ERDMAN ANTHONY

Memorandum

Date:	3/9/18	**To:**	Chris Robinson, PE
From:	Chad Martin, PE, PTOE	**Office:**	Harrisburg
Project Name:	SR 0228 Section 29B	**Project No.:**	57840.00
Subject:	Brickyard Rd Traffic Analysis	**Copy:**	File

This memorandum describes the traffic analysis performed at proposed Brickyard Road intersection as part of the SR 0228 Section 29B in Adams Township, Butler County. See **Appendix A** for a map of the study area.

Existing Conditions

SR 0228 and Brickyard Rd intersection

Manual turning movement counts (TMC) were conducted at SR 0228 and Brickyard Road to document the existing peak hour volumes. The traffic counts were initially conducted by PennDOT in September 2012 during the weekday morning (7:00 to 9:00 AM), midday (11:00 AM to 1:00 PM) and afternoon (3:00 PM to 6:00 PM). These counts were used for the traffic analysis memo entitled *Intersection Capacity Improvements for SR 0228 & Three Degree Rd and SR 0228 & Brickyard Road* and dated April 8, 2013. The existing peak hour volumes are included in **Appendix B**.

Due to the length of time between preliminary and final design, turning movement counts were again performed by Erdman Anthony in February 2017 during the PM peak period. These volumes were then compared to the original 2012 volumes. The 2017 volumes are approximately in line with the 2012 volumes suggesting that traffic patterns in that time have remained the same.

SR 0228 and Mars Area Elementary School Driveways

Mars Area Elementary School has separate one way driveways for ingress and egress located about 800' and 400' respectively from the SR 0228 and Brickyard Road intersection. Erdman Anthony conducted turning movement counts for these driveways in February 2017 during the AM and PM peak periods.

A diagram of the existing counts is shown in **Appendix C**. These are a combination of the 2012 counts at Brickyard and 2017 counts at the Mars Area Elementary School Driveways.

Proposed Conditions

Background Growth Factor

Traffic projections were made to account for growth in background traffic volumes to the 2040 build year using a 0.81 percent annual compounded growth rate. This rate was supplied by Southwestern Pennsylvania Commission (SPC) and matches the rate used in the traffic impact study currently under way for proposed development on the southeastern corner of the SR 0228 and Three Degree Road intersection. 2040 Build Year volumes are shown in **Appendix D**. To be conservative, it was assumed that all existing volumes were from 2012.

Adjacent Development Traffic

The Gables at Brickyard Hill, a community of duplex residences, is located approximately 1300' north of the intersection with SR 0228/Brickyard Road with the only access to Brickyard Road via Gables Court. Vehicles heading to SR 0228 would likely use the Brickyard Rd intersection.

Based on 2016 Google Earth imagery, there are 57 duplex residences currently constructed or under construction. There is space for approximately 75 residences in the build-out condition. The ITE Trip Generation Manual, 9th edition (2012) was used to estimate the number of trips which could be generated by this development. See **Appendix E** for a spreadsheet showing the trip generation calculations. Assuming approximately 50% of the development was completed in 2012, only 50% of the generated trips shown on the spreadsheet were added to the 2040 peak hour volumes. All of the generated trips are assumed to be cars.

Proposed Condition

In the proposed condition, the Mars Area School District driveways will move to Brickyard Road and the overall Brickyard Road intersection will be shifted west on SR 0228. Additionally, a fourth leg will be added to the south side of SR 0228 to combine the existing driveways into one access point on SR 0228 as shown in **Appendix F**.

A trip generation spreadsheet for the 12 existing driveways on the south side of SR 0228 at the proposed intersection is shown in **Appendix G**.

It was assumed that the Gables at Brickyard Hill traffic would use relocated Brickyard with a 60/40 directional split in the westbound and eastbound directions on SR 0228 since the more developed area of Cranberry is located to the west. Driveway traffic from the south side of SR 0228 follows this same assumption.

A diagram of the proposed conditions with redistributed 2040 peak hour volumes is shown in **Appendix H**.

Traffic Signal Warrant Analysis

A traffic signal warrant analysis was performed for the unsignalized intersection of SR 0228 and Brickyard Road. Traffic signal warrants 1 through 8 as listed in the 2009 MUTCD and additional PA Warrants 1 & 2 were evaluated using PennDOT's provided Microsoft Excel workbook. The existing traffic volumes grown to the estimated opening year of 2020 were used in the analysis. No estimated adjacent development traffic or relocated Mars Area School District traffic was included. The following warrants do not apply to this intersection as explained below:

-Warrant 4-Pedestrian Volume: There are no existing pedestrian facilities and no pedestrian facilities are proposed at the intersection due to the rural nature of this intersection location.

-Warrant 5-School Crossing: Although Mars Area Elementary School is located approximately 1200' east of the relocated intersection, students are transported by bus or parents' vehicles due to the rural nature of this school district.

-Warrant 9-Intersection near a Grade Crossing: No railroad crossings are present.

-Warrant PA-1: ADT Volume Warrant: No applied since other warrants were already met

-Warrant PA-2: Midblock and Trail Crossings: No midblock or trail crossings are present.

Based on an evaluation of the remaining applicable warrants, Warrant 2: Four-Hour Vehicular Volume, Warrant 3: Peak Hour Volume Peak Hour, and Warrant 8: Roadway Network were met. See **Appendix I** for the warrant analysis printouts. Also, a review of Warrant 7: Crash Experience revealed 5 crashes correctable by installing a traffic signal, but they were over a longer period than 12 months.

Since Warrants 2, 3, and 8 are met, it is recommended that a traffic signal be installed at the relocated SR 0228 and Brickyard Road intersection.

Turn Lane Analysis

PennDOT Publication 46, Traffic Engineering Manual, provides guidelines in Chapter 11, Section 16 to determine warrants for turn lanes and identify desirable length. Spreadsheets incorporating these guidelines have been developed by PennDOT and were used for the analysis.

SR 0228 and Brickyard Road

The following table summarizes the results of the turn lane analysis for the SR 0228 and Brickyard Road intersection. Turn lane analysis spreadsheets for this intersection are included in **Appendix J**.

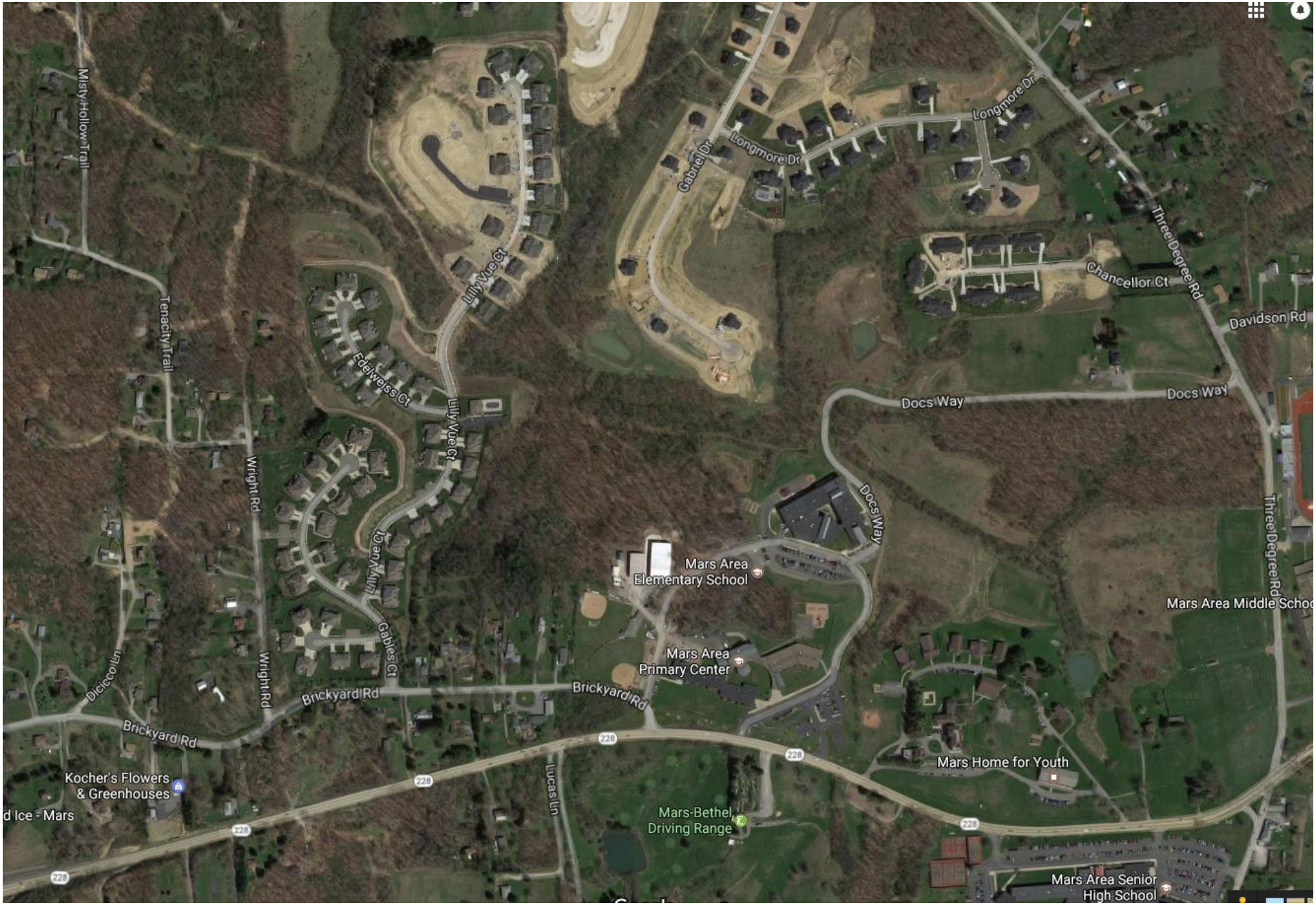
Approach	AM (Length)	PM(Length)	Recommendation
EB Left	Yes (175')	Yes (175')	Include additional 125' for **300' turn lane length**
WB Left	-	-	Include **250' left turn lane length** to match up with opposing EB left turn lane
WB Right	Yes (225')	Yes (250')	**250' turn lane length**
SB Left	No	No	Left turn lane not warranted but include **175' left turn lane length** for school bus queue storage
SB Right	No	No	Right turn lane not warranted.
NB Left	-	-	Include **75' left turn lane length** to match up with opposing SB left turn lane

Brickyard Road and Gables Court

The following table summarizes the results of the turn lane analysis for the Brickyard Road and Gables Court intersection. Turn lane analysis spreadsheets for this intersection are included in **Appendix K**.

Approach	AM (Length)	PM(Length)	Recommendation
NB Left	No	No	Left turn lane not warranted, however a **75' left turn lane length** included to allow the through lanes to line up due to the existing median on the SB approach
NB Right	No	No	Right turn lane not warranted

APPENDIX A



Appendix A: Study Area Map

APPENDIX B

NOTES:

PEAK HOUR FACTORS (PHF)

COUNTY: Butler
MUNICIPALITY: Adams Township
DATE: September 20, 2012
DAY: Thursday
WEATHER:

INTERSECTION: SR 228 and Brickyard Rd

	BRICKYARD RD SB				SR 228 WB				SR 228 EB				
Starting Time	From North				From East				From West				TOTAL TRAFFIC
	R		L	TOTAL	R	T		TOTAL		T	L	TOTAL	
645	2		2	4	18	212		230		105	1	106	340
700	0		9	9	14	159		173		136	1	137	319
715	0		8	8	13	158		171		207	2	209	388
730	0		8	8	12	199		211		183	0	183	402
PHF	0.25		0.75	0.81	0.79	0.86		0.85		0.76	0.50	0.76	0.90
1200	6		8	14	17	115		132		128	4	132	278
1215	3		11	14	13	112		125		129	1	130	269
1230	1		18	19	25	153		178		136	1	137	334
1245	5		12	17	17	122		139		153	3	156	312
PHF	0.63		0.68	0.84	0.72	0.82		0.81		0.89	0.56	0.89	0.89
430	7		32	39	27	181		208		233	2	235	482
445	4		19	23	23	182		205		186	1	187	415
500	4		5	9	19	167		186		220	0	220	415
515	0		13	13	20	174		194		216	2	218	425
PHF	0.54		0.54	0.54	0.82	0.97		0.95		0.92	0.63	0.91	0.90

TABLE TOTALS

	R		L	TOTAL	R	T		TOTAL		T	L	TOTAL	TOTAL
AM	2		27	29	57	728		785		631	4	635	1449
MID	15		49	64	72	502		574		546	9	555	1193
PM	15		69	84	89	704		793		855	5	860	1737

COUNTERS:

PennDOT

TRUCK PERCENTAGES

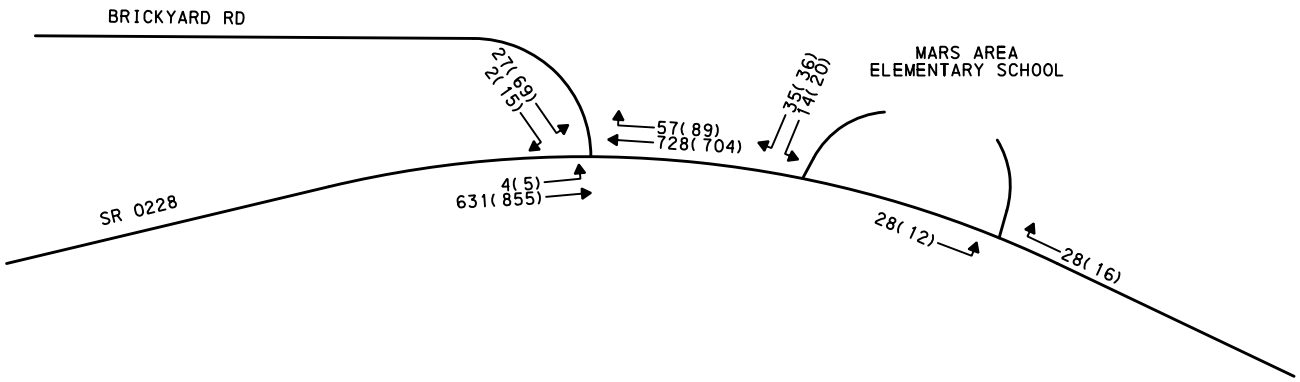
COUNTY: Butler
MUNICIPALITY: Adams Township
DATE: September 20, 2012
DAY: Thursday
WEATHER:

INTERSECTION: SR 228 and Brickyard Rd

	BRICKYARD RD SB				SR 228 WB				SR 228 EB				
Starting Time	From North				From East				From West				TOTAL TRAFFIC
	R		L	TOTAL	R	T		TOTAL		T	L	TOTAL	
645	2		2	4	18	212		230		105	1	106	340
700	0		9	9	14	159		173		136	1	137	319
715	0		8	8	13	158		171		207	2	209	388
730	0		8	8	12	199		211		183	0	183	402
AM Peak Vehicles	2		27	29	57	728		785		631	4	635	1449
AM Peak Trucks	0		4	4	1	66		67		51	1	52	123
AM Peak Truck %	**0.0%**		**14.8%**	**13.8%**	**1.8%**	**9.1%**		**8.5%**		**8.1%**	**25.0%**	**8.2%**	**8.5%**
1200	6		8	14	17	115		132		128	4	132	278
1215	3		11	14	13	112		125		129	1	130	269
1230	1		18	19	25	153		178		136	1	137	334
1245	5		12	17	17	122		139		153	3	156	312
MID Peak Vehicles	15		49	64	72	502		574		546	9	555	1193
MID Peak Trucks	2		5	7	4	65		69		67	1	68	144
MID Peak Truck %	**13.3%**		**10.2%**	**10.9%**	**5.6%**	**12.9%**		**12.0%**		**12.3%**	**11.1%**	**12.3%**	**12.1%**
430	7		32	39	27	181		208		233	2	235	482
445	4		19	23	23	182		205		186	1	187	415
500	4		5	9	19	167		186		220	0	220	415
515	0		13	13	20	174		194		216	2	218	425
PM Peak Vehicles	15		69	84	89	704		793		855	5	860	1737
PM Peak Trucks	0		0	0	1	50		51		33	0	33	84
PM Peak Truck %	**0.0%**		**0.0%**	**0.0%**	**1.1%**	**7.1%**		**6.4%**		**3.9%**	**0.0%**	**3.8%**	**4.8%**

APPENDIX C

NOT TO SCALE



LEGEND
AM(PM)

ERDMAN ANTHONY
ONE STERLING PLACE
100 STERLING PARKWAY, SUITE 212
MECHANICSBURG, PA 17050

EXISTING PEAK HOUR TRAFFIC VOLUMES

SR 0228 SECTION 29B
ADAMS TOWNSHIP, BUTLER COUNTY

DATE:4/24/2017 TIME:10:56:04 AM
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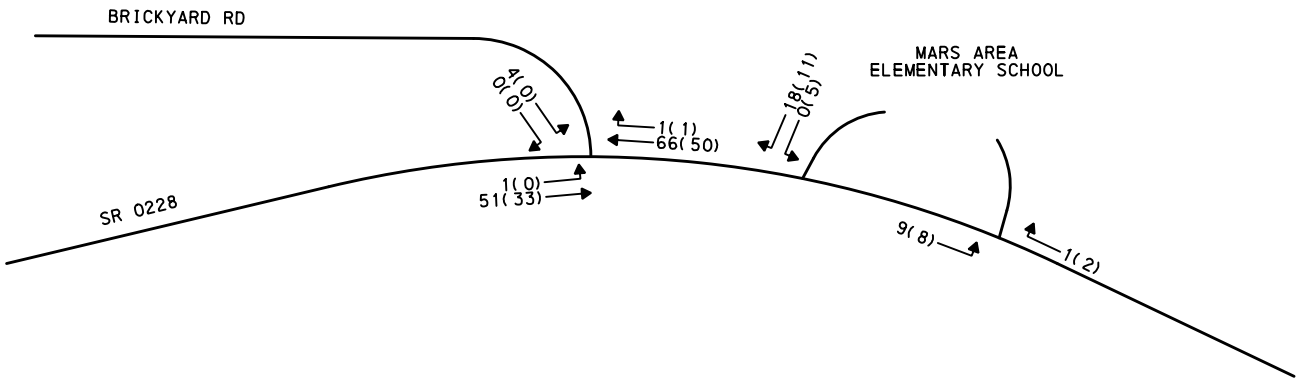
NOT TO SCALE



