

Formerly Appendix M- Traffic Generation Example

The following Traffic Generation Example is included as guidance for the Developer's Engineer to better understand the methodology for creating the Traffic Generation Diagram. Please note that DelDOT's Development Coordination Portal (www.devcoord.deldot.gov) provides worksheets and tools for determining various factors necessary to create a Trip Generation Diagram. These worksheets and tools are updated periodically which may cause inconsistencies with the example below.

Example Project:

A mixed use development is proposed on the southerly side of Old Coach Road between Polly Drummond Hill Road and Upper Pike Creek Road in New Castle County. The development consists of 5,000 s.f. pad site for a bank, 10,000 s.f. retail, 60 townhouses and 150 apartment units. The site proposes two entrances on Old Coach Road.

- **Road Traffic Data:**

- Functional Classification – Information from the latest DelDOT Traffic Summary: http://www.deldot.gov/information/pubs_forms/manuals/traffic_counts/index.shtml
N-316 Old Coach Road - Collector
- Posted Speed – Actual posted speed from the roadway – Google Earth: **35 MPH**
- AADT - Information from the latest DelDOT Traffic Summary: http://www.deldot.gov/information/pubs_forms/manuals/traffic_counts/index.shtml
5,488 Trips (Year 2013)
- 10 Year Projected AADT = Current ADT x 10-Year Growth Factor. Apply the same 10-Year Growth Factor that is used in the DelDOT Auxiliary Lane Worksheet. Currently the growth factor is 1.16. The most up-to-date worksheet is located at the bottom right of the DelDOT website: <http://www.deldot.gov/information/business/>
10 year AADT = 5,488 x 1.16 = **6,366 Trips**
- Traffic Pattern Group - Information from the latest DelDOT Traffic Summary: http://www.deldot.gov/information/pubs_forms/manuals/traffic_counts/index.shtml
TPG - 3

- Design Hourly Volume = K x Total ADT. The K factor is from the latest DelDOT Traffic Summary. http://www.deldot.gov/information/pubs_forms/manuals/traffic_counts/index.shtml
The Total ADT = 10 Year Projected ADT + Total ADT of the proposed development = **6,366 + 2,613 = 8,979 Trips**
Design Hourly Volume = 10.69% x 8,979 = 960 Trips

- **Site Traffic Data:**

- Trip generation is based on the latest edition of the ITE Trip Generation Manual. Procedure to determine if rates and /or equations are to be used to calculate the trip generation for the proposed development is based on the guidance provided in the latest ITE Trip Generation Manual - Volume 1: User's Guide and Handbook.
 - 150 – Apartment Units (ITE 220) – Use equation: $6.06(150)+123.56 = 1,033$ Trips
 - 60 – Townhouse Units (ITE 230) – Use equation: $\ln(T) = 0.87\ln(60)+2.46 = 412$ Trips
 - 10,000 Retail, Gross Leasable Area, SF (ITE 820) – Use average rate: $10 \times 42.70 = 427$ Trips
 - 5,000 Bank, Gross Floor Area, SF (ITE 912) – Use average rate: $5 \times 148.15 = 741$ Trips
- Number of entrances and corresponding configurations: **Two Entrances – Full Movement**
- Design Vehicle – Select a design vehicle that is likely to use the proposed development entrances with considerable frequency. **SU-30**
- Total ADT for Proposed Development - **2,613 Trips**
- Directional Distribution: This distribution is based on engineering judgment which is based upon existing and /or future traffic patterns surrounding the development area. In this case **75% to and from the west and 25% to and from the east.**
75% To and From the west = 1,960 ADT (136 AM PK) [224 PM PK]
25% To and From the east = 653 ADT (45 AM PK) [75 PM PK]
- Percent of Trucks & Buses - The Truck % factor is from the latest DelDOT Traffic Summary. http://www.deldot.gov/information/pubs_forms/manuals/traffic_counts/index.shtml
Truck % factor = **6.49%**. The left turn ingress ADT at the entrances are **98 and 229 Trips respectively**. The left turn ingress ADT of trucks and buses = $6.49\% \times 98 = 6$ at Proposed Entrance 1 and $6.49\% \times 229 = 15$ at Proposed Entrance 2.

