F. Tavani and Associates, Inc.
Traffic Engineering and Planning

248 Beech Hill Road • Wynnewood • PA • 19096 • (215) 625-3821 Phone • (484) 792-9495 Fax
www.FTAVANIASSOCIATES.com

25 August 2020

Charlie Houder
Haverford Properties
551 W. Lancaster Avenue, SU 307
Haverford, PA 19041

VIA EMAIL ONLY

RE: Traffic Engineering Investigations of Strafford Ave 41-unit Residential TH Site Radnor Township, Delaware County, PA

FTA Job #219-011

Dear Mr. Houder:

F. Tavani and Associates, Inc. (FTA) has conducted traffic engineering investigations for the above-referenced project in Strafford. This report has been prepared in accordance with Radnor code requirements and follows the recommended outline as identified in said ordinance.

GENERAL SITE DESCRIPTION

This study considers the traffic impact of a proposed townhouse community of 41 units. The housing is proposed to be for sale and will feature a mix of 3 and 4 bedrooms. The housing is proposed to be market-rate and not age-restricted. The process of entitlements, construction, and occupancy is expected to take 3-5 years. The site is immediately surrounded by other residential properties and the Eagle Village Shopping Center. Beyond them, there is a mix of office and retail buildings within a 1 mile radius of the site. Ample mass transit opportunities are also within a short distance of the site.

The site is located on the west side of Strafford Avenue, north of Eagle Road and is known as the Hamilton Estate. The site is presently developed with some existing housing, namely 6 total dwellings.

The site location and surrounding area are presented in figures which are attached to the end of this report, namely **Figure 1** and **Figure 2**. A reduced version of recent site plans for the project is featured in **Figure 3**. There are no other known approved land development projects in the vicinity of the site.

Note that technical appendices are provided following the figures. **Appendix A** is reserved for future project correspondence. Photodocumentation of the study area / surrounding intersections is provided in **Appendix B**.

TRANSPORTATION FACILITIES DESCRIPTION

The site is surrounded on two sides by existing, two-way, one-lane-per-direction, public roadways, namely Strafford Avenue and Eagle Road. The roadways generally do not feature on-street public parking. Posted speed limit signs are present in the vicinity of the site along both Strafford Avenue and Eagle Road, where the posted speed limit is 25 mph. There are limited sidewalk facilities in the study

area. The major intersections closest to the site are all-way stop-controlled intersections with no painted crosswalks. There are existing SEPTA mass transit opportunities near the site including bus route 106 and a regional rail station (Strafford), each of which are within approximately one half mile of the site. No traffic signals (save for a flashing beacon at the all-way stop-controlled intersection of Strafford Avenue and Eagle Road) exist or are proposed in the immediate vicinity of the site. More site driveway and surrounding intersection details can be seen in photodocumentation log as provided in **Appendix B**.

The site has 41 units and is proposed to feature internal roadways, 2 site driveways (both on Strafford Avenue), garage/driveway parking, and visitor parking (approximately 11 defined spaces). Sidewalks are also proposed.

There are no known planned roadway improvements in the vicinity of the site. None of the streets surrounding the site are "SR"s (state roadways) – instead they are all local roadways. Eagle Road is a "G" roadway, meaning it is not an SR but is eligible for liquid fuels funding and PennDOT does maintain traffic count data along it, as seen in **Appendix C**.

EXISTING TRAFFIC CONDITIONS

FTA conducted traffic counts at the intersections of:

- Strafford Avenue and Eagle Road,
- Strafford Avenue and Grant Lane/Hedgerow Lane, and
- Eagle Road and N Wayne Avenue.

The counts were conducted on Thursday, 16 May 2019 from 7:00 AM to 9:00 AM and from 4:00 PM to 6:00 PM. The counts were conducted during the school year, in fair weather, and on a typical weekday. Existing peak hours of 8:00 AM to 9:00 AM and 4:30 PM to 5:30 PM were selected for study based on a system-wide peak hour investigation. The corresponding existing peak hour traffic volumes are plotted and seen in **Figure 4**. Raw traffic volumes are attached in **Appendix D**, as is a spreadsheet which describes the system peak investigation.

With existing peak hour volumes established, present-day "levels of service" can be assessed. Level of service (or LOS) is a descriptive mechanism which is employed by traffic engineers to relate quality of traffic flow to both a letter grade and estimate of delay in seconds per vehicle. LOS results are assessed for traffic which must stop or yield to other traffic. Free-flowing traffic theoretically has no delay, and therefore no LOS rating. Existing levels of service were determined using *Synchro version 10* software, with HCS2010-format outputs selecting for performance reporting purposes. A **LOS Comparison Matrix** was prepared and is attached to the end of this report. The matrix summarizes AM and PM peak hour performance for existing and future (see next section) conditions for all intersections. As shown, existing levels of service are all LOS A and B, with all calculated delays being very low (10 seconds or less in most cases – an acceptable condition). No congestion locations (LOS E/F) are noted.

TRANSPORTATION IMPACT OF THE DEVELOPMENT

Site traffic was estimated using the Institute of Transportation Engineers (ITE) publication, Trip Generation, 10th edition. ITE website trip generation outputs are attached and provided in **Appendix E**. Raw trip generation could have been modified to reflect how this site is located in a setting which is within walking distance of several businesses as well as SEPTA bus route 106 plus the Strafford train station, though **no such multimodal credits were taken**. Instead, *all* site traffic was assigned (trip distributed) to the surrounding roadway network in accordance with existing traffic patterns as well as an understanding of

existing road network connectivity, current traffic/congestion patterns, and relative locations of major highway interchanges (Interstates 476, 76, 202, and 422 as well as Business Route 30). The assignments are summarized as follows:

- 30% to/from Routes 202 & 422 via Strafford Ave to Old Eagle School Rd;
- 30% to/from Routes 476 & 76 via Eagle Rd to King of Prussia Rd;
- 15% to/from Business Rt 30 West via Eagle Rd and Strafford Ave;
- 15% to/from Business Rt 30 East via Eagle Rd and Strafford Ave, West Ave., and/or Banbury Way; &
- 10% to/from Conestoga Road via Eagle Road.

The trip distribution model for the community is shown in **Figure 5** and the resultant assignment of new, site-generated, vehicular peak hour traffic is shown in **Figure 6**. A site trip generation summary table follows below. Note that a credit for the previously-mentioned 6 existing dwelling units was applied to the trip generation (net new 35 townhomes)

TABLE 1
PROJECTED VEHICULAR TRIP GENERATION

AM PEAK HOUR			**PM PEAK HOUR**		
IN	**OUT**	**TOTAL**	**IN**	**OUT**	**TOTAL**
4	14	18	14	9	23

Average daily site traffic was also calculated and determined to be approximately 250 trips for the proposed community. See **Appendix E** for more details.

ANALYSIS OF TRANSPORTATION IMPACT

Future traffic conditions are a function of three components: (1) existing traffic volumes, (2) additional traffic due to general background growth as well as other known approved developments in the immediate proximity of the site, and (3) site traffic.

As mentioned earlier, there are no other known approved land development projects in the vicinity of the site. Regarding background growth, the currently promulgated background growth rate for Delaware County is 0.00% per year as reported by PennDOT. This means that future 'no build' traffic volumes and levels of service are identical to existing traffic volumes and levels of service.

The projected future 'build' (no build plus site traffic) peak hour volumes are shown in **Figure 7**. The related projected levels of service are once shown in **LOS Comparison Matrix**. As shown projected 'build' levels of service once again remain essentially the same as they are today, and are all LOS B or better. The impact of site traffic is no added delay at all intersections/turning movements (i.e, the impact of site traffic never amounts to *any* added delay at *any* impacted turning movement), and this again is while taking no credits for multi-modalism. Even with this conservative approach, no congestion locations (LOS E/F) are noted.

No road improvements are necessary to offset the impact of added site traffic. No proposed site driveway will feature traffic volumes which warrant the installation of a traffic signal. The acceptable operation of each site driveway (LOS A and B) in unsignalized state underscores this conclusion. Level of service worksheets are provided in **Appendix F**.

AUXILIARY LANE ANALYSIS

The need for new auxiliary left- and right-turn lanes at the site driveways was investigated. Investigations were based on PennDOT Strike Off Letter 560-08-4 as well as PennDOT *Publication 46* Chapter 11 page 11-46 ("Turn Lane Warrants") using PennDOT-provided worksheets, and focusing on the highest peak hour. Investigations conclude that new auxiliary left- and right-turn lanes are not warranted at the site driveways. More details are provided in **Appendix G**.

CONCLUSIONS

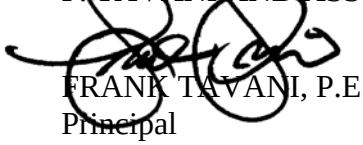
As mentioned earlier, a **LOS Comparison Matrix** is provided to afford a simple means to review and assess site traffic impact in the study area. In locations where levels of service are not forecasted to change from one scenario to the next (i.e., from Existing to No Build, or from No Build to Build), hyphens are used. As shown, there are many instances in which the impact of site traffic results in essentially no measurable change in traffic performance and the underlying traffic performance is already acceptable, and with very low delays.

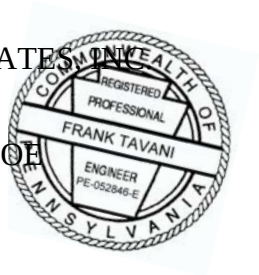
Other key conclusions are as follows:

- The study area is presently well-served by transit opportunities.
- There are no streets or intersections operating below LOS C under existing or future conditions.
- Both site driveways are forecasted to operate at LOS A/B during both peak hours, and for all turning movements.
- No site driveway requires new left-turn or right-turn auxiliary lanes per investigations using standard PennDOT tools.
- The foregoing conclusions were reached taking no credits for walking or transit, even though at least some of either/both are likely.

I hope this has been helpful. Please let me know if I can answer any questions.

Thank you,
F. TAVANI AND ASSOCIATES, INC.





FRANK TAVANI, P.E., PTOE
Principal

attachments

cc: George Broseman, Esq.
Rob Lambert, P.E.

LEVEL OF SERVICE AND EXPECTED DELAY
FOR UNSIGNALIZED INTERSECTIONS*

LEVEL OF SERVICE	CONTROL DELAY PER VEHICLE (SECONDS)
a	0 to 10.0
b	10.1 to 15.0
c	15.1 to 25.0
d	25.1 to 35.0
e	35.1 to 50.0
f	Over 50.0

* Transportation Research Board's Highway Capacity Manual

LEVEL OF SERVICE AND EXPECTED DELAY FOR SIGNALIZED INTERSECTIONS*

LEVEL OF SERVICE	DESCRIPTION	CONTROL DELAY PER VEHICLE (IN SECONDS)
A	Very short delay, good progression; most vehicles do not stop at intersection.	≤ 10.0
B	Generally good signal progression and/or short cycle length; more vehicles stop at intersection than Level of Service A.	10.1 to 20.0
C	Fair progression and/or longer cycle length; significant number of vehicles stop at intersection.	20.1 to 35.0
D	Congestion becomes noticeable; individual cycle failures; longer delays from unfavorable progression, long cycle length, or high volume/ capacity ratios; most vehicles stop at intersection.	35.1 to 55.0
E	Usually considered limit of acceptable delay indication of poor progression, long cycle length, or high volume/ capacity ratio; frequent individual cycle failures.	55.1 to 80.0
F	Could be considered excessive delay in some areas, frequently an indication of saturation (i.e., arrival flow exceeds capacity), or very long cycle lengths with minimal side street "green" time. Capacity is not necessarily exceeded under this level of service.	> 80.0

* Transportation Research Board's Highway Capacity Manual

LEVEL OF SERVICE COMPARISON TABLES

1. Strafford Ave & Grant Ln / Hedgerow Ln								
Direction	Movement	AM Peak Hour			PM Peak Hour			Control Type: AWSC
Strafford Ave		Existing (2019)	No Build (2024)	Build (2024)	Existing (2019)	No Build (2024)	Build (2024)	
Eastbound	LTR	A 8	--	--	A 9	--	--	
Westbound	LTR	A 9	--	--	A 8	--	A 9	
Grant Ln / Hedgerow Ln								
Northbound	LTR	A 8	--	--	A 7	--	--	
Southbound	LTR	A 8	--	--	A 7	--	--	
	OVERALL:	A 9	--	--	A 9	--	--	

2. Strafford Ave & Eagle Ave								
Direction	Movement	AM Peak Hour			PM Peak Hour			Control Type: AWSC
Strafford Ave		Existing (2019)	No Build (2024)	Build (2024)	Existing (2019)	No Build (2024)	Build (2024)	
Eastbound	LTR	A 10	--	--	B 11	--	--	
Westbound	LTR	A 9	--	--	B 10	--	--	
Eagle Ave								
Northbound	LTR	A 9	--	--	B 11	--	--	
Southbound	LTR	A 10	--	--	B 11	--	--	
	OVERALL:	A 9	--	A 10	B 11	--	--	

3. N Wayne Ave & Eagle Ave								
Direction	Movement	AM Peak Hour			PM Peak Hour			Control Type: Signal
N Wayne Ave		Existing (2019)	No Build (2024)	Build (2024)	Existing (2019)	No Build (2024)	Build (2024)	
Eastbound	LTR	A 4	--	--	A 5	--	--	
Westbound	LTR	A 3	--	--	A 5	--	--	
Eagle Ave								
Northbound	LTR	B 20	--	--	B 20	--	--	
Southbound	LTR	B 19	--	--	B 20	--	--	
	OVERALL:	A 8	--	--	B 10	--	--	