LEGEND
AM(PM)

ERDMAN ANTHONY
ONE STERLING PLACE
100 STERLING PARKWAY, SUITE 212
MECHANICSBURG, PA 17050

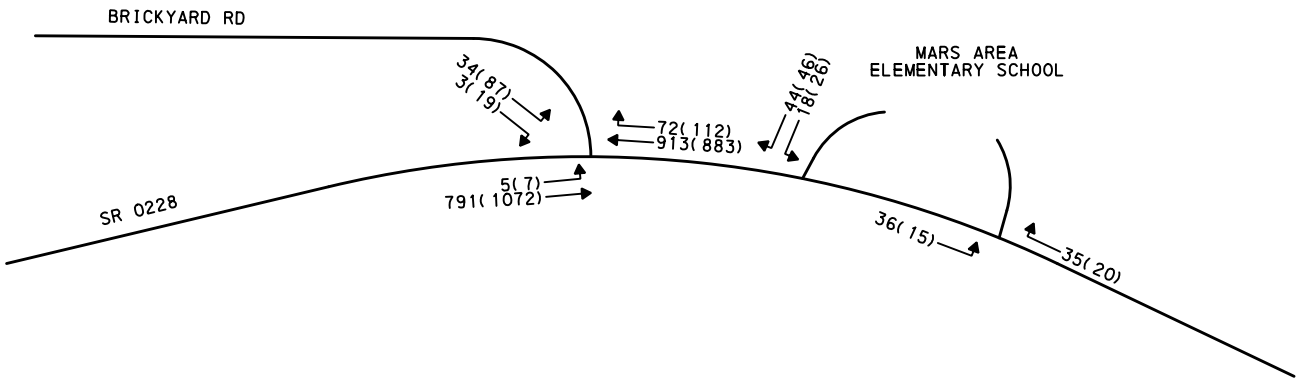
EXISTING PEAK HOUR TRAFFIC VOLUMES (HEAVY VEHICLES)

SR 0228 SECTION 29B
ADAMS TOWNSHIP, BUTLER COUNTY

DATE:4/24/2017 TIME:3:22:11 PM
FILENAME:N:\57840-00-228Sec29B\Drawings\Working\cam\ExistingBrickyardCounts-HV.dgn

APPENDIX D

NOT TO SCALE



LEGEND
AM(PM)

GROWTH RATE = $(1.0081)^{28}$ = 1.253

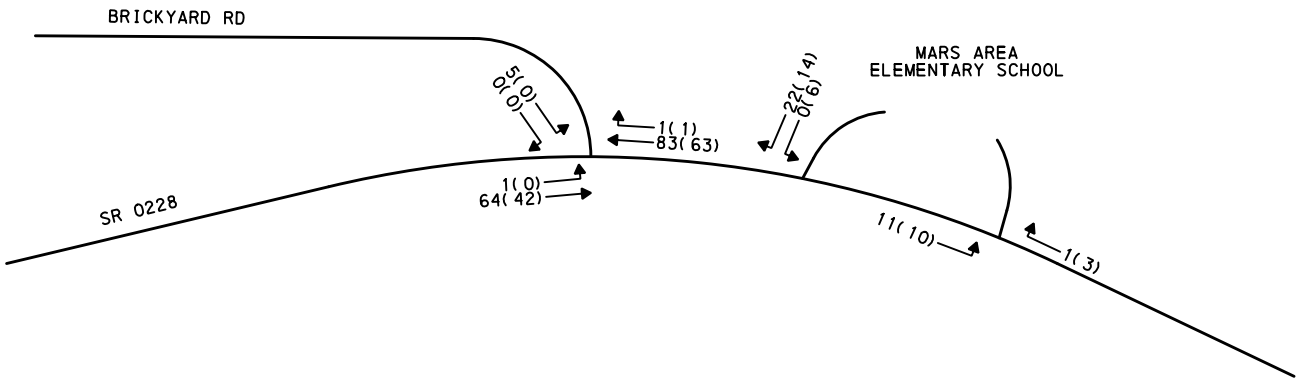
ERDMAN ANTHONY
ONE STERLING PLACE
100 STERLING PARKWAY, SUITE 212
MECHANICSBURG, PA 17050

2040 BUILD YEAR PEAK HOUR TRAFFIC VOLUMES

SR 0228 SECTION 29B
ADAMS TOWNSHIP, BUTLER COUNTY

DATE: 4/24/2017 TIME: 3:29:03 PM
FILENAME: N:\57840-00-228Sec29B\Drawings\Working\cam\2040BrickyardCounts.dgn

NOT TO SCALE



LEGEND
AM(PM)

GROWTH RATE = (1.0081) ^{28} = 1.253

ERDMAN ANTHONY
ONE STERLING PLACE
100 STERLING PARKWAY, SUITE 212
MECHANICSBURG, PA 17050

2040 BUILD YEAR PEAK HOUR TRAFFIC VOLUMES (HEAVY VEHICLES)

SR 0228 SECTION 29B
ADAMS TOWNSHIP, BUTLER COUNTY

DATE: 4/24/2017 TIME: 3:26:36 PM
FILENAME: N:\57840-00-228Sec29B\Drawings\Working\cam\2040BrickyardCounts-HV.dgn

APPENDIX E

24-Apr-17

ERDMAN ANTHONY

ITE Trip Generation Rates - 9th Edition
Pass-by rates from ITE Trip Generation Handbook - 2nd Edition
(copyrights, Insitute of Transportation Engineers)

Instructions: Enter Expected Unit Volumes into Column 'M'
Notes on Color Coding at Bottom

Description/ITE Code	Units	ITE Vehicle Trip Generation Rates (peak hours are for peak hour of adjacent street traffic unless highlighted)								Expected Units	Total Generated Trips			Total Distribution of Generated Trips						
		Weekday	AM	PM	Pass-By	AM In	AM Out	PM In	PM Out		Daily	AM Hour	PM Hour	AM In	AM Out	Pass-By	PM In	PM Out	Pass-By	
Waterport/Marine Terminal 010	Acres	11.93	NA	NA		NA	NA	NA	NA		0	NA	NA	NA	NA	0	NA	NA	0	
Waterport/Marine Terminal 010	Berths	171.52	NA	NA		NA	NA	NA	NA		0	NA	NA	NA	NA	0	NA	NA	0	
Commercial Airport 021	Employees	13.40	0.82	0.80		55%	45%	54%	46%		0	0	0	0	0	0	0	0	0	
Commercial Airport 021	Avg Flights/Day	104.73	5.40	5.75		54%	46%	56%	44%		0	0	0	0	0	0	0	0	0	
Commercial Airport 021	Com. Flights/Day	122.21	6.43	6.88		55%	45%	54%	46%		0	0	0	0	0	0	0	0	0	
General Aviation Airport 022	Employees	14.24	0.69	1.03		83%	17%	45%	55%		0	0	0	0	0	0	0	0	0	
General Aviation Airport 022	Avg. Flights/Day	1.97	0.24	0.30		NA	NA	NA	NA		0	0	0	NA	NA	0	NA	NA	0	
General Aviation Airport 022	Based Aircraft	5.00	0.24	0.37		83%	17%	45%	55%		0	0	0	0	0	0	0	0	0	
Intermodal Truck Terminal 030	Acres	81.90	7.28	6.55		41%	59%	43%	57%		0	0	0	0	0	0	0	0	0	
Intermodal Truck Terminal 030	Employees	6.99	0.66	0.55		40%	60%	47%	53%		0	0	0	0	0	0	0	0	0	
Park&Ride w/ Bus Service 090	Parking Spaces	4.50	0.71	0.62		79%	21%	25%	75%		0	0	0	0	0	0	0	0	0	
Park&Ride w/ Bus Service 090	Acres	372.32	48.81	43.75		NA	NA	NA	NA		0	0	0	NA	NA	0	NA	NA	0	
Park&Ride w/ Bus Service 090	Occ. Spaces	9.62	1.26	0.81		69%	31%	28%	72%		0	0	0	0	0	0	0	0	0	
Light Rail Station w/ Park. 093	Parking Space	2.51	1.07	1.24		80%	20%	58%	42%		0	0	0	0	0	0	0	0	0	
Light Rail Station w/ Park. 093	Occ. Spaces	3.91	1.14	1.33		80%	20%	58%	42%		0	0	0	0	0	0	0	0	0	
General Light Industrial 110	KSF^2	6.97	0.92	0.97		88%	12%	12%	88%		0	0	0	0	0	0	0	0	0	
General Light Industrial 110	Acres	51.80	7.51	7.26		83%	17%	22%	78%		0	0	0	0	0	0	0	0	0	
General Light Industrial 110	Employees	3.02	0.44	0.42		83%	17%	21%	79%		0	0	0	0	0	0	0	0	0	
General Heavy Industrial 120	KSF^2	1.50	0.51	0.19		NA	NA	NA	NA		0	0	0	NA	NA	0	NA	NA	0	
General Heavy Industrial 120	Acres	6.75	1.98	2.16		NA	NA	NA	NA		0	0	0	NA	NA	0	NA	NA	0	
General Heavy Industrial 120	Employees	0.82	0.51	0.88		NA	NA	NA	NA		0	0	0	NA	NA	0	NA	NA	0	
Industrial Park 130	KSF^2	6.83	0.82	0.85		82%	18%	21%	79%		0	0	0	0	0	0	0	0	0	
Industrial Park 130	Acres	61.17	8.20	8.53		83%	17%	21%	79%		0	0	0	0	0	0	0	0	0	
Industrial Park 130	Employees	3.34	0.47	0.46		86%	14%	20%	80%		0	0	0	0	0	0	0	0	0	
Manufacturing 140	KSF^2	3.82	0.73	0.73		78%	22%	36%	64%		0	0	0	0	0	0	0	0	0	
Manufacturing 140	Acres	38.88	7.44	8.35		93%	7%	53%	47%		0	0	0	0	0	0	0	0	0	
Manufacturing 140	Employees	2.13	0.40	0.36		73%	27%	44%	56%		0	0	0	0	0	0	0	0	0	
Warehousing 150	KSF^2	3.56	0.30	0.32		79%	21%	25%	75%		0	0	0	0	0	0	0	0	0	
Warehousing 150	Acres	57.23	10.03	8.69		72%	28%	35%	65%		0	0	0	0	0	0	0	0	0	
Warehousing 150	Employees	3.89	0.51	0.59		72%	28%	35%	65%		0	0	0	0	0	0	0	0	0	
Mini Warehouse 151	KSF^2	2.50	0.14	0.26		55%	45%	50%	50%		0	0	0	0	0	0	0	0	0	
Mini Warehouse 151	Storage Units	0.25	0.02	0.02		50%	50%	48%	52%		0	0	0	0	0	0	0	0	0	
Mini Warehouse 151	Acres	35.43	2.58	3.57		45%	55%	50%	50%		0	0	0	0	0	0	0	0	0	
Data Center 160	KSF^2	0.99	0.09	0.09		52%	48%	21%	79%		0	0	0	0	0	0	0	0	0	
High-Cube Warehouse/Dist Center 15	KSF^2	1.68	0.11	0.12		69%	31%	31%	69%		0	0	0	0	0	0	0	0	0	
Utilities 170	KSF^2	NA	0.80	0.76		NA	NA	45%	55%		0	0	0	NA	NA	0	0	0	0	
Utilities 170	Employees	NA	0.76	0.76		90%	10%	15%	85%		0	0	0	0	0	0	0	0	0	
Single Family Homes 210	DU	9.52	0.75	1.00		25%	75%	63%	37%	150.0	1,428	113	150	28	84	0	95	56	0	75 duplex residences x 2 units/residence
Single Family Homes 210	Acres	26.04	2.06	2.74		31%	69%	66%	34%		0	0	0	0	0	0	0	0	0	
Single Family Homes 210	Persons	2.55	0.21	0.28		31%	69%	66%	34%		0	0	0	0	0	0	0	0	0	
Single Family Homes 210	Vehicles	6.02	0.51	0.67		31%	69%	66%	34%		0	0	0	0	0	0	0	0	0	
Apartment 220	DU	6.65	0.51	0.62		20%	80%	65%	35%		0	0	0	0	0	0	0	0	0	
Apartment 220	Persons	3.31	0.28	0.40		NA	NA	NA	NA		0	0	0	NA	NA	0	NA	NA	0	
Apartment 220	Vehicles	5.10	0.46	0.60		NA	NA	NA	NA		0	0	0	NA	NA	0	NA	NA	0	
Low Rise Apartment 221	Occ.DU	6.59	0.46	0.58		21%	79%	65%	35%		0	0	0	0	0	0	0	0	0	
High Rise Apartment 222	DU	4.20	0.30	0.35		25%	75%	61%	39%		0	0	0	0	0	0	0	0	0	
Mid-Rise Apartment 223	DU	NA	0.30	0.39		31%	69%	58%	42%		0	0	0	0	0	0	0	0	0	
Rental Townhouse 224	DU	NA	0.70	0.72		33%	67%	51%	49%		0	0	0	0	0	0	0	0	0	
Resd. Condo/Townhouse 230	DU	5.81	0.44	0.52		17%	83%	67%	33%		0	0	0	0	0	0	0	0	0	
Resd. Condo/Townhouse 230	Persons	2.49	0.19	0.24		16%	84%	67%	33%		0	0	0	0	0	0	0	0	0	
Resd. Condo/Townhouse 230	Vehicles	3.34	0.24	0.32		16%	84%	66%	34%		0	0	0	0	0	0	0	0	0	
Low Rise Resd. Condo 231	DU	NA	0.67	0.78		25%	75%	58%	42%		0	0	0	0	0	0	0	0	0	
High Rise Resd. Condo 232	DU	4.18	0.34	0.38		19%	81%	62%	38%		0	0	0	0	0	0	0	0	0	
Luxury Condo/Townhouse 233	Occ. DU	NA	0.56	0.55		23%	77%	63%	37%		0	0	0	0	0	0	0	0	0	

APPENDIX F


GABLES CT
BRICKYARD RD

APPENDIX G

24-Apr-17

ERDMAN ANTHONY

ITE Trip Generation Rates - 9th Edition

Pass-by rates from ITE Trip Generation Handbook - 2nd Edition

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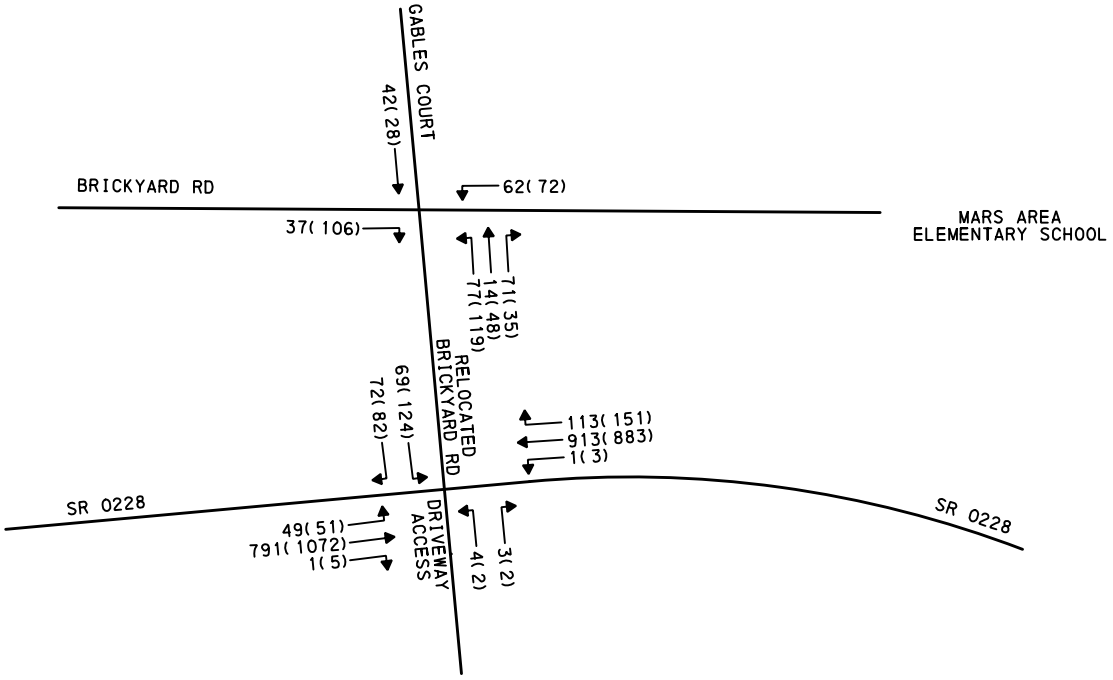
Instructions: Enter Expected Unit Volumes into Column 'M'