- **Traffic Generation Diagram:**

For the purpose of this sample, the directional distribution is 75% to and from the west and 25% to and from the east.

To develop the total projected 10 year ADT, the 10 year projected roadway ADT should be added to the development ADT. These values should be calculated along the major roadway, before and after the area of the proposed entrances. **For this example project, total ADT from the west = 10 year projected roadway ADT/2 + (ADT for Proposed Development/2 * percentage of Proposed Development from west) = $6,366/2 + (2,613/2 * 75\%) = 4,163$.**

The total ADT from the east = 10 year projected roadway ADT/2 + (ADT for Proposed Development/2 * percentage of Proposed Development from east) = 6,366/2 + (2,613/2 * 25%) = 3,510.

AM and PM peak hours In and Out Trip distribution is based on the latest edition of the ITE Trip Generation Manual.

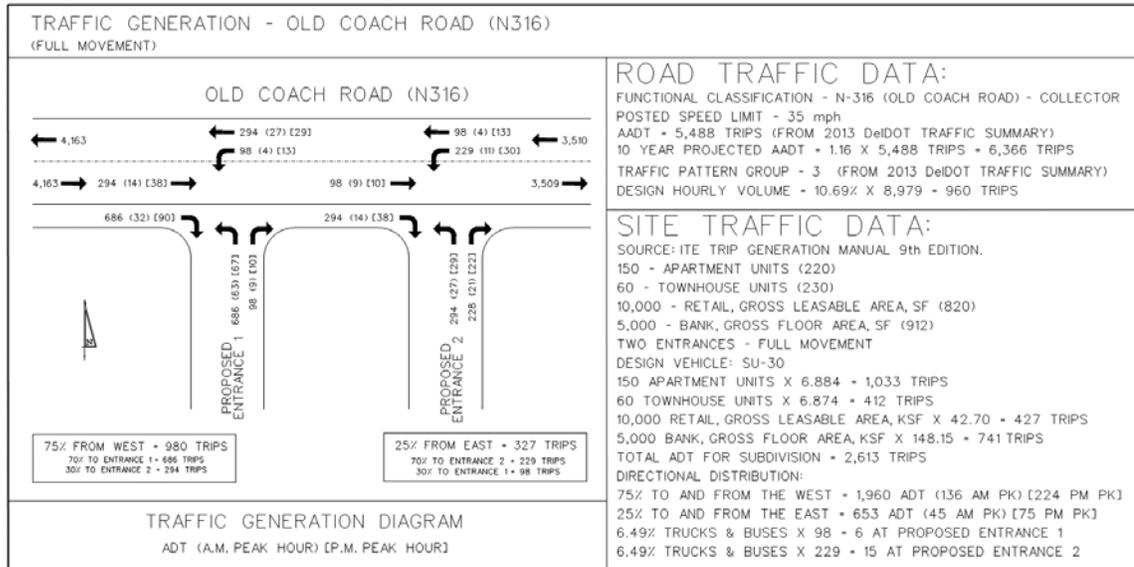
150 Apartment Units (ITE 220) –	AM In – 15 Trips, OUT – 62 Trips PM In – 65 Trips, OUT - 35 Trips
60 Townhouse Units (ITE 230) –	AM In – 6 Trips, OUT – 28 Trips PM In – 27 Trips, OUT - 13 Trips
10,000 Retail, Gross Leasable Area, SF (ITE 820) –	AM In – 6 Trips, OUT – 4 Trips PM In – 18 Trips, OUT - 19 Trips
5,000 Bank, Gross Floor Area, SF (ITE 912) –	AM In – 34 Trips, OUT – 26 Trips PM In – 61 Trips, OUT - 61 Trips
	Total AM In = 61, Out = 120, Total AM = 181 Trips Total PM In = 171, Out = 128, Total PM = 299 Trips