4. Strafford Ave & TH Site Drive N								
Direction	Movement	AM Peak Hour			PM Peak Hour			Control Type: TWSC
TH Site Drive		Existing (2019)	No Build (2024)	Build (2024)	Existing (2019)	No Build (2024)	Build (2024)	
Eastbound	LR			A 9			B 10	
Eagle Ave								
Northbound	L			A 9			A 9	
	OVERALL:			A 1			A 1	

5. Strafford Ave & SFDU Site Drive S								
Direction	Movement	AM Peak Hour			PM Peak Hour			Control Type: TWSC
SFDU Site Drive		Existing (2019)	No Build (2024)	Build (2024)	Existing (2019)	No Build (2024)	Build (2024)	
Eastbound	LR			A 10			A 10	
Eagle Ave								
Northbound	L			A 9			A 9	
	OVERALL:			A 1			A 1	

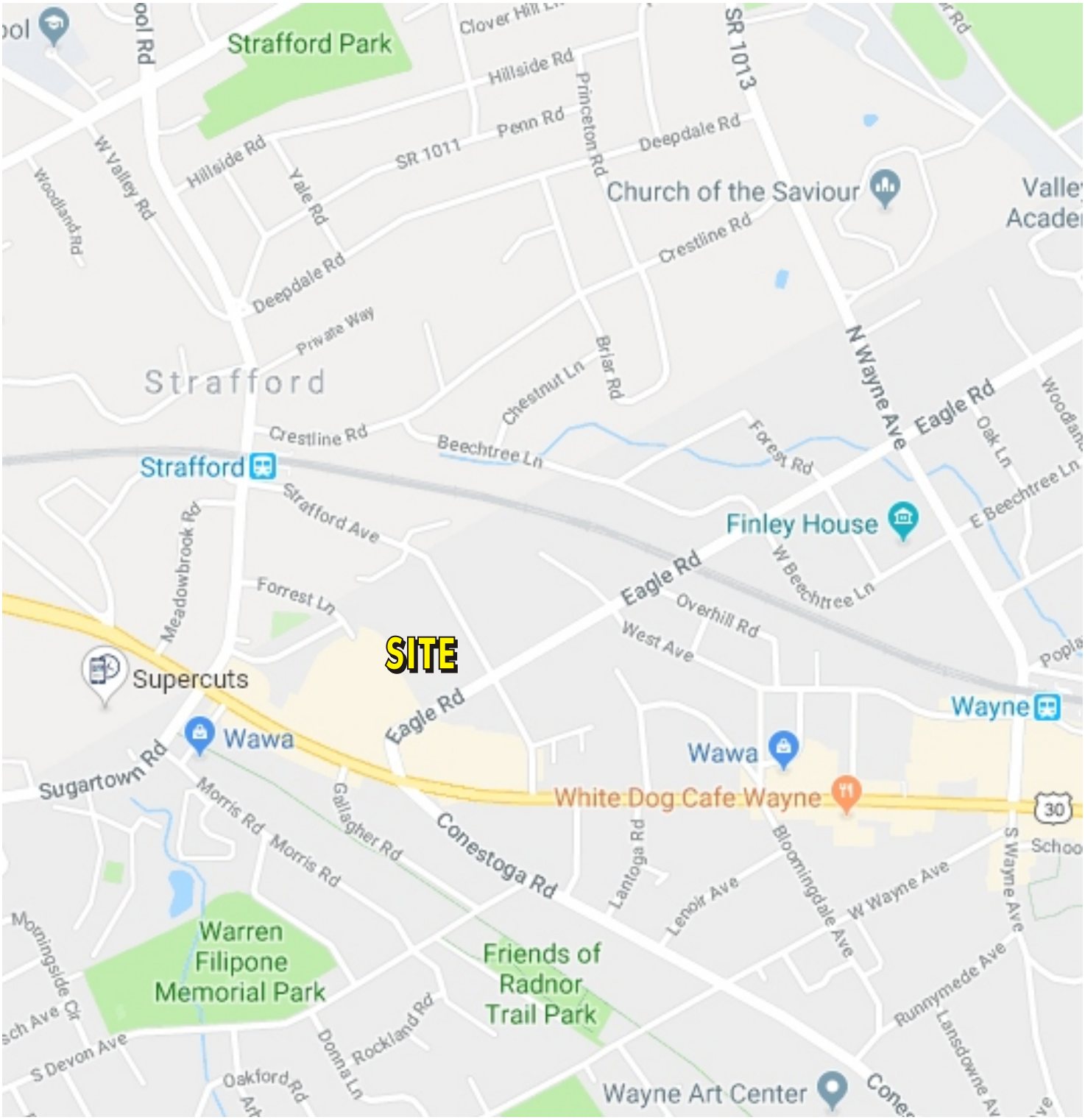
Future No Build volumes are identical to Existing volumes, so LOS are also identical

-- indicates no change from the previous scenario

Site and Surrounding Area – Map View

Strafford Avenue Residential - Townhouses
Radnor Township,
Delaware County, Pennsylvania

April 2020*



* Figure preparation date. See report for data collection date(s).

Site and Surrounding Area – Aerial View

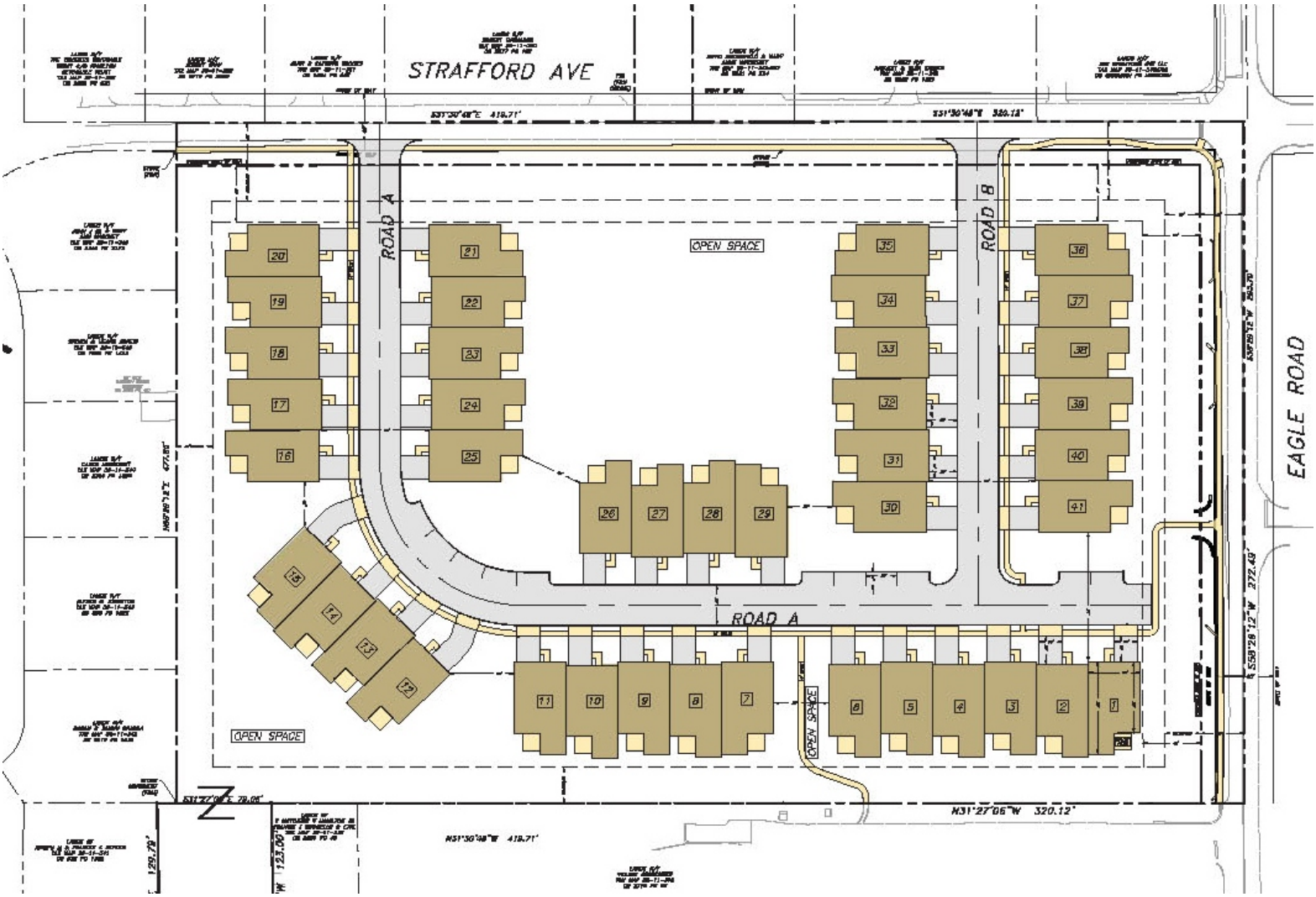
Strafford Avenue Residential - Townhouses
Radnor Township,
Delaware County, Pennsylvania

April 2020

Site Plan Excerpt

Strafford Avenue Residential - Townhouses
Radnor Township,
Delaware County, Pennsylvania