Notes on Color Coding at Bottom

Description/ITE Code	Units	ITE Vehicle Trip Generation Rates (peak hours are for peak hour of adjacent street traffic unless highlighted)								Expected Units	Total Generated Trips			Total Distribution of Generated Trips						
		Weekday	AM	PM	Pass-By	AM In	AM Out	PM In	PM Out		Daily	AM Hour	PM Hour	AM In	AM Out	Pass-By	PM In	PM Out	Pass-By	
Waterport/Marine Terminal 010	Acres	11.93	NA	NA		NA	NA	NA	NA		0	NA	NA	NA	NA	0	NA	NA	0	
Waterport/Marine Terminal 010	Berths	171.52	NA	NA		NA	NA	NA	NA		0	NA	NA	NA	NA	0	NA	NA	0	
Commercial Airport 021	Employees	13.40	0.82	0.80		55%	45%	54%	46%		0	0	0	0	0	0	0	0	0	
Commercial Airport 021	Avg Flights/Day	104.73	5.40	5.75		54%	46%	56%	44%		0	0	0	0	0	0	0	0	0	
Commercial Airport 021	Com. Flights/Day	122.21	6.43	6.88		55%	45%	54%	46%		0	0	0	0	0	0	0	0	0	
General Aviation Airport 022	Employees	14.24	0.69	1.03		83%	17%	45%	55%		0	0	0	0	0	0	0	0	0	
General Aviation Airport 022	Avg. Flights/Day	1.97	0.24	0.30		NA	NA	NA	NA		0	0	0	NA	NA	0	NA	NA	0	
General Aviation Airport 022	Based Aircraft	5.00	0.24	0.37		83%	17%	45%	55%		0	0	0	0	0	0	0	0	0	
Intermodal Truck Terminal 030	Acres	81.90	7.28	6.55		41%	59%	43%	57%		0	0	0	0	0	0	0	0	0	
Intermodal Truck Terminal 030	Employees	6.99	0.66	0.55		40%	60%	47%	53%		0	0	0	0	0	0	0	0	0	
Park&Ride w/ Bus Service 090	Parking Spaces	4.50	0.71	0.62		79%	21%	25%	75%		0	0	0	0	0	0	0	0	0	
Park&Ride w/ Bus Service 090	Acres	372.32	48.81	43.75		NA	NA	NA	NA		0	0	0	NA	NA	0	NA	NA	0	
Park&Ride w/ Bus Service 090	Occ. Spaces	9.62	1.26	0.81		69%	31%	28%	72%		0	0	0	0	0	0	0	0	0	
Light Rail Station w/ Park. 093	Parking Space	2.51	1.07	1.24		80%	20%	58%	42%		0	0	0	0	0	0	0	0	0	
Light Rail Station w/ Park. 093	Occ. Spaces	3.91	1.14	1.33		80%	20%	58%	42%		0	0	0	0	0	0	0	0	0	
General Light Industrial 110	KSF^2	6.97	0.92	0.97		88%	12%	12%	88%		0	0	0	0	0	0	0	0	0	
General Light Industrial 110	Acres	51.80	7.51	7.26		83%	17%	22%	78%		0	0	0	0	0	0	0	0	0	
General Light Industrial 110	Employees	3.02	0.44	0.42		83%	17%	21%	79%		0	0	0	0	0	0	0	0	0	
General Heavy Industrial 120	KSF^2	1.50	0.51	0.19		NA	NA	NA	NA		0	0	0	NA	NA	0	NA	NA	0	
General Heavy Industrial 120	Acres	6.75	1.98	2.16		NA	NA	NA	NA		0	0	0	NA	NA	0	NA	NA	0	
General Heavy Industrial 120	Employees	0.82	0.51	0.88		NA	NA	NA	NA		0	0	0	NA	NA	0	NA	NA	0	
Industrial Park 130	KSF^2	6.83	0.82	0.85		82%	18%	21%	79%		0	0	0	0	0	0	0	0	0	
Industrial Park 130	Acres	61.17	8.20	8.53		83%	17%	21%	79%		0	0	0	0	0	0	0	0	0	
Industrial Park 130	Employees	3.34	0.47	0.46		86%	14%	20%	80%		0	0	0	0	0	0	0	0	0	
Manufacturing 140	KSF^2	3.82	0.73	0.73		78%	22%	36%	64%		0	0	0	0	0	0	0	0	0	
Manufacturing 140	Acres	38.88	7.44	8.35		93%	7%	53%	47%		0	0	0	0	0	0	0	0	0	
Manufacturing 140	Employees	2.13	0.40	0.36		73%	27%	44%	56%		0	0	0	0	0	0	0	0	0	
Warehousing 150	KSF^2	3.56	0.30	0.32		79%	21%	25%	75%		0	0	0	0	0	0	0	0	0	
Warehousing 150	Acres	57.23	10.03	8.69		72%	28%	35%	65%		0	0	0	0	0	0	0	0	0	
Warehousing 150	Employees	3.89	0.51	0.59		72%	28%	35%	65%		0	0	0	0	0	0	0	0	0	
Mini Warehouse 151	KSF^2	2.50	0.14	0.26		55%	45%	50%	50%		0	0	0	0	0	0	0	0	0	
Mini Warehouse 151	Storage Units	0.25	0.02	0.02		50%	50%	48%	52%		0	0	0	0	0	0	0	0	0	
Mini Warehouse 151	Acres	35.43	2.58	3.57		45%	55%	50%	50%		0	0	0	0	0	0	0	0	0	
Data Center 160	KSF^2	0.99	0.09	0.09		52%	48%	21%	79%		0	0	0	0	0	0	0	0	0	
High-Cube Warehouse/Dist Center 15	KSF^2	1.68	0.11	0.12		69%	31%	31%	69%		0	0	0	0	0	0	0	0	0	
Utilities 170	KSF^2	NA	0.80	0.76		NA	NA	45%	55%		0	0	0	NA	NA	0	0	0	0	
Utilities 170	Employees	NA	0.76	0.76		90%	10%	15%	85%		0	0	0	0	0	0	0	0	0	
Single Family Homes 210	DU	9.52	0.75	1.00		25%	75%	63%	37%	12.0	114	9	12	2	7	0	8	4	0	12 houses according to Google maps
Single Family Homes 210	Acres	26.04	2.06	2.74		31%	69%	66%	34%		0	0	0	0	0	0	0	0	0	
Single Family Homes 210	Persons	2.55	0.21	0.28		31%	69%	66%	34%		0	0	0	0	0	0	0	0	0	
Single Family Homes 210	Vehicles	6.02	0.51	0.67		31%	69%	66%	34%		0	0	0	0	0	0	0	0	0	
Apartment 220	DU	6.65	0.51	0.62		20%	80%	65%	35%		0	0	0	0	0	0	0	0	0	
Apartment 220	Persons	3.31	0.28	0.40		NA	NA	NA	NA		0	0	0	NA	NA	0	NA	NA	0	
Apartment 220	Vehicles	5.10	0.46	0.60		NA	NA	NA	NA		0	0	0	NA	NA	0	NA	NA	0	
Low Rise Apartment 221	Occ.DU	6.59	0.46	0.58		21%	79%	65%	35%		0	0	0	0	0	0	0	0	0	
High Rise Apartment 222	DU	4.20	0.30	0.35		25%	75%	61%	39%		0	0	0	0	0	0	0	0	0	
Mid-Rise Apartment 223	DU	NA	0.30	0.39		31%	69%	58%	42%		0	0	0	0	0	0	0	0	0	
Rental Townhouse 224	DU	NA	0.70	0.72		33%	67%	51%	49%		0	0	0	0	0	0	0	0	0	
Resd. Condo/Townhouse 230	DU	5.81	0.44	0.52		17%	83%	67%	33%		0	0	0	0	0	0	0	0	0	
Resd. Condo/Townhouse 230	Persons	2.49	0.19	0.24		16%	84%	67%	33%		0	0	0	0	0	0	0	0	0	
Resd. Condo/Townhouse 230	Vehicles	3.34	0.24	0.32		16%	84%	66%	34%		0	0	0	0	0	0	0	0	0	
Low Rise Resd. Condo 231	DU	NA	0.67	0.78		25%	75%	58%	42%		0	0	0	0	0	0	0	0	0	
High Rise Resd. Condo 232	DU	4.18	0.34	0.38		19%	81%	62%	38%		0	0	0	0	0	0	0	0	0	
Luxury Condo/Townhouse 233	Occ. DU	NA	0.56	0.55		23%	77%	63%	37%		0	0	0	0	0	0	0	0	0	

APPENDIX H

NOT TO SCALE



LEGEND
AM(PM)

PROPOSED CONDITIONS

ERDMAN ANTHONY
ONE STERLING PLACE
100 STERLING PARKWAY, SUITE 212
MECHANICSBURG, PA 17050

2040 BUILD YEAR PEAK HOUR TRAFFIC VOLUMES

SR 0228 SECTION 29B
ADAMS TOWNSHIP, BUTLER COUNTY

DATE:4/24/2017 TIME:1:06:43 PM
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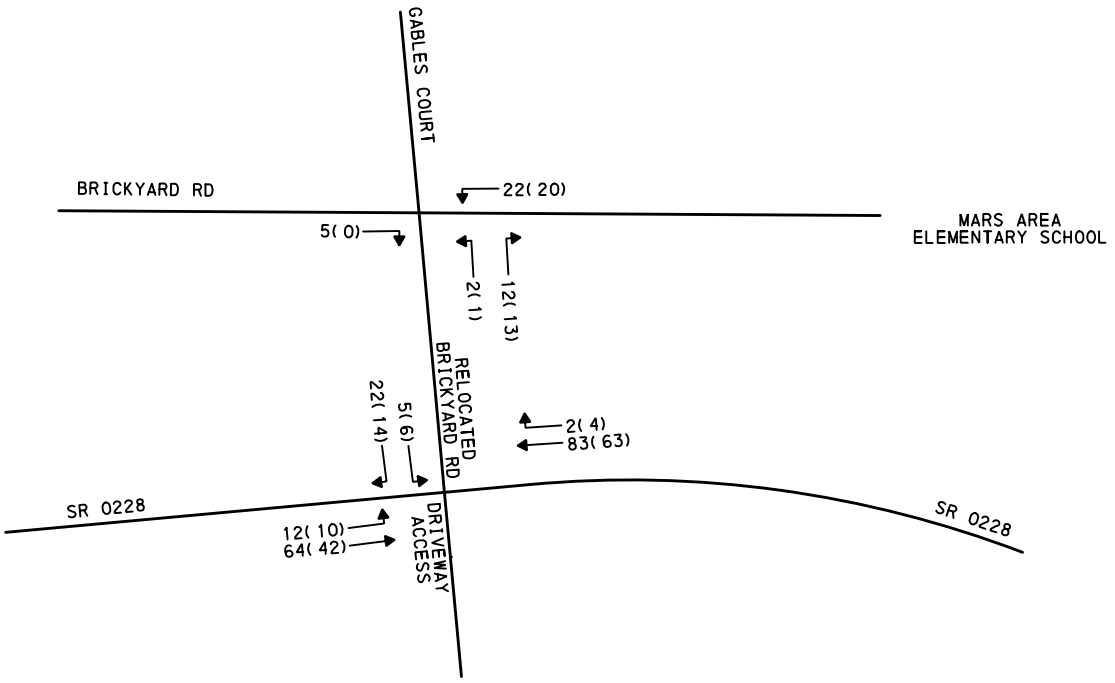
NOT TO SCALE



LEGEND
AM(PM)

PROPOSED CONDITIONS

ERDMAN ANTHONY

ONE STERLING PLACE
100 STERLING PARKWAY, SUITE 212
MECHANICSBURG, PA 17050

2040 BUILD YEAR PEAK HOUR TRAFFIC VOLUMES (HEAVY VEHICLES)

SR 0228 SECTION 29B
ADAMS TOWNSHIP, BUTLER COUNTY

DATE:4/24/2017 TIME:3:34:35 PM
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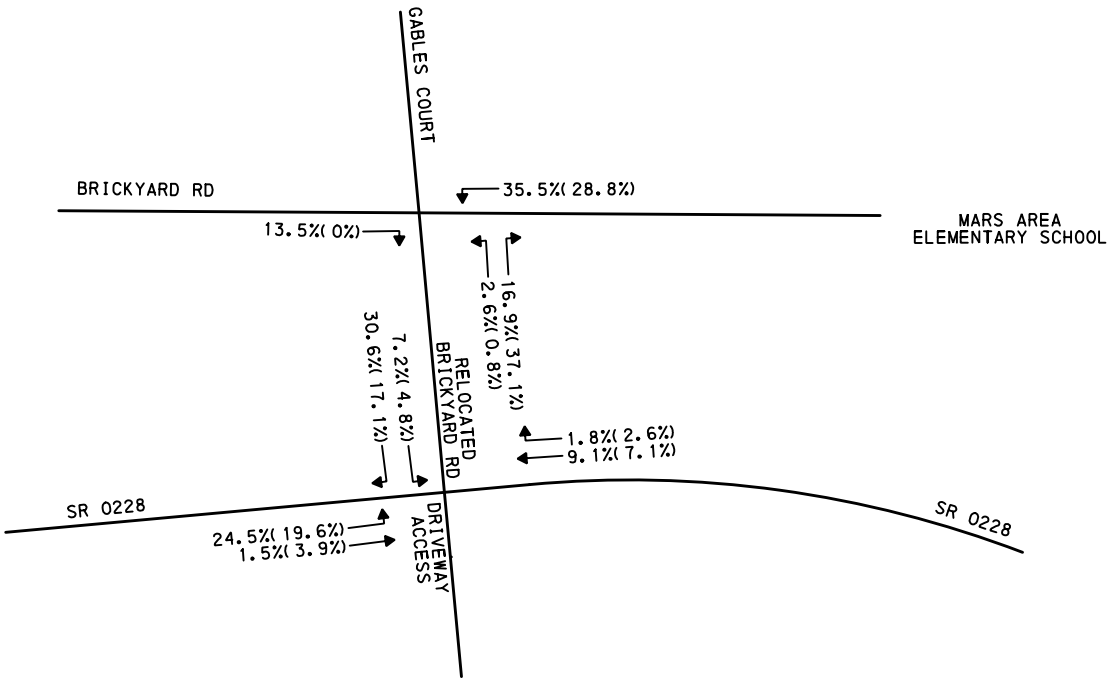
NOT TO SCALE



LEGEND
AM(PM)

PROPOSED CONDITIONS

ERDMAN ANTHONY
ONE STERLING PLACE
100 STERLING PARKWAY, SUITE 212
MECHANICSBURG, PA 17050

2040 BUILD YEAR PEAK HOUR TRAFFIC VOLUMES (HEAVY VEHICLE %)

SR 0228 SECTION 29B
ADAMS TOWNSHIP, BUTLER COUNTY

DATE:4/24/2017 TIME:3:38:10 PM
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APPENDIX I

NOTES:

Opening Year (2020) Volumes

Yearly Growth Rate: 0.81%
(Southwestern Planning Commission)
(Adams Township)

Count Notes:

COUNTY:	Butler
MUNICIPALITY:	Adams Township
DATE:	September 20, 2012
DAY:	Thursday
WEATHER:	

INTERSECTION: SR 228 and Brickyard Rd

	BRICKYARD RD				SR 228 WB				SR 228 EB				
Starting Time	From North				From East				From West				TOTAL TRAFFIC
	R		L	TOTAL	R	T		TOTAL		T	L	TOTAL	
AM													
630	0		9	9	10	185		194		112	3	115	318
645	2		2	4	19	226		245		112	1	113	363
700	0		10	10	15	170		185		145	1	146	340
715	0		9	9	14	169		182		221	2	223	414
730	0		9	9	13	212		225		195	0	195	429
745	0		7	7	20	159		179		116	2	118	305
800	1		6	7	13	108		121		142	1	143	271
815	0		5	5	12	144		156		147	2	149	310
830	3		16	19	38	178		217		154	3	157	393
845	2		16	18	52	218		270		131	4	135	423
900	5		15	20	28	191		219		103	6	110	349
915	1		13	14	15	156		171		126	12	138	322
MID													
1100	1		6	7	20	164		185		96	1	97	289
1115	0		3	3	18	158		176		106	1	107	286
1130	2		12	14	10	131		141		125	1	126	281
1145	2		9	11	28	159		187		114	3	117	315
1200	6		9	15	18	123		141		137	4	141	297
1215	3		12	15	14	119		133		138	1	139	287
1230	1		19	20	27	163		190		145	1	146	356
1245	5		13	18	18	130		148		163	3	166	333
PM													
300	4		5	10	32	158		190		185	2	187	386
315	2		16	18	20	146		166		190	4	194	379
330	4		17	21	31	169		199		196	4	201	421
345	0		13	13	21	169		190		215	0	215	418
400	3		11	14	26	135		161		190	2	192	367
415	9		6	15	26	180		206		205	3	208	429
430	7		34	42	29	193		222		249	2	251	514
445	4		20	25	25	194		219		198	1	199	443
500	4		5	10	20	178		198		235	0	235	443
515	0		14	14	21	186		207		230	2	233	453
530	4		19	23	26	173		198		203	2	205	427
545	2		11	13	49	185		234		199	7	207	453
Total				**451**				**6053**				**5308**	

Traffic Signal Warrant Analysis Workbook

STUDY AND ANALYSIS INFORMATION

Municipality:	Adams Township	**Analysis Date:**	3/17/2017
County:	Butler County	**Conducted By:**	CAM
PennDOT Engineering District:	10	**Agency/Company Name:**	Erdman Anthony

Analysis Information

Data Collection Date:	9/20/2012
Day of the Week:	Thursday

Is the intersection in a built-up area of an isolated community of <10,000 population? Yes

Major Street Information

Major Street Name and Route Number:	SR 0228
Major Street Approach #1 Direction:	E-Bound
Major Street Approach #2 Direction:	W-Bound

Number of Lanes for Moving Traffic on Each Major Street Approach:	2	**LANE(S)**
Speed Limit or 85th Percentile Speed on the Major Street:	45	**MPH**

Minor Street Information

Minor Street Name and Route Number:	Brickyard Road
Minor Street Approach #1 Direction:	S-Bound
Minor Street Approach #2 Direction:	N-Bound

Number of Lanes for Moving Traffic on Each Minor Street Approach:	1	**LANE(S)**

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Applicable?	Warrant Met?
Warrant 1, Eight-Hour Vehicular Volume	**Yes**	**No**
Warrant 2, Four-Hour Vehicular Volume	**Yes**	**Yes**
Warrant 3, Peak Hour	**Yes**	**Yes**
Warrant 4, Pedestrian Volume	**No**	**N/A**
Warrant 5, School Crossing	**No**	**N/A**
Warrant 6, Coordinated Signal System	**Yes**	**No**
Warrant 7, Crash Experience	**Yes**	**No**
Warrant 8, Roadway Network	**Yes**	**Yes**
Warrant 9, Intersection Near a Grade Crossing	**No**	**N/A**
Warrant PA-1, ADT Volume Warrant	**No**	**N/A**
Warrant PA-2, Midblock and Trail Crossings	**No**	**N/A**

