DelDOT
DC Manual

Chapter 5
Auxiliary Lane Updates

TEAM DelDOT

Transparent Efficient Accountable Measured

October 18, 2016

Auxiliary Lane Updates

- **Left-Turn Lane Warrants for Volumes Less Than 50 vph**
  - Current DC Manual
    - left-turn lane required for any AADT as long as left-turn volume requirements are satisfied
      - AADT $<$ 2,000 & left-turn volume 20-50 vph
      - AADT $\geq$ 2,000 and $\leq$ 4,000 & left-turn volume 10-50 vph
      - AADT $>$ 4,000 & left-turn volume 5-50 vph
  - Concerns when a left turn lane is warranted with very low left-turning volumes

Section 5.2.9.3.C

Auxiliary Lane Updates

- **Left-Turn Lane Warrants for Volumes Less Than 50 vph**
  - Compared the left turn lane warrants from NCHRP 745, the Maryland State Highway Administration (SHA), and the current DelDOT Road Design Manual

AADT 5000

TPG	Opposing Volume	Advancing Volume	NCHRP 745 Minimum Left Turn Volume To Warrant Left Turn Lane		MD SHA Maximum Allowable Left Turn Volume			DelDOT RDM Minimum Left Turn Volume to Warrant Left Turn Lane
			Rural Roadways	Urban /Suburban Roadways	Without Any Treatment	With Treatment		
1	319	255	5	9	N/A*	51	Bypass	-
						> 51	Left-turn Lane	
2	347	247	5	8		49	Bypass	-
						> 49	Left-turn Lane	
3	336	244	5	8		49	Bypass	-
						> 49	Left-turn Lane	
4	317	286	5	9		29	Bypass	-
						> 29	Left-turn Lane	
5	427	277	5	6		28	Bypass	40
						> 28	Left-turn Lane	
6	527	314	5	5		> 15	Left-turn Lane	30
7	652	281	5	5		> 14	Left-turn Lane	20
8	526	404	5	5		> 20	Left-turn Lane	15

Notes:
*- SHA without any treatment column is not applicable as all the volumes are either bypass or left-turn lane thresholds.

Auxiliary Lane Updates

- **Left-Turn Lane Warrants for Volumes Less Than 50 vph**
  - Compared the left turn lane warrants from NCHRP 745, the Maryland State Highway Administration (SHA), and the current DelDOT Road Design Manual

AADT 5000

TPG	Opposing Volume	Advancing Volume	NCHRP 745 Minimum Left Turn Volume To Warrant Left Turn Lane		MD SHA Maximum Allowable Left Turn Volume			DelDOT RDM Minimum Left Turn Volume to Warrant Left Turn Lane
			Rural Roadways	Urban /Suburban Roadways	Without Any Treatment	With Treatment		
1	319	255	5	9	N/A*	51	Bypass	-
						> 51	Left-turn Lane	
2	347	247	5	8		49	Bypass	-
						> 49	Left-turn Lane	
3	336	244	5	8		49	Bypass	-
						> 49	Left-turn Lane	
4	317	286	5	9		29	Bypass	-
						> 29	Left-turn Lane	
5	427	277	5	6		28	Bypass	40
						> 28	Left-turn Lane	
6	527	314	5	5		> 15	Left-turn Lane	30
7	652	281	5	5		> 14	Left-turn Lane	20
8	526	404	5	5		> 20	Left-turn Lane	15

Notes:
*- SHA without any treatment column is not applicable as all the volumes are either bypass or left-turn lane thresholds.

Auxiliary Lane Updates

- **Left-Turn Lane Warrants for Volumes Less Than 50 vph**
  - Compared the left turn lane warrants from NCHRP 745, the Maryland State Highway Administration (SHA), and the current DelDOT Road Design Manual

AADT 5000

TPG	Opposing Volume	Advancing Volume	NCHRP 745 Minimum Left Turn Volume To Warrant Left Turn Lane		MD SHA Maximum Allowable Left Turn Volume			DelDOT RDM Minimum Left Turn Volume to Warrant Left Turn Lane
			Rural Roadways	Urban /Suburban Roadways	Without Any Treatment	With Treatment		
1	319	255	5	9	N/A*	51	Bypass	-
						> 51	Left-turn Lane	
2	347	247	5	8		49	Bypass	-
						> 49	Left-turn Lane	
3	336	244	5	8		49	Bypass	-
						> 49	Left-turn Lane	
4	317	286	5	9		29	Bypass	-
						> 29	Left-turn Lane	
5	427	277	5	6		28	Bypass	40
						> 28	Left-turn Lane	
6	527	314	5	5		> 15	Left-turn Lane	30
7	652	281	5	5		> 14	Left-turn Lane	20
8	526	404	5	5		> 20	Left-turn Lane	15

Notes:
*- SHA without any treatment column is not applicable as all the volumes are either bypass or left-turn lane thresholds.