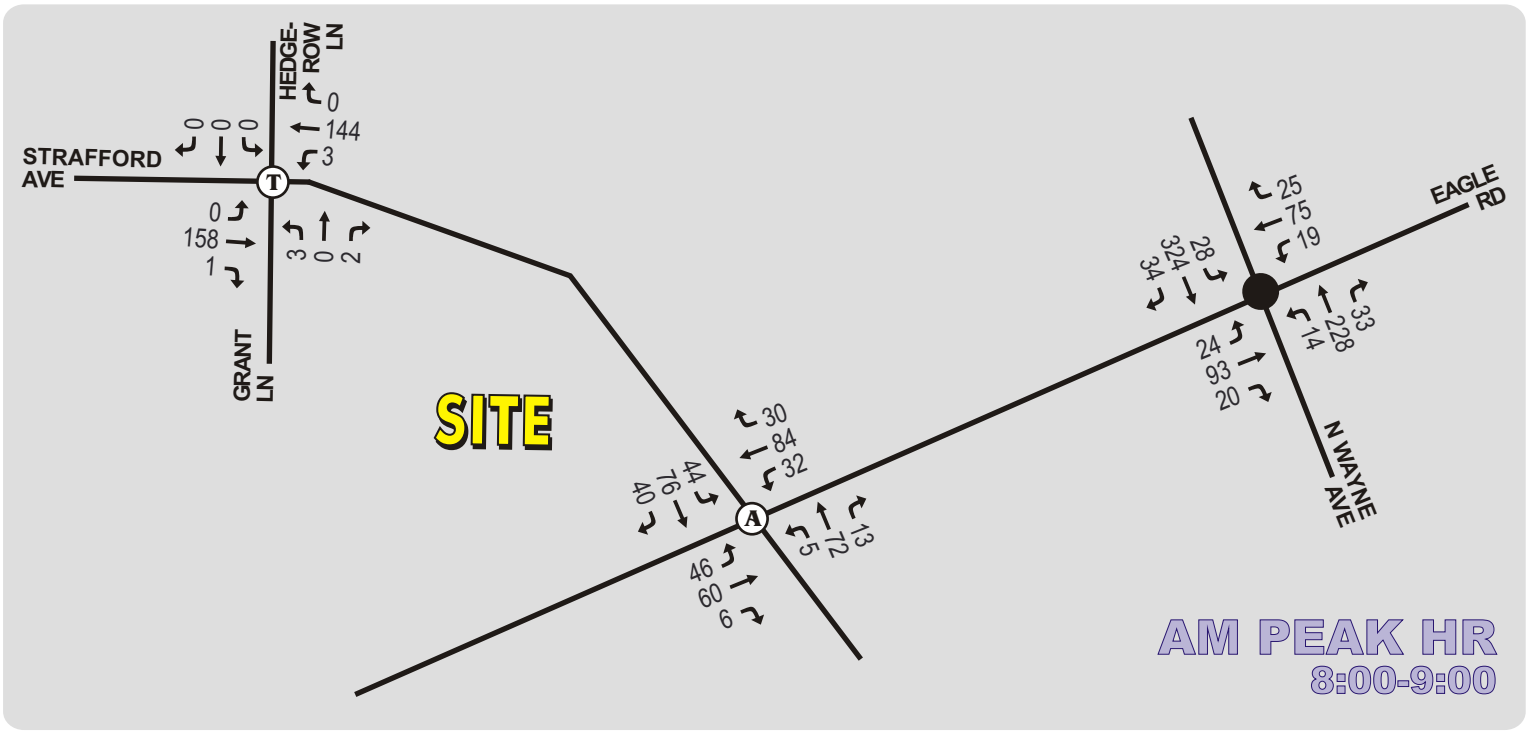
August 2020

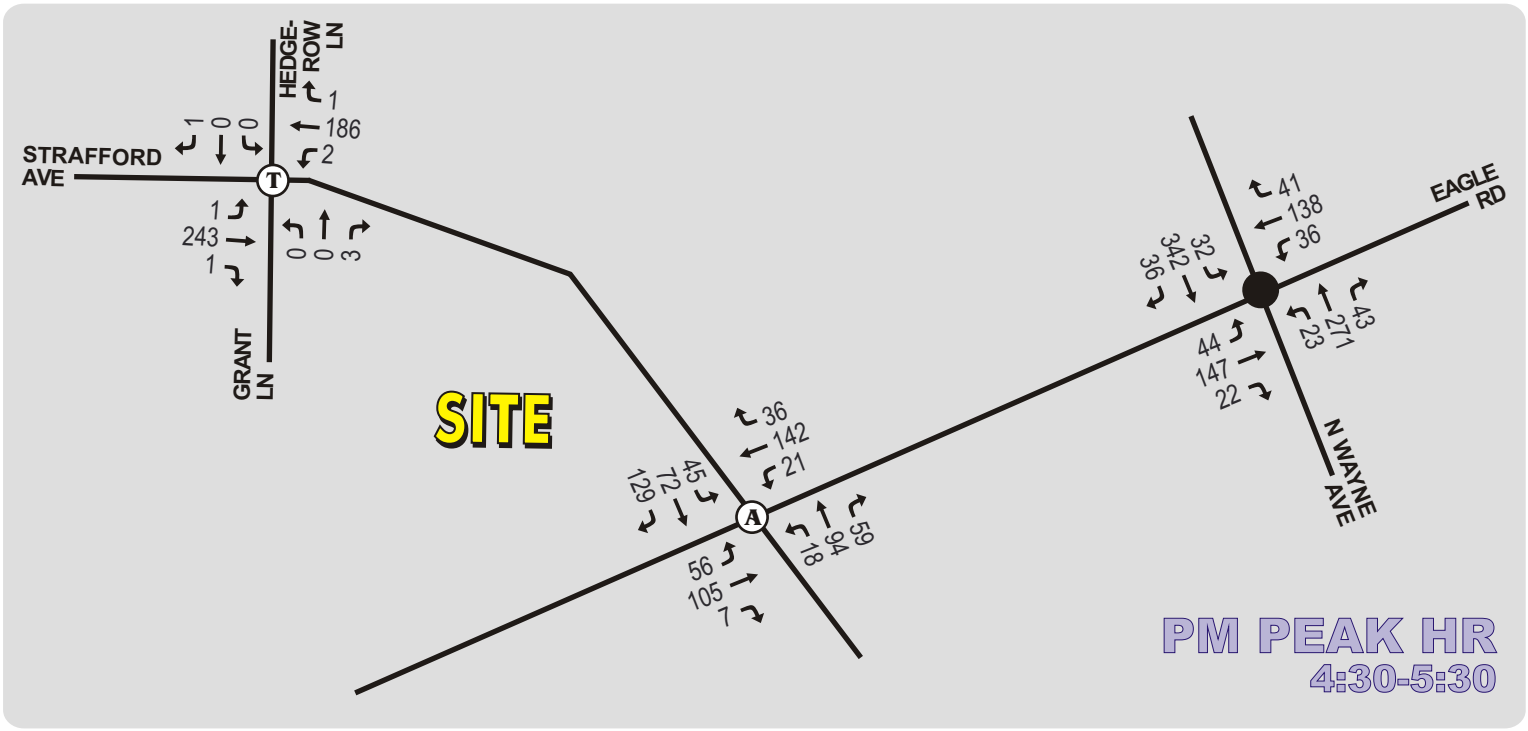


Existing (2019) Peak Hour Traffic Volumes

Strafford Avenue Residential - Townhouses
Radnor Township,
Delaware County, Pennsylvania

April 2020



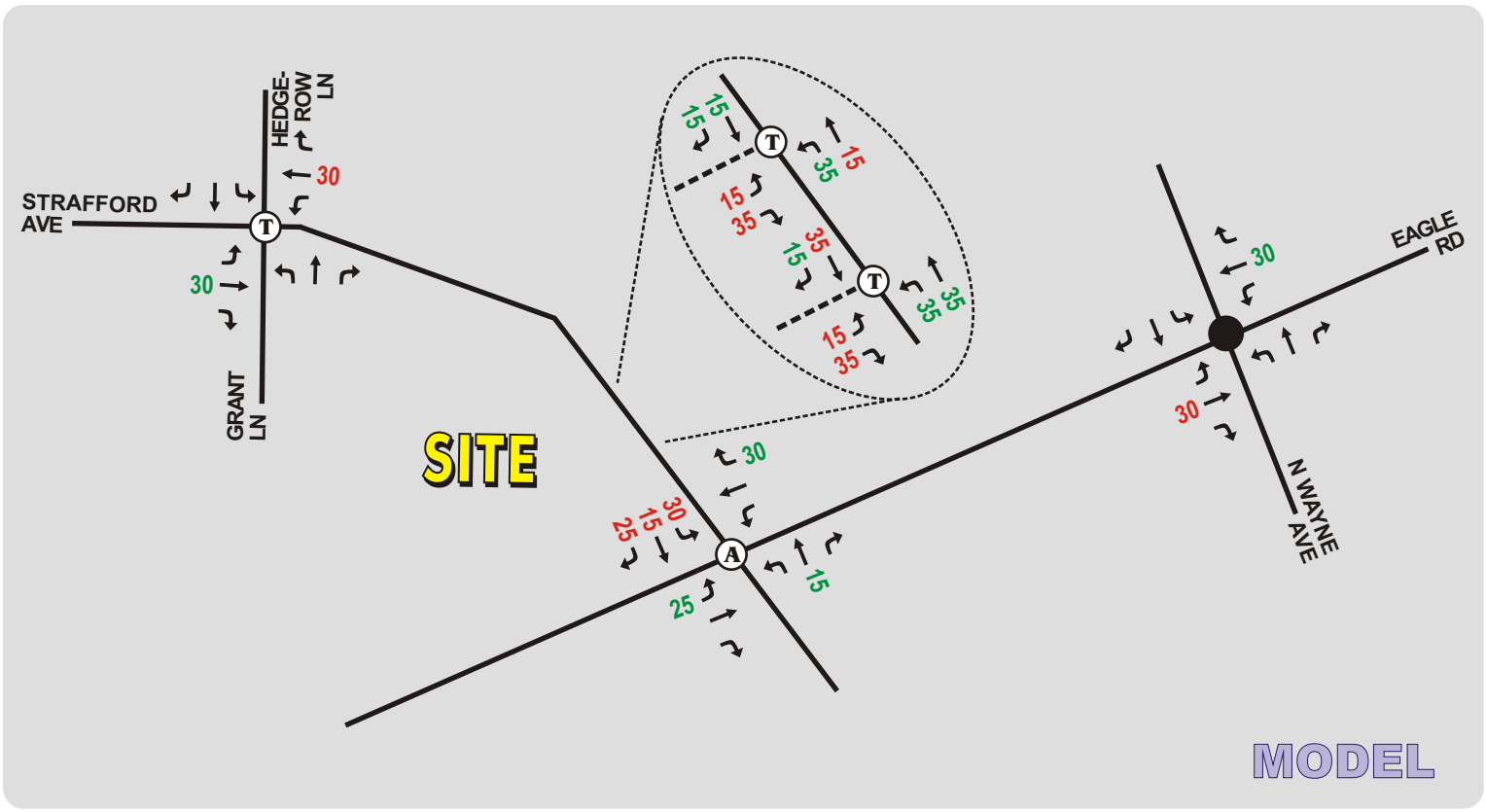


Signalized Intersection | (A) Unsignalized Intersection, All-Way Stop Control | (T) Unsignalized Intersection, Two-Way Stop Control (Side Street Only) | INBOUND OUTBOUND

Site Peak Hour Traffic – Model

Strafford Avenue Residential - Townhouses
Radnor Township,
Delaware County, Pennsylvania

April 2020

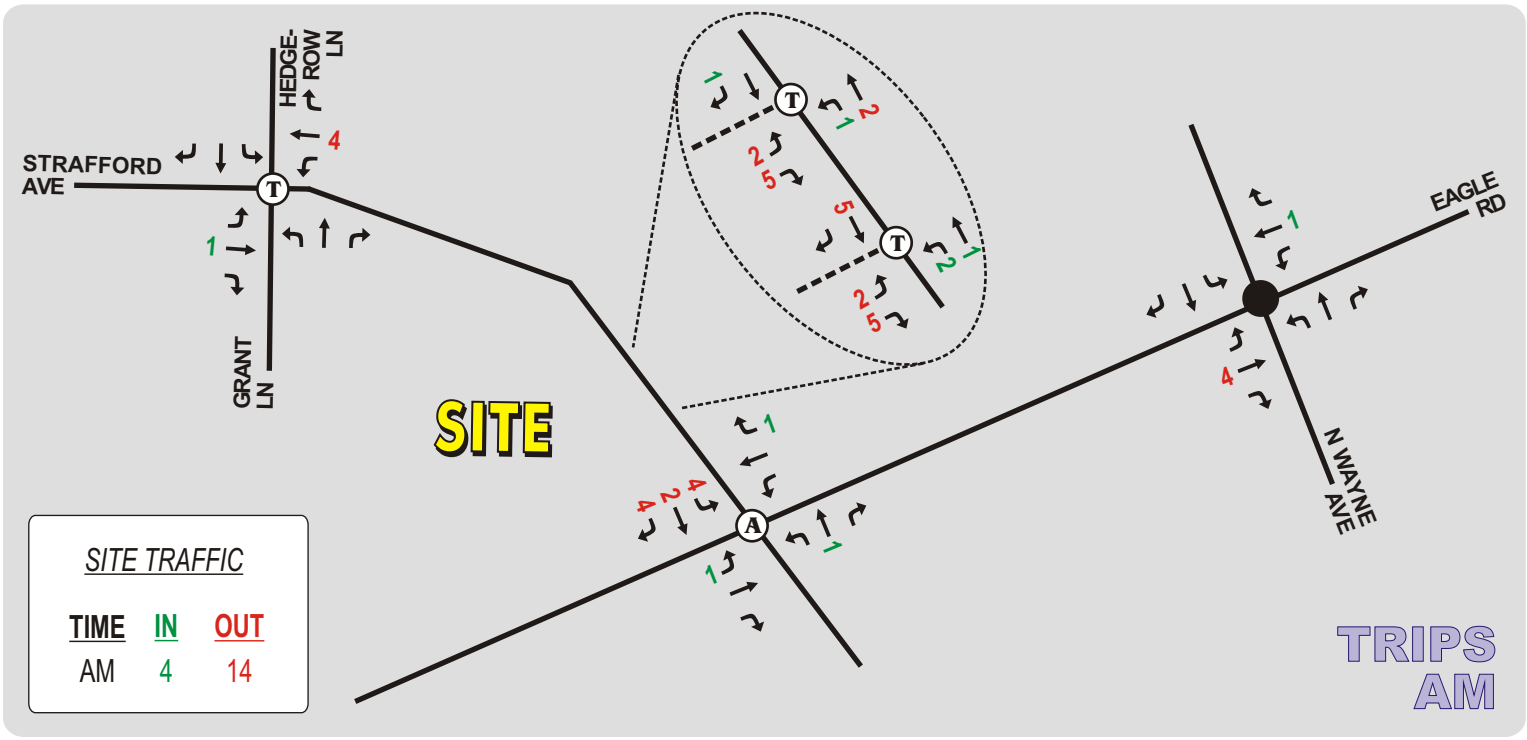


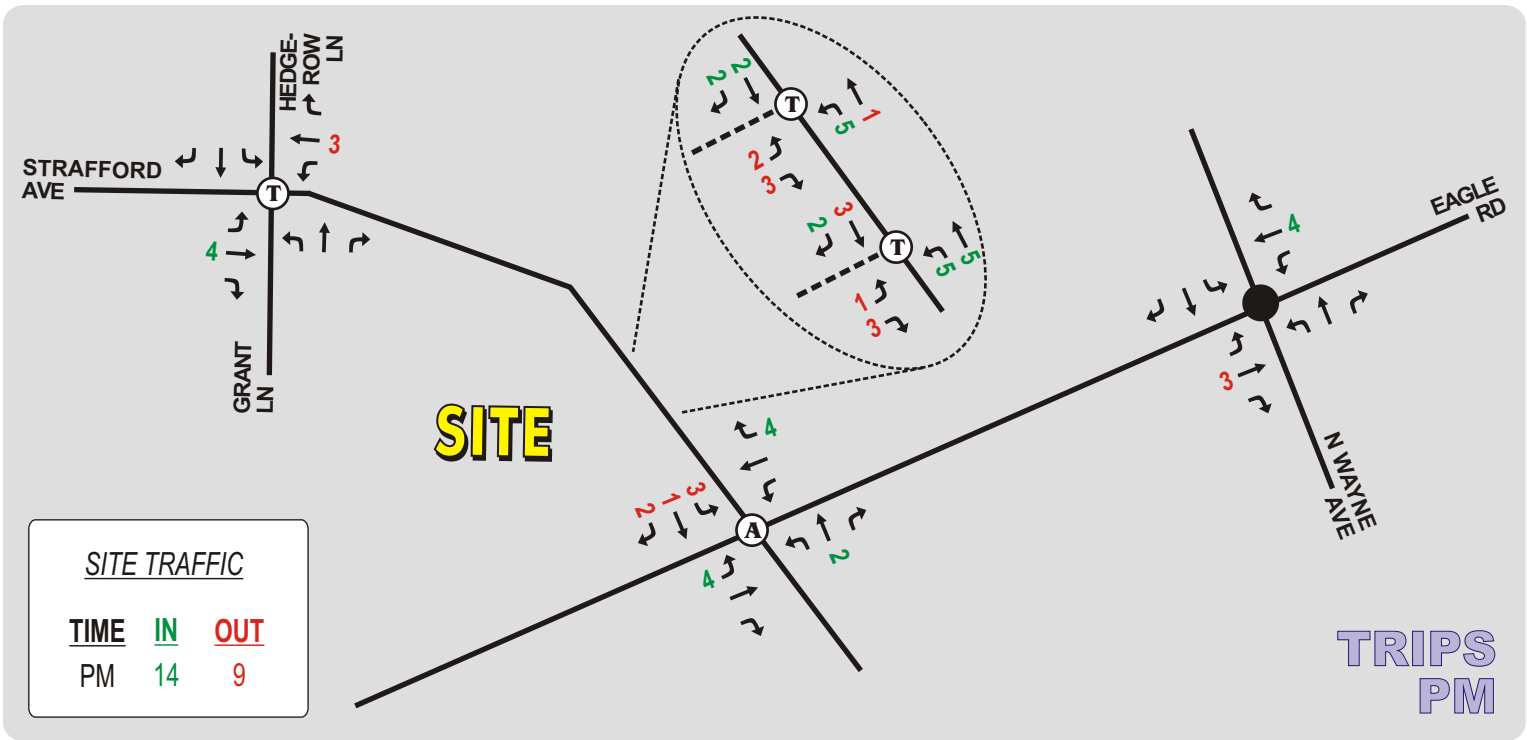
Signalized Intersection | (A) Unsignalized Intersection, All-Way Stop Control | (T) Unsignalized Intersection, Two-Way Stop Control (Side Street Only) | INBOUND OUTBOUND