Traffic Signal Warrant Analysis Workbook

ENTER VOLUME DATA PER 15 MINUTE INTERVAL, PER APPROACH

Time Interval		Major Street Approach #1 (E-Bound)	Major Street Approach #2 (W-Bound)	Major Street Combined	Minor Street Approach #1 (S-Bound)	Minor Street Approach #2 (N-Bound)
Begin At	End Of	Volume	Volume	Total Volume	Volume	Volume
12:00 AM	12:14 AM			0		
12:15 AM	12:29 AM			0		
12:30 AM	12:44 AM			0		
12:45 AM	12:59 AM			0		
1:00 AM	1:14 AM			0		
1:15 AM	1:29 AM			0		
1:30 AM	1:44 AM			0		
1:45 AM	1:59 AM			0		
2:00 AM	2:14 AM			0		
2:15 AM	2:29 AM			0		
2:30 AM	2:44 AM			0		
2:45 AM	2:59 AM			0		
3:00 AM	3:14 AM			0		
3:15 AM	3:29 AM			0		
3:30 AM	3:44 AM			0		
3:45 AM	3:59 AM			0		
4:00 AM	4:14 AM			0		
4:15 AM	4:29 AM			0		
4:30 AM	4:44 AM			0		
4:45 AM	4:59 AM			0		
5:00 AM	5:14 AM			0		
5:15 AM	5:29 AM			0		
5:30 AM	5:44 AM			0		
5:45 AM	5:59 AM			0		
6:00 AM	6:14 AM			0		
6:15 AM	6:29 AM			0		
6:30 AM	6:44 AM	115	194	309	9	1
6:45 AM	6:59 AM	113	245	358	4	1
7:00 AM	7:14 AM	146	185	331	10	1
7:15 AM	7:29 AM	223	182	405	9	1
7:30 AM	7:44 AM	195	225	420	9	1
7:45 AM	7:59 AM	118	179	297	7	1
8:00 AM	8:14 AM	143	121	264	7	1
8:15 AM	8:29 AM	149	156	305	5	1
8:30 AM	8:44 AM	157	217	374	19	1
8:45 AM	8:59 AM	135	270	405	18	1
9:00 AM	9:14 AM	110	219	329	20	1
9:15 AM	9:29 AM	138	171	309	14	1
9:30 AM	9:44 AM			0		
9:45 AM	9:59 AM			0		
10:00 AM	10:14 AM			0		
10:15 AM	10:29 AM			0		
10:30 AM	10:44 AM			0		
10:45 AM	10:59 AM			0		
11:00 AM	11:14 AM			0		
11:15 AM	11:29 AM	97	185	282	7	1
11:30 AM	11:44 AM	107	176	283	3	1
11:45 AM	11:59 AM	126	141	267	14	1

Traffic Signal Warrant Analysis Workbook

ENTER VOLUME DATA PER 15 MINUTE INTERVAL, PER APPROACH

Time Interval		Major Street Approach #1 (E-Bound)	Major Street Approach #2 (W-Bound)	Major Street Combined	Minor Street Approach #1 (S-Bound)	Minor Street Approach #2 (N-Bound)
Begin At	End Of	Volume	Volume	Total Volume	Volume	Volume
12:00 PM	12:14 PM	117	187	304	11	1
12:15 PM	12:29 PM	141	141	282	15	1
12:30 PM	12:44 PM	139	133	272	15	1
12:45 PM	12:59 PM	146	190	336	20	1
1:00 PM	1:14 PM	166	148	314	18	1
1:15 PM	1:29 PM			0		
1:30 PM	1:44 PM			0		
1:45 PM	1:59 PM			0		
2:00 PM	2:14 PM			0		
2:15 PM	2:29 PM			0		
2:30 PM	2:44 PM			0		
2:45 PM	2:59 PM			0		
3:00 PM	3:14 PM	187	190	377	10	1
3:15 PM	3:29 PM	194	166	360	18	1
3:30 PM	3:44 PM	201	199	400	21	1
3:45 PM	3:59 PM	215	190	405	13	1
4:00 PM	4:14 PM	192	161	353	14	1
4:15 PM	4:29 PM	208	206	414	15	1
4:30 PM	4:44 PM	251	222	473	42	1
4:45 PM	4:59 PM	199	219	418	25	1
5:00 PM	5:14 PM	235	198	433	10	1
5:15 PM	5:29 PM	233	207	440	14	1
5:30 PM	5:44 PM	205	198	403	23	1
5:45 PM	5:59 PM	207	234	441	13	1
6:00 PM	6:14 PM			0		
6:15 PM	6:29 PM			0		
6:30 PM	6:44 PM			0		
6:45 PM	6:59 PM			0		
7:00 PM	7:14 PM			0		
7:15 PM	7:29 PM			0		
7:30 PM	7:44 PM			0		
7:45 PM	7:59 PM			0		
8:00 PM	8:14 PM			0		
8:15 PM	8:29 PM			0		
8:30 PM	8:44 PM			0		
8:45 PM	8:59 PM			0		
9:00 PM	9:14 PM			0		
9:15 PM	9:29 PM			0		
9:30 PM	9:44 PM			0		
9:45 PM	9:59 PM			0		
10:00 PM	10:14 PM			0		
10:15 PM	10:29 PM			0		
10:30 PM	10:44 PM			0		
10:45 PM	10:59 PM			0		
11:00 PM	11:14 PM			0		
11:15 PM	11:29 PM			0		
11:30 PM	11:44 PM			0		
11:45 PM	11:59 PM			0		
	Approach Totals:	5308	6055	11363	452	32

MUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	2 or More Lanes
Minor Street:	1 Lane

Built-up Isolated Community With Less Than 10,000 Population or Above 40 MPH on Major Street?	Yes

Combination of Conditions A and B Necessary?*: No

**Only applicable for Warrant 1 if after an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems. See Section 4C.02 of the 2009 MUTCD for application.*

Condition A - Minimum Vehicular Volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor street approach (one direction only)			
Major Street	**Minor Street**	**100%**	**80%**	**70%**	**56%**	**100%**	**80%**	**70%**	**56%**
1	**1**	500	400	350	280	150	120	105	84
2 or More	**1**	600	480	420	336	150	120	105	84
2 or More	**2 or More**	600	480	420	336	200	160	140	112
1	**2 or More**	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor street approach (one direction only)			
Major Street	**Minor Street**	**100%**	**80%**	**70%**	**56%**	**100%**	**80%**	**70%**	**56%**
1	**1**	750	600	525	420	75	60	53	42
2 or More	**1**	900	720	630	504	75	60	53	42
2 or More	**2 or More**	900	720	630	504	100	80	70	56
1	**2 or More**	750	600	525	420	100	80	70	56

Condition A Evaluation

Number of Unique Hours Met: 0 **Condition A Satisfied?** No

Condition B Evaluation

Number of Unique Hours Met: 5 **Condition B Satisfied?** No

Combination of Condition A and Condition B Evaluation

Number of Unique Hours Met for Condition A: N/A

Number of Unique Hours Met for Condition B: N/A

Combination of Condition A and Condition B Satisfied? N/A

MUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	2 or More Lanes
Minor Street:	1 Lane

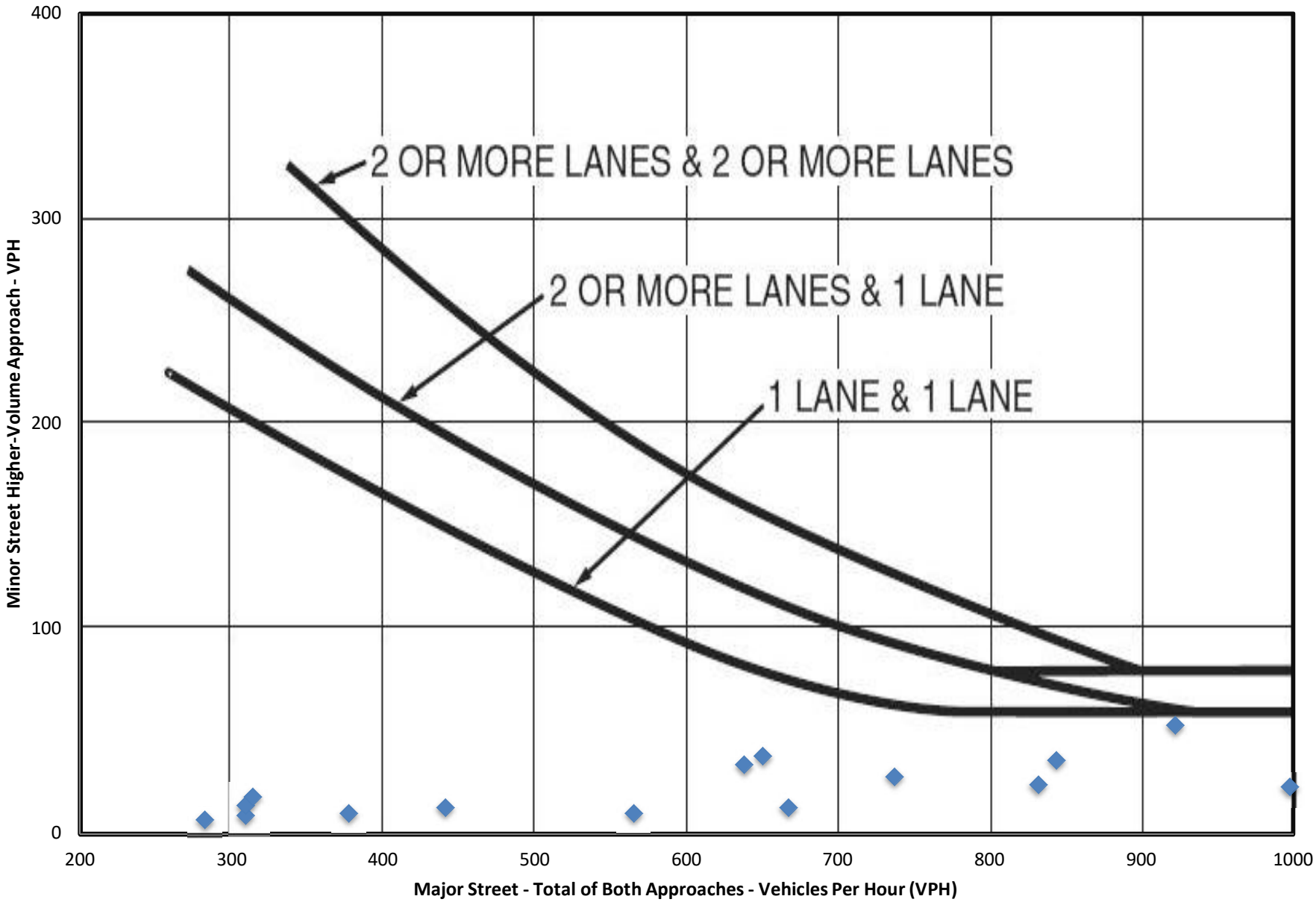
Total Number of Unique Hours Met On Figure 4C-2
5

Built-up Isolated Community With Less Than 10,000 Population or Above 40 MPH on Major Street?	Yes

Hourly Vehicular Volume			
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Hour Met?
12:00 AM	0	0	
12:15 AM	0	0	
12:30 AM	0	0	
12:45 AM	0	0	
1:00 AM	0	0	
1:15 AM	0	0	
1:30 AM	0	0	
1:45 AM	0	0	
2:00 AM	0	0	
2:15 AM	0	0	
2:30 AM	0	0	
2:45 AM	0	0	
3:00 AM	0	0	
3:15 AM	0	0	
3:30 AM	0	0	
3:45 AM	0	0	
4:00 AM	0	0	
4:15 AM	0	0	
4:30 AM	0	0	
4:45 AM	0	0	
5:00 AM	0	0	
5:15 AM	0	0	
5:30 AM	0	0	
5:45 AM	309	9	
6:00 AM	667	13	
6:15 AM	998	23	
6:30 AM	1403	32	
6:45 AM	1514	32	
7:00 AM	1453	35	
7:15 AM	1386	32	
7:30 AM	1286	28	
7:45 AM	1240	38	
8:00 AM	1348	49	
8:15 AM	1413	62	Met
8:30 AM	1417	71	Met
8:45 AM	1043	52	
9:00 AM	638	34	
9:15 AM	309	14	
9:30 AM	0	0	
9:45 AM	0	0	
10:00 AM	0	0	
10:15 AM	0	0	
10:30 AM	282	7	
10:45 AM	565	10	
11:00 AM	832	24	
11:15 AM	1136	35	
11:30 AM	1136	43	
11:45 AM	1125	55	

Hourly Vehicular Volume			
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Hour Met?
12:00 PM	1194	61	Met
12:15 PM	1204	68	Met
12:30 PM	922	53	
12:45 PM	650	38	
1:00 PM	314	18	
1:15 PM	0	0	
1:30 PM	0	0	
1:45 PM	0	0	
2:00 PM	0	0	
2:15 PM	377	10	
2:30 PM	737	28	
2:45 PM	1137	49	
3:00 PM	1542	62	Met
3:15 PM	1518	66	Met
3:30 PM	1572	63	Met
3:45 PM	1645	84	Met
4:00 PM	1658	96	Met
4:15 PM	1738	92	Met
4:30 PM	1764	91	Met
4:45 PM	1694	72	Met
5:00 PM	1717	60	Met
5:15 PM	1284	50	
5:30 PM	844	36	
5:45 PM	441	13	
6:00 PM	0	0	
6:15 PM	0	0	
6:30 PM	0	0	
6:45 PM	0	0	
7:00 PM	0	0	
7:15 PM	0	0	
7:30 PM	0	0	
7:45 PM	0	0	
8:00 PM	0	0	
8:15 PM	0	0	
8:30 PM	0	0	
8:45 PM	0	0	
9:00 PM	0	0	
9:15 PM	0	0	
9:30 PM	0	0	
9:45 PM	0	0	
10:00 PM	0	0	
10:15 PM	0	0	
10:30 PM	0	0	
10:45 PM	0	0	
11:00 PM	0	0	

MUTCD Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)



MUTCD WARRANT 3, PEAK HOUR

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	2 or More Lanes
Minor Street:	1 Lane

Built-up Isolated Community With Less Than 10,000 Population or Above 40 MPH on Major Street?	Yes

Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	Yes

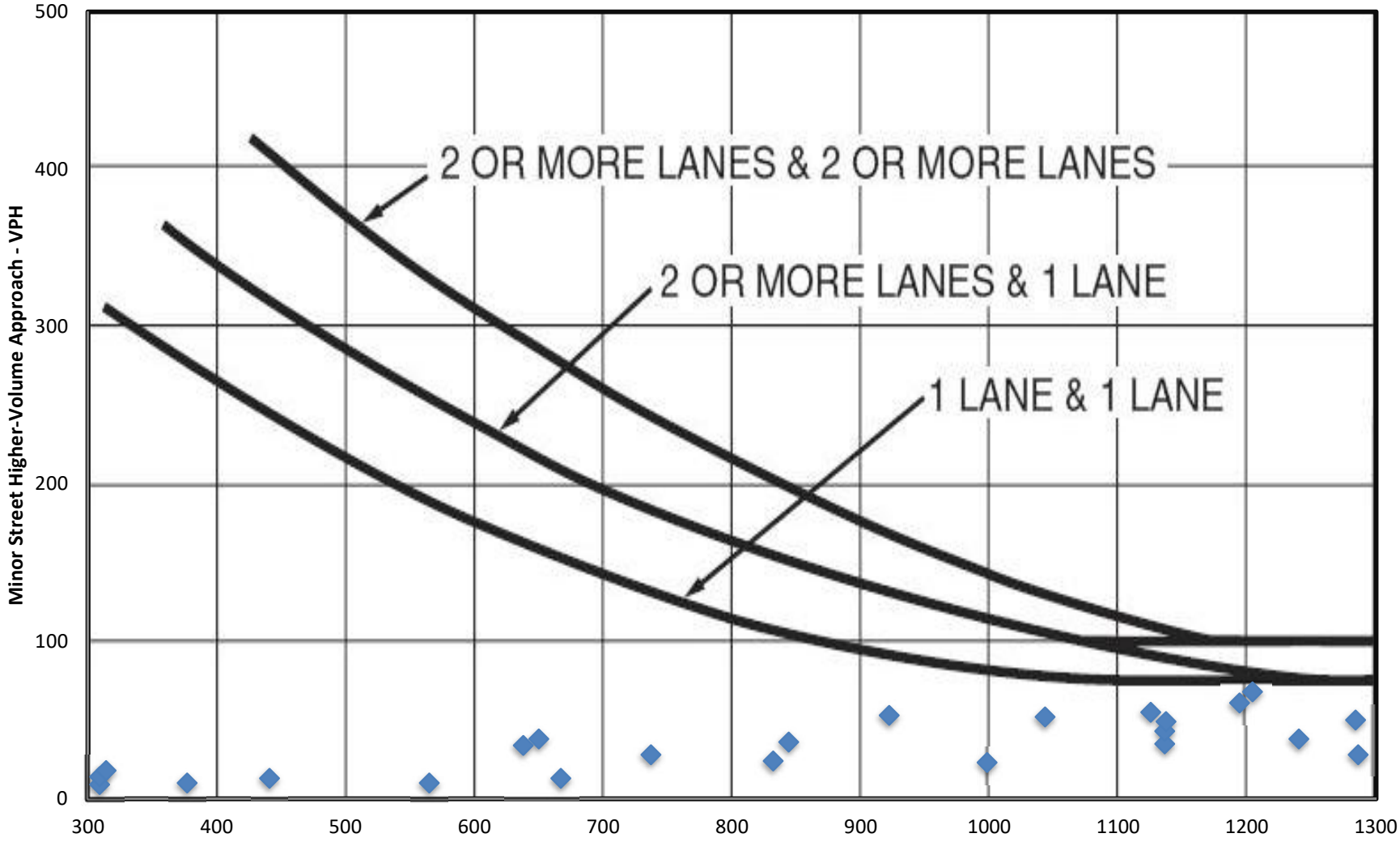
Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	N/A
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	N/A
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	N/A
**If applicable, attach all supporting calculations and documentation.*	

Total Number of Unique Hours Met On Figure 4C-4
1

Hourly Vehicular Volume			
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Hour Met?
12:00 AM	0	0	
12:15 AM	0	0	
12:30 AM	0	0	
12:45 AM	0	0	
1:00 AM	0	0	
1:15 AM	0	0	
1:30 AM	0	0	
1:45 AM	0	0	
2:00 AM	0	0	
2:15 AM	0	0	
2:30 AM	0	0	
2:45 AM	0	0	
3:00 AM	0	0	
3:15 AM	0	0	
3:30 AM	0	0	
3:45 AM	0	0	
4:00 AM	0	0	
4:15 AM	0	0	
4:30 AM	0	0	
4:45 AM	0	0	
5:00 AM	0	0	
5:15 AM	0	0	
5:30 AM	0	0	
5:45 AM	309	9	
6:00 AM	667	13	
6:15 AM	998	23	
6:30 AM	1403	32	
6:45 AM	1514	32	
7:00 AM	1453	35	
7:15 AM	1386	32	
7:30 AM	1286	28	
7:45 AM	1240	38	
8:00 AM	1348	49	
8:15 AM	1413	62	