Additionally, the trips coming in and out of the development are assigned 70% for the first entrance passed and 30% for the second entrance passed. **For this example project, the AM site traffic from the west entering at Entrance 1 via a right turn = total AM entering * 75% * 70% = 61 * 75% * 70% = 32. The AM site traffic from the west entering at Entrance 2 via a right turn = total AM entering * 75% * 30% = 61 * 75% * 30% = 14.**

The AM site traffic from the east entering at Entrance 2 via a left turn = total AM entering * 25% * 70% = 61 * 25% * 70% = 11. The AM site traffic from the east entering at Entrance 1 via a left turn = total AM entering * 25% * 30% = 61 * 25% * 30% = 4.

The same procedure should be done for the PM and ADT site traffic.

Development generated trips should be assigned to the proposed entrances according to the actual development site plan as well as existing and/or future traffic patterns surrounding the development area.



- **DeIDOT Auxiliary Lane Worksheets**
Since this example project has two proposed full access entrances, two DeIDOT Auxiliary Lane worksheets need to be created.
- **Creation of DeIDOT Auxiliary Lane Worksheet for Proposed Entrance 1**
 - Name of Project: **Proposed Mixed Use Development**
 - Date of Submittal: **10/07/2014**
 - Maintenance Road No.: **N316**
 - Road Name: **Old Coach Road**
 - Signalized/Unsignalized: **Unsignalized**
 - Total Number of Through Lanes: **2 Lanes**
 - Roadway Functional Classification: **Major Collector**
 - Number of Intersection Legs: **3**
 - Calculation for (specify leg): **Proposed Entrance 1**
 - Posted Speed Limit: **35**
 - Current Roadway ADT = AADT - Information from the latest DeIDOT Traffic Summary: **5,488 Trips** (Year 2013)
 - Site Generated ADT: **2,613**
 - Traffic Pattern Group: **3**
 - Left Turn ADT: **98 (Use 51 -100 in Worksheet)**
 - Left Turn VPH: **13**
 - Left-Turn Approach Grade: **0%**
 - Heavy Vehicle %: **6.49% (Use 5% in Worksheet)**

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- 10 Yr Opposing Vol. (COUNT Base) = (Design Hourly Volume of Roadway * 10-Year Growth Factor)/2 * K factor + Development peak hour opposing volume: [(5488 * 1.16)/2 * 10.69%]
+ 38 + 90 = **468**
- Right Turn ADT: **686 (Use Over 400 in Worksheet)**
- Right Turn Approach Grade: **0.0%**
- Entrance Radius: **R <= 50**

Results:

Left Turn Length: **220'**

Bypass Lane Taper: **Not Allowed**

Bypass Lane Storage: **Not Allowed**

Right Turn Length: **195'**

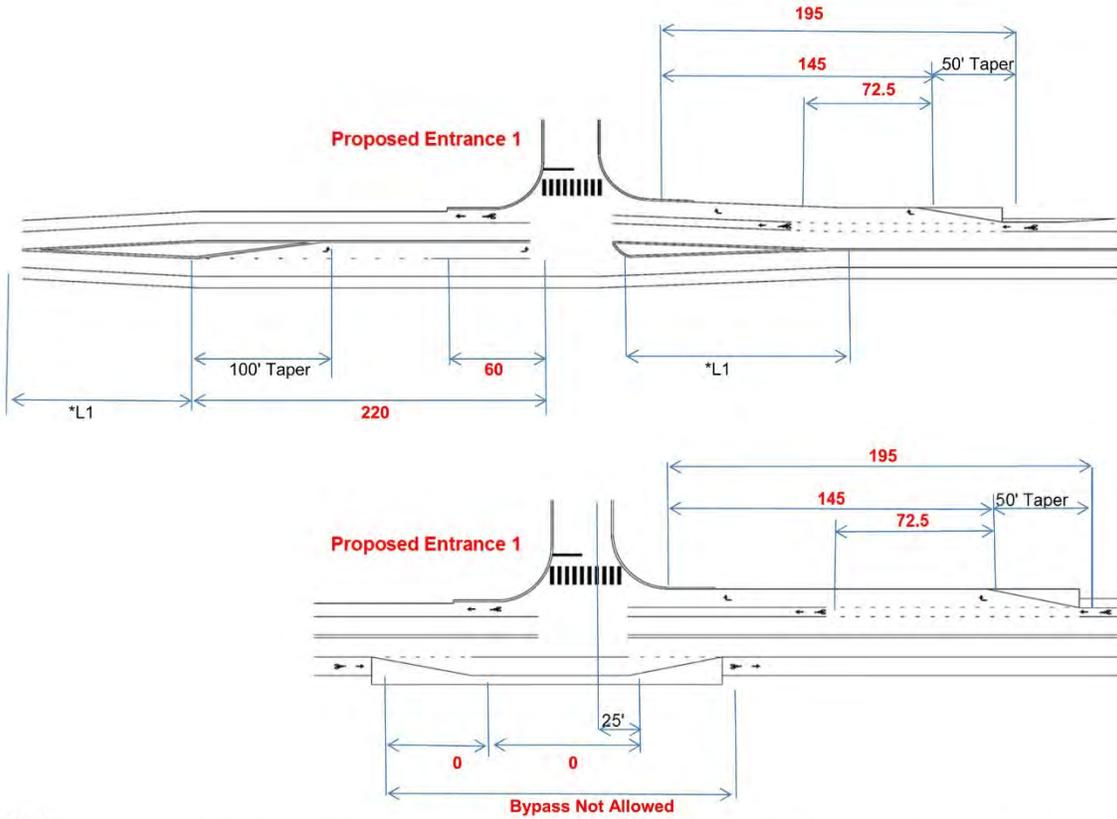
Entrance 1 Worksheet Output:

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15-Jul						
Name of Project		Proposed Mixed Used Dev	Date of Submittal	10/7/2014		
Maintenance Road No. (i.e. K234A)		N316	Road Name	Old Coach Road		
Signalized / Unsignalized		Unsignalized				
Total Number of Through Lanes (* Does Not Include Turn Lanes)		2 lanes	Roadway Functional Classification	Major Collector		
Number of intersection legs		3	Calculation for (specify leg)	Proposed Entrance 1		
Posted Speed Limit		35	Design Speed	40		
Roadway ADT (From DelDOT Traffic Manual)		5488	Projected 10yr ADT	8979		
Committed Development ADT (Add Additional Trips to Roadway)		2613				
Traffic Pattern Group	3	K Factor		10.69		
		D Factor		61.18		
Left Turn Information		Right Turn Information				
Left Turn ADT		51 - 100	Right Turn ADT		Over 400	
Left Turn VPH (0 - 400)		13				
Left Turn Approach Grade *(-9% - 9%)		0.0%	Right Turn Approach Grade *(-9% - 9%)		0.0%	
Heavy Vehicle %		5	Entrance Radius		R≤50'	
10 Yr Opposing Vol. (COUNT based)		468	< With DelDOT's concurrence, this cell may be used to override the automatically calculated 10-year opposing volume. This alternative 10 year opposing volume may be obtained from a TIS / TOA or shall otherwise be reviewed and approved by DelDOT Development Coordination Staff.			
10 Yr Opposing Volume (Calculated)		587				
10 Yr Opposing Volume (Count Vol.)		468	Right Turn Length (ft.)			195
Left Turn Length (ft.)		220				
Bypass Lane Taper		Bypass Not Allowed				
Bypass Lane Storage		Bypass Not Allowed				