Auxiliary Lane Updates

- **Left-Turn Lane Warrants for Volumes Less Than 50 vph**

	Current Warrants	Updated Warrants
1	Left-turn lane required for any AADT as long as left-turn volume requirements are satisfied	AADT <1,500 No left-turn lane required
2	AADT < 2,000 & Left-turn volume 20-50 vph	AADT ≥ 1,500 and < 2,000 & Left-turn volume 30-50 vph
3	AADT ≥ 2,000 and ≤ 4,000 & Left-turn volume 10-50 vph	AADT ≥ 2,000 and ≤ 4,000 & Left-turn volume 20-50 vph
4	AADT > 4,000 & Left-turn volume 5-50 vph	AADT > 4,000 & Left-turn volume 15–50 vph
5	For any special cases with very low opposing volumes, DelDOT's Subdivision Engineer may waive the requirement of a left-turn lane.	For any special cases with very low opposing volumes, DelDOT's Subdivision Engineer may waive the requirement of a left-turn lane.
6		For any intersection/corridor with high crash history, DelDOT's Subdivision Engineer may require a left-turn lane.

Auxiliary Lane Updates

- **Bypass Lane**
  - Current DC Manual
    - Inconsistency between left turn lane warrants and bypass lane warrants
    - VPH vs. AADT

Figure 5.2.9.3-a Left-Turn Lane Warrants at Unsignalized Intersections

QUEUE STORAGE (Feet)												
Left-Turning Vehicles (vph)	Projected 10-Year Opposing Volume (vph)											
	100	200	300	400	500	**600**	700	800	900	1000	1100	1200
50	15	15	15	40	40	40	40	40	40	65	65	65
100	15	15	40	40	40	65	65	65	65	65	90	90
150	15	40	40	40	65	**65**	65	90	90	90	115	115
200	15	40	40	65	65	90	90	90	115	115	140	140
250	40	40	65	65	90	90	90	115	115	140	165	190
300	40	40	65	65	90	90	115	140	140	165	190	240
350	40	40	65	90	90	115	140	140	165	190	240	290
400	40	65	65	90	115	115	140	165	190	240	290	365

Section 5.2.9.2

Auxiliary Lane Updates

- **Bypass Lane**
  - Current DC Manual
    - Inconsistency between left turn lane warrants and bypass lane warrants
    - VPH vs. AADT

Figure 5.2.9.3-a Left-Turn Lane Warrants at Unsignalized Intersections

QUEUE STORAGE (Feet)			
Left-Turning Vehicles (vph)	Projected 10-Year Opposing Volume (vph)		
	100	200	
50	15	15	
100	15	15	
150	15	40	
200	15	40	
250	40	40	
300	40	40	
350	40	40	
400	40	65	

Figure 5.2.9.2-a Bypass Lane Warrants

Projected 10-year Roadway ADT	Left-Turn ADT	Storage Length (feet)	Taper Length (feet)					Assumed Speed Change on Through Lane
			Highway Posted Speed					
			25 MPH	35 MPH	40 MPH	45 MPH	50 MPH	
Less than 2,000 Vehicles	0 – 200	–	–	–	–	–	–	–
	201 - 400	105	–	50	50	60	75	25
	Over 400	–	Separate Left-Turn Lane					
2,000 to 4,000 Vehicles	0 – 100	–	–	–	–	–	–	–
	101 – 200	105	–	50	50	60	75	25
	201 – 300	130	–	50	60	75	100	20
	301 – 400	155	–	60	75	100	Separate Left-Turn Lane	15
	Over 400		Separate Left-Turn Lane					
Over 4000 Vehicles	–	Separate Left-Turn Lane						