Site Peak Hour Traffic – Volumes

Strafford Avenue Residential - Townhouses
Radnor Township,
Delaware County, Pennsylvania

April 2020



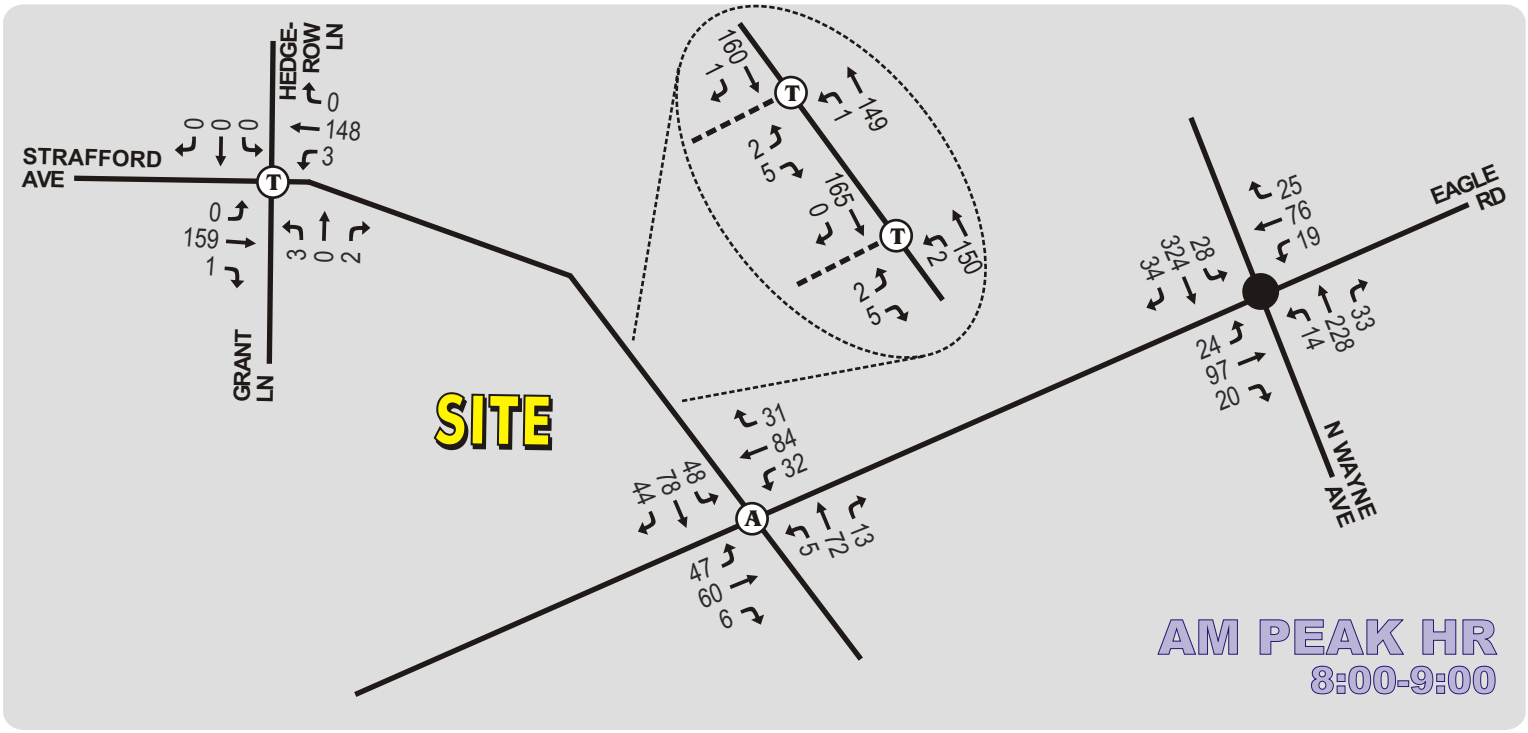


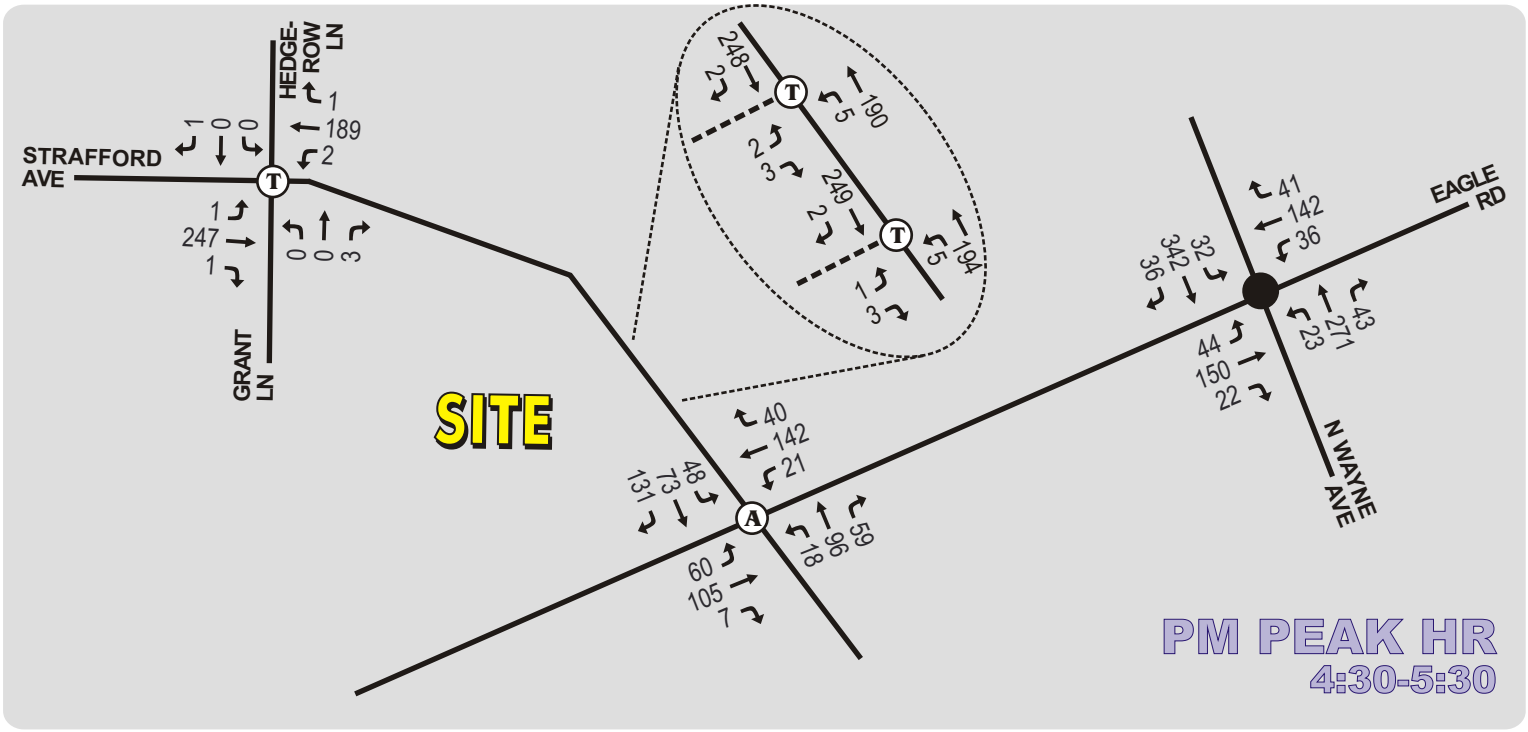
● Signalized Intersection (A) Unsignalized Intersection, All-Way Stop Control (T) Unsignalized Intersection, Two-Way Stop Control (Side Street Only) INBOUND OUTBOUND

Future (2024) Build Peak Hour Traffic Volumes

Strafford Avenue Residential - Townhouses
Radnor Township,
Delaware County, Pennsylvania

April 2020





● Signalized Intersection (A) Unsignalized Intersection, All-Way Stop Control (T) Unsignalized Intersection, Two-Way Stop Control (Side Street Only)

APPENDIX A

Correspondence

This page intentionally blank

APPENDIX B

Photodocumentation

Road name (# of pages)