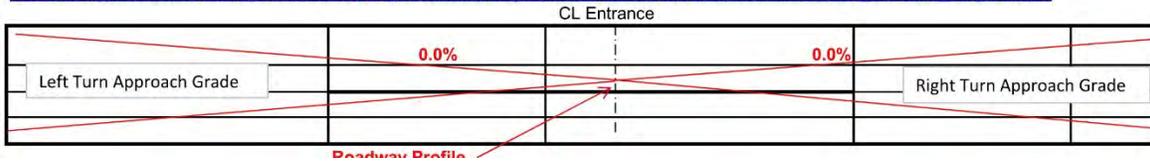
NOTE: This worksheet is for Right Turn Auxiliary Lanes, and Unsignalized Left Turn Auxiliary Lanes. If a signal analysis is required, please refer to signalized intersection analysis spreadsheet (Tab 6).

Entrance 1 Worksheet Output (Continued):



Note:

*L1 - See Typical Entrance Diagram located at: http://www.deldot.gov/information/business/subdivisions/Typical_Entrance_Diagrams.pdf



- Creation of DelDOT Auxiliary Lane Worksheet for Proposed Entrance 2

- Name of Project: **Proposed Mixed Use Development**
- Date of Submittal: **10/07/2014**
- Maintenance Road No.: **N316**
- Road Name: **Old Coach Road**
- Signalized/Unsignalized: **Unsignalized**
- Total Number of Through Lanes: **2 Lanes**
- Roadway Functional Classification: **Major Collector**
- Number of Intersection Legs: **3**
- Calculation for (specify leg): **Proposed Entrance 2**
- Posted Speed Limit: **35**
- Current Roadway ADT = AADT - Information from the latest DelDOT Traffic Summary:
5,488 Trips (Year 2013)
- Site Generated ADT: **2,613**
- Traffic Pattern Group: **3**
- Left Turn ADT: **229 (Use 201 – 300 in Worksheet)**
- Left Turn VPH: **30**
- Left-Turn Approach Grade: **0%**
- 10 Yr Opposing Vol. (COUNT based) = (Design Hourly Volume of Roadway * 10-Year Growth Factor)/2 * K factor + Development peak hour opposing volume: $(5488 * 1.16)/2 * 10.69\% + 10 + 38 = 468$
- Heavy Vehicle %: **6.49% (Use 5% in Worksheet)**
- Right Turn ADT: **294 (Use 201 - 300 in Worksheet)**
- Right Turn Approach Grade: **0.0%**
- Entrance Radius: **R <= 50**

Results:

Left Turn Length: **220'**

Bypass Lane Taper: **Not Allowed**

Bypass Lane Storage: **Not Allowed**

Right Turn Length: **160'**

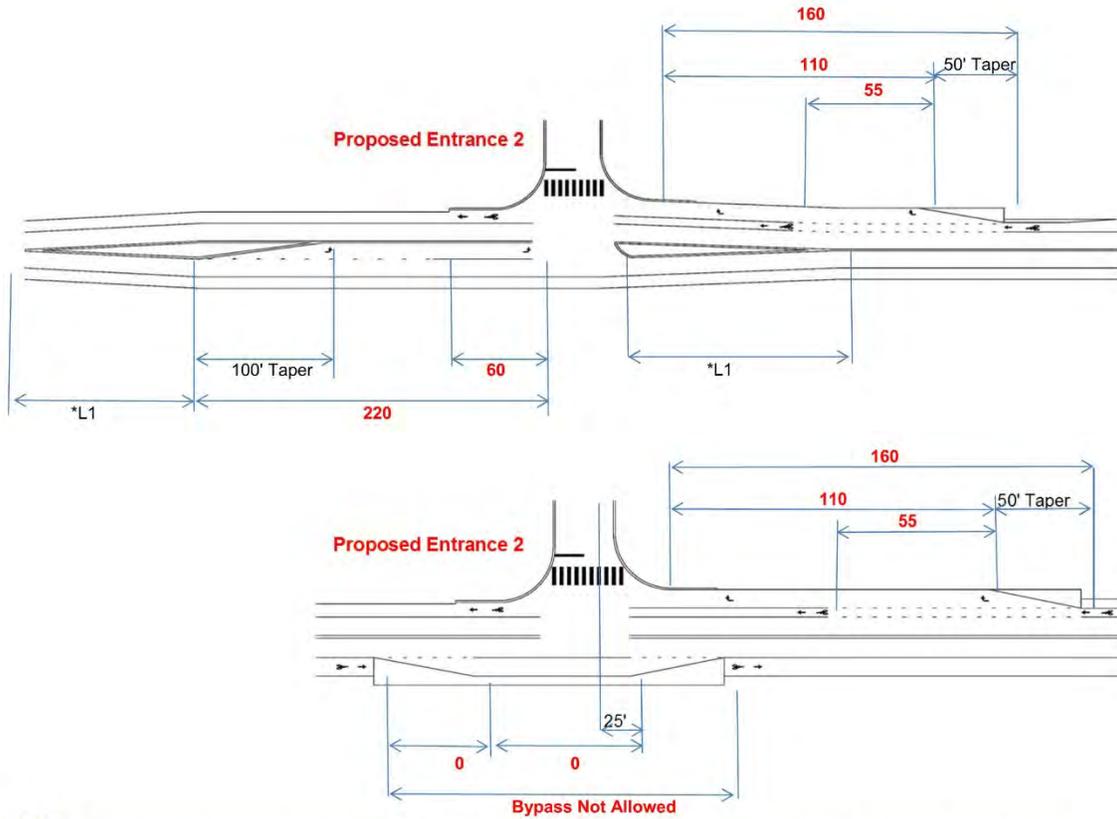
Entrance 2 Worksheet Output:

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15-Jul				July 15, 2014
Name of Project	Proposed Mixed Used Dev	Date of Submittal	10/7/2014	
Maintenance Road No. (i.e. K234A)	N316	Road Name	Old Coach Road	
Signalized / Unsignalized	Unsignalized			
Total Number of Through Lanes (* Does Not Include Turn Lanes)	2 lanes	Roadway Functional Classification	Major Collector	
Number of intersection legs	3	Calculation for (specify leg)	Proposed Entrance 2	
Posted Speed Limit	35	Design Speed	40	
Roadway ADT (From DelDOT Traffic Manual)	5488	Projected 10yr ADT	8979	
Committed Development ADT (Add Additional Trips to Roadway)	2613			
Traffic Pattern Group	3	K Factor	10.69	
		D Factor	61.18	
Left Turn Information		Right Turn Information		
Left Turn ADT	201 - 300	Right Turn ADT	201 - 300	
Left Turn VPH (0 - 400)	30			
Left Turn Approach Grade *(-9% - 9%)	0.0%	Right Turn Approach Grade *(-9% - 9%)	0.0%	
Heavy Vehicle %	5	Entrance Radius	R≤50'	
10 Yr Opposing Vol. (COUNT based)	468	< With DelDOT's concurrence, this cell may be used to override the automatically calculated 10-year opposing volume. This alternative 10 year opposing volume may be obtained from a TIS / TOA or shall otherwise be reviewed and approved by DelDOT Development Coordination Staff.		
10 Yr Opposing Volume (Calculated)	587	Right Turn Length (ft.)	160	
10 Yr Opposing Volume (Count Vol.)	468			
Left Turn Length (ft.)	220			
Bypass Lane Taper	Bypass Not Allowed			
Bypass Lane Storage	Bypass Not Allowed			

NOTE: This worksheet is for Right Turn Auxiliary Lanes, and Unsignalized Left Turn Auxiliary Lanes. If a signal analysis is required, please refer to signalized intersection analysis spreadsheet (Tab 6).

Entrance 2 Worksheet Output (Continued):



Note:

*L1 - See Typical Entrance Diagram located at: http://www.deldot.gov/information/business/subdivisions/Typical_Entrance_Diagrams.pdf