Section 5.2.9.2

Auxiliary Lane Updates

- **Bypass Lane**
  - Updated Warrants

Figure 5.2.9.2-a Bypass Lane Warrants

Projected 10-year Roadway AADT	Projected 10-Year Opposing Volume (vph)	Storage Length (feet)						
		Left-Turning Vehicles (vph)						
		Less than 5	5- 9	10-14	15-20	21-30	31-40	Over 40
Less than 2,000 Vehicles	100-200	-	-	50	50	50	50	Separate Left-Turn Lane
2,000 to 4,000 Vehicles	100	-	-	50	50	50	50	
	200	-	-	50	50	50	50	
	300	-	-	50	50	50		
	Over 400	-	-	75	75			
Over 4,000 Vehicles	Over 100	-	75	75				

Auxiliary Lane Updates

- **Bypass Lane**
  - Updated Warrants

Figure 5.2.9.2-a Bypass Lane Warrants

Projected 10-year Roadway AADT	Projected 10-Year Opposing Volume (vph)	Storage Length (feet)						
		Left-Turning Vehicles (vph)						
		Less than 5	5- 9	10-14	15-20	21-30	31-40	Over 40
Less than 2,000 Vehicles	100-200	-	-	50	50	50	50	Separate Left-Turn Lane
2,000 to 4,000 Vehicles	100	-	-	50	50	50	50	
	200	-	-	50	50	50	50	
	300	-	-	50	50	50		
	Over 400	-	-	75	75			
Over 4,000 Vehicles	Over 100	-	75	75				

Auxiliary Lane Updates

- **Bypass Lane**
  - Updated Warrants

Figure 5.2.9.2-a Bypass Lane Warrants

Projected 10-year Roadway AADT	Projected 10-Year Opposing Volume (vph)	Storage Length (feet)						
		Left-Turning Vehicles (vph)						
		Less than 5	5- 9	10-14	15-20	21-30	31-40	Over 40
Less than 2,[illegible] Vehicles						50	50	Separate Left-Turn Lane
2,000 to 4,[illegible] Vehicles						50	50	
						50	50	
						50		
Over 4,000 Ve[illegible]								

Posted Speed (mph)	Approach Taper Length (feet)
25	Bypass Lane Not Warranted
30	125
35	155
40	155
45	180
50	215

Auxiliary Lane Updates

- **Bypass Lane**
  - Updated Warrants

Figure 5.2.9.2-a Bypass Lane Warrants

Projected 10-year Roadway AADT	Projected 10-Year Opposing Volume (vph)	Storage Length (feet)						
		Left-Turning Vehicles (vph)						
		Less than 5	5- 9	10-14	15-20	21-30	31-40	Over 40
Less than 2, Vehicles						50	50	
2,000 to 4,(Vehicles						50	50	
Over 4,000 Ve								

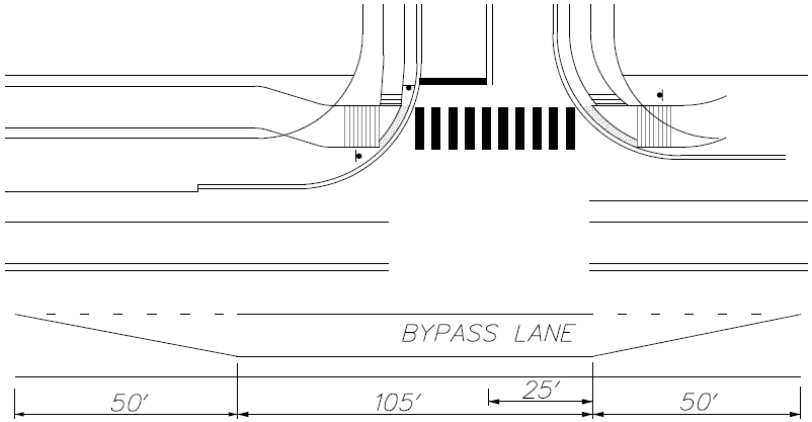
Posted Speed (mph)	Approach Taper Length (feet)
25	Bypass Lane Not Wa
30	125
35	155
40	155
45	180
50	215

Posted Speed (mph)	Departure Taper Length (feet)
25	Bypass Lane Not Warranted
30	65
35	80
40	80
45	90
50	110