1. Eagle Road & Strafford Road (3)
2. Strafford Avenue & Grant Lane/Hedgerow Lane (3)
3. Eagle Road & Wayne Avenue (3)

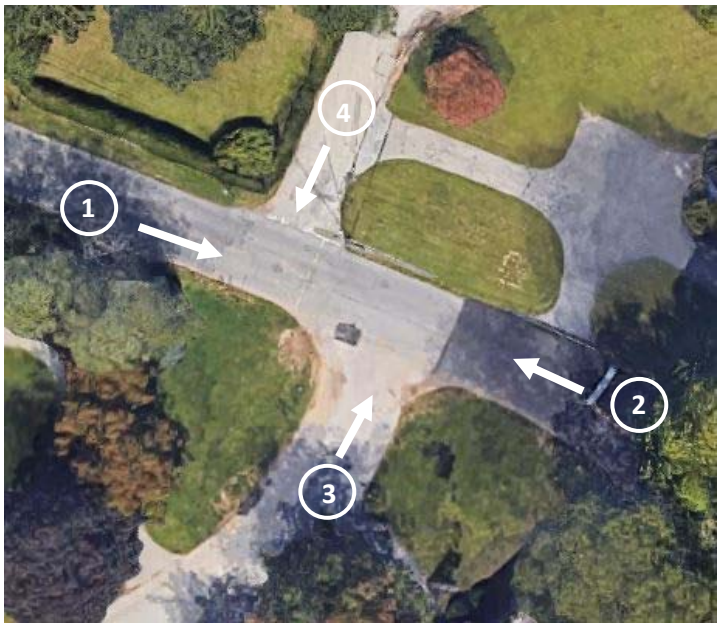
Aerial image of intersection

Photo # 1 - Description: Eastbound Strafford Road

Photo # 2 - Description: Westbound Strafford Road

Photo # 3 - Description: Northbound Eagle Road

Photo # 4 - Description: Southbound Eagle Road



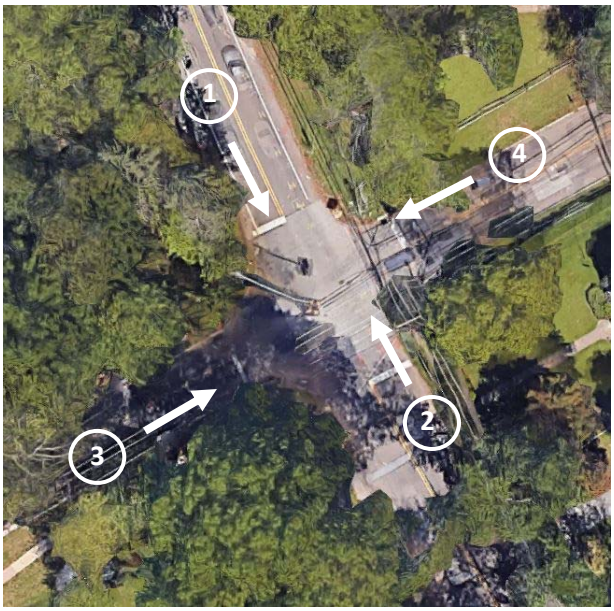
Aerial image of intersection

Photo # 1 - Description: Eastbound Strafford Road

Photo # 2 - Description: Westbound Strafford Road

Photo # 3 - Description: Northbound Grant Lane

Photo # 4 - Description: Southbound Hedgerow Lane



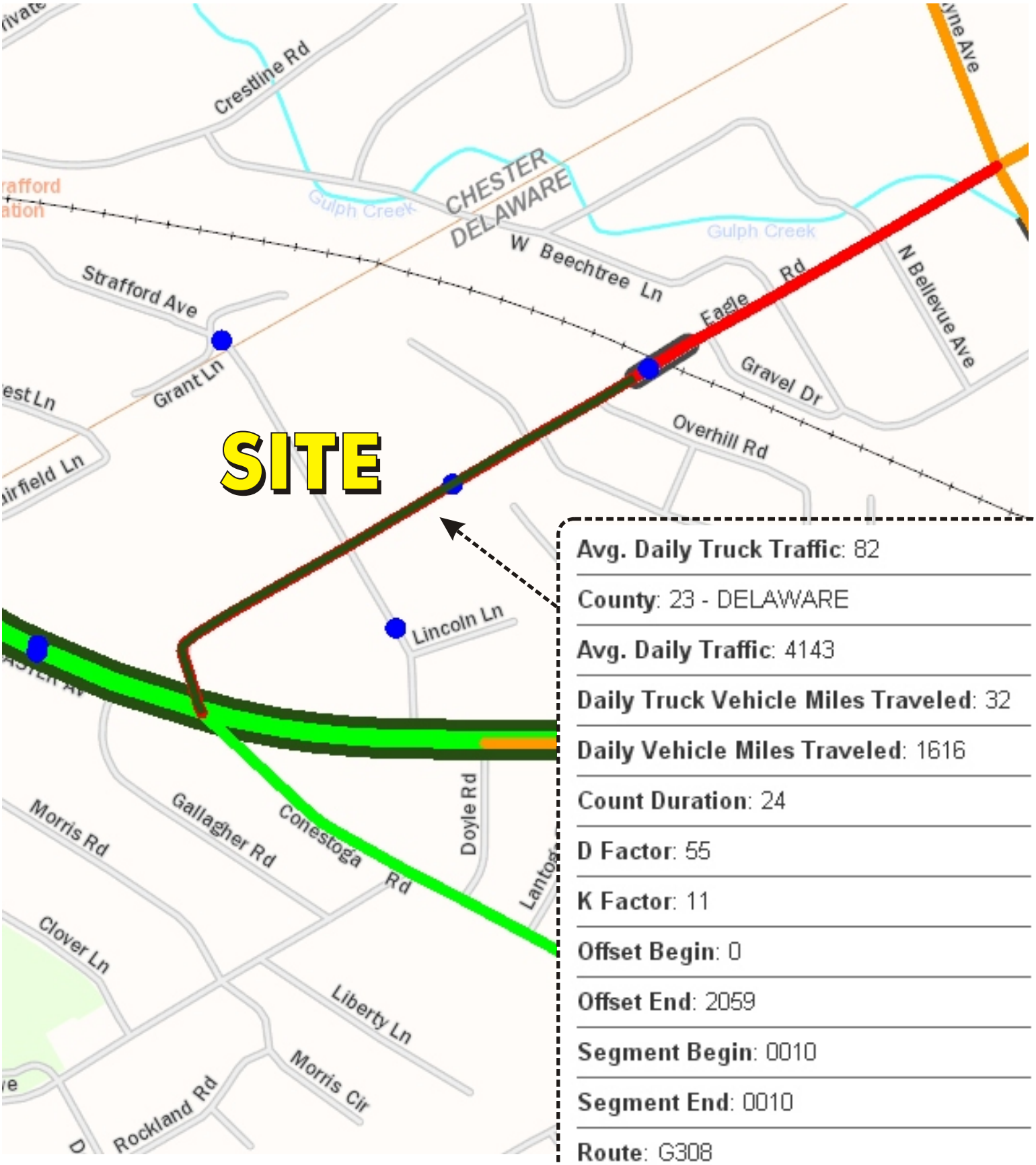
Aerial image of intersection

Photo # 1 - Description: Eastbound Wayne Avenue

Photo # 2 - Description: Westbound Wayne Avenue

Photo # 3 - Description: Northbound Eagle Road

Photo # 4 - Description: Southbound Eagle Road



Avg. Daily Truck Traffic: 82

County: 23 - DELAWARE

Avg. Daily Traffic: 4143

Daily Truck Vehicle Miles Traveled: 32

Daily Vehicle Miles Traveled: 1616

Count Duration: 24

D Factor: 55

K Factor: 11

Offset Begin: 0

Offset End: 2059

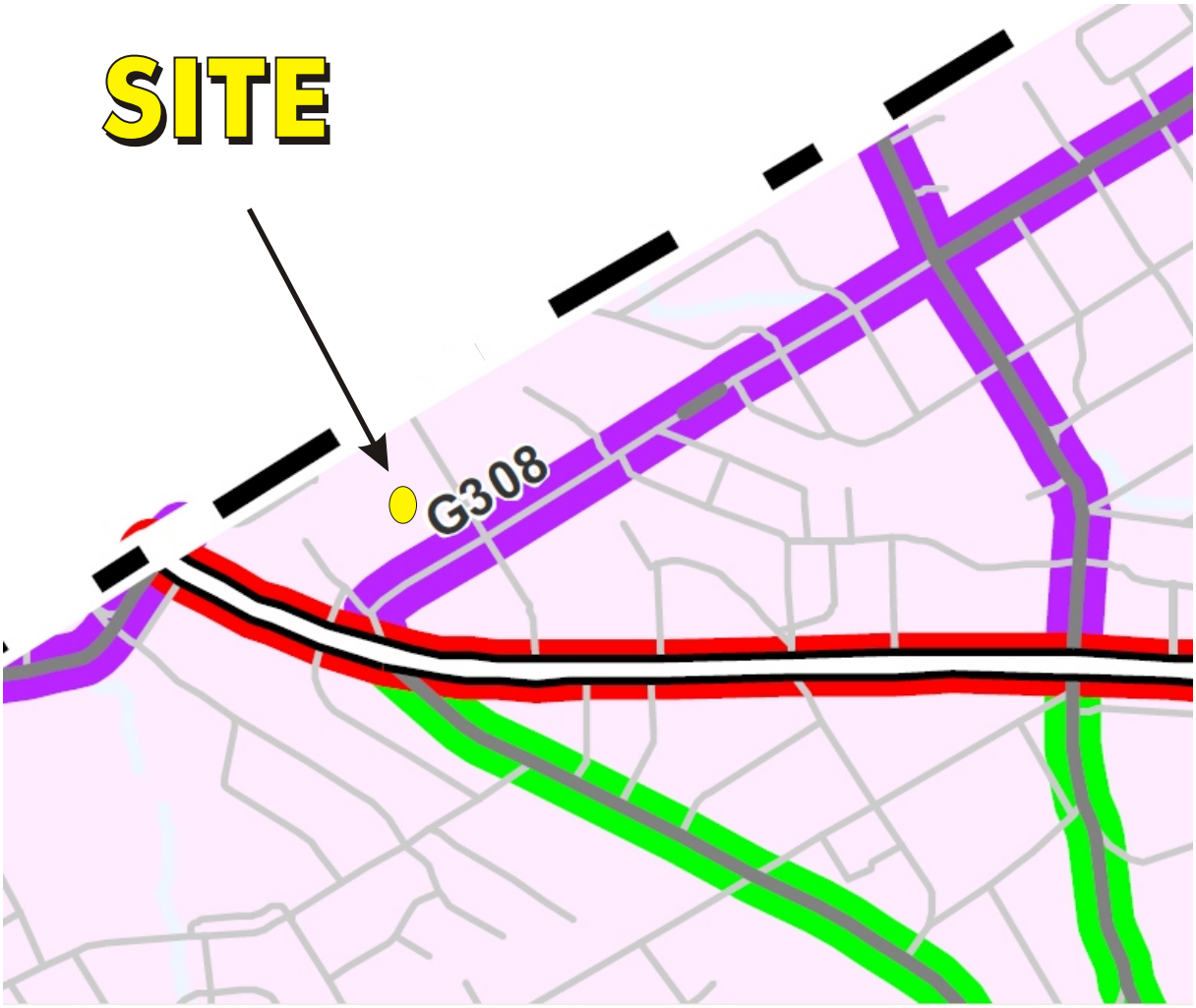
Segment Begin: 0010

Segment End: 0010

Route: G308

Traffic Pattern Group: 05 - URBAN - MINOR ARTERIALS, COLLECTORS, LOCAL ROADS

Truck Percent: 2



INTERSTATE HIGHWAYS (1, 11)

OTHER FREEWAYS AND EXPRESSWAYS (12)

OTHER PRINCIPAL ARTERIAL HIGHWAYS (2, 14)

MINOR ARTERIALS (6, 16)

URBAN COLLECTOR OR
RURAL MAJOR COLLECTOR (7, 17)

RURAL MINOR COLLECTOR (8)

APPENDIX E

Trip Generation, Background Growth & Other Developments

Growth Factors for August 2018 to July 2019				
County	Urban Interstate	Rural Interstate	Urban Non-Interstate	Rural Non-Interstate
ADAMS	*	*	0.98	0.75
ALLEGHENY	0.86	2.18	0.00	0.38
ARMSTRONG	0.85	*	0.00	0.38
BEAVER	0.80	1.96	0.00	0.35
BEDFORD	*	2.13	0.00	0.44
BERKS	1.16	2.43	0.26	0.58
BLAIR	0.81	1.94	0.00	0.37
BRADFORD	1.14	*	0.07	0.51
BUCKS	1.36	2.33	0.60	0.61
BUTLER	1.79	2.75	0.71	0.76
CAMBRIA	0.40	*	0.00	0.19
CAMERON	*	*	*	0.16
CARBON	1.35	2.60	0.38	0.64
CENTRE	1.53	2.55	0.70	0.69
CHESTER	1.74	3.02	0.58	0.82
CLARION	0.96	2.02	0.00	0.41
CLEARFIELD	0.99	2.09	0.01	0.44
CLINTON	0.95	2.26	0.00	0.47
COLUMBIA	1.19	2.29	0.35	0.56
CRAWFORD	0.95	2.00	0.09	0.44
CUMBERLAND	1.58	2.56	0.80	0.70
DAUPHIN	1.37	*	0.47	0.64
DELAWARE	0.99	*	0.00	*
ELK	*	*	0.00	0.31
ERIE	1.00	2.16	0.00	0.45
FAYETTE	0.84	*	0.00	0.40
FOREST	*	*	*	0.67
FRANKLIN	1.36	2.57	0.53	0.66
FULTON	*	2.13	*	0.52
GREENE	1.23	2.63	0.00	0.57
HUNTINGDON	*	1.96	0.00	0.39
INDIANA	1.22	*	0.17	0.53
JEFFERSON	*	2.13	0.00	0.44
JUNIATA	*	*	*	0.57
LACKAWANNA	0.85	2.30	0.00	0.44
LANCASTER	1.79	2.67	1.14	0.80
LAWRENCE	0.80	2.09	0.00	0.37
LEBANON	*	2.48	0.45	0.62
LEHIGH	1.58	2.88	0.48	0.74
LUZERNE	0.77	2.17	0.00	0.40
LYCOMING	1.02	2.18	0.04	0.47
MCKEAN	0.66	*	0.00	0.34
MERCER	0.69	1.99	0.00	0.35
MIFFLIN	0.80	*	0.00	0.39
MONROE	1.44	2.49	0.73	0.68
MONTGOMERY	1.21	*	0.34	0.58
MONTOUR	1.53	2.64	0.34	0.67
NORTHAMPTON	1.33	2.56	0.47	0.65
NORTHUMBERLAND	0.83	2.09	0.00	0.41
PERRY	*	*	0.98	0.65
PHILADELPHIA	0.75	*	0.00	*
PIKE	2.20	2.84	1.64	0.98
POTTER	*	*	*	0.48
SCHUYLKILL	0.64	1.92	0.00	0.35
SNYDER	1.21	*	0.40	0.57
SOMERSET	0.65	1.76	0.00	0.34
SULLIVAN	*	*	*	0.43
SUSQUEHANNA	1.16	2.26	0.33	0.54
TIOGA	*	*	*	0.50
UNION	1.57	2.46	0.87	0.70
VENANGO	*	1.71	0.00	0.29
WARREN	*	*	0.00	0.38
WASHINGTON	1.32	2.63	0.15	0.60
WAYNE	*	2.25	0.21	0.53
WESTMORELAND	0.96	2.09	0.00	0.42
WYOMING	*	*	0.00	0.44
YORK	1.39	2.56	0.60	0.67

* = Functional Class Doesn't Exist in County

Questions? Please contact Andrew O'Neill at the Bureau of Planning and Research, 717-346-3250 or andoneill@pa.gov

NOTE: The projected growth factors are derived using historical VMT (Vehicle Miles Traveled) data (1994 to 2017), as well as Woods and Poole demographic and economic data. The factors should be compounded when calculating future values. The factors should not be used to project traffic beyond a 20-year period. Please be aware that these factors are estimates, and unforeseen events (opening of shopping centers, fast food franchises, gas stations, etc) could cause growth to change over time.

pennsylvania
DEPARTMENT OF TRANSPORTATION

Growth Factors for August 2019 to July 2020				
County	Urban Interstate	Rural Interstate	Urban Non-Interstate	Rural Non-Interstate
ADAMS	*	*	0.93	0.73
ALLEGHENY	0.81	*	0.00	0.37
ARMSTRONG	0.79	*	0.00	0.36
BEAVER	0.73	1.93	0.00	0.33
BEDFORD	*	2.10	0.00	0.42
BERKS	1.10	2.41	0.20	0.57
BLAIR	0.75	1.91	0.00	0.36
BRADFORD	1.08	*	0.01	0.49
BUCKS	1.31	2.31	0.54	0.59
BUTLER	1.75	2.74	0.65	0.75
CAMBRIA	0.34	*	0.00	0.18
CAMERON	*	*	*	0.14
CARBON	1.30	2.58	0.33	0.62
CENTRE	1.49	2.53	0.65	0.68
CHESTER	1.70	2.99	0.52	0.80
CLARION	0.90	2.00	0.00	0.40
CLEARFIELD	0.93	2.06	0.00	0.42
CLINTON	0.88	2.21	0.00	0.45
COLUMBIA	1.14	2.25	0.30	0.54
CRAWFORD	0.89	1.96	0.03	0.42
CUMBERLAND	1.53	2.55	0.74	0.69
DAUPHIN	1.31	*	0.41	0.63
DELAWARE	0.93	*	0.00	*
ELK	*	*	0.00	0.29
ERIE	0.95	2.14	0.00	0.43
FAYETTE	0.77	*	0.00	0.38
FOREST	*	*	*	0.65
FRANKLIN	1.31	2.54	0.47	0.65
FULTON	*	2.10	*	0.50
GREENE	1.19	2.62	0.00	0.56
HUNTINGDON	*	1.91	0.00	0.37
INDIANA	1.17	*	0.11	0.52
JEFFERSON	*	2.11	0.00	0.42
JUNIATA	*	*	*	0.55
LACKAWANNA	0.78	2.27	0.00	0.42
LANCASTER	1.74	2.64	1.08	0.78
LAWRENCE	0.74	2.05	0.00	0.35
LEBANON	*	2.44	0.39	0.61
LEHIGH	1.54	2.86	0.43	0.73
LUZERNE	0.71	2.14	0.00	0.39
LYCOMING	0.96	2.16	0.00	0.45
MCKEAN	0.60	*	0.00	0.33
MERCER	0.63	1.96	0.00	0.33
MIFFLIN	0.73	*	0.00	0.37
MONROE	1.40	2.46	0.68	0.67
MONTGOMERY	1.17	*	0.28	0.57
MONTOUR	1.48	2.61	0.28	0.65
NORTHAMPTON	1.28	2.53	0.41	0.63
NORTHUMBERLAND	0.75	2.04	0.00	0.39
PERRY	*	*	0.92	0.63
PHILADELPHIA	0.69	*	0.00	*
PIKE	2.14	2.79	1.59	0.96
POTTER	*	*	*	0.46
SCHUYLKILL	0.58	1.89	0.00	0.33
SNYDER	1.15	*	0.35	0.55
SOMERSET	0.59	1.72	0.00	0.32
SULLIVAN	*	*	*	0.42
SUSQUEHANNA	1.11	2.23	0.27	0.53
TIOGA	*	*	*	0.48
UNION	1.52	2.42	0.82	0.69
VENANGO	*	1.67	0.00	0.28
WARREN	*	*	0.00	0.36
WASHINGTON	1.28	2.62	0.10	0.59
WAYNE	*	2.22	0.16	0.51
WESTMORELAND	0.89	2.05	0.00	0.40
WYOMING	*	*	0.00	0.43
YORK	1.34	2.53	0.54	0.66