Hourly Vehicular Volume			
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Hour Met?
8:30 AM	1417	71	
8:45 AM	1043	52	
9:00 AM	638	34	
9:15 AM	309	14	
9:30 AM	0	0	
9:45 AM	0	0	
10:00 AM	0	0	
10:15 AM	0	0	
10:30 AM	282	7	
10:45 AM	565	10	
11:00 AM	832	24	
11:15 AM	1136	35	
11:30 AM	1136	43	
11:45 AM	1125	55	
12:00 PM	1194	61	
12:15 PM	1204	68	
12:30 PM	922	53	
12:45 PM	650	38	
1:00 PM	314	18	
1:15 PM	0	0	
1:30 PM	0	0	
1:45 PM	0	0	
2:00 PM	0	0	
2:15 PM	377	10	
2:30 PM	737	28	
2:45 PM	1137	49	
3:00 PM	1542	62	
3:15 PM	1518	66	
3:30 PM	1572	63	
3:45 PM	1645	84	Met
4:00 PM	1658	96	Met
4:15 PM	1738	92	Met
4:30 PM	1764	91	Met
4:45 PM	1694	72	
5:00 PM	1717	60	
5:15 PM	1284	50	
5:30 PM	844	36	
5:45 PM	441	13	
6:00 PM	0	0	
6:15 PM	0	0	
6:30 PM	0	0	
6:45 PM	0	0	
7:00 PM	0	0	
7:15 PM	0	0	
7:30 PM	0	0	
7:45 PM	0	0	
8:00 PM	0	0	
8:15 PM	0	0	
8:30 PM	0	0	
8:45 PM	0	0	
9:00 PM	0	0	
9:15 PM	0	0	
9:30 PM	0	0	
9:45 PM	0	0	
10:00 PM	0	0	
10:15 PM	0	0	
10:30 PM	0	0	
10:45 PM	0	0	
11:00 PM	0	0	

MUTCD Figure 4C-4. Warrant 3, Peak Hour (70% Factor)



MUTCD WARRANT 5, SCHOOL CROSSING

Do schoolchildren (elementary through high school students) cross the major street?	No
Has consideration been given to implement other remedial measures, such as warning signs and flashers, school speed zones, school crossing guards, or a grade-separated crossing?	No
Is the distance to the nearest traffic control signal along the major street less than 300 feet?	No
If the distance to the nearest traffic control signal along the major street is less than 300 feet, will the proposed traffic control signal restrict the progressive movement of traffic?	No
Minimum of 20 schoolchildren during the highest crossing hour?	No
Has a traffic engineering study been conducted to determine the adequacy and frequency of gaps in the vehicular traffic stream as related to the number and size of groups of schoolchildren at an established school crossing across the major street?	No

Pedestrian Gap Acceptance Engineering and Traffic Study Evaluation*

Data Collection Date:	7/25/2012	Sufficient median for major street Crossing 1?	No
Day of the Week:	Monday	Sufficient median for major street Crossing 2?	No

	Study Period	Study Duration (mins)	Crossing 1 (Stage 1)		Crossing 1 (Stage 2)		Crossing 2 (Stage 1)		Crossing 2 (Stage 2)	
			Total Adequate Gaps	Met?	Total Adequate Gaps	Met?	Total Adequate Gaps	Met?	Total Adequate Gaps	Met?
1	Morning			N/A		N/A		N/A		N/A
2	Afternoon			N/A		N/A		N/A		N/A
3				N/A		N/A		N/A		N/A
4				N/A		N/A		N/A		N/A
5				N/A		N/A		N/A		N/A
			Summary:	Not Met		Not Met		Not Met		Not Met

**Refer to Section 4.3 of PennDOT Publication 46 (Traffic Engineering Manual) for specific study requirements and additional Department documentation requirements to justify the installation of a signal under Warrant 5. Refer to ITE's Manual of Transportation Engineering Studies for specific details related to conducting a pedestrian gap acceptance engineering and traffic study. Attach all supplementary documentation and calculations.*

MUTCD WARRANT 6, COORDINATED SIGNAL SYSTEM*

On a one-way street or a street that has traffic predominantly in one direction, the adjacent traffic control signals are so far apart that they do not provide the necessary degree of vehicular platooning.	N/A
On a two-way street, adjacent traffic control signals do not provide the necessary degree of platooning and the proposed and adjacent traffic control signals will collectively provide a progressive operation.	No

**Warrant 6 should not be applied where the resultant spacing of traffic control signals would be less than 1,000 feet.*

MUTCD WARRANT 7, CRASH EXPERIENCE

Built-up Isolated Community With Less Than 10,000 Population or Above 40 MPH on Major Street?	Yes

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	2 or More Lanes
Minor Street:	1 Lane

Has adequate trial of alternatives with satisfactory observance and enforcement failed to reduce the crash frequency? N/A

Five or more reportable and/or non-reportable crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12-month period during the most recent 3 years of available crash data.* No

**If applicable, attach a summary of the crash data analysis used for this criterion.*

For each of any 8 hours of an average day, the vehicles per hour given in both the 80% columns of Condition A in Table 4C-1 exists on the major-street and the higher-volume minor-street approach, respectively, to the intersection. **No**

For each of any 8 hours of an average day, the vehicles per hour given in both the 80% columns of Condition B in Table 4C-1 exists on the major-street and the higher-volume minor-street approach, respectively, to the intersection. **No**

The volume of pedestrian traffic is not less than 80% of the requirements specified in Warrant 4, the Pedestrian Volume warrant.* N/A

**If applicable, attach all supporting calculations and documentation.*

MUTCD WARRANT 8, ROADWAY NETWORK*

Is the major street classified as an Urban Extension, Principal Arterial, or Minor Arterial that is a reasonable connection between two Principal Arterials and/or Urban Extensions as shown on the official Functional Classification Map? Yes

Does the intersection have a total existing, or immediately projected, entering volume of at least 1,000 vehicles per hour during the peak hour of a typical weekday and has 5-year projected traffic volumes, based on an engineering study, that meet one or more of Warrants 1,2, and 3 during an average weekday? Yes

Does the intersection have a total existing or immediately projected entering volume of at least 1,000 vehicles per hour for each of any 5 hours of a non-normal business day (Saturday or Sunday)? No

Is the major street part of the street or highway system that serves as the principal roadway network for through traffic flow? Yes

Does the major street include rural or suburban highways outside, entering, or traversing a city? No

Does the major street appear as a major route on an official plan, such as a major street plan in an urban area traffic and transportation study? No

**Refer to Section 4.3 of PennDOT Publication 46 (Traffic Engineering Manual) for additional Department documentation requirements to justify the installation of a signal under Warrant 8. Attach all supplementary documentation and calculations, especially those relating to traffic volume projections and subsequent Warrant analyses.*

APPENDIX J

Turn Lane Warrant and Length Analysis Workbook

STUDY LOCATION AND ANALYSIS INFORMATION

Municipality:	Adams Township	**Analysis Date:**	4/24/2017
County:	Butler County	**Conducted By:**	CAM
PennDOT Engineering District:	10	**Checked By:**	
		Agency/Company Name:	Erdman Anthony

Intersection & Approach Description: SR 0228 and Relocated Brickyard Rd-Eastbound

Analysis Period:	2040 Build	**Number of Approach Lanes:**	2
Design Hour:	AM Peak Hour	**Undivided or Divided Highway:**	Undivided
Intersection Control:	Signalized		
Posted Speed Limit (MPH):	45	**Type of Analysis**	
Type of Terrain:	Rolling	**Left or Right-Turn Lane Analysis?:**	Left Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	49	24.5%	68
	Through	-	791	1.5%	809
	Right	No	1	0.0%	N/A
Opposing	Left	No	1	0.0%	N/A
	Through	-	913	9.1%	1038
	Right	Yes	113	1.8%	117

Advancing Volume:	877
Opposing Volume:	1155
Left Turn Volume:	68
% Left Turns in Advancing Volume:	7.75%

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left				N/A
	Through	-			N/A
	Right	-			N/A

Advancing Volume:	N/A
Right Turn Volume:	N/A

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: Figure 7

Warrant Met?: Yes

Right Turn Lane Warrant Findings

Applicable Warrant Figure: N/A

Warrant Met?: N/A

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Signalized
Design Hour Volume of Turning Lane:	68
Cycles Per Hour (Assumed):	40
Cycles Per Hour (If Known):	40

Average # of Vehicles/Cycle: 2.0

PennDOT Publication 46, Exhibit 11-6

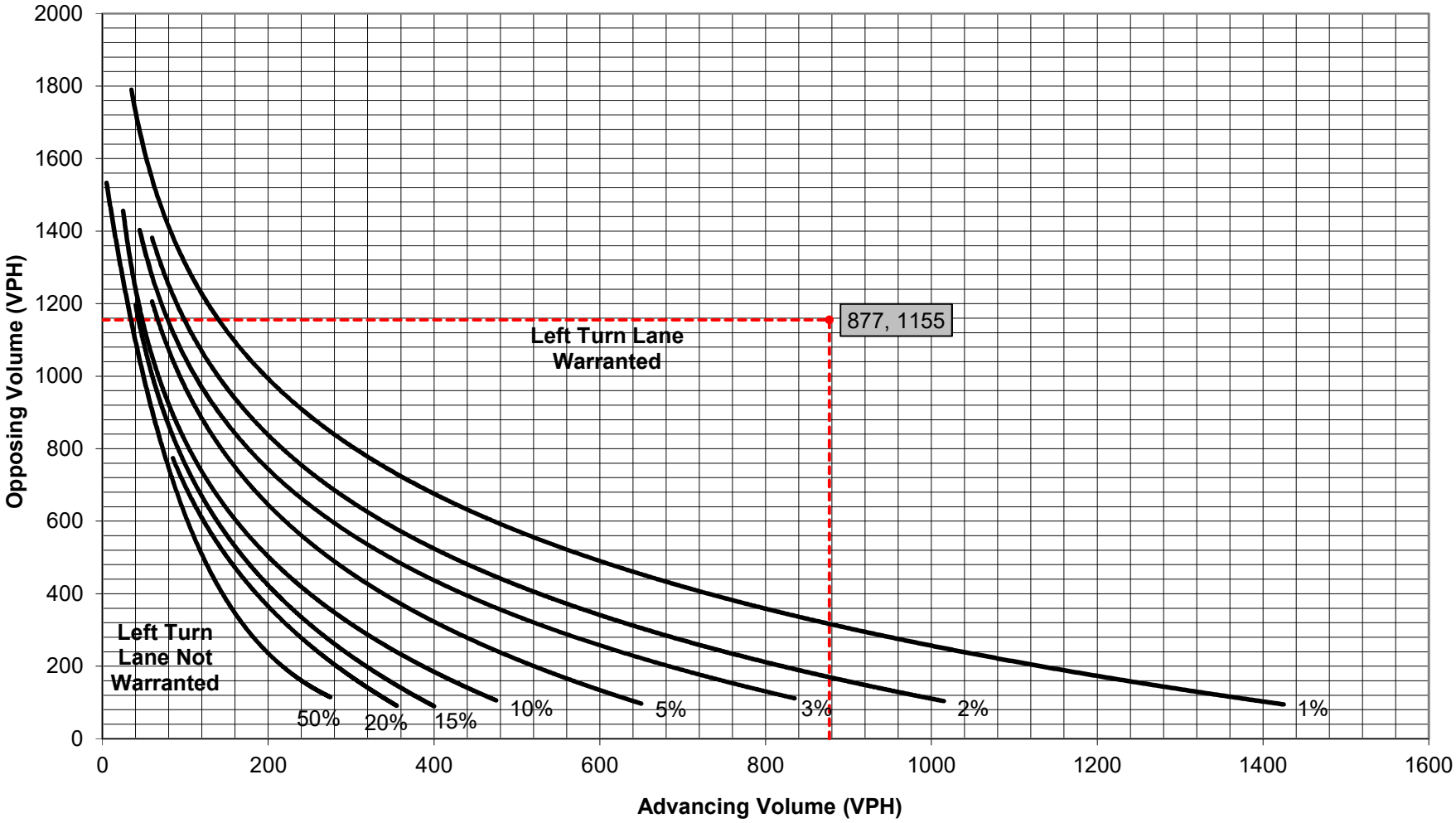
Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

Left Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	125	Feet
Condition C:	175	Feet
Required Left Turn Lane Storage Length:	175	Feet

Additional Findings: N/A

Additional Comments / Justifications:

Figure 7. Warrant for left turn lanes on four-lane, undivided highways (unsignalized and signalized intersections)
(L = % Left Turns in Advancing Volume)



Turn Lane Warrant and Length Analysis Workbook

STUDY LOCATION AND ANALYSIS INFORMATION

Municipality:	Adams Township	**Analysis Date:**	4/24/2017
County:	Butler County	**Conducted By:**	CAM
PennDOT Engineering District:	10	**Checked By:**	
		Agency/Company Name:	Erdman Anthony

Intersection & Approach Description: SR 0228 and Relocated Brickyard Rd-Eastbound

Analysis Period:	2040 Build	**Number of Approach Lanes:**	2
Design Hour:	PM Peak Hour	**Undivided or Divided Highway:**	Undivided
Intersection Control:	Signalized		
Posted Speed Limit (MPH):	45	**Type of Analysis**	
Type of Terrain:	Rolling	**Left or Right-Turn Lane Analysis?:**	Left Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	51	19.6%	66
	Through	-	1072	3.9%	1135
	Right	No	5	0.0%	N/A
Opposing	Left	No	3	0.0%	N/A
	Through	-	883	7.1%	978
	Right	Yes	151	2.6%	157

Advancing Volume:	1201
Opposing Volume:	1135
Left Turn Volume:	66
% Left Turns in Advancing Volume:	5.50%

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left				N/A
	Through	-			N/A
	Right	-			N/A

Advancing Volume:	N/A
Right Turn Volume:	N/A

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: Figure 7

Warrant Met?: Yes

Right Turn Lane Warrant Findings

Applicable Warrant Figure: N/A

Warrant Met?: N/A

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Signalized
Design Hour Volume of Turning Lane:	66
Cycles Per Hour (Assumed):	40
Cycles Per Hour (If Known):	40

Average # of Vehicles/Cycle: 2.0

PennDOT Publication 46, Exhibit 11-6

Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

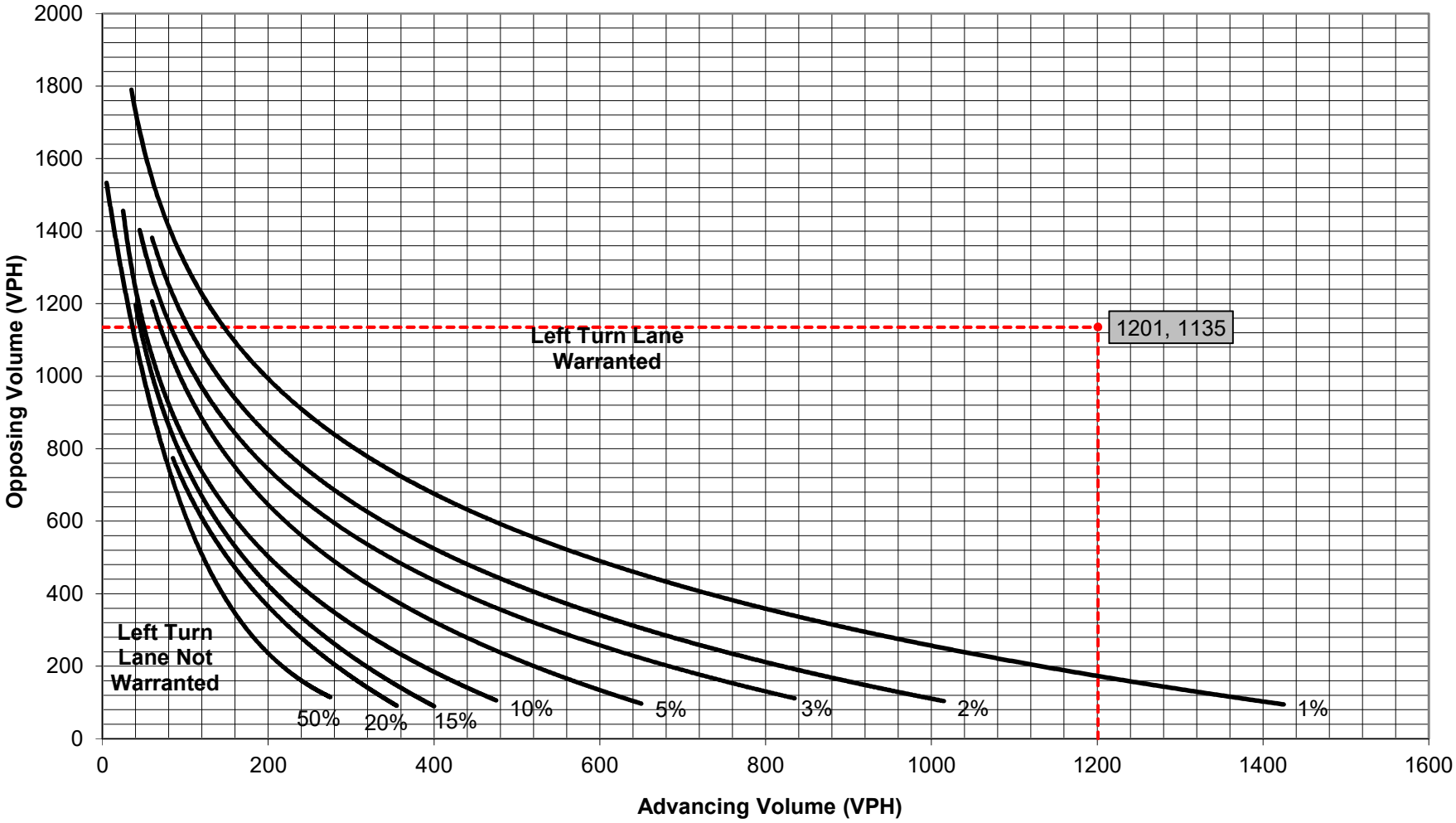
Left Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	125	Feet
Condition C:	175	Feet
Required Left Turn Lane Storage Length:	175	Feet

Additional Findings:

N/A

Additional Comments / Justifications:

Figure 7. Warrant for left turn lanes on four-lane, undivided highways (unsignalized and signalized intersections)
(L = % Left Turns in Advancing Volume)



Turn Lane Warrant and Length Analysis Workbook

STUDY LOCATION AND ANALYSIS INFORMATION

Municipality:	Adams Township	Analysis Date:	4/24/2017
County:	Butler County	Conducted By:	CAM
PennDOT Engineering District:	10	Checked By:	
		Agency/Company Name:	Erdman Anthony

Intersection & Approach Description: SR 0228 and Relocated Brickyard Rd- Westbound

Analysis Period:	2040 Build	Number of Approach Lanes:	2
Design Hour:	AM Peak Hour	Undivided or Divided Highway:	Undivided
Intersection Control:	Signalized		
Posted Speed Limit (MPH):	45	**Type of Analysis**	
Type of Terrain:	Rolling	Left or Right-Turn Lane Analysis?:	Right Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left				N/A
	Through	-			N/A
	Right				N/A
Opposing	Left				N/A
	Through	-			N/A
	Right				N/A

Advancing Volume:	N/A
Opposing Volume:	N/A
Left Turn Volume:	N/A
% Left Turns in Advancing Volume:	N/A

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	No	1	0.0%	N/A
	Through	-	913	9.1%	1038
	Right	-	113	1.8%	117

Advancing Volume:	1155
Right Turn Volume:	117

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: N/A

Warrant Met?: N/A

Right Turn Lane Warrant Findings

Applicable Warrant Figure: Figure 12

Warrant Met?: Yes

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Signalized
Design Hour Volume of Turning Lane:	117
Cycles Per Hour (Assumed):	40
Cycles Per Hour (If Known):	40

Average # of Vehicles/Cycle: 3.0

PennDOT Publication 46, Exhibit 11-6

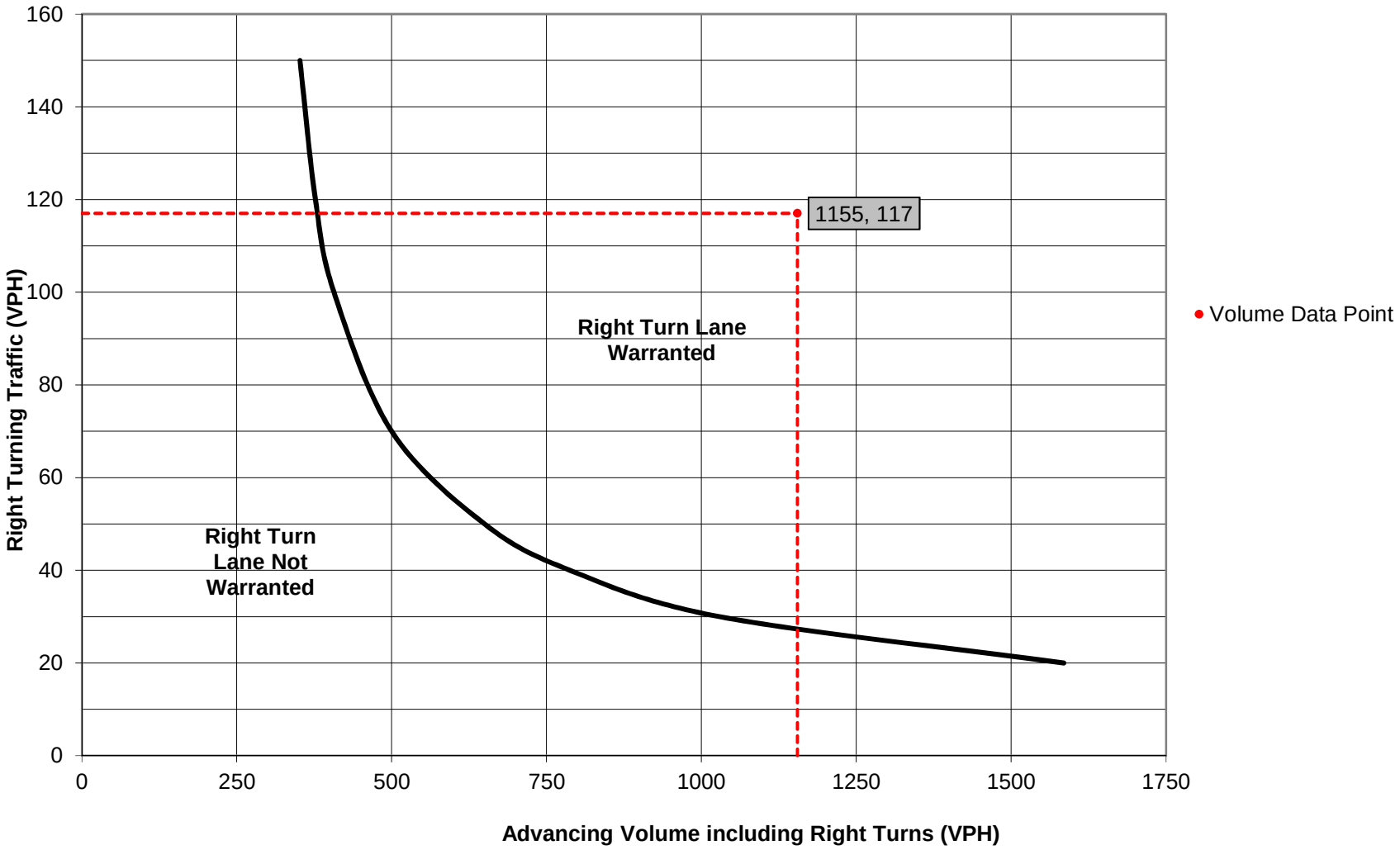
Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

Right Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	125	Feet
Condition C:	225	Feet
Required Right Turn Lane Storage Length:	225	Feet

Additional Findings: N/A

Additional Comments / Justifications:

Figure 12. Warrant for right turn lanes on four-lane roadways
(45 mph or greater speeds, unsignalized and signalized intersections)



Turn Lane Warrant and Length Analysis Workbook

STUDY LOCATION AND ANALYSIS INFORMATION

Municipality:	Adams Township	Analysis Date:	4/24/2017
County:	Butler County	Conducted By:	CAM
PennDOT Engineering District:	10	Checked By:	
		Agency/Company Name:	Erdman Anthony

Intersection & Approach Description: SR 0228 and Relocated Brickyard Rd- Westbound

Analysis Period:	2040 Build	Number of Approach Lanes:	2
Design Hour:	PM Peak Hour	Undivided or Divided Highway:	Undivided
Intersection Control:	Signalized		
Posted Speed Limit (MPH):	45	**Type of Analysis**	
Type of Terrain:	Rolling	Left or Right-Turn Lane Analysis?:	Right Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left				N/A
	Through	-			N/A
	Right				N/A
Opposing	Left				N/A
	Through	-			N/A
	Right				N/A

Advancing Volume:	N/A
Opposing Volume:	N/A
Left Turn Volume:	N/A
% Left Turns in Advancing Volume:	N/A

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	No	3	0.0%	N/A
	Through	-	883	7.1%	978
	Right	-	151	2.6%	157

Advancing Volume:	1135
Right Turn Volume:	157

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: N/A

Warrant Met?: N/A

Right Turn Lane Warrant Findings

Applicable Warrant Figure: Figure 12

Warrant Met?: Yes

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Signalized
Design Hour Volume of Turning Lane:	157
Cycles Per Hour (Assumed):	40
Cycles Per Hour (If Known):	40

Average # of Vehicles/Cycle: 4.0

PennDOT Publication 46, Exhibit 11-6

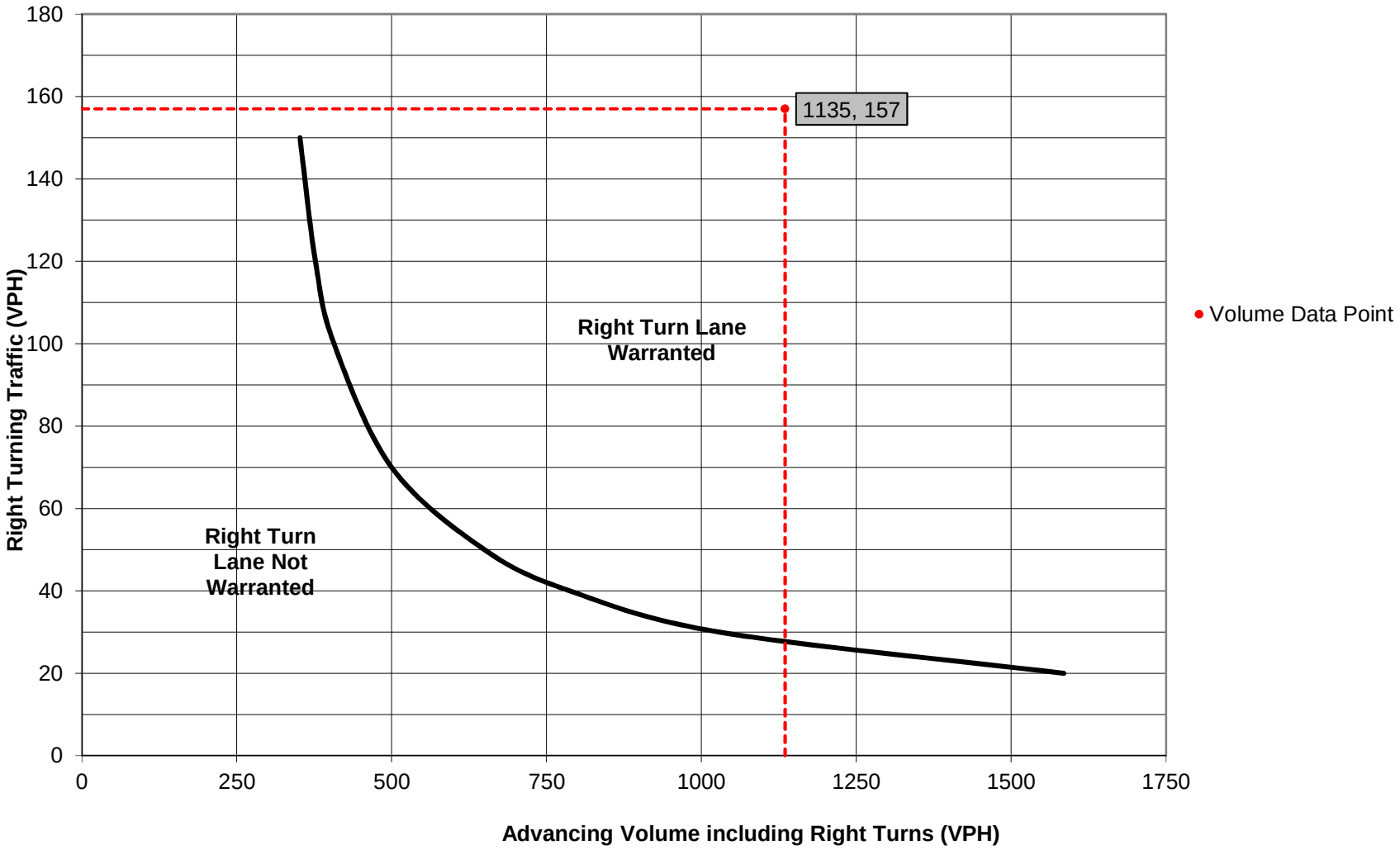
Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

Right Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	125	Feet
Condition C:	250	Feet
Required Right Turn Lane Storage Length:	250	Feet

Additional Findings: N/A

Additional Comments / Justifications:

Figure 12. Warrant for right turn lanes on four-lane roadways
(45 mph or greater speeds, unsignalized and signalized intersections)



Turn Lane Warrant and Length Analysis Workbook

STUDY LOCATION AND ANALYSIS INFORMATION

Municipality:	Adams Township	Analysis Date:	4/24/2017
County:	Butler County	Conducted By:	CAM
PennDOT Engineering District:	10	Checked By:	
		Agency/Company Name:	Erdman Anthony

Intersection & Approach Description: SR 0228 and Relocated Brickyard Rd-Southbound

Analysis Period:	2040 Build	Number of Approach Lanes:	1
Design Hour:	AM Peak Hour	Undivided or Divided Highway:	Undivided
Intersection Control:	Signalized		
Posted Speed Limit (MPH):	25	**Type of Analysis**	
Type of Terrain:	Rolling	Left or Right-Turn Lane Analysis?:	Left Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	69	7.2%	77
	Through	-	0	0.0%	0
	Right	Yes	72	30.6%	106
Opposing	Left	Yes	4	0.0%	4
	Through	-	0	0.0%	0
	Right	Yes	3	0.0%	3

Advancing Volume:	183
Opposing Volume:	7
Left Turn Volume:	77
% Left Turns in Advancing Volume:	42.08%

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left				N/A
	Through	-			N/A
	Right	-			N/A

Advancing Volume:	N/A
Right Turn Volume:	N/A

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: Figure 1

Warrant Met?: No

Right Turn Lane Warrant Findings

Applicable Warrant Figure: N/A

Warrant Met?: N/A

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Signalized
Design Hour Volume of Turning Lane:	77
Cycles Per Hour (Assumed):	40
Cycles Per Hour (If Known):	40

Average # of Vehicles/Cycle: N/A

PennDOT Publication 46, Exhibit 11-6

Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

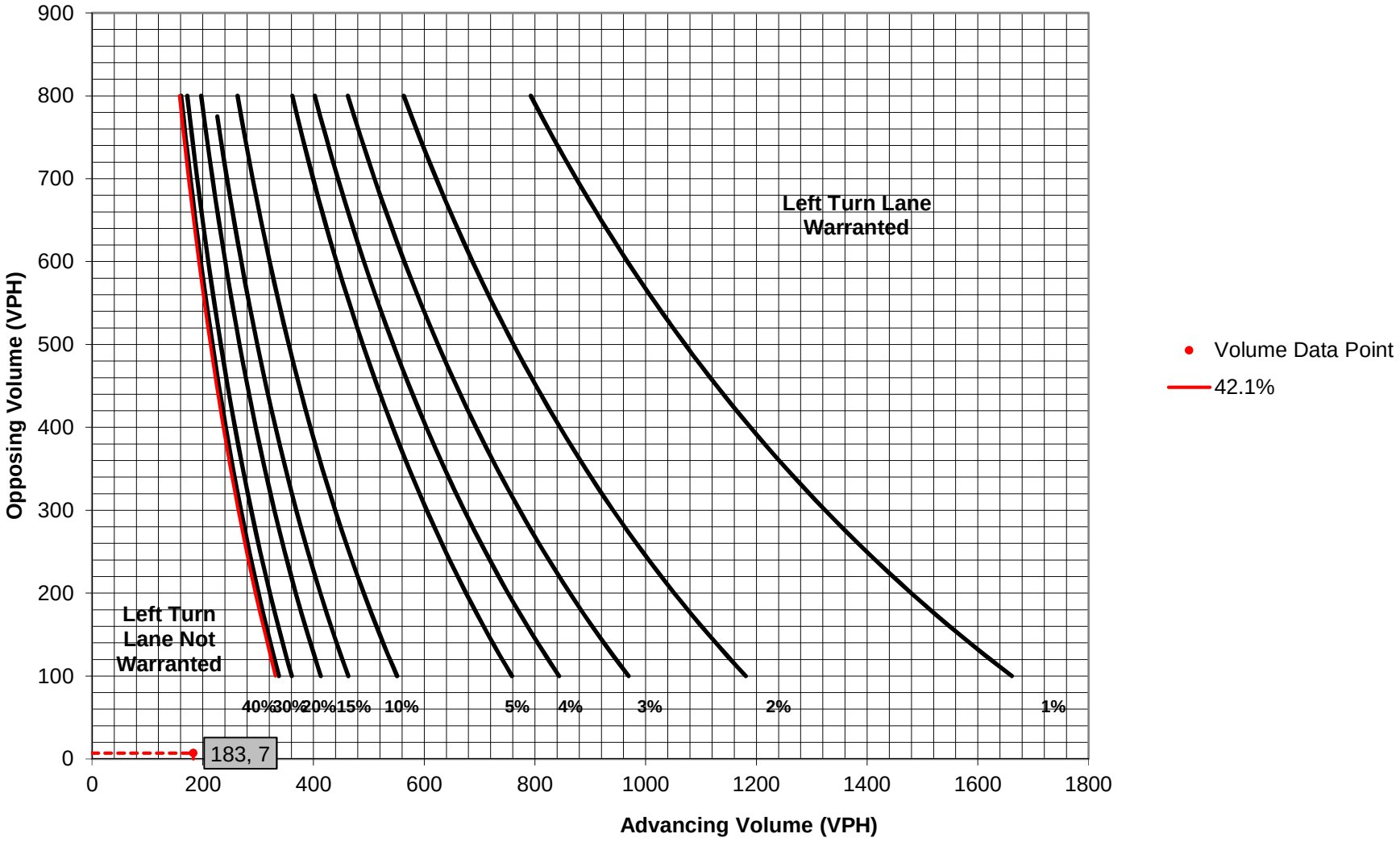
Left Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	N/A	Feet
Condition C:	N/A	Feet
Required Left Turn Lane Storage Length:	N/A	Feet

Additional Findings:

N/A

Additional Comments / Justifications:

Figure 1. Warrant for left turn lanes on two-lane roadways
(speeds to 35 mph, unsignalized and signalized intersections)
(L = % Left Turns in Advancing Volume)



Turn Lane Warrant and Length Analysis Workbook

STUDY LOCATION AND ANALYSIS INFORMATION

Municipality:	Adams Township	Analysis Date:	4/24/2017
County:	Butler County	Conducted By:	CAM
PennDOT Engineering District:	10	Checked By:	
		Agency/Company Name:	Erdman Anthony

Intersection & Approach Description: SR 0228 and Relocated Brickyard Rd-Southbound