Auxiliary Lane Updates

- **Bypass Lane Storage and Taper Lengths**

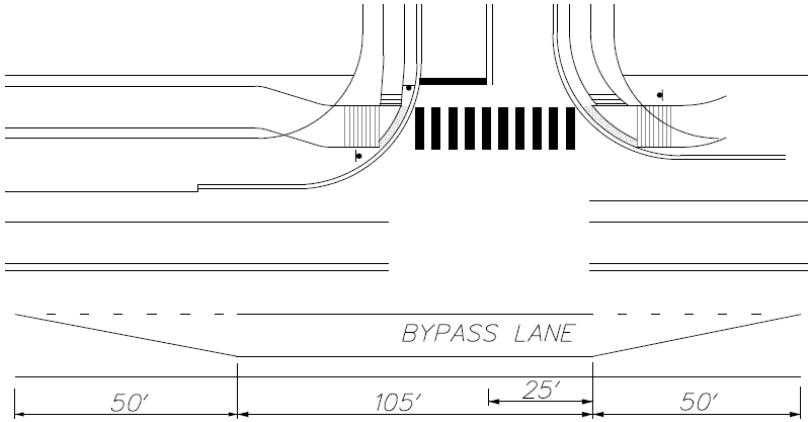
  Current Methodology



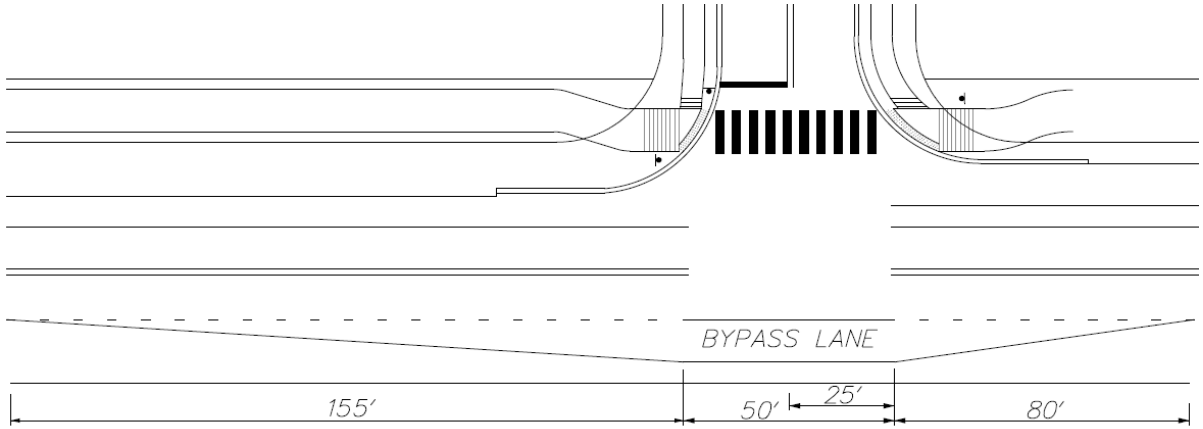
Auxiliary Lane Updates

- **Bypass Lane Storage and Taper Lengths**

Current Methodology



Updated Methodology



Auxiliary Lane Updates

- Additional Changes
  - Bypass lanes will not be permitted in the following locations:
    - AADT ≥ 4,000 vpd and a projected left turn volume ≥ 15 vph
    - On roads where physical characteristics limit the ability to provide adequate sight distance meeting DelDOT's requirements. Inadequate intersection sight distance would trigger the need for left turn lane(s).
    - For any intersection/corridor with high crash history, DelDOT's Subdivision Engineer may require a left-turn lane.

Auxiliary Lane Updates

- Worksheet

Name of Project	Test	Date of Submittal	10/18/2016
Maintenance Road No. (i.e. K234A)	N999	Road Name	Test Road
Signalized / Unsignalized	Unsignalized	Posted Speed Limit	50
Roadway ADT (From DelDOT Traffic Manual)	4000	Traffic Pattern Group	3
Committed Development ADT (Add Additional Trips to Roadway)	100		
Total Number of Through Lanes (Does Not Include Turn Lanes)	2 lanes	Number of intersection legs	3
Roadway Functional Classification	Major Collector	Calculation for (specify leg)	Proposed Entrance 1
Projected 10 yr ADT	4740	K Factor	11.77
		D Factor	61.54
Left Turn Information		**Right Turn Information**	
Left Turn VPH	10	Right Turn ADT	0-50
Left Turn Approach Grade	0.0%	Right Turn Approach Grade	0.0%
Heavy Vehicle %	5	Effective Radius of Entrance	R>50'
10 Yr Opposing Vol. (COUNT based)			
10 Yr Opposing Volume (Calculated)	343	Right Turn Length (ft.)	RTL Not Required
Bypass Lane Approach Taper	215		
Bypass Lane Departure Taper	110		
Bypass Lane Storage	75		