* = Functional Class Doesn't Exist in County

Questions? Please contact Andrew O'Neill at the Bureau of Planning and Research, 717-346-3250 or andoneill@pa.gov

NOTE: The projected growth factors are derived using historical VMT (Vehicle Miles Traveled) data (1994 to 2018), as well as Woods and Poole demographic and economic data. The factors should be compounded when calculating future values. The factors should not be used to project traffic beyond a 20-year period. Please be aware that these factors are estimates, and unforeseen events (opening of shopping centers, fast food franchises, gas stations, etc) could cause growth to change over time.

pennsylvania
DEPARTMENT OF TRANSPORTATION

Land Use: 220
Multifamily Housing (Low-Rise)

Description

Low-rise multifamily housing includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units and that have one or two levels (floors). Multifamily housing (mid-rise) (Land Use 221), multifamily housing (high-rise) (Land Use 222), and off-campus student apartment (Land Use 225) are related land uses.

Additional Data

In prior editions of *Trip Generation Manual*, the low-rise multifamily housing sites were further divided into rental and condominium categories. An investigation of vehicle trip data found no clear differences in trip making patterns between the rental and condominium sites within the ITE database. As more data are compiled for future editions, this land use classification can be reinvestigated.

For the three sites for which both the number of residents and the number of occupied dwelling units were available, there were an average of 2.72 residents per occupied dwelling unit.

For the two sites for which the numbers of both total dwelling units and occupied dwelling units were available, an average of 96.2 percent of the total dwelling units were occupied.

This land use included data from a wide variety of units with different sizes, price ranges, locations, and ages. Consequently, there was a wide variation in trips generated within this category. Other factors, such as geographic location and type of adjacent and nearby development, may also have had an effect on the site trip generation.

Time-of-day distribution data for this land use are presented in Appendix A. For the 10 general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 7:15 and 8:15 a.m. and 4:45 and 5:45 p.m., respectively. For the one site with Saturday data, the overall highest vehicle volume was counted between 9:45 and 10:45 a.m. For the one site with Sunday data, the overall highest vehicle volume was counted between 11:45 a.m. and 12:45 p.m.

For the one dense multi-use urban site with 24-hour count data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 7:00 and 8:00 a.m. and 6:15 and 7:15 p.m., respectively.

For the three sites for which data were provided for both occupied dwelling units and residents, there was an average of 2.72 residents per occupied dwelling unit.

The average numbers of person trips per vehicle trip at the five general urban/suburban sites at which both person trip and vehicle trip data were collected were as follows:

- 1.13 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 7 and 9 a.m.
- 1.21 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in British Columbia (CAN), California, District of Columbia, Florida, Georgia, Illinois, Indiana, Maine, Maryland, Minnesota, New Jersey, New York, Ontario, Oregon, Pennsylvania, South Dakota, Tennessee, Texas, Utah, Virginia, and Washington.

It is expected that the number of bedrooms and number of residents are likely correlated to the number of trips generated by a residential site. Many of the studies included in this land use did not indicate the total number of bedrooms. To assist in the future analysis of this land use, it is important that this information be collected and included in trip generation data submissions.

Source Numbers

168, 187, 188, 204, 211, 300, 305, 306, 319, 320, 321, 357, 390, 412, 418, 525, 530, 571, 579, 583, 864, 868, 869, 870, 896, 903, 918, 946, 947, 948, 951

Multifamily Housing (Low-Rise)
(220)

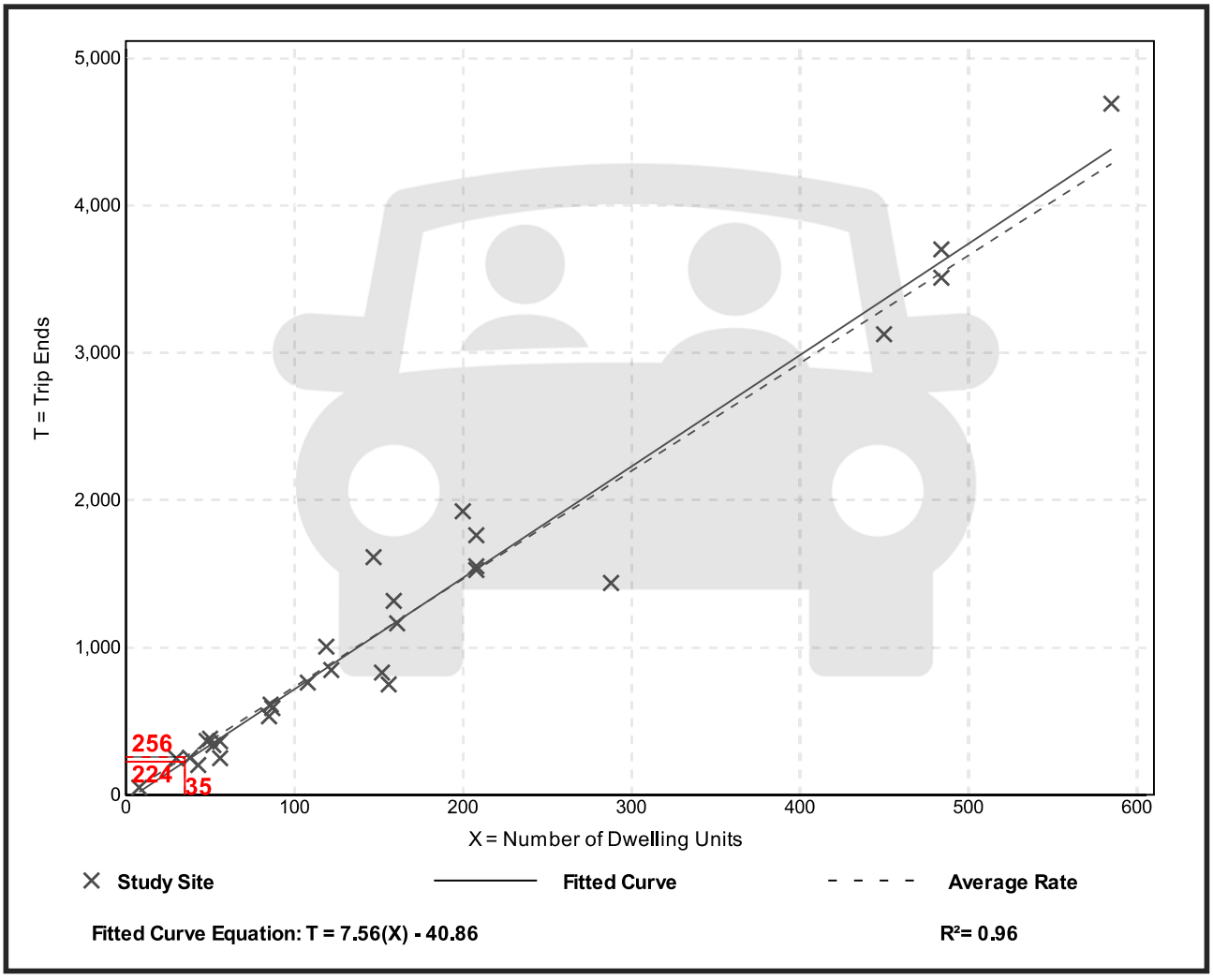
Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 29
Avg. Num. of Dwelling Units: 168
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
7.32	4.45 - 10.97	1.31

Data Plot and Equation



Trip Gen Manual, 10th Ed + Supplement • Institute of Transportation Engineers

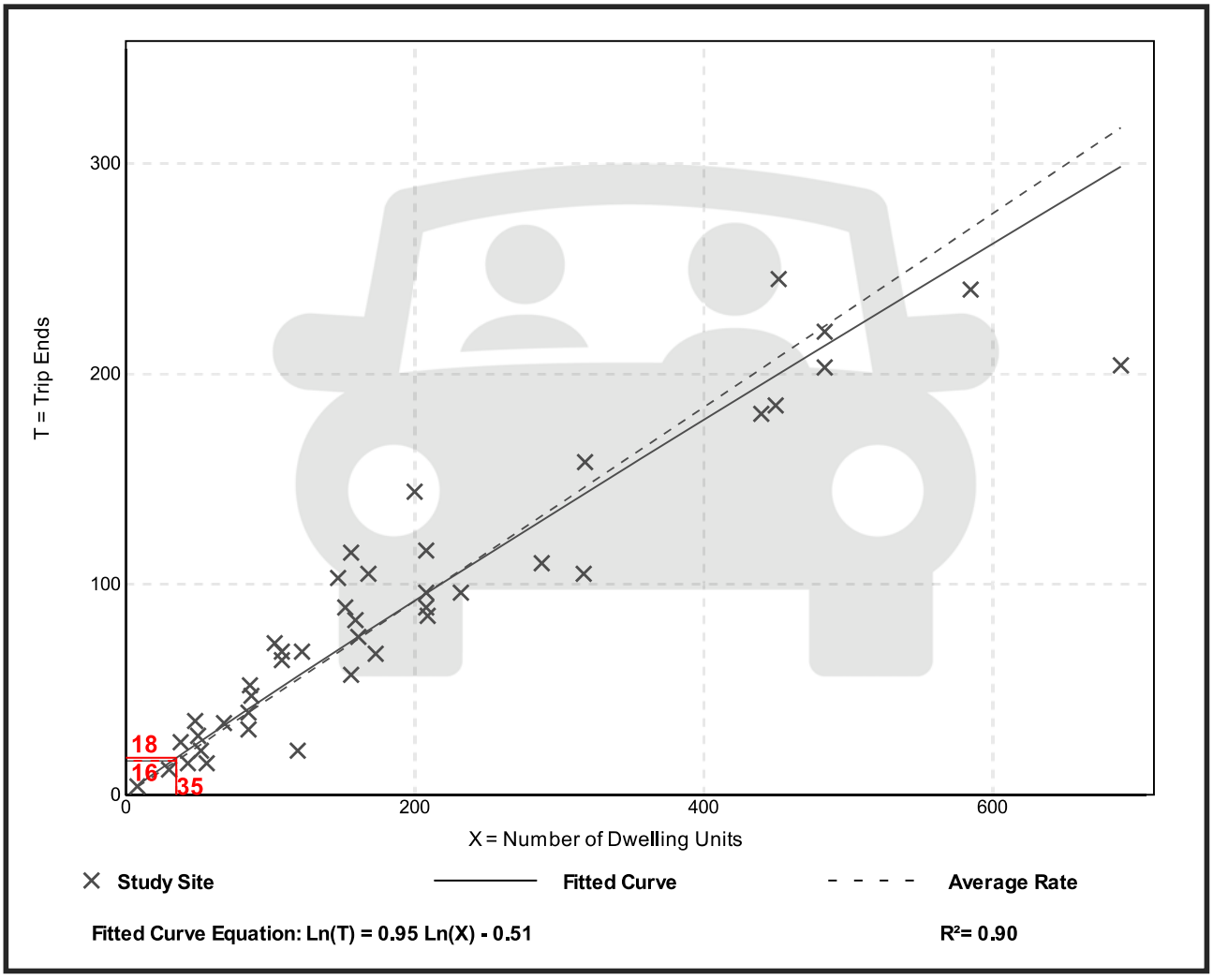
Multifamily Housing (Low-Rise)
(220)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	42
Avg. Num. of Dwelling Units:	199
Directional Distribution:	23% entering, 77% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.46	0.18 - 0.74	0.12