Analysis Period:	2040 Build	Number of Approach Lanes:	1
Design Hour:	PM Peak Hour	Undivided or Divided Highway:	Undivided
Intersection Control:	Signalized		
Posted Speed Limit (MPH):	25		**Type of Analysis**
Type of Terrain:	Rolling	Left or Right-Turn Lane Analysis?:	Left Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	124	4.8%	133
	Through	-	0	0.0%	0
	Right	Yes	82	17.1%	104
Opposing	Left	Yes	2	0.0%	2
	Through	-	0	0.0%	0
	Right	Yes	2	0.0%	2

Advancing Volume:	237
Opposing Volume:	4
Left Turn Volume:	133
% Left Turns in Advancing Volume:	56.12%

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left				N/A
	Through	-			N/A
	Right	-			N/A

Advancing Volume:	N/A
Right Turn Volume:	N/A

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: Figure 1

Warrant Met?: No

Right Turn Lane Warrant Findings

Applicable Warrant Figure: N/A

Warrant Met?: N/A

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Signalized
Design Hour Volume of Turning Lane:	133
Cycles Per Hour (Assumed):	40
Cycles Per Hour (If Known):	40

Average # of Vehicles/Cycle: N/A

PennDOT Publication 46, Exhibit 11-6

Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

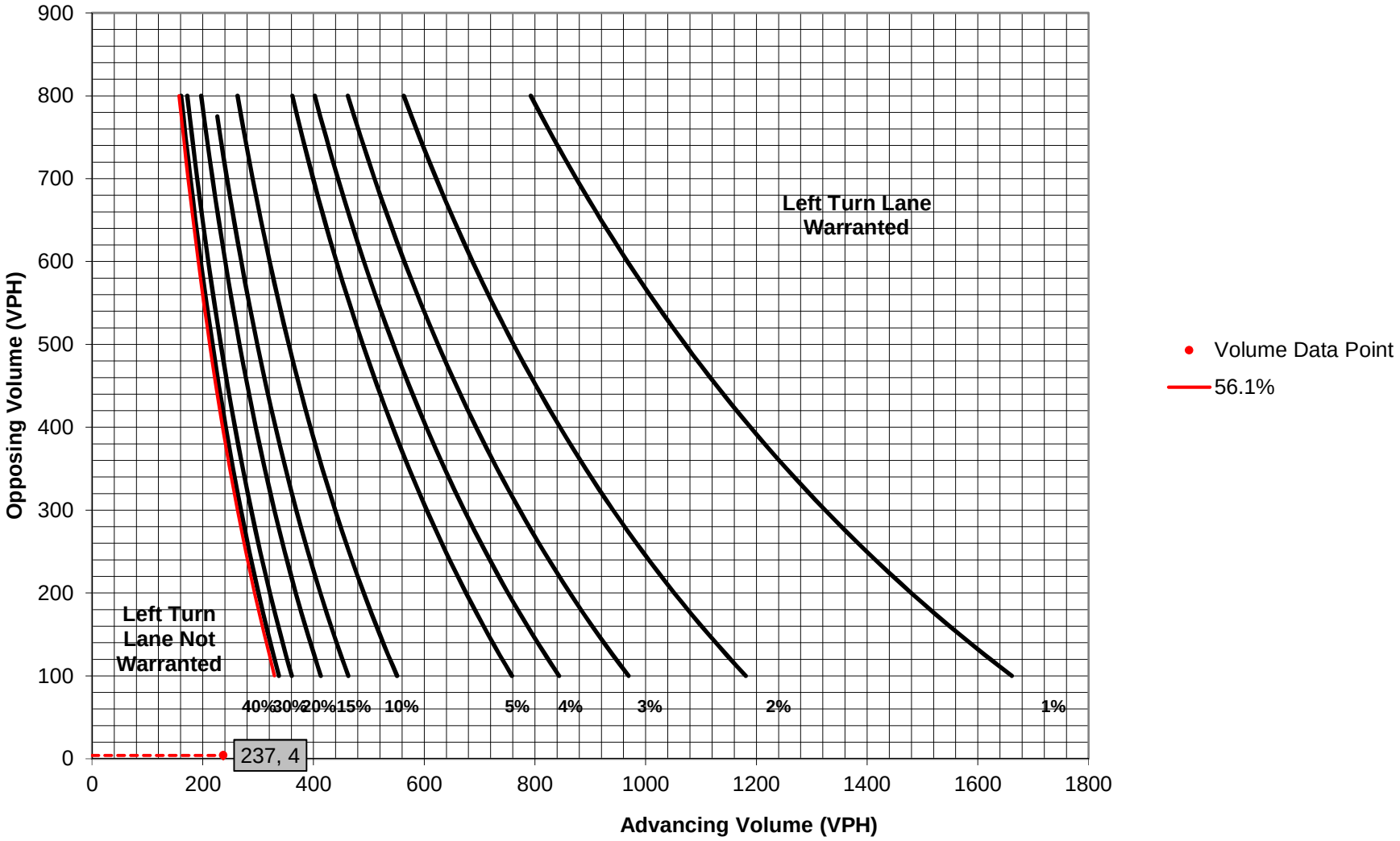
Left Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	N/A	Feet
Condition C:	N/A	Feet
Required Left Turn Lane Storage Length:	N/A	Feet

Additional Findings:

N/A

Additional Comments / Justifications:

Figure 1. Warrant for left turn lanes on two-lane roadways
(speeds to 35 mph, unsignalized and signalized intersections)
(L = % Left Turns in Advancing Volume)



Turn Lane Warrant and Length Analysis Workbook

STUDY LOCATION AND ANALYSIS INFORMATION

Municipality:	Adams Township	Analysis Date:	4/24/2017
County:	Butler County	Conducted By:	CAM
PennDOT Engineering District:	10	Checked By:	
		Agency/Company Name:	Erdman Anthony

Intersection & Approach Description: SR 0228 and Relocated Brickyard Rd- Southbound

Analysis Period:	2040 Build	Number of Approach Lanes:	1
Design Hour:	AM Peak Hour	Undivided or Divided Highway:	Undivided
Intersection Control:	Signalized		
Posted Speed Limit (MPH):	25	**Type of Analysis**	
Type of Terrain:	Rolling	Left or Right-Turn Lane Analysis?:	Right Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left				N/A
	Through	-			N/A
	Right				N/A
Opposing	Left				N/A
	Through	-			N/A
	Right				N/A

Advancing Volume:	N/A
Opposing Volume:	N/A
Left Turn Volume:	N/A
% Left Turns in Advancing Volume:	N/A

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	69	7.2%	77
	Through	-	0	0.0%	0
	Right	-	72	30.6%	106

Advancing Volume:	183
Right Turn Volume:	106

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: N/A

Warrant Met?: N/A

Right Turn Lane Warrant Findings

Applicable Warrant Figure: Figure 9

Warrant Met?: No

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Signalized
Design Hour Volume of Turning Lane:	106
Cycles Per Hour (Assumed):	40
Cycles Per Hour (If Known):	40

Average # of Vehicles/Cycle: N/A

PennDOT Publication 46, Exhibit 11-6

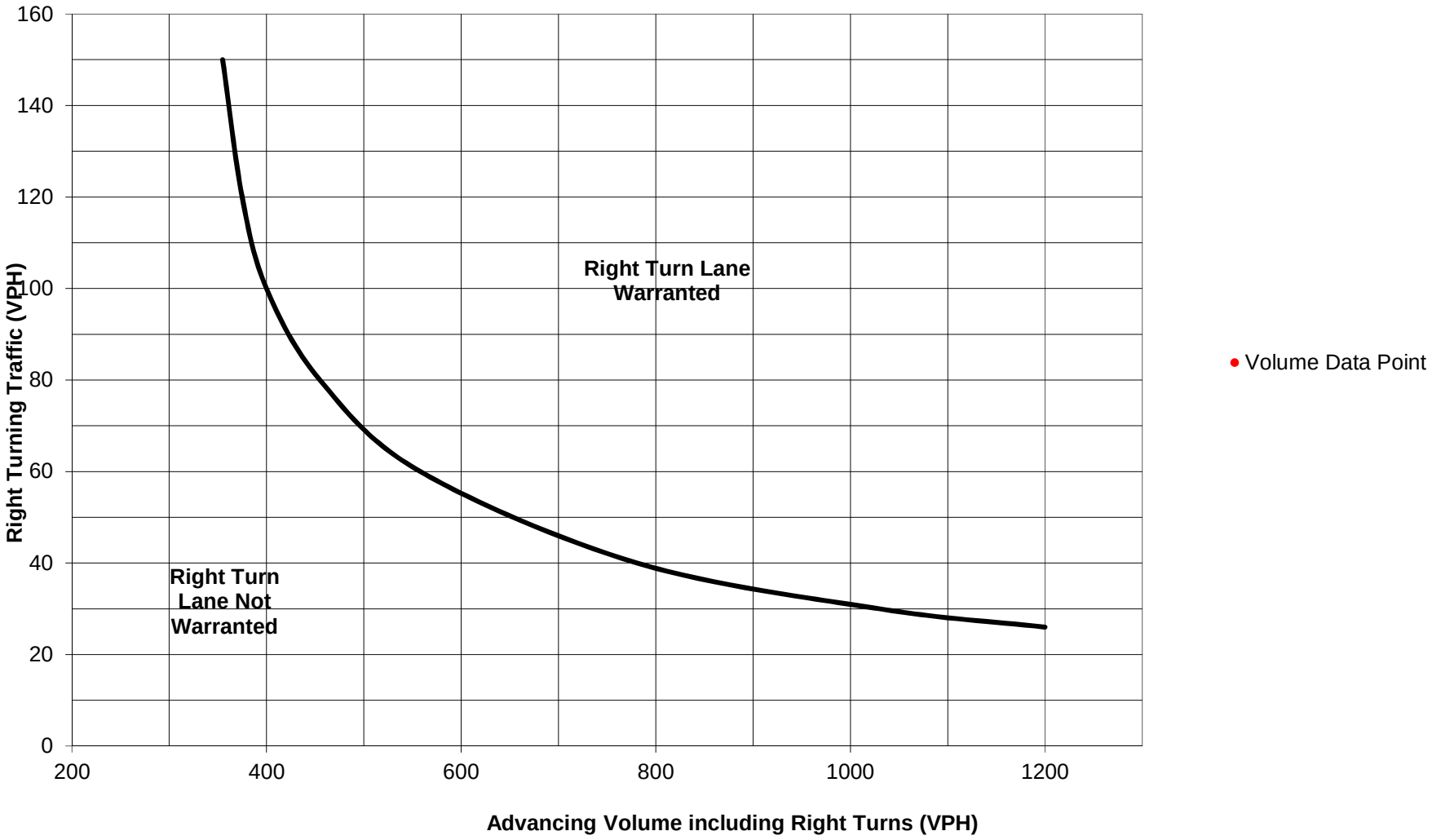
Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

Right Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	N/A	Feet
Condition C:	N/A	Feet
Required Right Turn Lane Storage Length:	N/A	Feet

Additional Findings: N/A

Additional Comments / Justifications:

Figure 9. Warrant for right turn lanes on two-lane roadways
(40 mph or lower speeds, unsignalized and signalized intersections)



Turn Lane Warrant and Length Analysis Workbook

STUDY LOCATION AND ANALYSIS INFORMATION

Municipality:	Adams Township	Analysis Date:	4/24/2017
County:	Butler County	Conducted By:	CAM
PennDOT Engineering District:	10	Checked By:	
		Agency/Company Name:	Erdman Anthony

Intersection & Approach Description: SR 0228 and Relocated Brickyard Rd- Southbound

Analysis Period:	2040 Build	Number of Approach Lanes:	1
Design Hour:	PM Peak Hour	Undivided or Divided Highway:	Undivided
Intersection Control:	Signalized		
Posted Speed Limit (MPH):	25	**Type of Analysis**	
Type of Terrain:	Rolling	Left or Right-Turn Lane Analysis?:	Right Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left				N/A
	Through	-			N/A
	Right				N/A
Opposing	Left				N/A
	Through	-			N/A
	Right				N/A

Advancing Volume:	N/A
Opposing Volume:	N/A
Left Turn Volume:	N/A
% Left Turns in Advancing Volume:	N/A

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	124	4.8%	133
	Through	-	0	0.0%	0
	Right	-	82	17.1%	104

Advancing Volume:	237
Right Turn Volume:	104

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: N/A

Warrant Met?: N/A

Right Turn Lane Warrant Findings

Applicable Warrant Figure: Figure 9

Warrant Met?: No

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Signalized
Design Hour Volume of Turning Lane:	104
Cycles Per Hour (Assumed):	40
Cycles Per Hour (If Known):	40

Average # of Vehicles/Cycle: N/A

PennDOT Publication 46, Exhibit 11-6

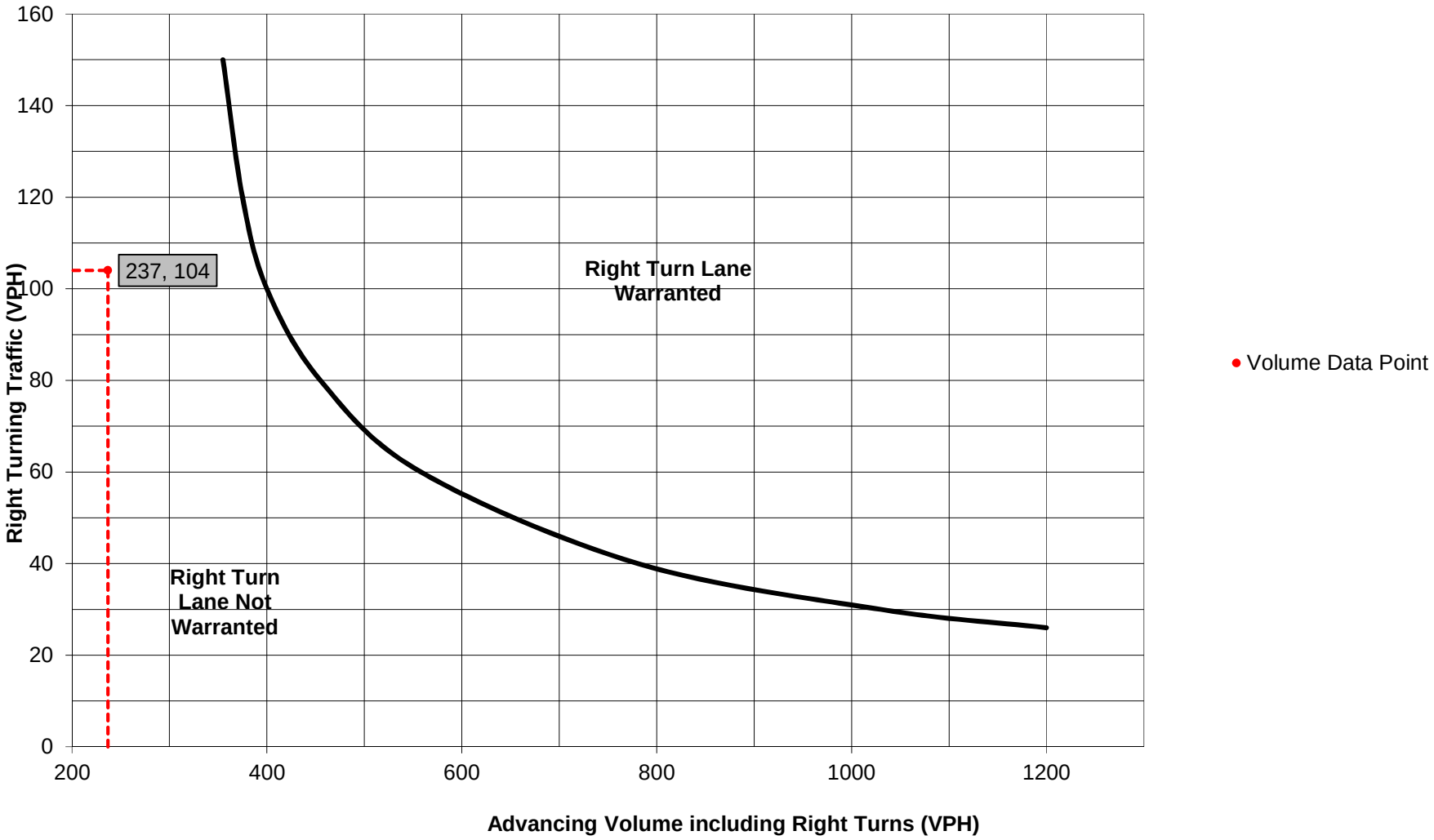
Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

Right Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	N/A	Feet
Condition C:	N/A	Feet
Required Right Turn Lane Storage Length:	N/A	Feet

Additional Findings: N/A

Additional Comments / Justifications:

Figure 9. Warrant for right turn lanes on two-lane roadways
(40 mph or lower speeds, unsignalized and signalized intersections)



APPENDIX K

Turn Lane Warrant and Length Analysis Workbook

STUDY LOCATION AND ANALYSIS INFORMATION

Municipality:	Adams Township	Analysis Date:	4/24/2017
County:	Butler County	Conducted By:	CAM
PennDOT Engineering District:	10	Checked By:	
		Agency/Company Name:	Erdman Anthony

Intersection & Approach Description: Relocated Brickyard Rd and Gables Court-Northbound

Analysis Period:	2040 Build	Number of Approach Lanes:	1
Design Hour:	AM Peak Hour	Undivided or Divided Highway:	Undivided
Intersection Control:	Unsignalized		
Posted Speed Limit (MPH):	25		**Type of Analysis**
Type of Terrain:	Rolling	Left or Right-Turn Lane Analysis?:	Left Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	77	2.6%	81
	Through	-	14	0.0%	14
	Right	Yes	71	16.9%	89
Opposing	Left	Yes	0	0.0%	0
	Through	-	42	0.0%	42
	Right	Yes	0	0.0%	0

Advancing Volume:	184
Opposing Volume:	42
Left Turn Volume:	81
% Left Turns in Advancing Volume:	44.02%

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left				N/A
	Through	-			N/A
	Right	-			N/A

Advancing Volume:	N/A
Right Turn Volume:	N/A

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: Figure 1

Warrant Met?: No

Right Turn Lane Warrant Findings

Applicable Warrant Figure: N/A

Warrant Met?: N/A

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Unsignalized
Design Hour Volume of Turning Lane:	81
Cycles Per Hour (Assumed):	40
Cycles Per Hour (If Known):	40