Auxiliary Lane Updates

- Worksheet

Name of Project	Test	Date of Submittal	10/18/2016
Maintenance Road No. (i.e. K234A)	N999	Road Name	Test Road
Signalized / Unsignalized	Unsignalized	Posted Speed Limit	50
Roadway ADT (From DelDOT Traffic Manual)	4000	Traffic Pattern Group	3
Committed Development ADT (Add Additional Trips to Roadway)	100		
Total Number of Through Lanes (Does Not Include Turn Lanes)	2 lanes	Number of intersection legs	3
Roadway Functional Classification	Major Collector	Calculation for (specify leg)	Proposed Entrance 1
Projected 10 yr ADT	4740	K Factor	11.77
		D Factor	61.54
Left Turn Information		**Right Turn Information**	
Left Turn VPH	10	Right Turn ADT	0-50
Left Turn Approach Grade	0.0%	Right Turn Approach Grade	0.0%
Heavy Vehicle %	5	Effective Radius of Entrance	R>50'
10 Yr Opposing Vol. (COUNT based)			
10 Yr Opposing Volume (Calculated)	343	Right Turn Length (ft.)	RTL Not Required
Bypass Lane Approach Taper	215		
Bypass Lane Departure Taper	110		
Bypass Lane Storage	75		

Auxiliary Lane Updates

- Worksheet

Name of Project	Test	Date of Submittal	10/18/2016
Maintenance Road No. (i.e. K234A)	N999	Road Name	Test Road
Signalized / Unsignalized	Unsignalized	Posted Speed Limit	50
Roadway ADT (From DelDOT Traffic Manual)	4000	Traffic Pattern Group	3
Committed Development ADT (Add Additional Trips to Roadway)	100		
Total Number of Through Lanes (Does Not Include Turn Lanes)	2 lanes	Number of intersection legs	3
Roadway Functional Classification	Major Collector	Calculation for (specify leg)	Proposed Entrance 1
Projected 10 yr ADT	4740	K Factor	11.77
		D Factor	61.54
Left Turn Information		Right Turn Information	
Left Turn VPH	15	Right Turn ADT	0-50
Left Turn Approach Grade	0.0%	Right Turn Approach Grade	0.0%
Heavy Vehicle %	5	Effective Radius of Entrance	R>50'
10 Yr Opposing Vol. (COUNT based)			
10 Yr Opposing Volume (Calculated)	343	Right Turn Length (ft.)	RTL Not Required
Left Turn Length (ft.)	285		
Bypass Lane Approach Taper	LTL Required		
Bypass Lane Departure Taper	LTL Required		
Bypass Lane Storage	LTL Required		

Auxiliary Lane Updates

- Worksheet

Name of Project	Test	Date of Submittal	10/18/2016
Maintenance Road No. (i.e. K234A)	N999	Road Name	Test Road
Signalized / Unsignalized	Unsignalized	Posted Speed Limit	50
Roadway ADT (From DelDOT Traffic Manual)	4000	Traffic Pattern Group	3
Committed Development ADT (Add Additional Trips to Roadway)	100		
Total Number of Through Lanes (Does Not Include Turn Lanes)	2 lanes	Number of intersection legs	3
Roadway Functional Classification	Major Collector	Calculation for (specify leg)	Proposed Entrance 1
Projected 10 yr ADT	4740	K Factor	11.77
		D Factor	61.54
Left Turn Information		**Right Turn Information**	
Left Turn VPH	15	Right Turn ADT	0-50
Left Turn Approach Grade	0.0%	Right Turn Approach Grade	0.0%
Heavy Vehicle %	5	Effective Radius of Entrance	R>50'
10 Yr Opposing Vol. (COUNT based)			
10 Yr Opposing Volume (Calculated)	343	Right Turn Length (ft.)	RTL Not Required
Left Turn Length (ft.)	285		
Bypass Lane Approach Taper	LTL Required		
Bypass Lane Departure Taper	LTL Required		
Bypass Lane Storage	LTL Required		

Auxiliary Lane Updates

- Questions?