Data Plot and Equation



Trip Gen Manual, 10th Ed + Supplement • Institute of Transportation Engineers

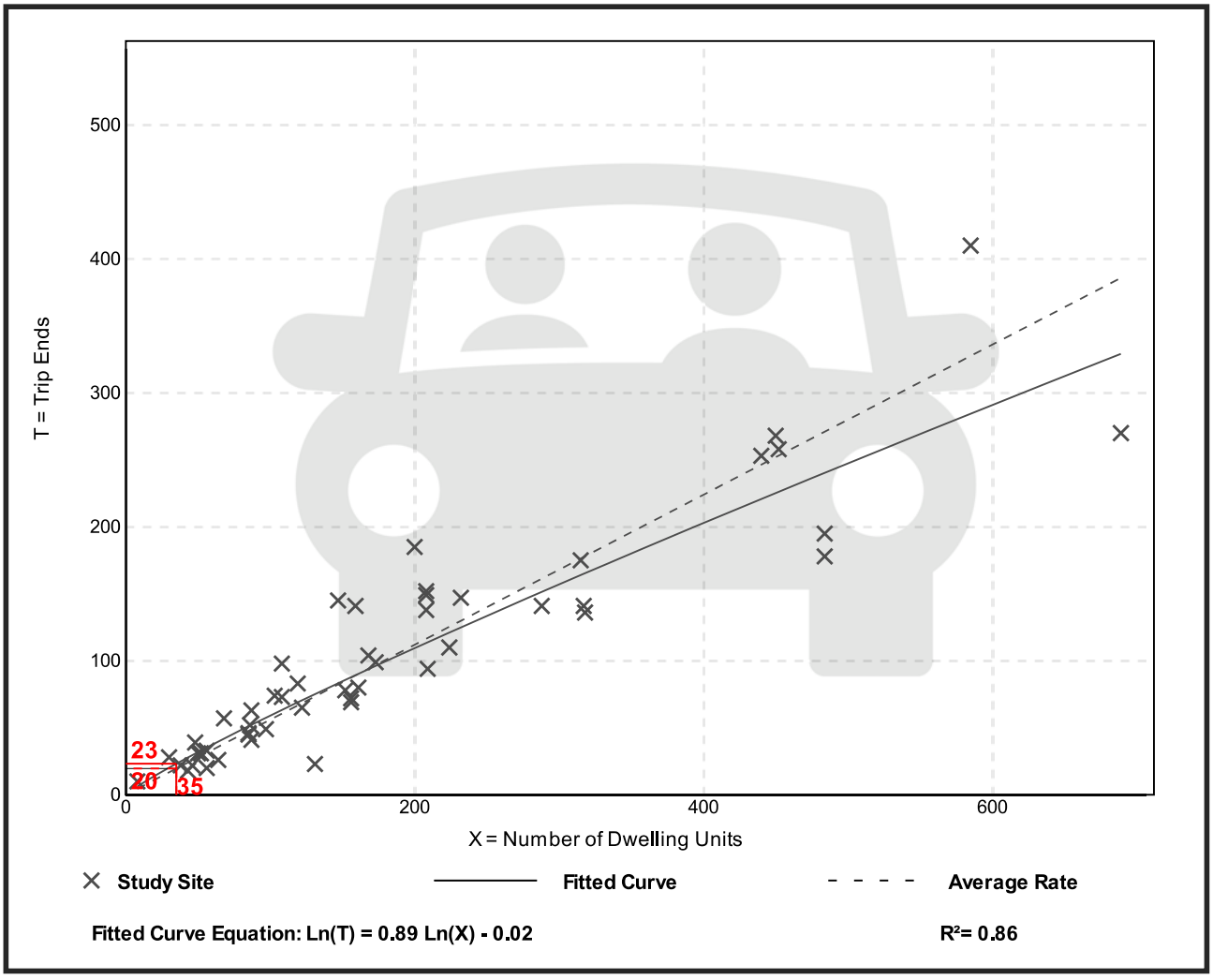
Multifamily Housing (Low-Rise)
(220)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	50
Avg. Num. of Dwelling Units:	187
Directional Distribution:	63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.56	0.18 - 1.25	0.16

Data Plot and Equation



APPENDIX F

Capacity Analyses

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	24	93	20	19	75	25	14	228	33	28	324	34
Future Volume (veh/h)	24	93	20	19	75	25	14	228	33	28	324	34
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1761	1800	1872	1827	1872	1872	1806	1872	1800	1756	1800
Adj Flow Rate, veh/h	26	101	22	21	82	27	15	248	36	30	352	37
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	0	0	0	4	4	4	2	2	2
Cap, veh/h	119	186	38	115	180	55	99	1026	143	117	1016	102
Arrive On Green	0.15	0.15	0.15	0.15	0.15	0.15	0.68	0.68	0.68	0.68	0.68	0.68
Sat Flow, veh/h	205	1212	245	188	1178	358	30	1505	210	55	1491	150
Grp Volume(v), veh/h	149	0	0	130	0	0	299	0	0	419	0	0
Grp Sat Flow(s),veh/h/ln	1662	0	0	1725	0	0	1745	0	0	1696	0	0
Q Serve(g_s), s	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	3.9	0.0	0.0	3.2	0.0	0.0	3.1	0.0	0.0	4.9	0.0	0.0
Prop In Lane	0.17		0.15	0.16		0.21	0.05		0.12	0.07		0.09
Lane Grp Cap(c), veh/h	342	0	0	350	0	0	1268	0	0	1236	0	0
V/C Ratio(X)	0.44	0.00	0.00	0.37	0.00	0.00	0.24	0.00	0.00	0.34	0.00	0.00
Avail Cap(c_a), veh/h	794	0	0	816	0	0	1268	0	0	1236	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	19.0	0.0	0.0	18.7	0.0	0.0	3.0	0.0	0.0	3.2	0.0	0.0
Incr Delay (d2), s/veh	0.9	0.0	0.0	0.7	0.0	0.0	0.4	0.0	0.0	0.7	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.4	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	4.7	0.0	0.0
LnGrp Delay(d),s/veh	19.9	0.0	0.0	19.4	0.0	0.0	3.4	0.0	0.0	4.0	0.0	0.0
LnGrp LOS	B			B			A			A		
Approach Vol, veh/h		149			130			299			419	
Approach Delay, s/veh		19.9			19.4			3.4			4.0	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		37.0		11.4		37.0		11.4
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0
Max Green Setting (Gmax), s		32.0		20.0		32.0		20.0
Max Q Clear Time (g_c+I1), s		5.1		5.9		6.9		5.2
Green Ext Time (p_c), s		2.0		0.6		2.9		0.6

Intersection Summary	
HCM 2010 Ctrl Delay	8.2
HCM 2010 LOS	A

Intersection	
Intersection Delay, s/veh	9.4
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	46	60	6	32	84	30	5	72	13	44	76	40
Future Vol, veh/h	46	60	6	32	84	30	5	72	13	44	76	40
Peak Hour Factor	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Heavy Vehicles, %	2	7	0	6	1	3	0	3	0	5	0	0
Mvmt Flow	58	76	8	41	106	38	6	91	16	56	96	51
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	9.3	9.6	8.9	9.7
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	41%	22%	28%
Vol Thru, %	80%	54%	58%	48%
Vol Right, %	14%	5%	21%	25%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	90	112	146	160
LT Vol	5	46	32	44
Through Vol	72	60	84	76
RT Vol	13	6	30	40
Lane Flow Rate	114	142	185	203
Geometry Grp	1	1	1	1
Degree of Util (X)	0.155	0.196	0.25	0.272
Departure Headway (Hd)	4.886	4.988	4.873	4.833
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	728	715	732	737
Service Time	2.956	3.058	2.938	2.897
HCM Lane V/C Ratio	0.157	0.199	0.253	0.275
HCM Control Delay	8.9	9.3	9.6	9.7
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.5	0.7	1	1.1

Intersection	
Intersection Delay, s/veh	8.8
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	158	1	3	144	0	3	0	2	1	0	0
Future Vol, veh/h	0	158	1	3	144	0	3	0	2	1	0	0
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Heavy Vehicles, %	0	1	0	33	3	0	33	0	0	0	0	0
Mvmt Flow	0	208	1	4	189	0	4	0	3	1	0	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.4	9.2	8.3	8
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	60%	0%	2%	100%
Vol Thru, %	0%	99%	98%	0%
Vol Right, %	40%	1%	0%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	5	159	147	1
LT Vol	3	0	3	1
Through Vol	0	158	144	0
RT Vol	2	1	0	0
Lane Flow Rate	7	209	193	1
Geometry Grp	1	1	1	1
Degree of Util (X)	0.01	0.237	0.249	0.002
Departure Headway (Hd)	5.259	4.071	4.635	5.023
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	685	872	772	717
Service Time	3.259	2.145	2.688	3.024
HCM Lane V/C Ratio	0.01	0.24	0.25	0.001
HCM Control Delay	8.3	8.4	9.2	8
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0	0.9	1	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	44	147	22	36	138	41	23	271	43	32	342	36
Future Volume (veh/h)	44	147	22	36	138	41	23	271	43	32	342	36
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1779	1800	1872	1872	1872	1872	1838	1872	1800	1770	1800
Adj Flow Rate, veh/h	46	153	23	38	144	43	24	282	45	33	356	38
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	1	1	1	0	0	0	2	2	2	2	2	2
Cap, veh/h	135	246	34	123	240	66	108	960	146	117	963	98
Arrive On Green	0.20	0.20	0.20	0.20	0.20	0.20	0.65	0.65	0.65	0.65	0.65	0.65
Sat Flow, veh/h	253	1257	175	207	1227	339	51	1482	225	63	1487	151
Grp Volume(v), veh/h	222	0	0	225	0	0	351	0	0	427	0	0
Grp Sat Flow(s),veh/h/ln	1685	0	0	1773	0	0	1758	0	0	1701	0	0
Q Serve(g_s), s	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	6.0	0.0	0.0	5.7	0.0	0.0	4.4	0.0	0.0	5.8	0.0	0.0
Prop In Lane	0.21		0.10	0.17		0.19	0.07		0.13	0.08		0.09
Lane Grp Cap(c), veh/h	414	0	0	429	0	0	1214	0	0	1178	0	0
V/C Ratio(X)	0.54	0.00	0.00	0.52	0.00	0.00	0.29	0.00	0.00	0.36	0.00	0.00
Avail Cap(c_a), veh/h	759	0	0	794	0	0	1214	0	0	1178	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	18.9	0.0	0.0	18.8	0.0	0.0	3.9	0.0	0.0	4.2	0.0	0.0
Incr Delay (d2), s/veh	1.1	0.0	0.0	1.0	0.0	0.0	0.6	0.0	0.0	0.9	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.0	0.0	0.0	3.0	0.0	0.0	2.3	0.0	0.0	3.0	0.0	0.0
LnGrp Delay(d),s/veh	20.0	0.0	0.0	19.8	0.0	0.0	4.5	0.0	0.0	5.1	0.0	0.0
LnGrp LOS	B			B			A			A		
Approach Vol, veh/h		222			225			351			427	
Approach Delay, s/veh		20.0			19.8			4.5			5.1	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		37.0		13.9		37.0		13.9
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0
Max Green Setting (Gmax), s		32.0		20.0		32.0		20.0
Max Q Clear Time (g_c+I1), s		6.4		8.0		7.8		7.7
Green Ext Time (p_c), s		2.4		1.0		3.0		1.0

Intersection Summary	
HCM 2010 Ctrl Delay	10.3
HCM 2010 LOS	B

Intersection	
Intersection Delay, s/veh	10.7
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	56	105	7	21	142	36	18	94	59	45	72	129
Future Vol, veh/h	56	105	7	21	142	36	18	94	59	45	72	129
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles, %	4	0	0	5	1	0	6	1	2	0	1	0
Mvmt Flow	60	112	7	22	151	38	19	100	63	48	77	137
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	10.6	10.9	10.3	10.9
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	11%	33%	11%	18%
Vol Thru, %	55%	62%	71%	29%
Vol Right, %	35%	4%	18%	52%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	171	168	199	246
LT Vol	18	56	21	45
Through Vol	94	105	142	72
RT Vol	59	7	36	129
Lane Flow Rate	182	179	212	262
Geometry Grp	1	1	1	1
Degree of Util (X)	0.268	0.274	0.315	0.363
Departure Headway (Hd)	5.295	5.518	5.357	4.99
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	677	651	671	720
Service Time	3.335	3.559	3.396	3.027
HCM Lane V/C Ratio	0.269	0.275	0.316	0.364
HCM Control Delay	10.3	10.6	10.9	10.9
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	1.1	1.1	1.3	1.7

Intersection	
Intersection Delay, s/veh	8.7
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	243	1	2	186	1	0	0	3	0	0	1
Future Vol, veh/h	1	243	1	2	186	1	0	0	3	0	0	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	0	0	0	0	2	0	0	0	0	0	0	0
Mvmt Flow	1	264	1	2	202	1	0	0	3	0	0	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.9	8.4	7.3	7.3
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	0%	1%	0%
Vol Thru, %	0%	99%	98%	0%
Vol Right, %	100%	0%	1%	100%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	3	245	189	1
LT Vol	0	1	2	0
Through Vol	0	243	186	0
RT Vol	3	1	1	1
Lane Flow Rate	3	266	205	1
Geometry Grp	1	1	1	1
Degree of Util (X)	0.004	0.3	0.234	0.001
Departure Headway (Hd)	4.294	4.059	4.104	4.297
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	838	881	869	838
Service Time	2.294	2.103	2.159	2.297
HCM Lane V/C Ratio	0.004	0.302	0.236	0.001
HCM Control Delay	7.3	8.9	8.4	7.3
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0	1.3	0.9	0