Average # of Vehicles/Cycle: N/A

PennDOT Publication 46, Exhibit 11-6

Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

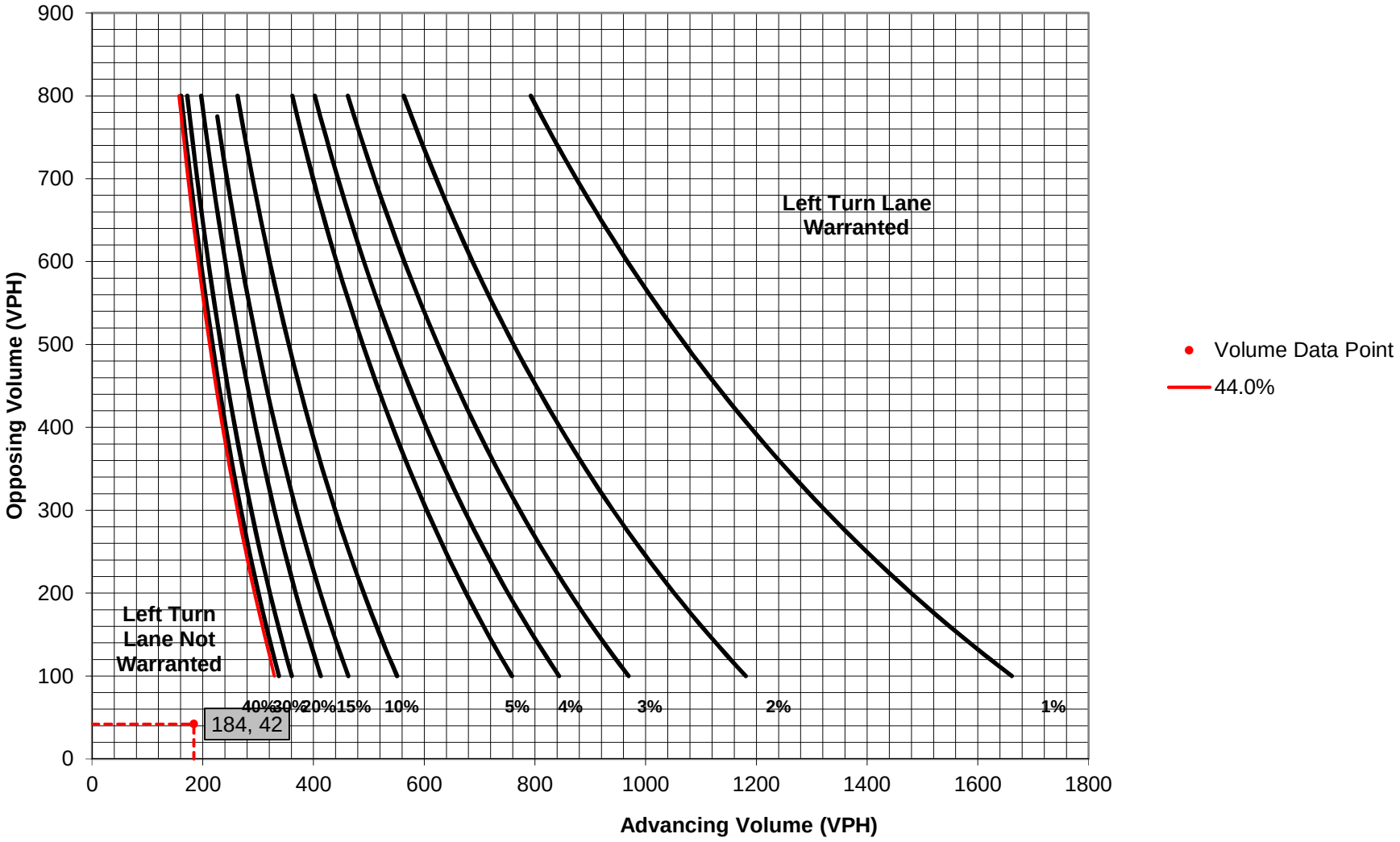
Left Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	N/A	Feet
Condition C:	N/A	Feet
Required Left Turn Lane Storage Length:	N/A	Feet

Additional Findings:

N/A

Additional Comments / Justifications:

Figure 1. Warrant for left turn lanes on two-lane roadways
(speeds to 35 mph, unsignalized and signalized intersections)
(L = % Left Turns in Advancing Volume)



Turn Lane Warrant and Length Analysis Workbook

STUDY LOCATION AND ANALYSIS INFORMATION

Municipality:	Adams Township	Analysis Date:	4/24/2017
County:	Butler County	Conducted By:	CAM
PennDOT Engineering District:	10	Checked By:	
		Agency/Company Name:	Erdman Anthony

Intersection & Approach Description: Relocated Brickyard Rd and Gables Court-Northbound

Analysis Period:	2040 Build	Number of Approach Lanes:	1
Design Hour:	PM Peak Hour	Undivided or Divided Highway:	Undivided
Intersection Control:	Unsignalized		
Posted Speed Limit (MPH):	25		**Type of Analysis**
Type of Terrain:	Rolling	Left or Right-Turn Lane Analysis?:	Left Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	119	0.8%	121
	Through	-	48	0.0%	48
	Right	Yes	35	37.1%	55
Opposing	Left	Yes	0	0.0%	0
	Through	-	28	0.0%	28
	Right	Yes	0	0.0%	0

Advancing Volume:	224
Opposing Volume:	28
Left Turn Volume:	121
% Left Turns in Advancing Volume:	54.02%

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left				N/A
	Through	-			N/A
	Right	-			N/A

Advancing Volume:	N/A
Right Turn Volume:	N/A

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: Figure 1

Warrant Met?: No

Right Turn Lane Warrant Findings

Applicable Warrant Figure: N/A

Warrant Met?: N/A

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Unsignalized
Design Hour Volume of Turning Lane:	121
Cycles Per Hour (Assumed):	40
Cycles Per Hour (If Known):	40

Average # of Vehicles/Cycle: N/A

PennDOT Publication 46, Exhibit 11-6

Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

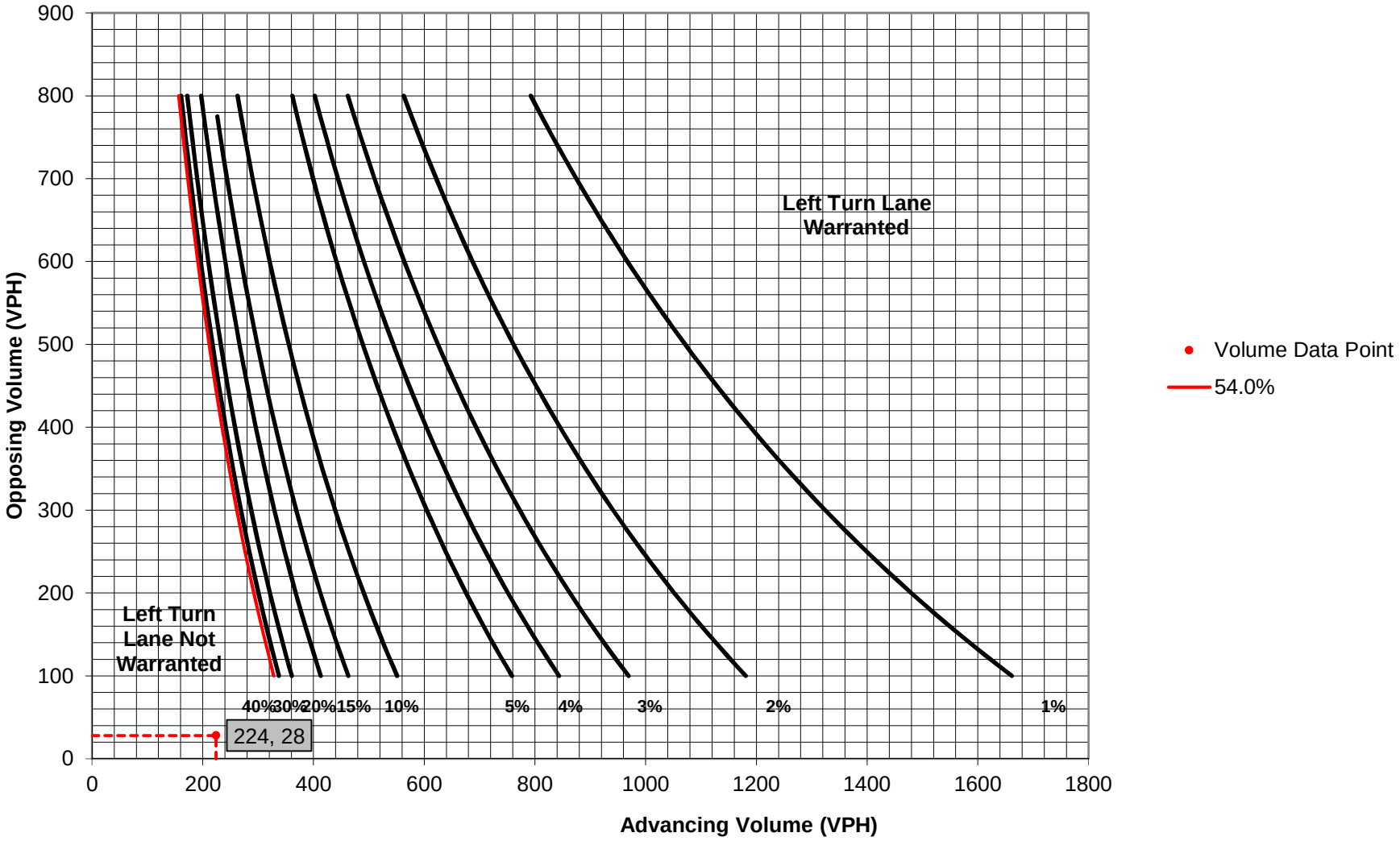
Left Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	N/A	Feet
Condition C:	N/A	Feet
Required Left Turn Lane Storage Length:	N/A	Feet

Additional Findings:

N/A

Additional Comments / Justifications:

Figure 1. Warrant for left turn lanes on two-lane roadways
(speeds to 35 mph, unsignalized and signalized intersections)
(L = % Left Turns in Advancing Volume)



Turn Lane Warrant and Length Analysis Workbook

STUDY LOCATION AND ANALYSIS INFORMATION

Municipality:	Adams Township	Analysis Date:	4/24/2017
County:	Butler County	Conducted By:	CAM
PennDOT Engineering District:	10	Checked By:	
		Agency/Company Name:	Erdman Anthony

Intersection & Approach Description: Relocated Brickyard Rd and Gables Court- Northbound

Analysis Period:	2040 Build	Number of Approach Lanes:	1
Design Hour:	AM Peak Hour	Undivided or Divided Highway:	Undivided
Intersection Control:	Unsignalized		
Posted Speed Limit (MPH):	25		**Type of Analysis**
Type of Terrain:	Rolling	Left or Right-Turn Lane Analysis?:	Right Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left				N/A
	Through	-			N/A
	Right				N/A
Opposing	Left				N/A
	Through	-			N/A
	Right				N/A

Advancing Volume:	N/A
Opposing Volume:	N/A
Left Turn Volume:	N/A
% Left Turns in Advancing Volume:	N/A

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	77	2.6%	81
	Through	-	14	0.0%	14
	Right	-	71	16.9%	89

Advancing Volume:	184
Right Turn Volume:	89

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: N/A

Warrant Met?: N/A

Right Turn Lane Warrant Findings

Applicable Warrant Figure: Figure 9

Warrant Met?: No

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Unsignalized
Design Hour Volume of Turning Lane:	89
Cycles Per Hour (Assumed):	40
Cycles Per Hour (If Known):	40

Average # of Vehicles/Cycle: N/A

PennDOT Publication 46, Exhibit 11-6

Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

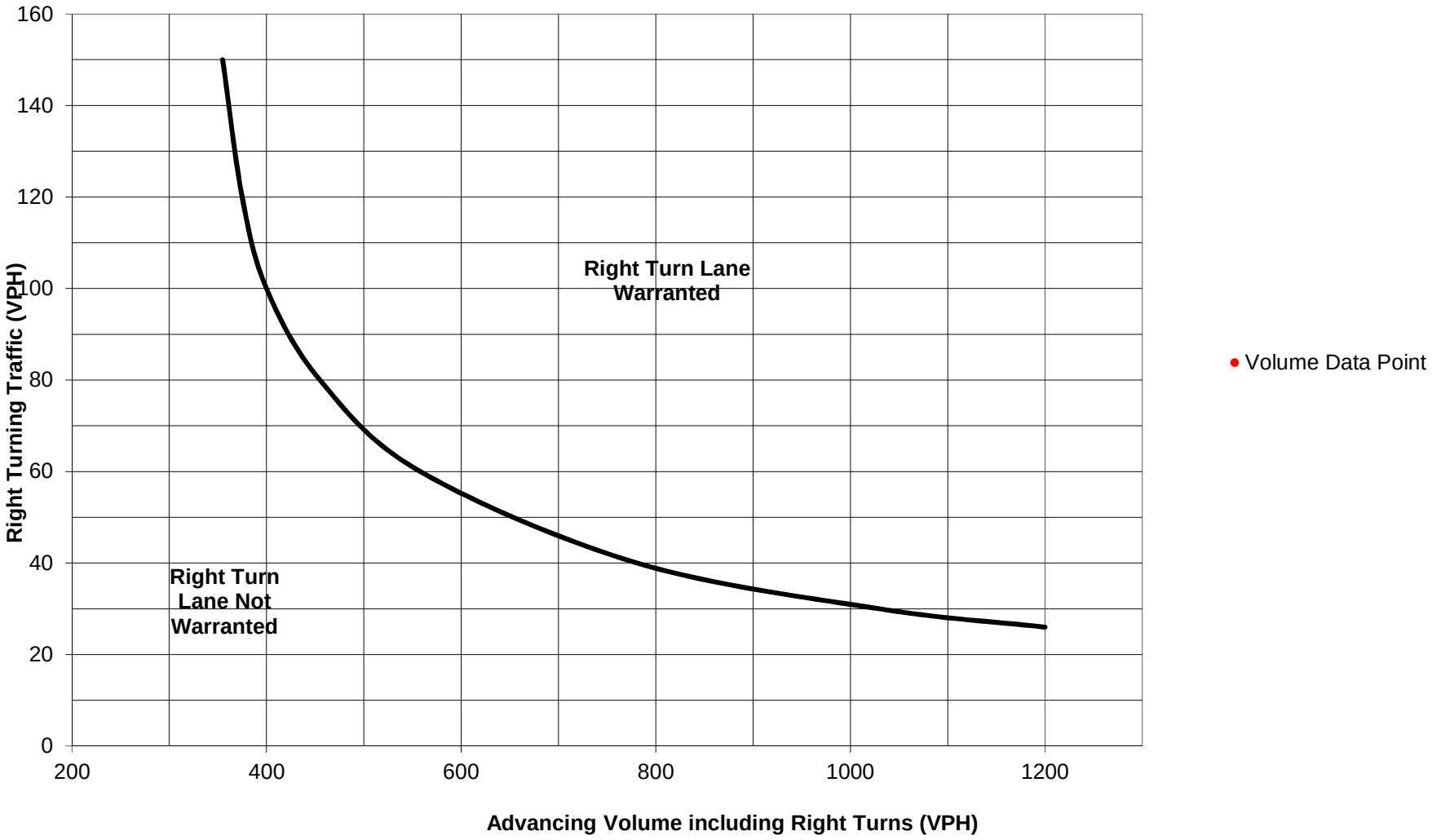
Right Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	N/A	Feet
Condition C:	N/A	Feet
Required Right Turn Lane Storage Length:	N/A	Feet

Additional Findings:

N/A

Additional Comments / Justifications:

Figure 9. Warrant for right turn lanes on two-lane roadways
(40 mph or lower speeds, unsignalized and signalized intersections)



Turn Lane Warrant and Length Analysis Workbook

STUDY LOCATION AND ANALYSIS INFORMATION

Municipality:	Adams Township	**Analysis Date:**	4/24/2017
County:	Butler County	**Conducted By:**	CAM
PennDOT Engineering District:	10	**Checked By:**	
		Agency/Company Name:	Erdman Anthony

Intersection & Approach Description: Relocated Brickyard Rd and Gables Court- Northbound

Analysis Period:	2040 Build	**Number of Approach Lanes:**	1
Design Hour:	PM Peak Hour	**Undivided or Divided Highway:**	Undivided
Intersection Control:	Unsignalized		
Posted Speed Limit (MPH):	25		**Type of Analysis**
Type of Terrain:	Rolling	**Left or Right-Turn Lane Analysis?:**	Right Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left				N/A
	Through	-			N/A
	Right				N/A
Opposing	Left				N/A
	Through	-			N/A
	Right				N/A

Advancing Volume:	N/A
Opposing Volume:	N/A
Left Turn Volume:	N/A
% Left Turns in Advancing Volume:	N/A

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	119	0.8%	121
	Through	-	48	0.0%	48
	Right	-	35	37.1%	55

Advancing Volume:	224
Right Turn Volume:	55

TURN LANE WARRANT FINDINGS

Left Turn Lane Warrant Findings

Applicable Warrant Figure: N/A

Warrant Met?: N/A

Right Turn Lane Warrant Findings

Applicable Warrant Figure: Figure 9

Warrant Met?: No

TURN LANE LENGTH CALCULATIONS

Intersection Control:	Unsignalized
Design Hour Volume of Turning Lane:	55
Cycles Per Hour (Assumed):	40
Cycles Per Hour (If Known):	40

Average # of Vehicles/Cycle: N/A

PennDOT Publication 46, Exhibit 11-6

Type of Traffic Control	Speed (MPH)					
	25-35		40-45		50-60	
	Turn Demand Volume					
	High	Low	High	Low	High	Low
Signalized	A	A	B or C	B or C	B or C	B or C
Unsignalized	A	A	C	B	B or C	B

Right Turn Lane Storage Length, Condition A:	N/A	Feet
Condition B:	N/A	Feet
Condition C:	N/A	Feet
Required Right Turn Lane Storage Length:	N/A	Feet

Additional Findings:

N/A

Additional Comments / Justifications:

Figure 9. Warrant for right turn lanes on two-lane roadways
(40 mph or lower speeds, unsignalized and signalized intersections)