					Scenar	rio:	Existing	– Split All I	hasing - Sha	ared Lefts		
CF	RITICAI	L LANE MO	VEMENT SU	MMATION	Compu	ited By:	ABC		Date	: 01	/01/06	
AN	ND LEV	EL OF SERV	/ICE		Check	ed By:	JHI	P	Date	: 01	/02/06	
	$\begin{array}{c c} \hline \hline 1 \\ \hline \hline \hline 1 \\ \hline 1 \\ \hline \hline 1 \hline 1$					Rt. 300		Rt. 42				
Sig	nal Phas	ing ( <b>Φ)</b>	•						I I			
	1		2	<b>A</b>	3	i	4					
	•	_		· • <u></u> -[					<b>↓</b>			
		•		•	•							
	•											
	r							1		1	1	
_			<b>T</b> 7 1				Lane		LTC	Critical	СМ	
Φ	M	ovement	Vol	ume		LU	Volume	UL (Add)	(Subtract)	Lane Volume	(*)	
1	Rt. 300	EB.	223+7	12+49	984	1.00	984			984	*	
2	Rt 300	WB.	110+56	51+106	777	1.00	777			777	*	
Ļ_	1		110-50			1.00	.,,,			.,,,		
2	D: 40.4		117.1	4+121	402	1.00	402			400	ۍ ب	
3	кt. 42 S	5B	117/+16	94+121	402	1.00	402			402	Ŷ	
4	Rt. 42 1	NB	20+4	7+18	85	1.00	85			85	*	
						1						
Re	marks <sup>.</sup>							TOTAL		2240		
1.0								IUIAL:		2248		
		a	-				LEVEL OF	SERVICE:		F		
I	Level Critical Movement		No. of Lan	es L	ane Use factor		LF	EGEND				
	A Less than 1 000 veh/br		1		1.00	-	OL = Onno	osing Lefts				
	A         Less than 1,000 ven/nr           B         1,000 to 1,150 veh/hr		2		0.55		TC = Left	Turn Credit				
	С	1,151 to 1,	300 veh/hr		3		0.40					
	D	1,301 to 1,	450 veh/hr		4		0.30					
	E	1,451 to 1,	600 veh/hr									
	F	More than 1	600 veh/hr									

Figure P-7 CMS Example 3 – Split All Phasing – Shared Lefts

P-7 Critical Movement Summation How-To Guide

	CRITICAL LANE MOVEMENT SUMMATION					on: Date: io:	Rt. 300 a 12/25/20 Existing	and Rt. 42 005 – Permissiv	e Lefts - Sep	efts - Separate Lefts	
CRÍ ANT	TICAI	L LANE MOV	VEMENT SU ACE	MMATION	Compu	ited By:	ABC		Date	$\frac{01}{01}$	/01/06
$\begin{array}{c c c c c c c c c c c c c c c c c c c $							Rt. 300		Rt. 42		/02/00
Signa	$\begin{array}{c c} \hline 49 \\ \hline \\ \hline$										
					_						
Φ	M	ovement	Volu	ume		LU	Lane Volume	OL (Add)	LTC (Subtract)	Critical Lane Volume	CM (*)
2 ]	Rt.300	EB.	712 <sup>.</sup>	+49	761	1.00	761	110		871	
6 ]	Rt. 300	WB.	561+	-106	667	1.00	667	223		890	*
4 ] 8 ]	Rt. 42 S Rt. 42 I	SB NB	117+16 20+4	54+121 7+18	402 85	1.00 1.00	402 85	20 117		422 202	*
Rem	Remarks:							TOTAL:		1312	
Critical Managert			1,	LEVEL OI	F SERVICE:		D				
Le	Level Volume		No. of Lane	es La	(LU)			EGEND			
1	A Less than 1,000 veh/hr		1		1.00	$\neg$	OL = Oppo	osing Lefts			
I	B 1,000 to 1,150 veh/hr		3		0.55		LIC = Left	i urn Credit			
		1,101,01,	450 1 /l	-			0.10				
1	)	1,301 to 1,4	450 ven/hr		4		0.30				

 Figure P-8
 CMS Example 4 – Permissive Lefts – Separate Lefts

P-8 Critical Movement Summation How-To Guide



Figure P-9 CMS Example 5 – Permissive Lefts – Two Throughs and a Shared Left

P-9 Critical Movement Summation How-To Guide

				Locatio	Location: Rt. 300 and R			Rt. 42			
		elDOT 📃			Count	Date:	12/25/20	05			
					Scenar	io:	Existing	- Protected	Lefts – Sepa	rate Lefts	
CR	RITICAI	L LANE MOV	VEMENT SUN	<b>MATION</b>	Compu	ited By:	ABC		Date	01	/01/06
AN	ND LEV	EL OF SERV	/ICE		Checke	ed By:	JHI		Date	01	/02/06
$\begin{array}{c c} \hline 106 \\ \hline 561 \\ \hline 110 \\ \hline 223 \\ \hline 712 \\ \hline 49 \\ \hline $							Rt. 300		Rt. 42	-	
Sig	$\frac{1}{5}$	ıng ( <b>Φ)</b>	2+6		4+0					<u> </u>	
<u> </u>	1+5		2+6		4+8	⊢⊢►	▲				
			$\rightarrow$			↓ ◆	┼▶				
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<u> </u>											
	1										
Φ	M	ovement	Volur	ne		LU	Lane	OL (Add)		Critical Lane	CM
						-	volume		(Subtract)	Volume	(*)
1	Rt. 300	WB.	110		110	1.00	110			110	
5	Rt.300	EB.	223		223	1.00	223			223	*
2	Rt.300	EB.	712+4	49	761	1.00	761		113	648	
6	Rt. 300	WB.	561+1	06	667	1.00	667			667	*
4	Rt. 42	SB	117+164	+121	402	1.00	402	20		422	*
8	Rt. 42 1	NB	20+47-	+18	85	1.00	85	117		202	
Re	marks:							TOTAL:		1312	
							LEVEL OF	F SERVICE:		D	
I	Level Critical Movement			No. of Land	es La	ne Use factor		LF	GEND		
	A Less than 1 000 veh/hr			1		(LU) 1.00	┥ ┝─	OL = Opp(	sing Lefts		
B         1,000 to 1,150 veh/hr			2		0.55	I	TC = Left	Turn Credit			
C 1,151 to 1,300 veh/hr			3		0.40						
D 1,301 to 1,450 veh/hr		4		0.30							
E 1,451 to 1,600 veh/hr											
F More than 1,600 veh/hr											

Figure P-10 CMS Example 6 – Protected Lefts – Separate Lefts



Figure P-11 CMS Example 7 – Split EW – Separate Lefts

CRITICAL LANE MOVEMENT SUMMATION AND LEVEL OF SERVICE $\boxed{3}$ $\boxed{3}$ $\boxed{5}$ $\boxed{106}$ $\boxed{561}$ $110$ $223$ $\boxed{712}$ $\boxed{5}$ $\boxed{5}$ $\boxed{106}$ $\boxed{561}$ $110$				Locatio Count Scenar Compu Checke	on: Date: io: ited By: ed By:	Rt. 300 a         12/25/20         Existing         Lefts - S         ABC         JHI         Rt. 300	Protected eparate Rig	Permissive I nts Date: Date: E	Lefts – Sepa	rate /01/06 /02/06	
$ \begin{array}{c} 225 \\ 712 \\ 49 \\ \hline \hline$											
4	$\begin{array}{c c} 1+5 \\ \hline \\ $			4+8	→ ▲						
							,	l			
Φ	М	ovement	Volu	me		LU	Lane Volume	OL (Add)	LTC (Subtract)	Critical Lane Volume	CM (*)
1	Rt. 300	WB.	110	0	110	1.00	110			110	
5	Rt.300	EB.	223	3	223	1.00	223			223	*
2	Rt.300	EB.	712+	-49	761	1.00	761		113	648	
6	Rt. 300	WB.	561+	106	667	1.00	667			667	*
4	Rt. 42	SB	117+	164	281	1.00	281	20		301	*
8	Rt. 42	NB	20+4	47	67	1.00	67	117		184	
Da	marke							TOTAL		1101	
KC.	111 <b>a</b> 1KS.							IUTAL:		1191 C	
Critical Movement				T	LEVEL OF ane Use factor			U			
I	Level Volume		No. of Land	es L	(LU)			GEND			
	A Less than 1,000 veh/hr		1		1.00	$\perp$	OL = Oppo	sing Lefts			
	B 1,000 to 1,150 veh/hr		2		0.55		LIC = Left	I urn Credit			
	D	1,301 to 1.	450 veh/hr	F	4		0.40	_			
D         1,301 to 1,450 veh/hr           E         1,451 to 1,600 veh/hr		•			4						
F More than 1,600 veh/hr											

Figure P-12 CMS Example 8 – Protected Permissive Lefts – Separate Lefts – Separate Rights

P-12 Critical Movement Summation How-To Guide



Figure P-13 CMS Example 9 – Protected Lefts – Double Lefts

P-13 Critical Movement Summation How-To Guide

CRITICAL LANE MOVEMENT SUMMATION AND LEVEL OF SERVICE			Location Count Scenar Compu Checko	on: Date: io: uted By: ed By:	Rt. 300 a 12/25/20 Existing ABC JHI	nd Rt. 42 05 – Lead-Lag	Phasing Date Date	01 01	/01/06 /02/06		
$\begin{array}{c c} \hline 1 & \hline 1$					Rt. 300		Rt. 42				
	5		2+6	<b>▲</b>	1		4+8		<b>▲</b>		
Φ	М	ovement	Volı	ıme		LU	Lane Volume	OL (Add)	LTC (Subtract)	Critical Lane Volume	CM (*)
5 Rt.300 EB.		22	.3	223	0.55	123			123	*	
2	Rt.300	EB.	712-	+49	761	1.00	761		123	638	*
6	Rt. 300	WB.	106+	-561	667	1.00	667		61	606	
1	Rt. 300	WB.	11	0	110	0.55	61			61	*
4	Rt. 42 \$	SB	117+16	4+121	402	1.00	402	20		422	*
8 Rt. 42 NB		20+4	7+18	85	1.00	85	117		202		
Remarks:					LEVEL OF	TOTAL: F SERVICE:		1244 C			
I	Level	Critical N	lovement		No. of Lan	es La	ane Use factor		LEGEND		
	А	Less than 1	Volume Less than 1 000 veh/hr		1		1.00		OL = Opposing Lefts		
	В	1,000 to 1,	150 veh/hr		2		0.55 LT		LTC = Left Turn Credit		
C 1,151 to 1,300 veh/hr			3		0.40						
D 1,301 to 1,450 veh/hr		450 veh/hr	l	4		0.30					
<u> </u>	E F	More than 1	600 veh/hr								

Figure P-14 CMS Example 10 – Lead-Lag Phasing

P-14 Critical Movement Summation How-To Guide

			Normh an af	Results	
Exercise	Picture	Phasing	critical movements	Critical Movement Summation	LOS
1	Rt. 300	Simple 2-phase (permissive lefts)	2	1516	Е
2	Rt. 300	Split E-W	3	2183	F
3	Rt. 300	Split all	4	2248	F
4		Simple 2-phase (permissive lefts)	2	1312	D
5		Simple 2-phase (permissive lefts)	2	1196	С

Figure P-15 Summary of Exercises

				Results		
Exercise	Picture	Phasing	Number of critical movements	Critical Movement Summation	LOS	
6	Rt. 300	Exclusive concurrent E-W lefts	3	1312	D	
7		Split E-W	3	1850	F	
8		Exclusive concurrent E-W lefts with N-S rights	3	1191	С	
9		Exclusive concurrent E-W lefts	3	1255	С	
10		Lead-Lag E-W	3	1611	F	

DelDOT Standards and Regulations for Subdivision Streets and State Highway Access

	1	Figure P-16	Traffic Signal	Timing Exercis	e	
Location:	Rt. 300 and	Rt. 42		Date:	01/01/06	
Cycle Length:	100 Cycles per Hour: 36		Prepared by:	ABC	01/01/06	
Time of Day:	AM Peak Hour			Checked by:	JHI	01/02/06
Phases	Movement	Critical lane Volume (CLV)	Vehicles per Cycle	Green Time Required (see Greenshield Figure P-3)	Clearance (Red + Yellow)	Walk + Don't Walk

				Figure P-3)		
2+6	Rt. 300	1094	30	67	3+2	-
4+8	Rt. 42	422	12	29	3+2	-

Total Green	96	
Total Clearance	10	
Total Time Required	106	

Cycle	Cycles per
Length	Hour
45	80
60	60
75	48
90	40
100	36
120	30
150	24
180	20
210	17
240	15