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	5	2	150	165	0
Future Vol, veh/h	2	5	2	150	165	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	79	79	79	79	79	79
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	3	6	3	190	209	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	405	209	209	0	-	0
Stage 1	209	-	-	-	-	-
Stage 2	196	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.3	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3	3.1	3	-	-	-
Pot Cap-1 Maneuver	688	885	1019	-	-	-
Stage 1	956	-	-	-	-	-
Stage 2	969	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	686	885	1019	-	-	-
Mov Cap-2 Maneuver	686	-	-	-	-	-
Stage 1	953	-	-	-	-	-
Stage 2	969	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.5	0.1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1019	-	817	-	-
HCM Lane V/C Ratio	0.002	-	0.011	-	-
HCM Control Delay (s)	8.5	0	9.5	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	24	97	20	19	76	25	14	228	33	28	324	34
Future Volume (veh/h)	24	97	20	19	76	25	14	228	33	28	324	34
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1762	1800	1872	1827	1872	1872	1806	1872	1800	1756	1800
Adj Flow Rate, veh/h	26	105	22	21	83	27	15	248	36	30	352	37
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	0	0	0	4	4	4	2	2	2
Cap, veh/h	118	191	37	115	184	55	98	1023	143	117	1013	102
Arrive On Green	0.16	0.16	0.16	0.16	0.16	0.16	0.68	0.68	0.68	0.68	0.68	0.68
Sat Flow, veh/h	198	1227	239	185	1185	356	30	1505	210	55	1491	150
Grp Volume(v), veh/h	153	0	0	131	0	0	299	0	0	419	0	0
Grp Sat Flow(s),veh/h/ln	1665	0	0	1725	0	0	1745	0	0	1696	0	0
Q Serve(g_s), s	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	4.0	0.0	0.0	3.3	0.0	0.0	3.2	0.0	0.0	5.0	0.0	0.0
Prop In Lane	0.17		0.14	0.16		0.21	0.05		0.12	0.07		0.09
Lane Grp Cap(c), veh/h	346	0	0	355	0	0	1264	0	0	1232	0	0
V/C Ratio(X)	0.44	0.00	0.00	0.37	0.00	0.00	0.24	0.00	0.00	0.34	0.00	0.00
Avail Cap(c_a), veh/h	793	0	0	814	0	0	1264	0	0	1232	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	19.0	0.0	0.0	18.7	0.0	0.0	3.0	0.0	0.0	3.3	0.0	0.0
Incr Delay (d2), s/veh	0.9	0.0	0.0	0.6	0.0	0.0	0.4	0.0	0.0	0.8	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.5	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	4.7	0.0	0.0
LnGrp Delay(d),s/veh	19.9	0.0	0.0	19.3	0.0	0.0	3.4	0.0	0.0	4.0	0.0	0.0
LnGrp LOS	B			B			A			A		
Approach Vol, veh/h		153			131			299			419	
Approach Delay, s/veh		19.9			19.3			3.4			4.0	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		37.0		11.6		37.0		11.6
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0
Max Green Setting (Gmax), s		32.0		20.0		32.0		20.0
Max Q Clear Time (g_c+I1), s		5.2		6.0		7.0		5.3
Green Ext Time (p_c), s		2.0		0.7		2.9		0.6

Intersection Summary	
HCM 2010 Ctrl Delay	8.3
HCM 2010 LOS	A

Intersection	
Intersection Delay, s/veh	9.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	47	60	6	32	84	31	5	72	13	48	78	44
Future Vol, veh/h	47	60	6	32	84	31	5	72	13	48	78	44
Peak Hour Factor	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Heavy Vehicles, %	2	7	0	6	1	3	0	3	0	5	0	0
Mvmt Flow	59	76	8	41	106	39	6	91	16	61	99	56
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	9.4	9.7	8.9	9.9
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	42%	22%	28%
Vol Thru, %	80%	53%	57%	46%
Vol Right, %	14%	5%	21%	26%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	90	113	147	170
LT Vol	5	47	32	48
Through Vol	72	60	84	78
RT Vol	13	6	31	44
Lane Flow Rate	114	143	186	215
Geometry Grp	1	1	1	1
Degree of Util (X)	0.156	0.2	0.254	0.289
Departure Headway (Hd)	4.914	5.027	4.906	4.842
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	723	708	726	736
Service Time	2.99	3.099	2.974	2.909
HCM Lane V/C Ratio	0.158	0.202	0.256	0.292
HCM Control Delay	8.9	9.4	9.7	9.9
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.6	0.7	1	1.2

Intersection	
Intersection Delay, s/veh	8.8
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	159	1	3	148	0	3	0	2	1	0	0
Future Vol, veh/h	0	159	1	3	148	0	3	0	2	1	0	0
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Heavy Vehicles, %	0	1	0	33	3	0	33	0	0	0	0	0
Mvmt Flow	0	209	1	4	195	0	4	0	3	1	0	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.4	9.3	8.3	8
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	60%	0%	2%	100%
Vol Thru, %	0%	99%	98%	0%
Vol Right, %	40%	1%	0%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	5	160	151	1
LT Vol	3	0	3	1
Through Vol	0	159	148	0
RT Vol	2	1	0	0
Lane Flow Rate	7	211	199	1
Geometry Grp	1	1	1	1
Degree of Util (X)	0.01	0.238	0.256	0.002
Departure Headway (Hd)	5.273	4.075	4.636	5.038
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	683	869	771	714
Service Time	3.273	2.151	2.689	3.039
HCM Lane V/C Ratio	0.01	0.243	0.258	0.001
HCM Control Delay	8.3	8.4	9.3	8
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0	0.9	1	0

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	5	1	149	160	1
Future Vol, veh/h	2	5	1	149	160	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	79	79	79	79	79	79
Heavy Vehicles, %	0	0	0	3	3	0
Mvmt Flow	3	6	1	189	203	1

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	395	204	204	0	-	0
Stage 1	204	-	-	-	-	-
Stage 2	191	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.3	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3	3.1	3	-	-	-
Pot Cap-1 Maneuver	698	891	1023	-	-	-
Stage 1	961	-	-	-	-	-
Stage 2	975	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	697	891	1023	-	-	-
Mov Cap-2 Maneuver	697	-	-	-	-	-
Stage 1	960	-	-	-	-	-
Stage 2	975	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.4	0.1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1023	-	825	-	-
HCM Lane V/C Ratio	0.001	-	0.011	-	-
HCM Control Delay (s)	8.5	0	9.4	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	1	3	5	194	249	2
Future Vol, veh/h	1	3	5	194	249	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	1	3	6	216	277	2

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	506	278	279	0	-	0
Stage 1	278	-	-	-	-	-
Stage 2	228	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.3	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3	3.1	3	-	-	-
Pot Cap-1 Maneuver	598	809	964	-	-	-
Stage 1	886	-	-	-	-	-
Stage 2	936	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	594	809	964	-	-	-
Mov Cap-2 Maneuver	594	-	-	-	-	-
Stage 1	880	-	-	-	-	-
Stage 2	936	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.9	0.2	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	964	-	742	-	-
HCM Lane V/C Ratio	0.006	-	0.006	-	-
HCM Control Delay (s)	8.8	0	9.9	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	44	150	22	36	142	41	23	271	43	32	342	36
Future Volume (veh/h)	44	150	22	36	142	41	23	271	43	32	342	36
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1779	1800	1872	1872	1872	1872	1838	1872	1800	1770	1800
Adj Flow Rate, veh/h	46	156	23	38	148	43	24	282	45	33	356	38
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	1	1	1	0	0	0	2	2	2	2	2	2
Cap, veh/h	134	249	34	122	244	66	108	958	146	117	961	98
Arrive On Green	0.20	0.20	0.20	0.20	0.20	0.20	0.65	0.65	0.65	0.65	0.65	0.65
Sat Flow, veh/h	249	1265	172	203	1238	333	51	1482	225	63	1486	151
Grp Volume(v), veh/h	225	0	0	229	0	0	351	0	0	427	0	0
Grp Sat Flow(s),veh/h/ln	1686	0	0	1775	0	0	1758	0	0	1701	0	0
Q Serve(g_s), s	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	6.1	0.0	0.0	5.9	0.0	0.0	4.4	0.0	0.0	5.9	0.0	0.0
Prop In Lane	0.20		0.10	0.17		0.19	0.07		0.13	0.08		0.09
Lane Grp Cap(c), veh/h	417	0	0	432	0	0	1212	0	0	1175	0	0
V/C Ratio(X)	0.54	0.00	0.00	0.53	0.00	0.00	0.29	0.00	0.00	0.36	0.00	0.00
Avail Cap(c_a), veh/h	758	0	0	793	0	0	1212	0	0	1175	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	18.9	0.0	0.0	18.8	0.0	0.0	4.0	0.0	0.0	4.2	0.0	0.0
Incr Delay (d2), s/veh	1.1	0.0	0.0	1.0	0.0	0.0	0.6	0.0	0.0	0.9	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.0	0.0	0.0	3.0	0.0	0.0	2.3	0.0	0.0	3.0	0.0	0.0
LnGrp Delay(d),s/veh	20.0	0.0	0.0	19.8	0.0	0.0	4.6	0.0	0.0	5.1	0.0	0.0
LnGrp LOS	B			B			A			A		
Approach Vol, veh/h		225			229			351			427	
Approach Delay, s/veh		20.0			19.8			4.6			5.1	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		37.0		14.1		37.0		14.1
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0
Max Green Setting (Gmax), s		32.0		20.0		32.0		20.0
Max Q Clear Time (g_c+I1), s		6.4		8.1		7.9		7.9
Green Ext Time (p_c), s		2.4		1.0		3.0		1.0

Intersection Summary	
HCM 2010 Ctrl Delay	10.4
HCM 2010 LOS	B

Intersection	
Intersection Delay, s/veh	10.9
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	60	105	7	21	142	40	18	96	59	48	73	131
Future Vol, veh/h	60	105	7	21	142	40	18	96	59	48	73	131
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles, %	4	0	0	5	1	0	6	1	2	0	1	0
Mvmt Flow	64	112	7	22	151	43	19	102	63	51	78	139
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	10.8	11	10.4	11.1
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	10%	35%	10%	19%
Vol Thru, %	55%	61%	70%	29%
Vol Right, %	34%	4%	20%	52%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	173	172	203	252
LT Vol	18	60	21	48
Through Vol	96	105	142	73
RT Vol	59	7	40	131
Lane Flow Rate	184	183	216	268
Geometry Grp	1	1	1	1
Degree of Util (X)	0.273	0.283	0.323	0.375
Departure Headway (Hd)	5.345	5.565	5.39	5.033
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	672	644	665	713
Service Time	3.386	3.606	3.43	3.071
HCM Lane V/C Ratio	0.274	0.284	0.325	0.376
HCM Control Delay	10.4	10.8	11	11.1
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	1.1	1.2	1.4	1.7

Intersection	
Intersection Delay, s/veh	8.7
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	247	1	2	189	1	0	0	3	0	0	1
Future Vol, veh/h	1	247	1	2	189	1	0	0	3	0	0	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	0	0	0	0	2	0	0	0	0	0	0	0
Mvmt Flow	1	268	1	2	205	1	0	0	3	0	0	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.9	8.5	7.3	7.3
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	0%	1%	0%
Vol Thru, %	0%	99%	98%	0%
Vol Right, %	100%	0%	1%	100%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	3	249	192	1
LT Vol	0	1	2	0
Through Vol	0	247	189	0
RT Vol	3	1	1	1
Lane Flow Rate	3	271	209	1
Geometry Grp	1	1	1	1
Degree of Util (X)	0.004	0.305	0.238	0.001
Departure Headway (Hd)	4.31	4.061	4.108	4.313
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	835	880	868	835
Service Time	2.31	2.107	2.163	2.313
HCM Lane V/C Ratio	0.004	0.308	0.241	0.001
HCM Control Delay	7.3	8.9	8.5	7.3
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0	1.3	0.9	0

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	3	5	190	248	3
Future Vol, veh/h	2	3	5	190	248	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	2	3	0
Mvmt Flow	2	3	6	211	276	3

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	501	278	279	0	-	0
Stage 1	278	-	-	-	-	-
Stage 2	223	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.3	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3	3.1	3	-	-	-
Pot Cap-1 Maneuver	602	809	964	-	-	-
Stage 1	886	-	-	-	-	-
Stage 2	941	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	598	809	964	-	-	-
Mov Cap-2 Maneuver	598	-	-	-	-	-
Stage 1	880	-	-	-	-	-
Stage 2	941	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.1	0.2	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	964	-	709	-	-
HCM Lane V/C Ratio	0.006	-	0.008	-	-
HCM Control Delay (s)	8.8	0	10.1	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

APPENDIX G

Auxiliary Turn Lane Warrants

Turn Lane Warrant and Length Analysis Workbook

STUDY LOCATION AND ANALYSIS INFORMATION

Municipality:	Radnor	**Analysis Date:**	4/15/2020
County:	Delaware County	**Conducted By:**	FT
PennDOT Engineering District:	6	**Checked By:**	NB Approach
		Agency/Company Name:	FTA

Intersection & Approach Description: Strafford Ave & Site Driveway (assumes combined volumes into one hypothetical driveway)

Analysis Period:	2024	**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:	Level	**Left or Right-Turn Lane Analysis?:**	Left Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	10	0.0%	10
	Through	-	194	5.0%	199
	Right	No	0	0.0%	N/A
Opposing	Left	No	0	0.0%	N/A
	Through	-	249	5.0%	256
	Right	Yes	4	0.0%	4

Advancing Volume:	209
Opposing Volume:	260
Left Turn Volume:	10
% Left Turns in Advancing Volume:	4.78%

Right Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	No	0	0.0%	N/A
	Through	-	0	0.0%	N/A
	Right	-	0	0.0%	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:	10
Cycles Per Hour (Assumed):	60
Cycles Per Hour (If Known):	

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:

hypothetical analysis of combined volumes is maximal conservative approach

Turn Lane Warrant and Length Analysis Workbook

STUDY LOCATION AND ANALYSIS INFORMATION

Municipality:	Radnor	**Analysis Date:**	4/15/2020
County:	Delaware County	**Conducted By:**	FT
PennDOT Engineering District:	6	**Checked By:**	SB Approach
		Agency/Company Name:	FTA

Intersection & Approach Description: Strafford Ave & Site Driveway

Analysis Period:	2024	**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:	Level	**Left or Right-Turn Lane Analysis?:**	Right Turn Lane

VOLUME CALCULATIONS

Left Turn Lane Volume Calculations

Movement		Include?	Volume	% Trucks	PCEV
Advancing	Left	Yes	0	0.0%	N/A
	Through	-	0	0.0%	N/A
	Right	No	0	0.0%	N/A
Opposing	Left	No	0	0.0%	N/A
	Through	-	0	0.0%	N/A
	Right	Yes	0	0.0%	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	0	0.0%	N/A
	Through	-	249	5.0%	256
	Right	-	4	0.0%	4

Advancing Volume:	260
Right Turn Volume:	4

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:	4
Cycles Per Hour (Assumed):	60
Cycles Per Hour (If Known):	

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: