Transportation Impact Study

Upper Dublin Township, Montgomery County, PA

PROPOSED TD BANK

Prepared for

TD Bank, N.A.

Prepared by

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

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McMahon Project No. 813478.11

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Executive Summary

TD Bank, N.A., proposes to develop a 2,939 s.f. bank with 2 drive-thru lanes, to be located on the northeast quadrant of the intersection of Bethlehem Pike (S.R. 2015) and Pennsylvania Avenue (S.R. 2037) in Upper Dublin Township, Montgomery County, Pennsylvania. The site is currently occupied by an existing restaurant (Toner's Beef & Ale Tavern), which is still in operation. The proposed plan is to demolish the existing tavern and construct the new TD Bank with drive-thru lanes. Access to the site is currently provided via three (3) unsignalized driveways; one along Bethlehem Pike (S.R. 2018), one along Pennsylvania Ave (S.R. 2037), and one along Fort Washington Ave (S.R. 2022). The existing access driveways along Bethlehem Pike (S.R. 2018) and Fort Washington Ave (S.R. 2022) will remain as part of the new development, while the access driveway located along Pennsylvania Ave (S.R. 2037) will be eliminated as part of the TD Bank development.

It should be noted that our office had correspondence with PennDOT District 6-0 Permits Unit prior to the commencement of the traffic study preparation, and have incorporated suggestions on the scope of study received via an email from Fran Hanney dated July 3, 2013. Additionally, the traffic study analysis and recommendations also incorporates items outlined in a memorandum received from Metz Engineers, Township Engineer, dated July 23, 2013, which summarizes a telephone conversation between Metz Engineers offices and Fran Hanney at PennDOT.

The scope of this study includes an evaluation of the existing 2013 weekday morning, weekday afternoon, and Saturday midday peak hours, as well as the future 2014 build-out year, both without and with the TD Bank development at the following study intersections:

- Bethlehem Pike (S.R. 2018) and Existing Toner's Tavern/Proposed Access
- Bethlehem Pike (S.R. 2018) and Pennsylvania Ave (S.R. 2037)/ Hollywood Road
- Pennsylvania Ave (S.R. 2037) and Existing Toner's Tavern
- Pennsylvania Ave (S.R. 2037) and Fort Washington Ave (S.R. 2022)/Mercedes Benz Driveway
- Fort Washington Ave (S.R. 2022) and Existing Toner's Tavern/Proposed Access

The trip generation for the proposed development is based on data contained in the Institute of Transportation Engineers (ITE) publication, ITE Trip Generation, 9th Edition for Drive-in Bank (ITE LU Code 912). Accordingly, the proposed development will result in approximately 36 "new" total trips (inbound and outbound) during the weekday morning peak hour, 32 "new" total trips (inbound and outbound) during the weekday afternoon peak hour, and 49 "new" total trips (inbound and outbound) during the Saturday midday peak hour. It should be noted, the trip generation of the existing restaurant on site was minimal based on the traffic counts conducted. Additionally, since the existing restaurant land use on site could potentially generate 22 "new" trips during the weekday afternoon peak hour, and 39 "new" trips on Saturday, the difference in potential "new" trips could have been studied. However, to provide a conservative evaluation of future conditions, no credit was taken for existing trips to/from the site, and the traffic illustrated and analyzed for the access driveways and adjacent roadways reflect the total "new" trips generated by the new development.

The evaluation of traffic conditions associated with the proposed TD Bank development reveals the following findings and conclusions.

Site Accesses

The existing access locations and permitted turning movements at the site access driveways along Bethlehem Pike (S.R. 2018) and Fort Washington Ave (S.R. 2022) will remain. The existing access driveway along Pennsylvania Ave (S.R. 2037) will be eliminated. Based on the analysis conducted, the access driveways will operate at acceptable levels of service during peak hour conditions. No modifications to the current configuration of the driveways, including the provision of auxiliary turn lanes are warranted or required. Additionally, based on a gap study performed by our office, adequate vehicle gaps are available along Bethlehem Pike (S.R. 2018) for vehicles exiting the site driveway at this location.

Study Area Intersections - Recommended Modifications

- Pennsylvania Ave (S.R. 2037) and Fort Washington Ave (S.R. 2022)/Mercedes Benz Driveway - Minor traffic signal timing modifications are recommended during the weekday morning peak only, to help optimize the intersection operations and mitigate the delay associated with the additional traffic from the development. ADA curb ramps/crossings were installed with the addition of the Mercedes Benz Driveway in 2011.

- Bethlehem Pike (S.R. 2018) and Pennsylvania Ave (S.R. 2037)/ Hollywood Road - Minor traffic signal timing modifications are recommended during the weekday morning peak only, to help optimize the intersection operations and mitigate the delay associated with the additional traffic from the development. Additionally, upgrades to the pedestrian facilities at the intersection, including ADA compliant curb ramps/crossings at the existing crossing locations, and any required upgrades to the pedestrian signals (i.e., count-down timers, etc.) should also be provided.

  Additionally, as part of the upgrades to the pedestrian facilities at the intersection, it is recommended to increase the existing curb radius (approximately 10 feet) along the northeast corner of the intersection (site side) to provide better flow for vehicles turning right. The curb radius should be maximized, but should not interfere or require relocation of the existing signal mast arm or utility pole on the corner, and should also not require relocation of the existing stop bar along Pennsylvania Avenue, as too maximize available vehicle storage on the approach.

- The peak hour traffic analysis results indicate that future with development traffic conditions, as well as maximum vehicle queues will be the same, or better, than future without development conditions with implementation of the signal timing modifications as suggested. Therefore, it is our conclusion that roadway widening improvements, to provide additional lanes of traffic at the study area intersections, are not required as a result of this site redevelopment.

The traffic analyses contained herein reveal that safe and efficient access to and from the proposed development can be provided with minor signal timing modifications, and furthermore, site-generated traffic can be accommodated at the study area intersections.

Introduction

TD Bank, N.A. proposes to develop a 2,939 s.f. bank with 2 drive-thru lanes, to be located on the northeast quadrant of the intersection of Bethlehem Pike (S.R. 2015) and Pennsylvania Avenue (S.R. 2037) in Upper Dublin Township, Montgomery County, PA (**Figure 1**). Access to the site is proposed to be provided via two existing full-movement driveways, one along Bethlehem Pike (S.R. 2018) and the other along Fort Washington Ave (S.R. 2022). The sketch plan, prepared by Bohler Engineering, is provided in **Figure 2**.

The purpose of this Transportation Impact Study is to present an evaluation of the incremental traffic impacts of the proposed development within the study area in Upper Dublin Township.

It should be noted that our office had correspondence with PennDOT District 6-0 Permits Unit prior to the commencement of the traffic study preparation, and have incorporated suggestions on the scope of study received via an email from Fran Hanney dated July 3, 2013. Additionally, the traffic study analysis and recommendations also incorporates items outlined in a memorandum received from Metz Engineers, Township Engineer, dated July 23, 2013, which summarizes a telephone conversation between Metz Engineers offices and Fran Hanney at PennDOT. The correspondence with PennDOT is contained in **Appendix A**.

Manual turning movement traffic counts were completed at five study intersections in July 2013 during the weekday morning peak period (8:00 AM to 10:00 AM), the weekday afternoon peak period (4:00 PM to 6:00 PM), and the Saturday midday peak period (11:00AM to 1:00 PM). The peak hours coincide with both commuter peak hours and TD Bank operating hours. In order to assess the existing traffic conditions, these existing traffic volumes were subjected to detailed capacity/level-of-service and queuing analysis, in accordance with accepted methodologies, for the highest peak hour during each peak period, which serves as the basis for this evaluation.

Next, future traffic volumes without the proposed bank development were projected utilizing an annual traffic growth rate to account for regional traffic growth. The future traffic volumes were projected to the future 2014 build-out year at each of the study intersections. The future traffic volumes without the proposed development were then subjected to detailed capacity/level-of-service and queuing analysis.

Finally, the traffic generated by the proposed bank development was established based on data compiled by the Institute of Transportation Engineers, and assigned to the roadway network and site accesses. The site-generated traffic volumes were then added to future without-development traffic volumes, and subjected to detailed capacity/level-of-service and queuing analysis to assess the future traffic conditions with the development.

Existing Transportation Setting & Conditions

The proposed TD Bank will be located on the northeast quadrant of the intersection of Bethlehem Pike (S.R. 2018) and Pennsylvania Ave (S.R. 2037) in Upper Dublin Township, Montgomery County, PA **(Figure 1)**. The existing roadways and intersections in the vicinity of the site, which comprise the study area roadway network, are described in this section.

Roadway Characteristics

The main roadways surrounding the proposed bank development are summarized in **Table 1**. Based upon the daily volume of traffic utilizing each roadway, as well as the typical cross-section and posted speed limits, an additional classification has been completed for each roadway based upon the guidelines provided in *Smart Transportation Guidebook (Table 5.1).*

Table 1 - Existing Roadway Characteristics

Roadway	Average Daily Traffic Volumes (vehicles per day)	Roadway Classification		Travel Lanes (per direction)	Speed Limit (mph)
		Smart Transportation[1]	PennDOT/County/Township[2]		
Bethlehem Pike (S.R. 2018)	16,202[3]	Community Arterial	Urban Minor Arterial	1	35-40
Pennsylvania Ave (S.R. 2037)	21,050[3]	Community Arterial	Urban Minor Arterial	2	35
Fort Washington Ave (S.R. 2022)	3,987[3]	Neighborhood Collector	Urban Minor Arterial	1	35
Hollywood Road	NA	Local Road/Street	Local	1	25

1 – Based on Table 5.1 – Roadway Categories in the PennDOT publication, *Smart Transportation Guidebook*.
2 – Based on the roadway classifications provided on PennDOT's Internet Traffic Monitoring System (iTMS) website.
3 – Based on average daily traffic volume provided on PennDOT's Internet Traffic Monitoring System (iTMS) website.

The following key intersections in the vicinity of the site comprise the study area:

- Bethlehem Pike (S.R. 2018) and Existing Toner's Tavern/Proposed Access
- Bethlehem Pike (S.R. 2018) and Pennsylvania Ave (S.R. 2037)/ Hollywood Road
- Pennsylvania Ave (S.R. 2037) and Existing Toner's Tavern
- Pennsylvania Ave (S.R. 2037) and Fort Washington Ave (S.R. 2022)/Mercedes Benz Driveway
- Fort Washington Ave (S.R. 2022) and Existing Toner's Tavern/Proposed Access

The existing characteristics of the study intersections, including the existing traffic signal permit plans, field sketches, and photographs, are summarized in **Appendix B**.

Traffic Count Data

Daily traffic counts were obtained from PennDOT's Internet Traffic Monitoring System (iTMS) website for Bethlehem Pike (S.R. 2018), Pennsylvania Ave (S.R. 2037), and Fort Washington Ave (S.R. 2022). The PennDOT iTMS traffic count data is provided in **Appendix C**.

Manual turning movement traffic counts were conducted at five study intersections in July 2013 during the weekday morning peak period (8:00 AM to 10:00 AM), the weekday afternoon peak period (4:00 PM to 6:00 PM), and Saturday midday peak period (11:00 AM to 1:00 PM). The peak hours coincide with both commuter peak hours and TD Bank operating hours. The results of these traffic counts are tabulated by 15-minute intervals in **Appendix D**. The four highest consecutive 15-minute peak intervals during these traffic count periods constitute the peak hours that are the basis of this traffic analysis.

The resultant peak hour traffic volumes are depicted in **Figure 3A** for the weekday morning, weekday afternoon, and Saturday midday peak hours.

Capacity/Level-of-Service Analysis

The peak hour traffic volumes were analyzed to determine the existing operating conditions and future operating conditions, both without- and with-development of the proposed bank development, in accordance with the standard techniques contained in the current *Highway Capacity Manual (2010)*. These standard capacity/level-of-service analysis techniques, which calculate total control delay, are more thoroughly described in **Appendix E** for both signalized and unsignalized intersections, as well as the correlation between average total control delay and the respective level-of-service (LOS) criteria for each intersection type. It should be noted, HCM 2010 methodology does not support clustered intersections; therefore percentile level-of-service results were used. The results of the capacity/level-of-service analyses are illustrated in **Figure 3B** for the existing peak hour traffic conditions, and the detailed capacity/level-of-service analysis worksheets are contained in **Appendix F**. Specific details regarding the analysis results and traffic operations are provided later in this report.

Site Characteristics

This section presents the details regarding the proposed site, including the incremental increase in traffic volumes generated by the development during the peak hours and the distribution of this site traffic to the study area roadways, as well as the proposed site access configuration, and traffic controls.

Trip Generation

Traffic volumes generated by the proposed development were prepared based on trip generation data compiled from numerous studies contained in the Institute of Transportation Engineers (ITE) publication, *Trip Generation, 9th Edition*. **Table 2** presents a comparison of the anticipated vehicular trip generation for the proposed bank development and the potential trip generation for the existing restaurant land use.

Table 2 - Vehicular Trip Generation

Land Use	Size (s.f.)	Daily	Weekday Morning Peak Hour			Weekday Afternoon Peak Hour			Saturday Midday Peak Hour		
			In	Out	In	In	Out	Total	In	Out	Total
Proposed Bank with 2 Drive-thru lanes[1]	2,939	435	21	15	36	35	35	70	39	38	77
Pass-By Trips[2]			-0	-0	-0	-16	-16	-32	-14	-14	-28
"New" Trips			***21***	***15***	***36***	***19***	***19***	***38***	***25***	***24***	***49***
Existing Restaurant Land Use[3]	4,039		0	0	0	24	16	40	30	27	57
Pass-By Trips[4]			-0	-0	-0	-9	-9	-18	-9	-9	--18
"New" Trips			***0***	***0***	***0***	***15***	***7***	***22***	***21***	***18***	***39***

1 – ITE Land Use Code 912 for Drive-in Bank.
2 – According to ITE's *Trip Generation Handbook*, a pass-rate of 47% was used for the Weekday Afternoon Peak hour. A rate of 37% (10% less than the Afternoon Peak) was used for the Saturday Midday peak hour.
3 – ITE Land Use Code 932 for High-Turnover (Sit-Down) Restaurant.
4 – According to ITE's *Trip Generation Handbook*, a pass-rate of 43% was used for the Weekday Afternoon Peak hour. A rate of 33% (10% less than the Afternoon Peak) was used for the Saturday Midday peak hour.

It should be noted, the trip generation of the existing restaurant on site was minimal based on the traffic counts conducted. Additionally, since the existing restaurant land use on site could potentially generate 22 "new" trips during the weekday afternoon peak hour, and 39 "new" trips on Saturday, the difference in potential "new" trips could have been studied. However, to provide a conservative evaluation of future conditions, no credit was taken for existing trips to/from the site, and the traffic illustrated and analyzed for the access driveways and adjacent roadways reflect the total "new" trips generated by the new development.

Trip Distribution and Assignment

Site-generated traffic will approach and depart the site via different routes depending on factors such as the existing traffic patterns, location of major roadways, and the location of the development's site access. The distribution percentages for the anticipated directions of approach and departure are illustrated in **Figure 4A**, while the application of the percentages in Figure 4A to the trip generation contained above in Table 2 for the weekday morning, weekday afternoon, and Saturday midday peak hours are illustrated in **Figure 4B**. The pass-by trip distribution percentages for the bank for the peak hours are illustrated in **Figure 4C**, while application of the percentages to the pass-by trips shown in Table 2 is illustrated in **Figure 4D**. The net "new" and pass-by trips are shown in **Figure 4E**.

Figure 4F illustrates the potential total net "new" and pass-by trips for the existing restaurant land use for the weekday morning, weekday afternoon peak hours, and Saturday midday peak hours. It should be noted, it was assumed that the existing restaurant would not be open for breakfast.

Site Access Configuration and Traffic Control

Access to the TD Bank is proposed to be provided via existing accesses along Bethlehem Pike (S.R. 2018) and Fort Washington Ave (S.R. 2022). The site access locations as shown on the site plans prepared by Bohler Engineering; last revised April 11, 2013, are as currently existing for the site.

The proposed recommendations for auxiliary turn lanes were based on industry accepted criteria and guidelines. Specifically, the need for left- and right-turn deceleration lanes was based on the current PennDOT guidelines in accordance with *Publication 46, Chapter 11 – Traffic Studies*. The various warrant/guideline analysis worksheets are contained in **Appendix G**.

The existing access locations and turning movements along Bethlehem Pike (S.R. 2018) and Fort Washington Ave (S.R. 2022) will remain. The current access driveway along Pennsylvania Ave (S.R. 2037) will be eliminated as part of this development. Based on the analysis conducted, the access driveways will operate acceptably. No modifications to the current configuration of the driveways, including the provision of auxiliary turn lanes are warranted or required.

Future Build-Out Year Traffic Conditions

This section presents the future build-out year traffic conditions, both without and with the proposed TD Bank development, which is anticipated to be completed by 2014. The future 2014 build-out year without-development traffic volumes were estimated by increasing the existing 2013 traffic volumes to account for regional growth, as described below. The incremental increase due to the anticipated trip generation for the site was then added, resulting in the future 2014 build-out year with-development traffic volumes.

Future 2014 Without-Development Traffic Volumes

To account for regional traffic growth, the existing traffic volumes were increased by an annual traffic growth rate of 0.73 percent for one year. This growth rate is consistent with the traffic growth rate recommended by the PennDOT Bureau of Planning and Research *Growth Factors for September 2012 to July 2013* for similar roadways in Montgomery County.

The total background growth was added to the existing 2013 traffic volumes, and the resultant future 2014 build-out year peak hour traffic volumes are illustrated in **Figure 5A** for the weekday morning, weekday afternoon, and Saturday midday peak hours.

Planned Roadway Improvements

Through discussions with the Township and review of PennDOT's *Twelve Year Transportation Program*, there are no plans to improve any of the study area roadways by the Township, PennDOT, or other area developers that would have a significant effect on the traffic operations.

Future 2014 With-Development Traffic Volumes

The site generated traffic volumes, as shown in Figure 4E, were added to the future 2014 without-development traffic volumes, resulting in the future 2014 with-development peak hour traffic volumes illustrated in **Figure 5B** for the weekday morning, weekday afternoon, and Saturday midday peak hours.

Capacity/Level-of-Service Analysis

The future 2014 peak hour traffic volumes, as illustrated in Figures 5A and 5B, were then subjected to detailed capacity/level-of-service analysis. The results of the traffic analyses are illustrated in **Figures 5C and 5D**, and the detailed capacity/level-of-service analysis worksheets are provided in **Appendices H and I**. Specific details regarding the analysis results and traffic operations are provided later in this report.

Gap Study

A gap study was conducted along Bethlehem Pike (S.R. 2018), in the vicinity of the proposed site access to assure adequate opportunities are available for turning vehicles. The gap study was performed during the same peak periods as the manual turning movement counts. The results of these traffic counts are tabulated by 15-minute intervals in **Appendix J**.

A critical gap is defined as the minimum length of time along the major street (Bethlehem Pike (S.R. 2018)) traffic stream that allows entry for one minor street (site access) vehicle. The value utilized in Synchro 8 for vehicles exiting the proposed site access is 6.4 seconds for left-turning vehicles and 6.2 seconds for right-turning vehicles. **Table 3** presents the average gap available for vehicles exiting the proposed site access along Bethlehem Pike (S.R. 2018) according to the gap study.

Table 3 – Average Gaps Available along Bethlehem Pike (S.R. 2018)

Land Use	Weekday Morning Peak Hour		Weekday Afternoon Peak Hour		Saturday Midday Peak Hour	
	Left-Turn Out	Right-Turn Out	Left-Turn Out	Right-Turn Out	Left-Turn Out	Right-Turn Out
Average Gap (seconds)	8-9	16-17	8-9	10-11	10-11	16-17

The gap study shows that the average gaps available along Bethlehem Pike are greater than the critical value utilized in Synchro; therefore the site access approaches along Bethlehem Pike (S.R. 2018) are expected to operate better than shown in the Synchro analysis results.

Capacity/Level-of-Service and Queuing Analyses

This section presents a detailed summary of the traffic analysis results for the existing and future 2014 traffic conditions, both without and with the proposed TD Bank, for the three peak hours at each of the study intersections and site access intersections.

Bethlehem Pike (S.R. 2018) and Pennsylvania Ave (S.R. 2037)/Hollywood Road

This intersection currently operates with delay (LOS E or F) on the northbound Bethlehem Pike (S.R. 2018) thru movement, the westbound Pennsylvania Ave (S.R. 2037) left-turn movement, and the southbound lanes of Bethlehem Pike (S.R. 2018). With optimized signal timings, this intersection only operates with delay on the northbound thru movement during the weekday afternoon peak hour only. In the future with development conditions, this intersection will continue to operate at acceptable conditions, with no level-of-service drops on any movement.

Pennsylvania Ave (S.R. 2037) and Fort Washington Ave (S.R. 2022)/Mercedes Benz Driveway

This intersection currently operates with overall acceptable levels of service (LOS C or better) with delay (LOS F) on the southbound Fort Washington Ave (S.R. 2022) shared thru/left-turn movement; and will operate with similar LOS in the future without development conditions with optimized signal timings. In the future with the development of the TD Bank, minor signal timing modifications are recommended during the weekday morning peak hour only, to mitigate a level of service drop along the southbound Fort Washington Ave (S.R. 2022) shared thru/left-turn movement.

Site Accesses

The site access intersections located along Bethlehem Pike (S.R. 2018) and Fort Washington Ave (S.R. 2022) will operate at acceptable levels of service (LOS C or better) on all approaches during all peaks with adequate gaps available for vehicles exiting the site.

Queuing Analysis

Queuing analysis was completed utilizing Synchro 8 traffic analysis software to determine the adequacy of the existing storage lengths at the study intersections in the future with the proposed bank.

Based on the results of the queuing analysis as outlined previously, various lane group queues are <u>not</u> accommodated within the existing lane storages at the intersection of Bethlehem Pike (S.R. 2018) and Pennsylvania Ave (S.R. 2037)/ Hollywood Road. Specifically, the westbound Pennsylvania Ave (S.R. 2037) left-turn lane, northbound Bethlehem Pike (S.R. 2018) right-turn lane, and the southbound Bethlehem Pike (S.R. 2018) left-turn lane. However, it should be noted, the vehicle queue lengths greatly improve at the intersection with signal timing optimization, and are not further impacted by the development of the proposed TD Bank. Therefore, the vehicle queues would be greatly improved with implementation of the traffic signal timing adjustments as evaluated in this study.

Analysis Results and Study Recommendations

Site Accesses

The existing access locations and permitted turning movements at the site access driveways along Bethlehem Pike (S.R. 2018) and Fort Washington Ave (S.R. 2022) will remain. The existing access driveway along Pennsylvania Ave (S.R. 2037) will be eliminated. Based on the analysis conducted, the access driveways will operate at acceptable levels of service during peak hour conditions. No modifications to the current configuration of the driveways, including the provision of auxiliary turn lanes are warranted or required. Additionally, based on a gap study performed by our office, adequate vehicle gaps are available along Bethlehem Pike (S.R. 2018) for vehicles exiting the site driveway at this location.

Study Area Intersections - Recommended Modifications

- Pennsylvania Ave (S.R. 2037) and Fort Washington Ave (S.R. 2022)/Mercedes Benz Driveway - Minor traffic signal timing modifications are recommended during the weekday morning peak only, to help optimize the intersection operations and mitigate the delay associated with the additional traffic from the development. ADA curb ramps/crossings were installed with the addition of the Mercedes Benz Driveway in 2011.

- Bethlehem Pike (S.R. 2018) and Pennsylvania Ave (S.R. 2037)/ Hollywood Road - Minor traffic signal timing modifications are recommended during the weekday morning peak only, to help optimize the intersection operations and mitigate the delay associated with the additional traffic from the development. Additionally, upgrades to the pedestrian facilities at the intersection, including ADA compliant curb ramps/crossings at the existing crossing locations, and any required upgrades to the pedestrian signals (i.e., count-down timers, etc.) should also be provided.

  Additionally, as part of the upgrades to the pedestrian facilities at the intersection, it is recommended to increase the existing curb radius (approximately 10 feet) along the northeast corner of the intersection (site side) to provide better flow for vehicles turning right. The curb radius should be maximized, but should not interfere or require relocation of the existing signal mast arm or utility pole on the corner, and should also not require relocation of the existing stop bar along Pennsylvania Avenue, as too maximize available vehicle storage on the approach.

- The peak hour traffic analysis results indicate that future with development traffic conditions, as well as maximum vehicle queues will be the same, or better, than future without development conditions with implementation of the signal timing modifications as suggested. Therefore, it is our conclusion that roadway widening improvements, to provide additional lanes of traffic at the study area intersections, are not required as a result of this site redevelopment.

The traffic analyses contained herein reveal that safe and efficient access to and from the proposed development can be provided with minor signal timing modifications, and furthermore, site-generated traffic can be accommodated at the study area intersections.

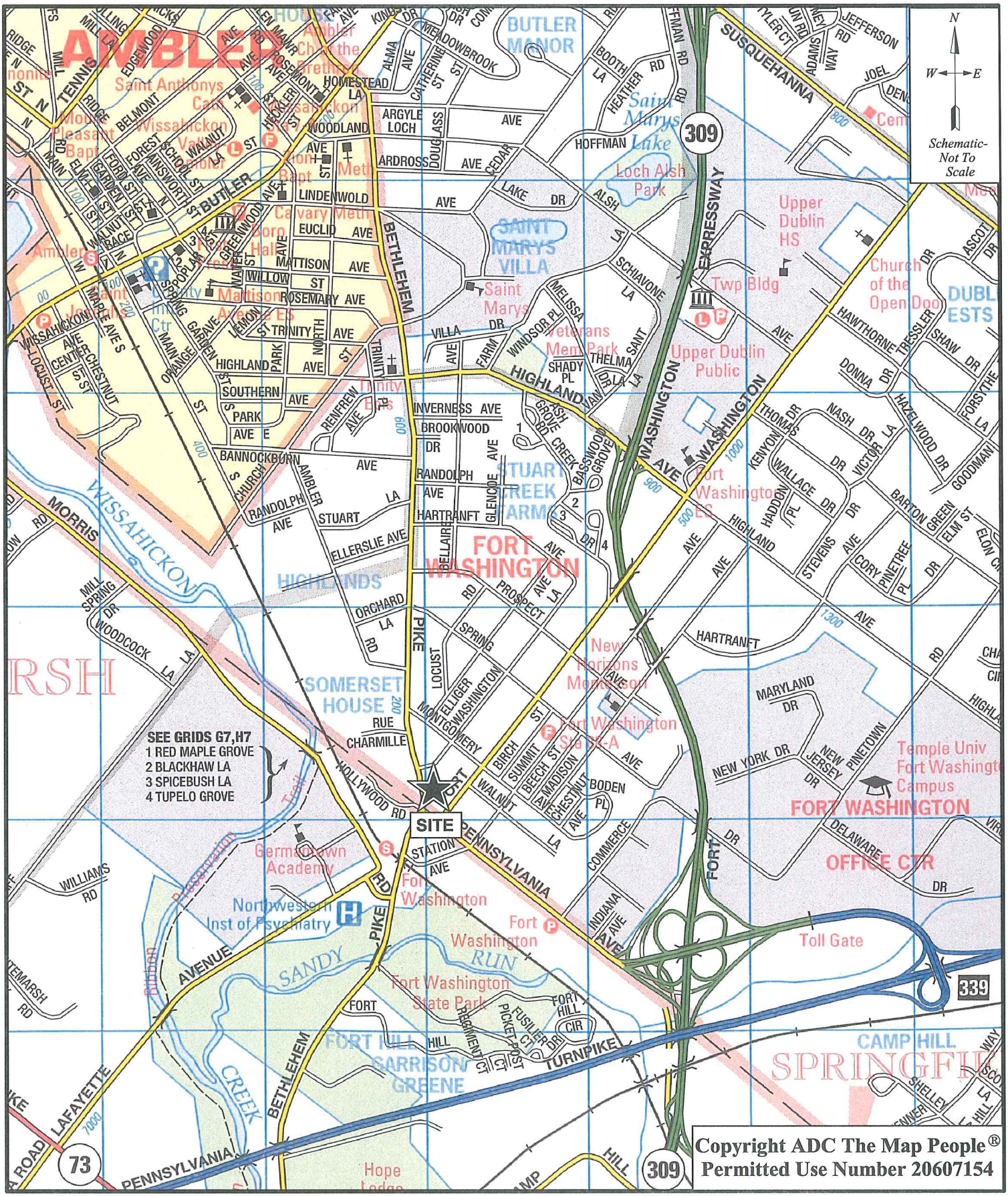

FIGURE 1

Site Location Map

PROPOSED TD BANK

UPPER DUBLIN TOWNSHIP, MONTGOMERY COUNTY, PA

McMAHON
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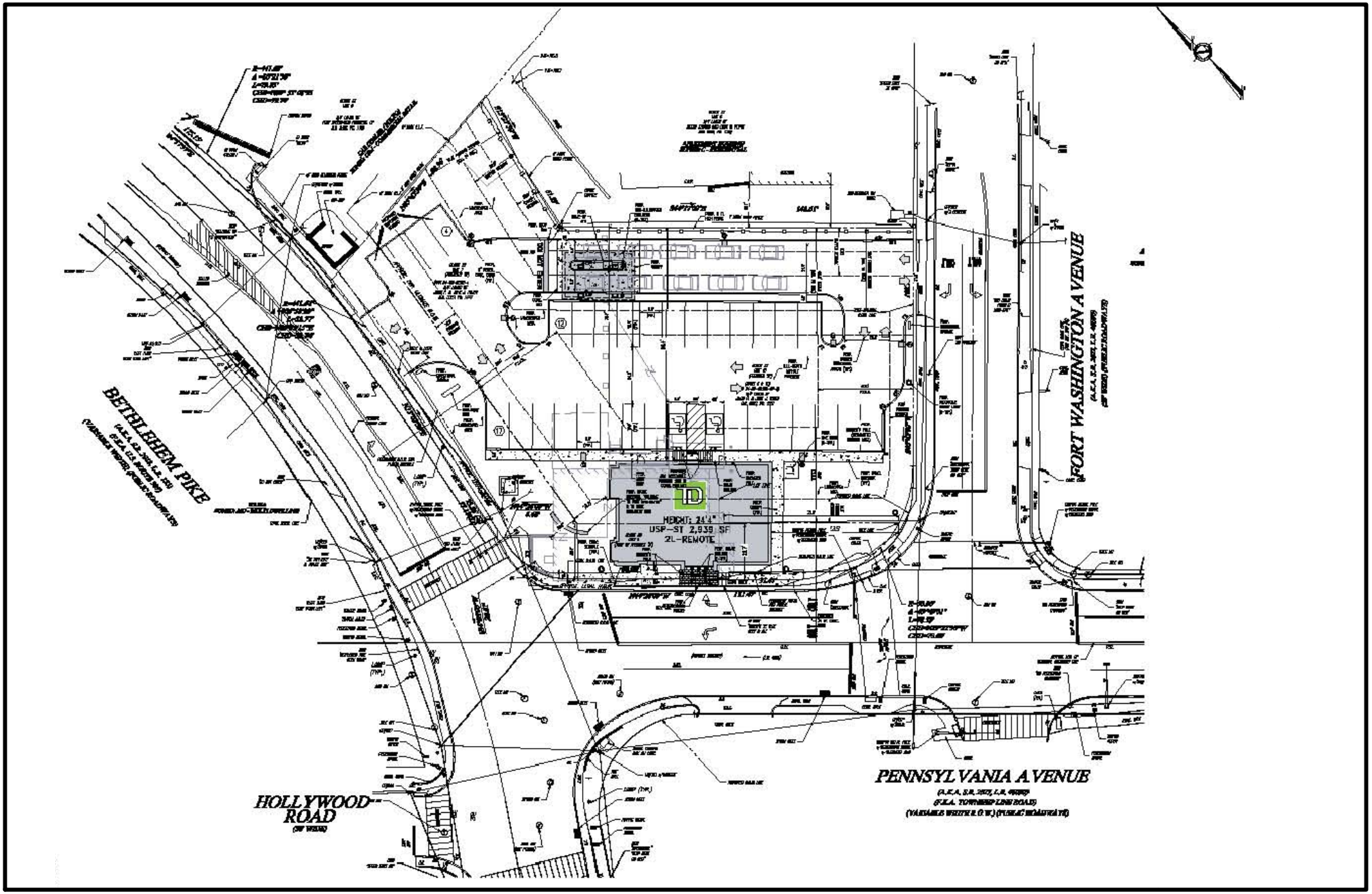

FIGURE 2

Site Plan (Prepared by Bohler Engineering 4/11/13)

PROPOSED TD BANK

UPPER DUBLIN TOWNSHIP, MONTGOMERY COUNTY, PA

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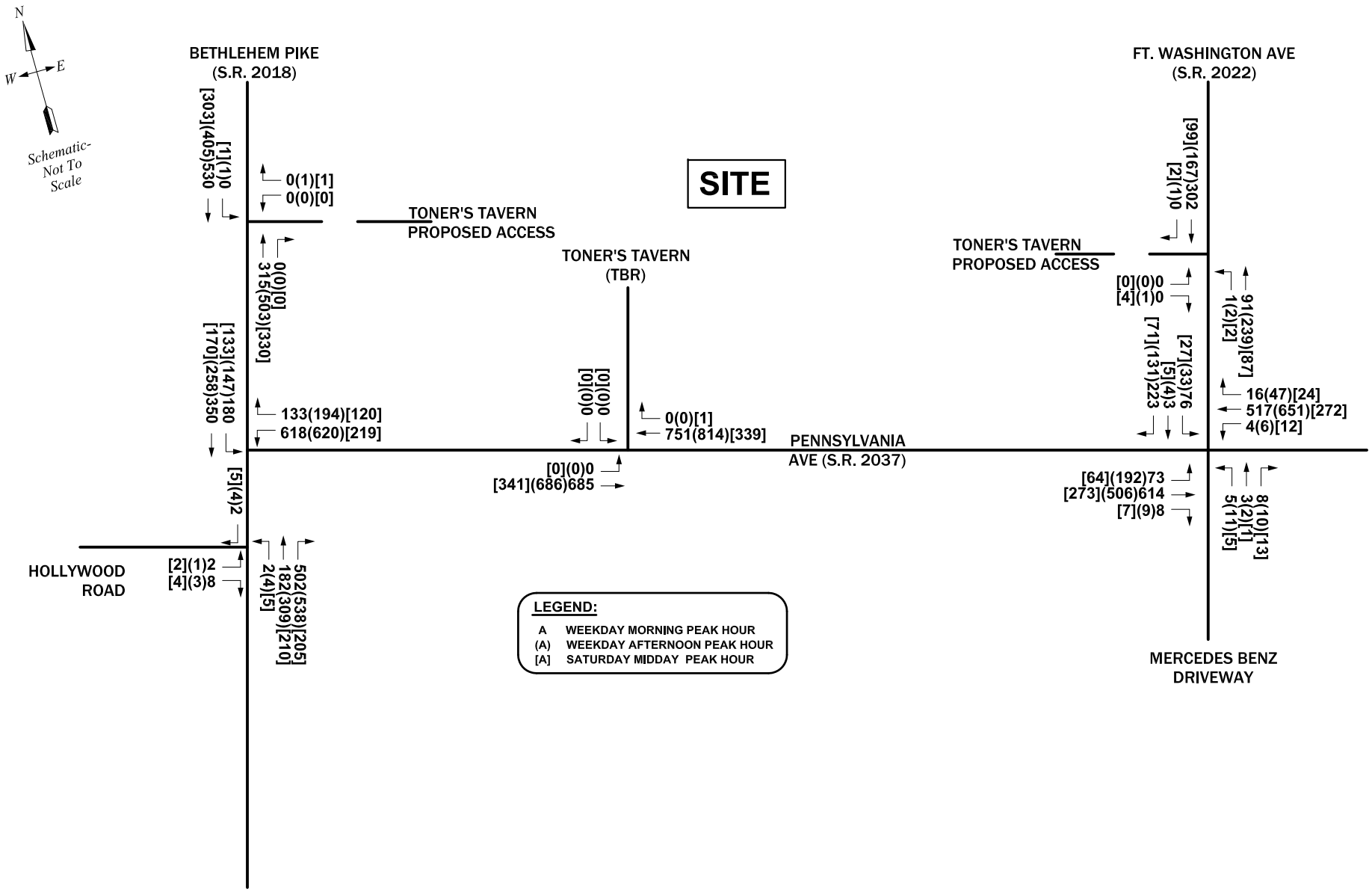

FIGURE 3A

2013 Existing Peak Hour Traffic Volumes

PROPOSED TD BANK

UPPER DUBLIN TOWNSHIP, MONTGOMERY COUNTY, PA

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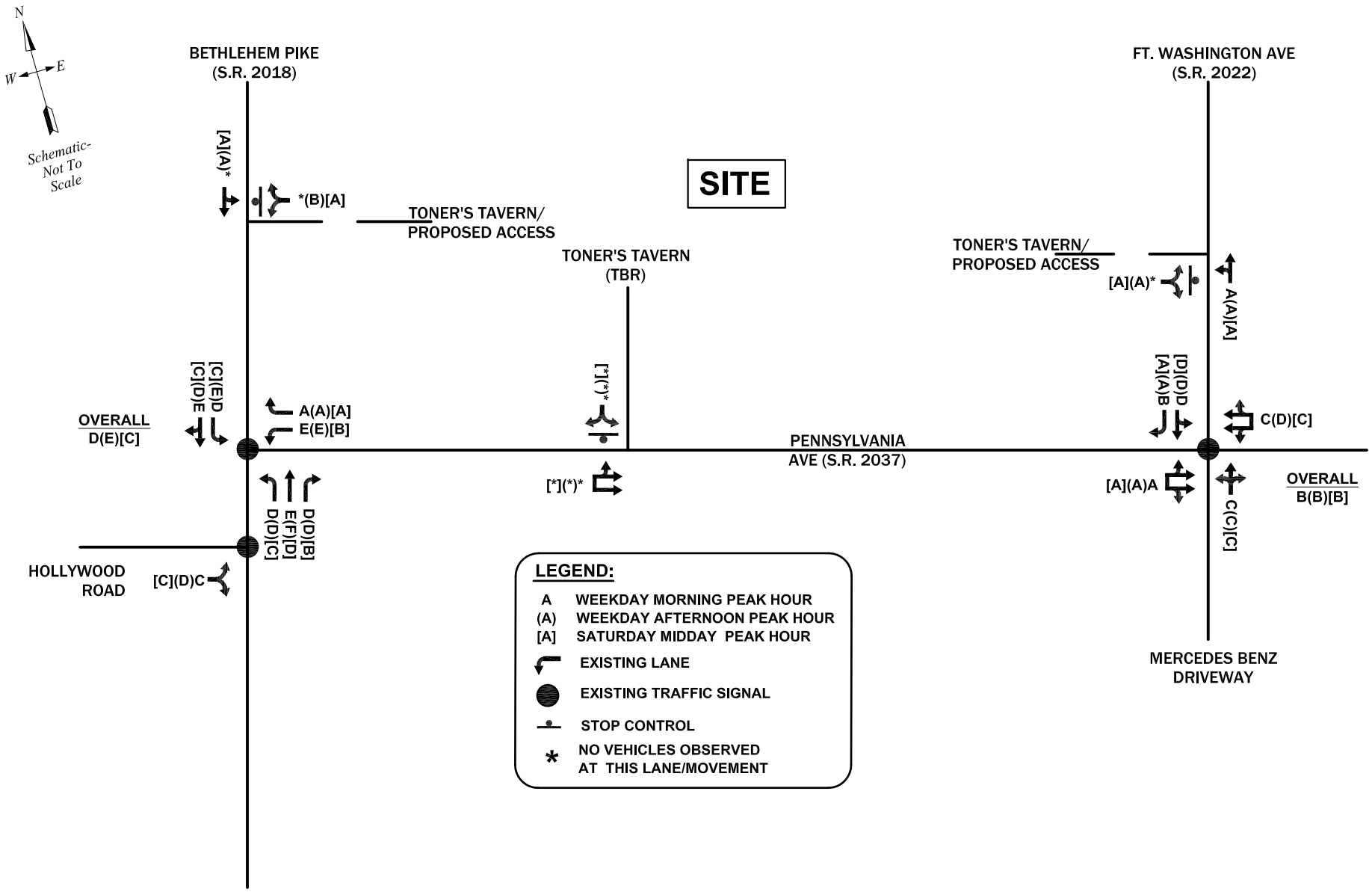

FIGURE 3B

2013 Existing Levels of Service

PROPOSED TD BANK

UPPER DUBLIN TOWNSHIP, MONTGOMERY COUNTY, PA

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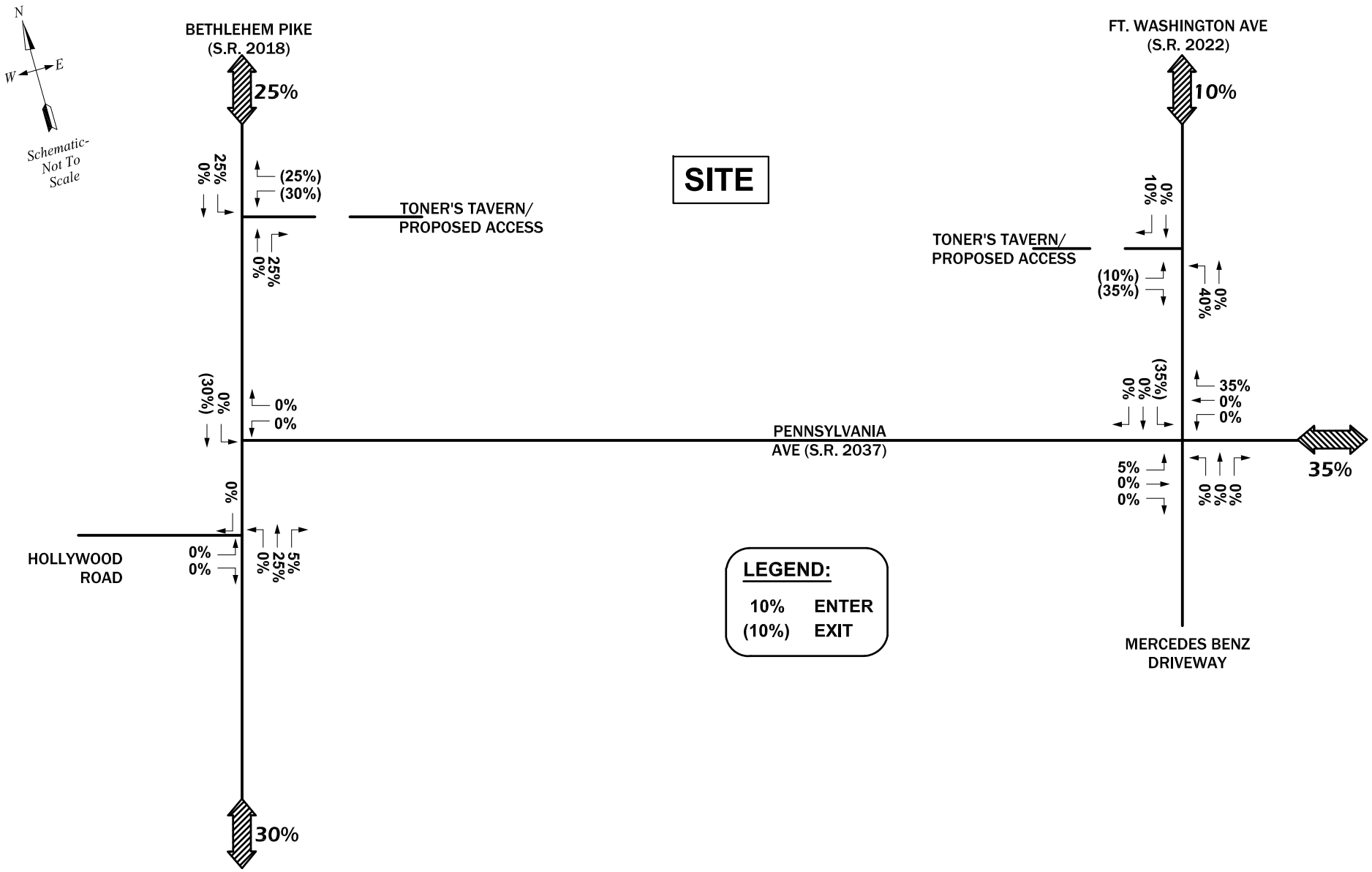


FIGURE 4A

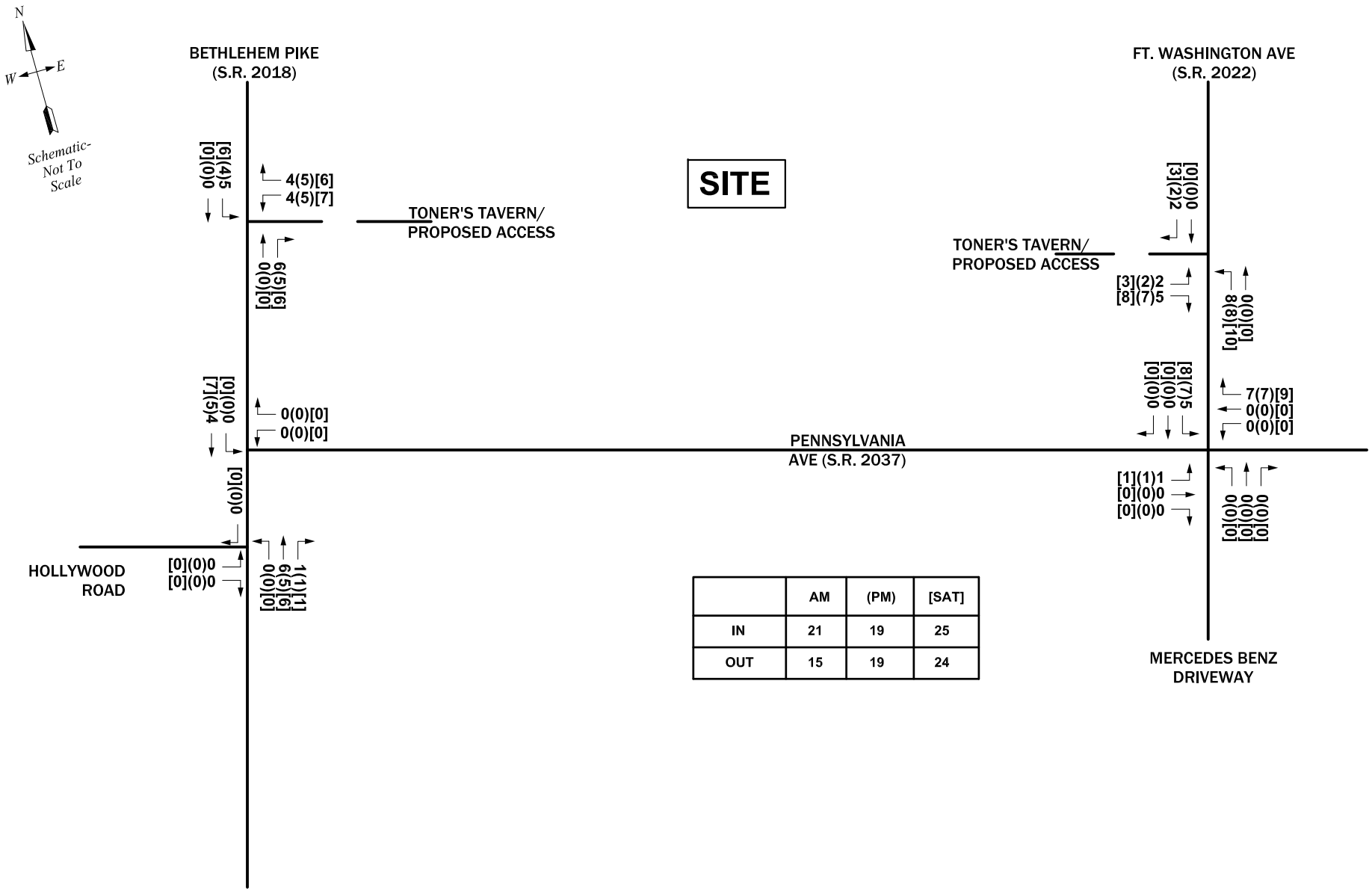
'New" Trip Distribution

PROPOSED TD BANK

UPPER DUBLIN TOWNSHIP, MONTGOMERY COUNTY, PA

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

R:\eng\813478 - TD Bank - Fort Washington\dwg\figures\Figure 4A.dwg



	AM	(PM)	[SAT]
IN	21	19	25
OUT	15	19	24

FIGURE 4B

"New" Trip Assignment

PROPOSED TD BANK

UPPER DUBLIN TOWNSHIP, MONTGOMERY COUNTY, PA

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

R:\eng\813478 - TD Bank - Fort Washington\dwg\figures\Figure 4B.dwg

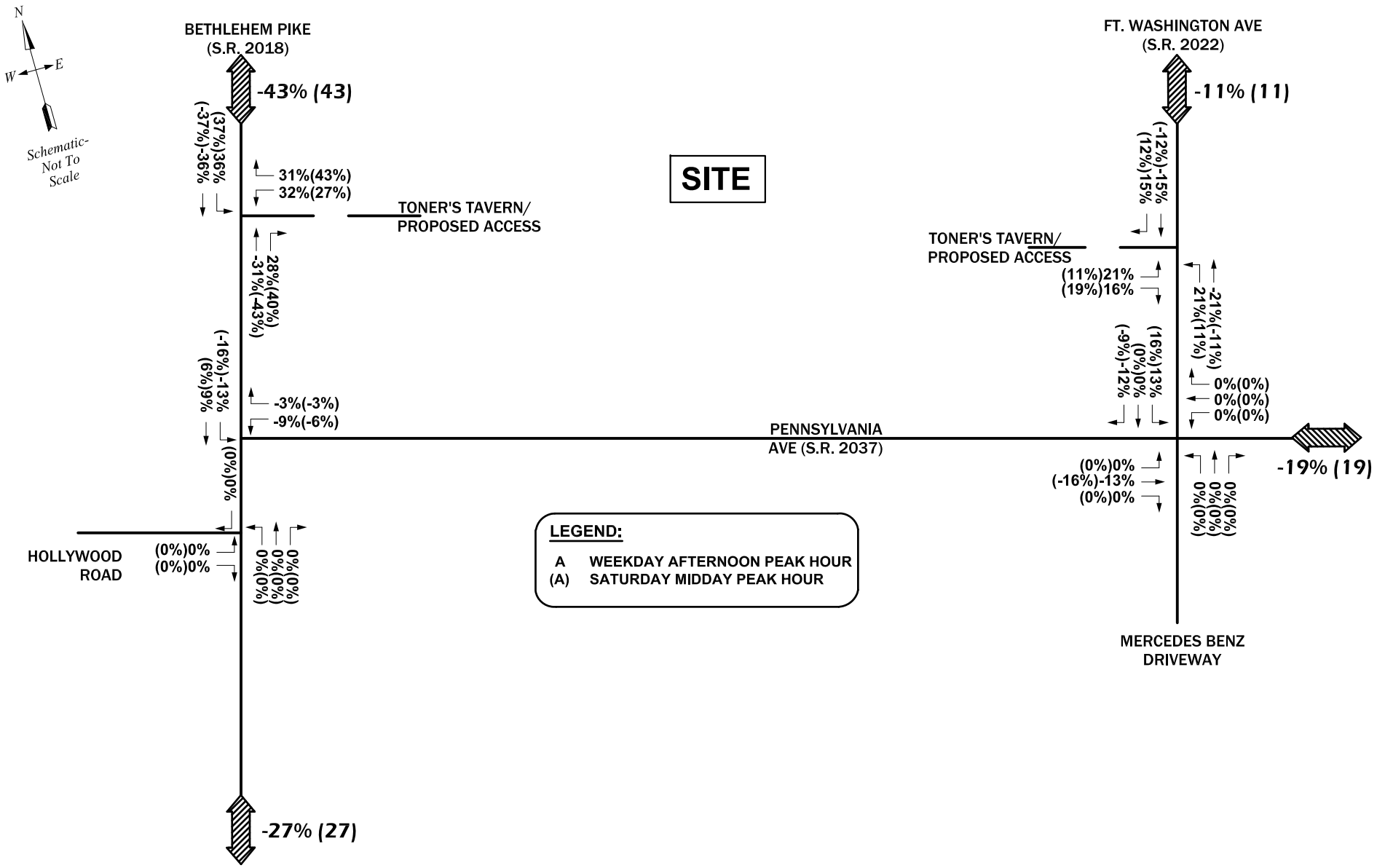


FIGURE 4C

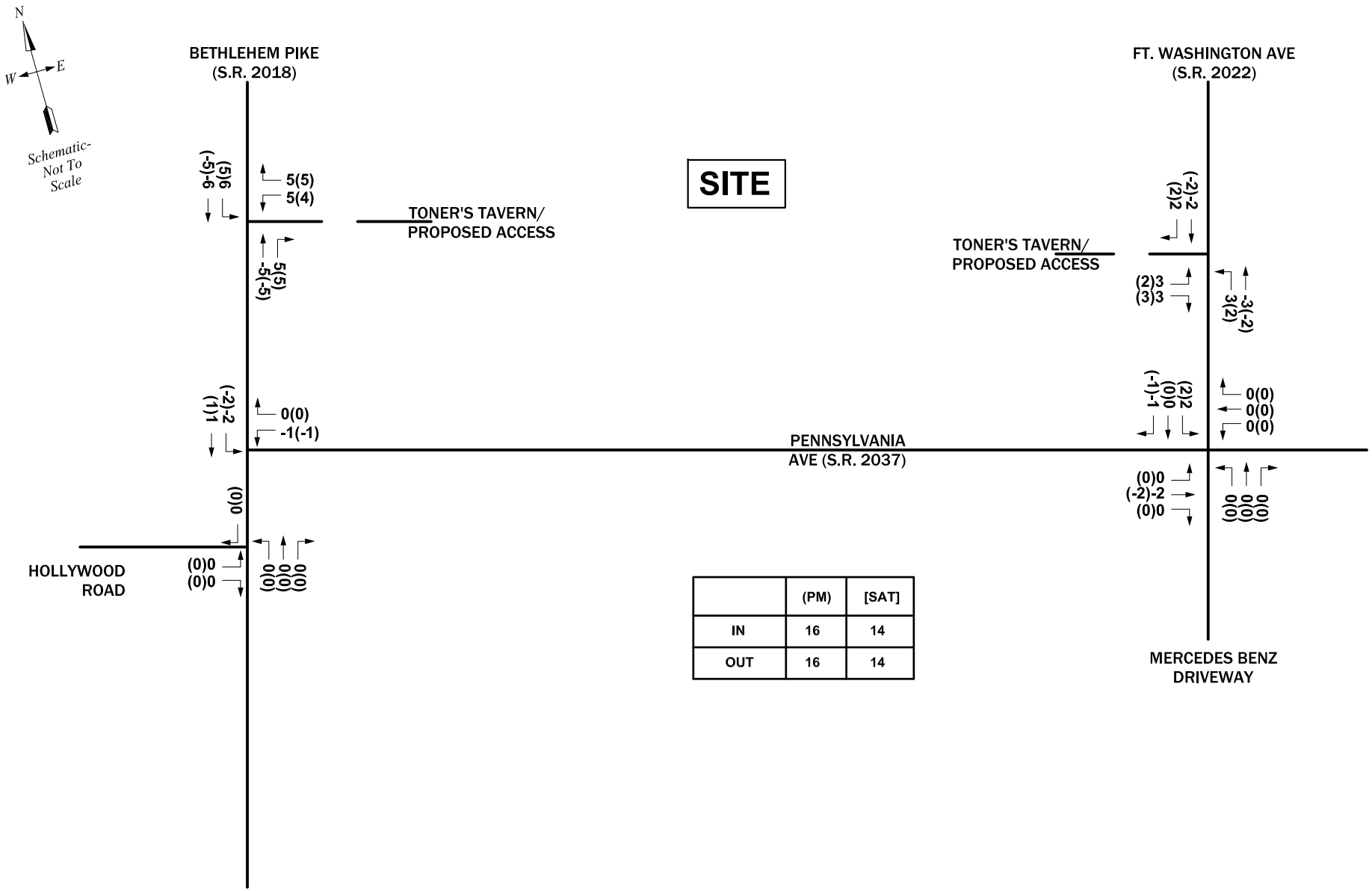
Pass-by Trip Distribution (for PM/SAT only)

PROPOSED TD BANK

UPPER DUBLIN TOWNSHIP, MONTGOMERY COUNTY, PA

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

R:\eng\813478 - TD Bank - Fort Washington\dwg\figures\Figure 4C.dwg



	(PM)	[SAT]
IN	16	14
OUT	16	14

FIGURE 4D

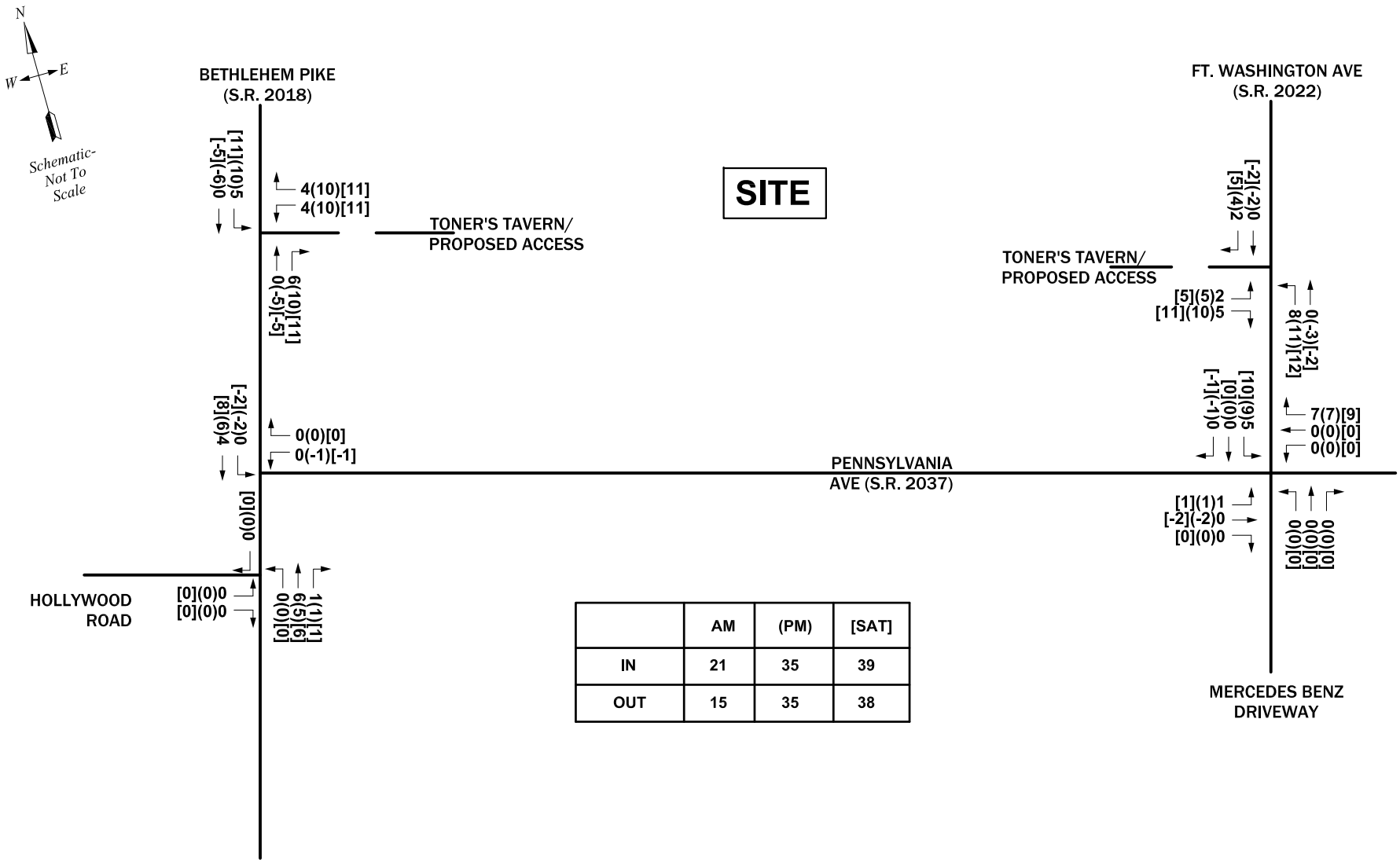
Pass-by Trip Assignment (for PM/SAT only)

PROPOSED TD BANK

UPPER DUBLIN TOWNSHIP, MONTGOMERY COUNTY, PA

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

R:\eng\813478 - TD Bank - Fort Washington\dwg\figures\Figure 4D.dwg



	AM	(PM)	[SAT]
IN	21	35	39
OUT	15	35	38

FIGURE 4E

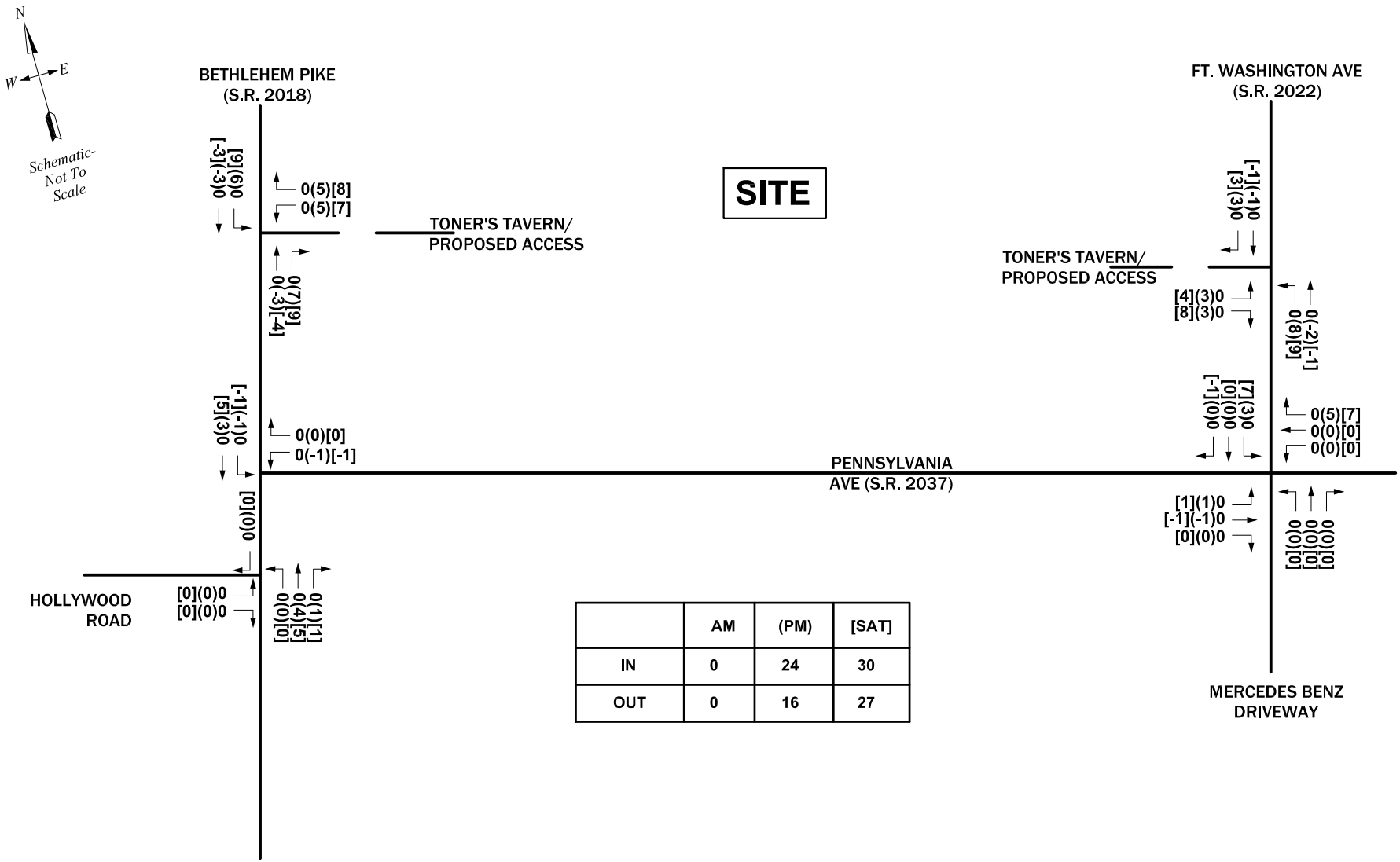
Net "New" and Pass-by Trips

PROPOSED TD BANK

UPPER DUBLIN TOWNSHIP, MONTGOMERY COUNTY, PA

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

R:\eng\813478 - TD Bank - Fort Washington\dwg\figures\Figure 4E.dwg



	AM	(PM)	[SAT]
IN	0	24	30
OUT	0	16	27

FIGURE 4F

Net "New" and Pass-by Trips - Existing Restaurant Land Use

PROPOSED TD BANK

UPPER DUBLIN TOWNSHIP, MONTGOMERY COUNTY, PA

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

I:\eng\813478 - TD Bank - Fort Washington\dwg\figures\Figure 4F.dwg

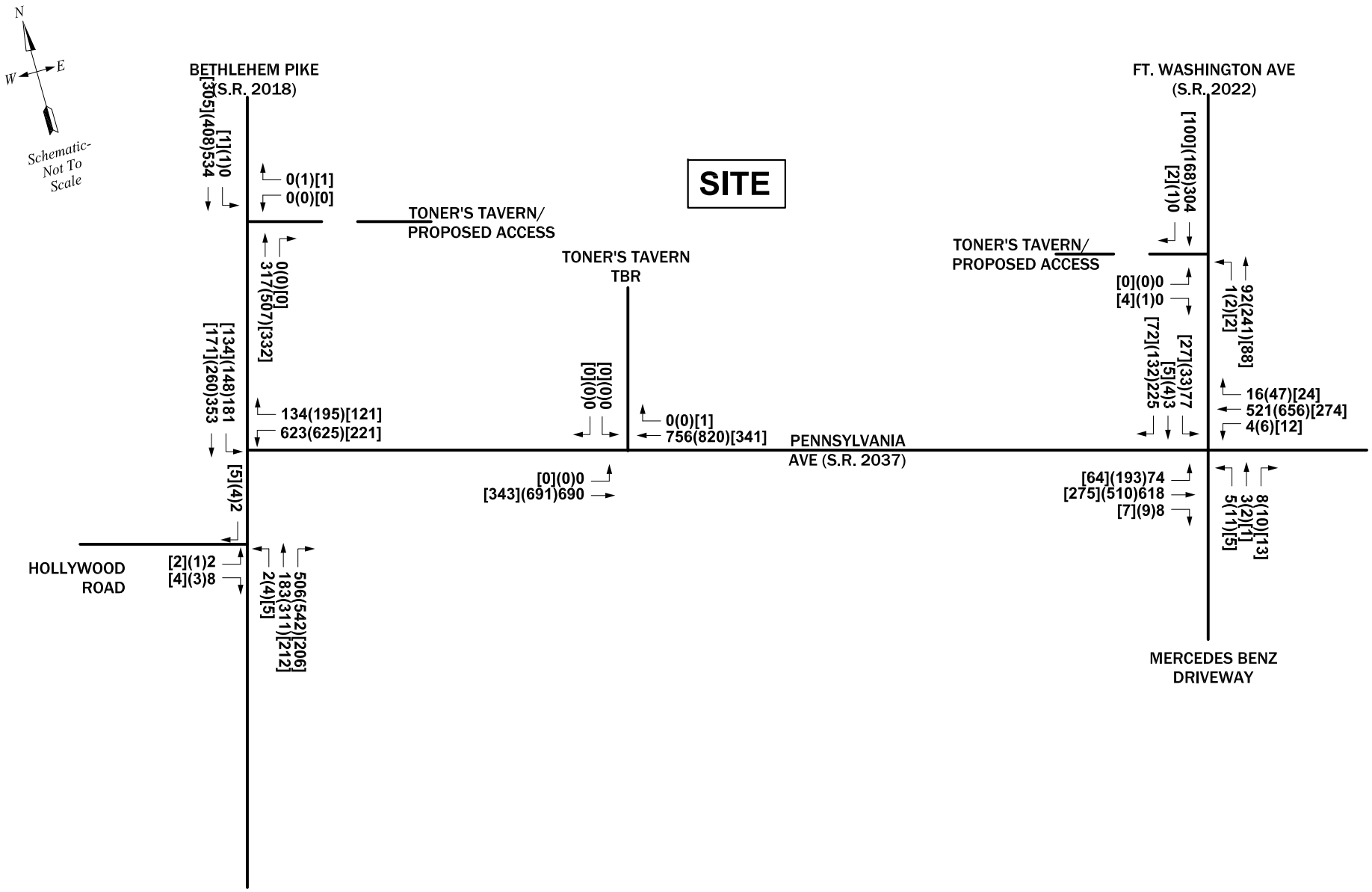


FIGURE 5A

2014 Future Peak Hour Traffic Volumes without Development

PROPOSED TD BANK

UPPER DUBLIN TOWNSHIP, MONTGOMERY COUNTY, PA

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

R:\eng\813478 - TD Bank - Fort Washington\dwg\figures\Figure 5A.dwg

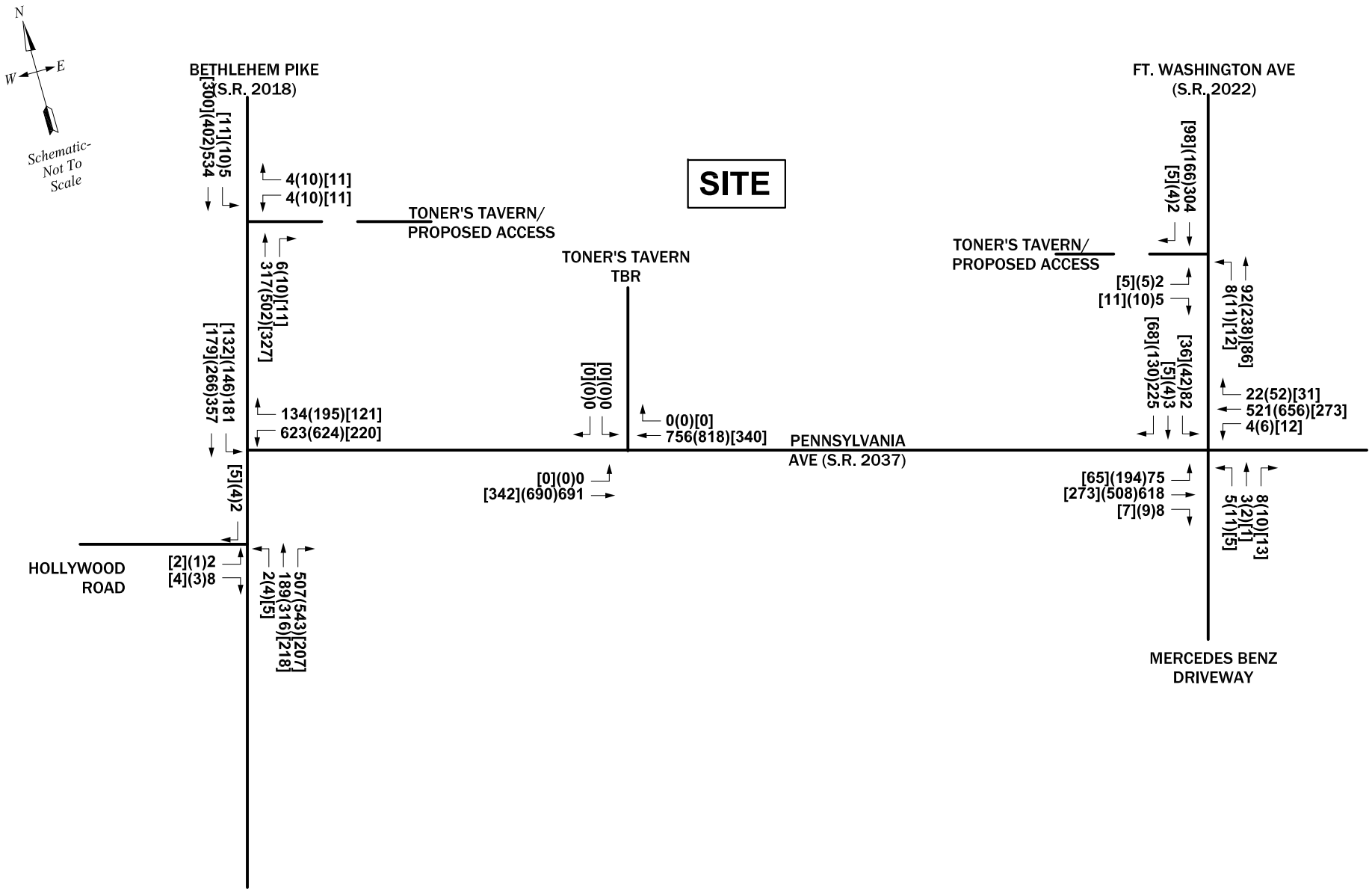


FIGURE 5B

2014 Future Peak Hour Traffic Volumes with Development

PROPOSED TD BANK

UPPER DUBLIN TOWNSHIP, MONTGOMERY COUNTY, PA

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

R:\eng\813478 - TD Bank - Fort Washington\dwg\figures\Figure 5B.dwg

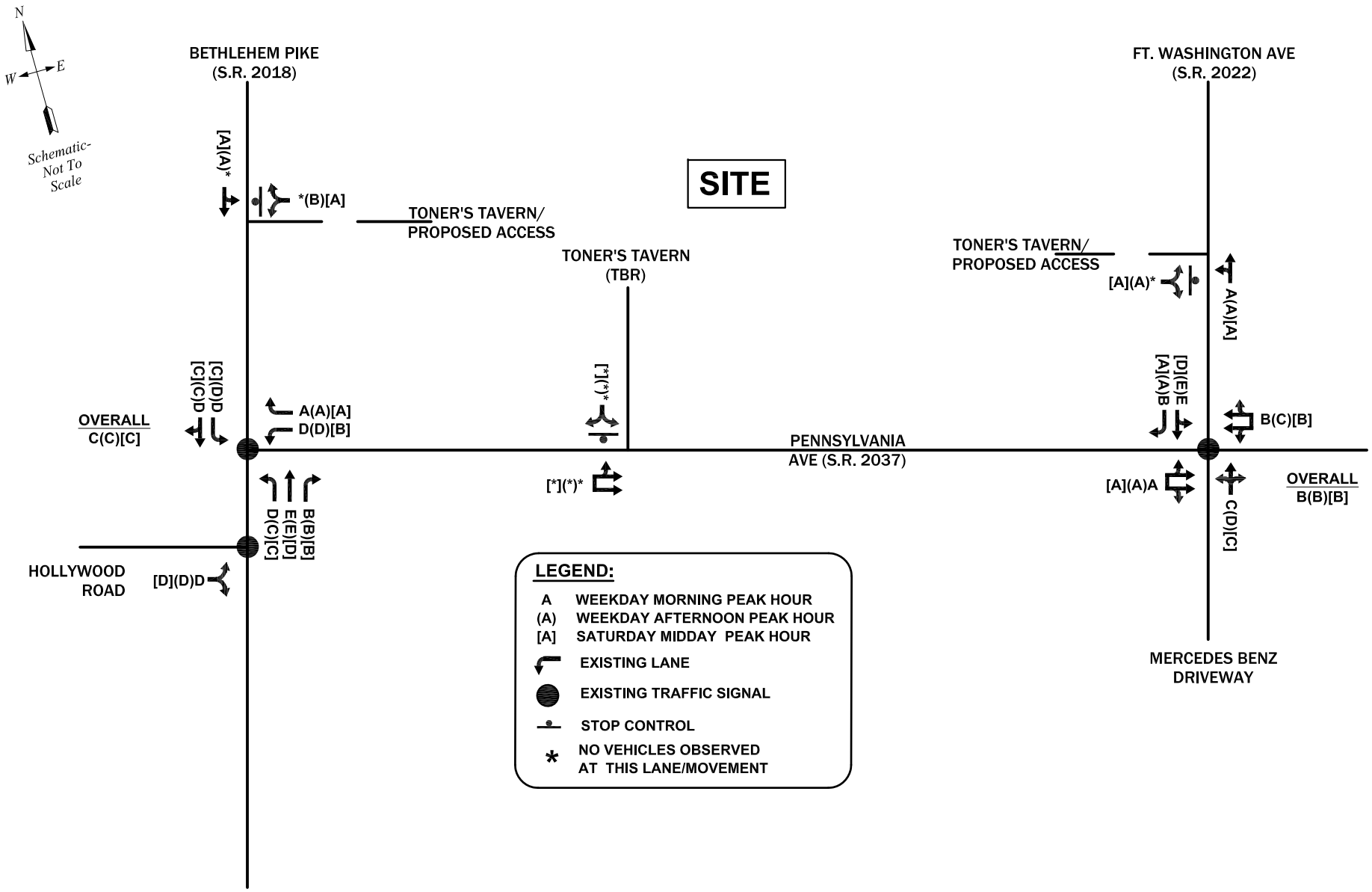


FIGURE 5C

2014 Future Levels of Service without Development

PROPOSED TD BANK

UPPER DUBLIN TOWNSHIP, MONTGOMERY COUNTY, PA

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

I:\eng\813478 - TD Bank - Fort Washington\dwg\figures\Figure 5C.dwg

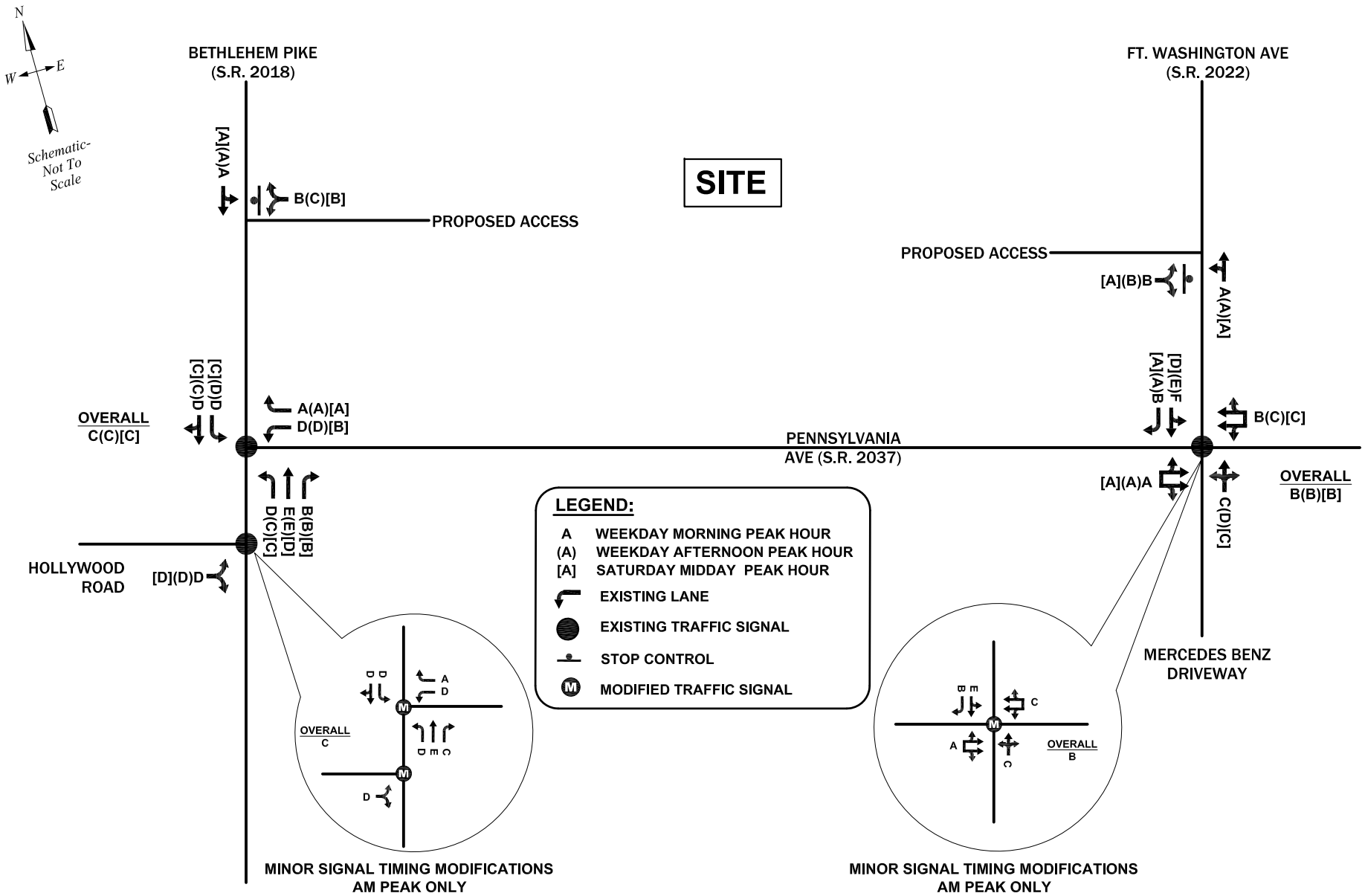


FIGURE 5D

2014 Future Levels of Service with Development

PROPOSED TD BANK

UPPER DUBLIN TOWNSHIP, MONTGOMERY COUNTY, PA

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

I:\eng\813478 - TD Bank - Fort Washington\dwg\figures\Figure 5D.dwg

APPENDIX A

Correspondence

Balgowan, Heather

From: Hanney, Francis J. <FHANNEY@pa.gov>
Sent: Wednesday, July 03, 2013 5:48 PM
To: Moore, Casey
Cc: Roth, Mark; Lapenta, Susan; Federico, Al P.
Subject: RE: Upper Dublin/Ft Washington - Proposed TD Bank

This looks promising. We should be able to live with the accesses subject to a TIA analysis that identifies satisfactory levels of service and sufficient gaps. The study will need to be a TIA not TIS and will need to include both driveways, Beth Pike and Pennsylvania and Pennsylvania and Ft Washington Ave. it may also have to take into account any other nearby signals that may be part of a system if one exists. I don't have a handle on the scope of improvements at this time but would want to see what the analysis says. I could envision the installation of traffic adaptive signal control and possibly a lengthening of the SB left turn lane on Beth Pike if warranted. Signal upgrades and ADA improvements will also most likely be necessary. Don't take these as a final answer but as an initial thought based on a quick perusal of the materials submitted. I hope this gives you enough to at least get going on the preparation of the TIA. Have a nice 4th of July holiday!

From: Moore, Casey [mailto:cmoore@mcmahonassociates.com]
Sent: Wednesday, July 03, 2013 9:42 AM
To: Hanney, Francis J.
Cc: Roth, Mark
Subject: RE: Upper Dublin/Ft Washington - Proposed TD Bank
Importance: High

Fran –

Happy 4th of July to you, as well! Hope you have a great extended weekend.

As to the project redevelopment, I have attached two plans that Mark Roth and I would like to discuss with you. The first is the existing plan of the site, which is situated at the intersection of Pennsylvania Avenue and Bethlehem Pike and presently occupied by a restaurant/bar, Toner's Ye Olde Ale House, that is open and operating on the property. The site has existing access to both Ft. Washington Avenue and to Bethlehem Pike, and under the proposed redevelopment scenario with the bank, these access intersections are proposed to be maintained. The site today is approx. 99% impervious covered, and with the TD Bank proposed redevelopment would drop to 77%, making much of the frontage along Pennsylvania Ave adjacent to the building landscaped /green area. Along Bethlehem Pike is a Wawa across from this site and the car dealership. Signals are located at both intersections on the plan.

FYI - The TD Bank has a disconnected two-bay drive-thru in which the pneumatic tubes run under the parking lot.

From what little I know, since we are just getting involved with this, TD Bank has met with the Township to discuss the redevelopment, and they have been warm to the plan, and thus why TD Bank is moving forward with the necessary consultants to get the project development approvals.

The items we need to discuss are:

1). Maintaining access locations and movements, per the proposed site plan
2). Discuss DOT-required adjacent intersection improvements you feel may be necessary (site is bound on all sides by state roads)
3). Confirm a scope of traffic assessment vs a large traffic study.

I have also attached a copy of the signal permit plan for the adjacent intersections if that is helpful to refer to.

Please let Mark and I know a time that we can talk to you for about 20 minutes or so, as we then can get the ball rolling on our end.

Thanks again -

Casey A. Moore, P.E.
McMahon Associates, Inc.
p: 215.283.9444 x 1203
www.mcmahonassociates.com

From: Hanney, Francis J. [mailto:FHANNEY@pa.gov]
Sent: Tuesday, July 02, 2013 5:44 PM
To: Moore, Casey
Cc: Roth, Mark
Subject: RE: Upper Dublin/Ft Washington - Proposed TD Bank

Thank you for understanding. Enjoy the 4th of July holiday!

From: Moore, Casey [mailto:cmoore@mcmahonassociates.com]
Sent: Tuesday, July 02, 2013 4:37 PM
To: Hanney, Francis J.
Cc: Roth, Mark
Subject: RE: Upper Dublin/Ft Washington - Proposed TD Bank

Fran –

We will send you the existing site plan and the proposed plan for its redevelopment. Stay tuned, and we can have a brief call to discuss and get your feedback. The two plans are will show the summary of the project, and the potential issues, etc. are what we are trying to get from you in the discussion.

Thanks -

Casey A. Moore, P.E.
McMahon Associates, Inc.
p: 215.283.9444 x 1203
www.mcmahonassociates.com

From: Hanney, Francis J. [mailto:FHANNEY@pa.gov]
Sent: Monday, July 01, 2013 4:41 PM
To: Moore, Casey
Cc: Roth, Mark
Subject: RE: Upper Dublin/Ft Washington - Proposed TD Bank

Casey, send me a sketch and short summary of the project and or any potential issues. I am pretty much booked this week and next but perhaps we can have a phone conference. Either way we can start looking at it and give you some feedback.

From: Moore, Casey [mailto:cmoore@mcmahonassociates.com]
Sent: Sunday, June 30, 2013 10:23 PM
To: Hanney, Francis J.
Cc: Roth, Mark
Subject: RE: Upper Dublin/Ft Washington - Proposed TD Bank

Fran –

Hope your vacation was a good one! Can we get together with you on Tues or Wed this week before the 4th of July holiday?

Thanks -

Casey A. Moore, P.E.
McMahon Associates, Inc.
p: 215.283.9444 x 1203
www.mcmahonassociates.com

From: Moore, Casey
Sent: Monday, June 24, 2013 4:57 PM
To: Hanney, Francis J.
Cc: Roth, Mark
Subject: Re: Upper Dublin/Ft Washington - Proposed TD Bank

If a day works we'll take it. Just let us know. Enjoy vacation.

Casey A. Moore, P.E.
Vice President and Regional Manager - Mid-Atlantic
McMahon Associates, Inc.
425 Commerce Drive, Suite 200
Ft. Washington, PA 19034
(W) 215-283-9444 ext. 203
(Cell) 215-280-9423
casey.moore@mcmtrans.com
www.mcmtrans.com

On Jun 24, 2013, at 4:54 PM, "Hanney, Francis J." <FHANNEY@pa.gov> wrote:

> I'm in next mon-wed only.
> ----------
> Sent from my BlackBerry Wireless Handheld
>
> ---
>
> **From**: Moore, Casey [mailto:cmoore@mcmahonassociates.com]
> **Sent**: Monday, June 24, 2013 04:41 PM
> **To**: Hanney, Francis J.
> **Cc**: Roth, Mark <mroth@mcmahonassociates.com>
> **Subject**: Upper Dublin/Ft Washington - Proposed TD Bank
>
> Fran –
>
> Good afternoon. I left you a vmail today, along with Mark Roth, hoping to get your PennDOT input early in the project process regarding the redevelopment of a site in the subject area being proposed for a TD Bank. McMahon has been requested by TD Bank to perform a traffic study, and we felt it would be beneficial to get DOT input and feedback sooner than later.
>
> If you have time for either a brief phone meeting, field meeting or meeting in your office to scan the plan and offer your early feedback within the next week or two, that would be great. Please let one of us know.
>
> Thanks much -

APPENDIX B

Study Area Intersection Photographs, Field Sketches, and Signal Plans

IMG_0159.JPG

Pennsylvania Ave & Fort Washington Ave - Looking west on Pennsylvania Ave

Upper Dublin Township, Montgomery County, Pennsylvania

IMG_0160.JPG

Pennsylvania Ave & Fort Washington Ave - Looking west to Bethlehem Pk

Upper Dublin Township, Montgomery County, Pennsylvania

IMG_0161.JPG

Pennsylvania Ave & Fort Washington Ave - Looking north on Fort Washington Ave

Upper Dublin Township, Montgomery County, Pennsylvania

IMG_0162.JPG

Pennsylvania Ave & Fort Washington Ave - Looking west into Ale House

Upper Dublin Township, Montgomery County, Pennsylvania

IMG_0163.JPG

Pennsylvania Ave & Fort Washington Ave - Looking south on Fort Washington Ave

Upper Dublin Township, Montgomery County, Pennsylvania

IMG_0164.JPG

Pennsylvania Ave & Fort Washington Ave - Looking south on Fort Washington Ave

Upper Dublin Township, Montgomery County, Pennsylvania

IMG_0165.JPG

Pennsylvania Ave & Fort Washington Ave - Looking into Mercedes Dealership

Upper Dublin Township, Montgomery County, Pennsylvania

IMG_0166.JPG

Pennsylvania Ave & Fort Washington Ave - Looking east on Pennsylvania Avenue

Upper Dublin Township, Montgomery County, Pennsylvania

IMG_0168.JPG

Pennsylvania Ave & Bethlehem Pk - Looking north on Bethlehem Pk

Upper Dublin Township, Montgomery County, Pennsylvania

IMG_0169.JPG

Pennsylvania Ave & Bethlehem Pk - Looking south on Bethlehem Pk

Upper Dublin Township, Montgomery County, Pennsylvania

IMG_0170.JPG

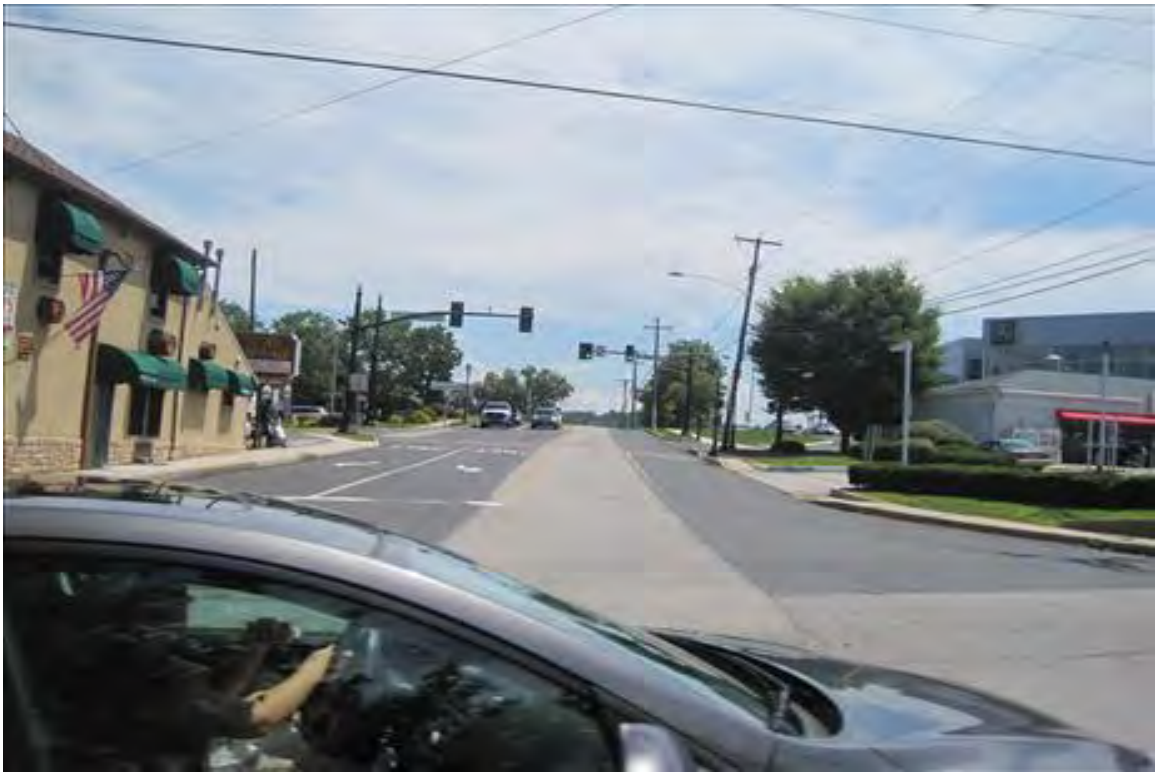
Pennsylvania Ave & Bethlehem Pk - Looking south on Bethlehem Pk

Upper Dublin Township, Montgomery County, Pennsylvania

IMG_0171.JPG

Pennsylvania Ave & Bethlehem Pk - Looking east into Ale House Access

Upper Dublin Township, Montgomery County, Pennsylvania



IMG_0172.JPG

Pennsylvania Ave & Bethlehem Pk - Looking east on Pennsylvania Ave

Upper Dublin Township, Montgomery County, Pennsylvania

IMG_0174.JPG

Pennsylvania Ave & Bethlehem Pk - Looking south on Bethlehem Pk

Upper Dublin Township, Montgomery County, Pennsylvania

IMG_0175.JPG

Pennsylvania Ave & Bethlehem Pk - Bethlehem Pk Northbound Approach

Upper Dublin Township, Montgomery County, Pennsylvania

IMG_0176.JPG

Pennsylvania Ave & Bethlehem Pk - Looking east on Pennsylvania to Fort Washington Avenue

Upper Dublin Township, Montgomery County, Pennsylvania

IMG_0177.JPG

Pennsylvania Ave & Fort Washington Ave - Looking east on Pennsylvania Avenue

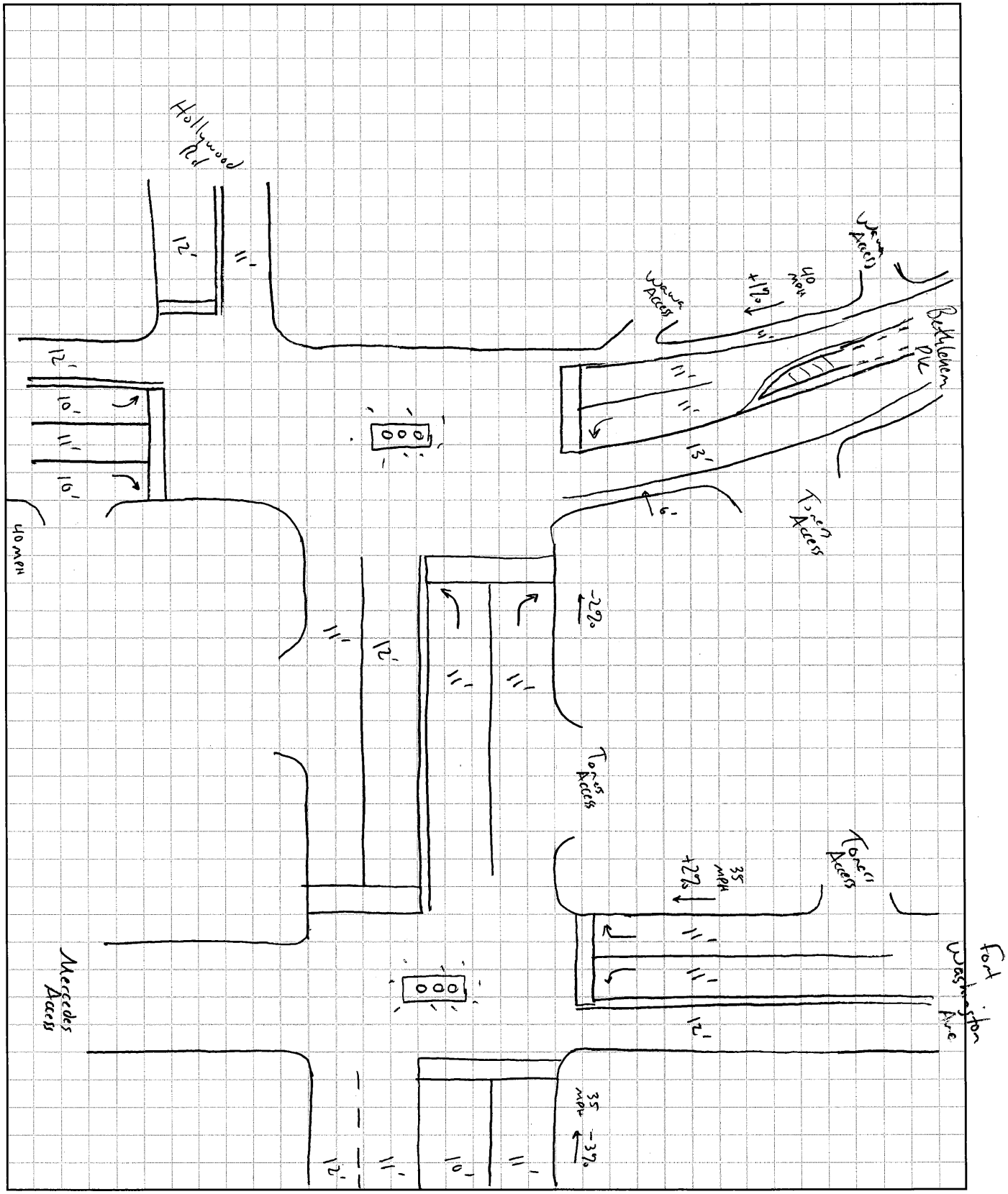
Upper Dublin Township, Montgomery County, Pennsylvania

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

Job _____ McMahon Project No. _____ Sheet _____ of _____

Description _____ Designed By NOB Date _____

_____ Checked By _____ Date _____



UpperDublin File 0681

EMERGENCY PRE-EMPTION PHASING

PHASE	2			6			10			8		
INTERVAL / SIGNALS	20	21	22	23	24	25	26	27	28	29	30	31
1,12	R	R	R	G	Y	R	R	R	R	R	R	R
2	R	R	R	R	R	R	R	R	R	R	R	R
3,4,11	G	Y	R	R	R	R	R	R	R	R	R	R
5	R	R	R	R	R	R	R	R	R	R	R	R
6	R	R	R	R	R	R	G	Y	R	G	Y	R
7	R	R	R	R	R	R	R	R	R	R	R	R
8	R	R	R	R	R	R	G	Y	R	G	Y	R
9	R	R	R	R	R	R	R	R	R	R	R	R
10	R	R	R	R	R	R	R	R	R	R	R	R
13,14	H	H	H	H	H	H	H	H	H	H	H	H
15,16	H	H	H	H	H	H	H	H	H	H	H	H
17,18	H	H	H	H	H	H	H	H	H	H	H	H
19	R	R	R	G	Y	R	R	R	R	G	Y	R
20	G	Y	R	R	R	R	R	R	R	R	R	R
21,22	R	R	R	R	R	R	G	Y	R	R	R	R
23,24	R	R	R	R	R	R	R	R	R	G	Y	R
25,26	H	H	H	H	H	H	H	H	H	H	H	H
27,28,30,31	H	H	H	H	H	H	H	H	H	H	H	H
32,33	R	R	R	R	R	R	R	R	R	R	R	R
FIXED TIME	*	4	3	*	4	2	*	4	3	*	4	2

SELECTIVE CLEARANCES

* FOR DURATION OF PRE-EMPTION

EMERGENCY PRE-EMPTION NOTES

CONTROLLER TO BE EQUIPPED WITH EMERGENCY PRE-EMPTION FOR THE NORTHBOUND & SOUTHBOUND APPROACHES OF BETHLEHEM PIKE (SR 2018), THE WESTBOUND APPROACH OF PENNSYLVANIA AVENUE (SR 2037), AND THE SOUTHBOUND APPROACH OF FORT WASHINGTON AVENUE (SR 2022) WITH A FAIL-SAFE DEVICE FOR EACH DIRECTION OF OPERATION.

THIS FAIL SAFE DEVICE SHALL CONSIST OF A FLASHING WHITE FLOOD LIGHT, AND SHALL BEGIN FLASHING WHEN THE PREEMPTION PHASE DISPLAYS PREEMPTION GREEN FOR THE EMERGENCY VEHICLE. LOCATION OF THE EMERGENCY VEHICLE DETECTORS ARE TO BE FIELD ADJUSTED TO ACHIEVE MAXIMUM OPERATION.

THE SIGNALS, WHEN ACTIVATED BY AN EMERGENCY VEHICLE, SHALL TERMINATE ALL GREEN INDICATIONS IMMEDIATELY, FOLLOWED BY THE COMPLETE YELLOW AND RED CLEARANCE INTERVALS, ACCORDINGLY. THEN THE GREEN INTERVAL FOR THE PRE-EMPTION PHASE SHALL FOLLOW. ONLY THOSE PHASES NOT POSING A YELLOW TRAP CONDITION MAY REMAIN GREEN (8) WHEN GOVERNED BY APPROACHING EMERGENCY VEHICLE.

THE SIGNALS, WHEN ACTIVATED BY EMERGENCY VEHICLES, SHALL TIME OUT ALL YELLOW AND RED INDICATIONS, FOLLOWED BY THE GREEN INTERVAL OF THE PRE-EMPTION PHASE GOVERNED BY THE THE APPROACHING EMERGENCY VEHICLE.

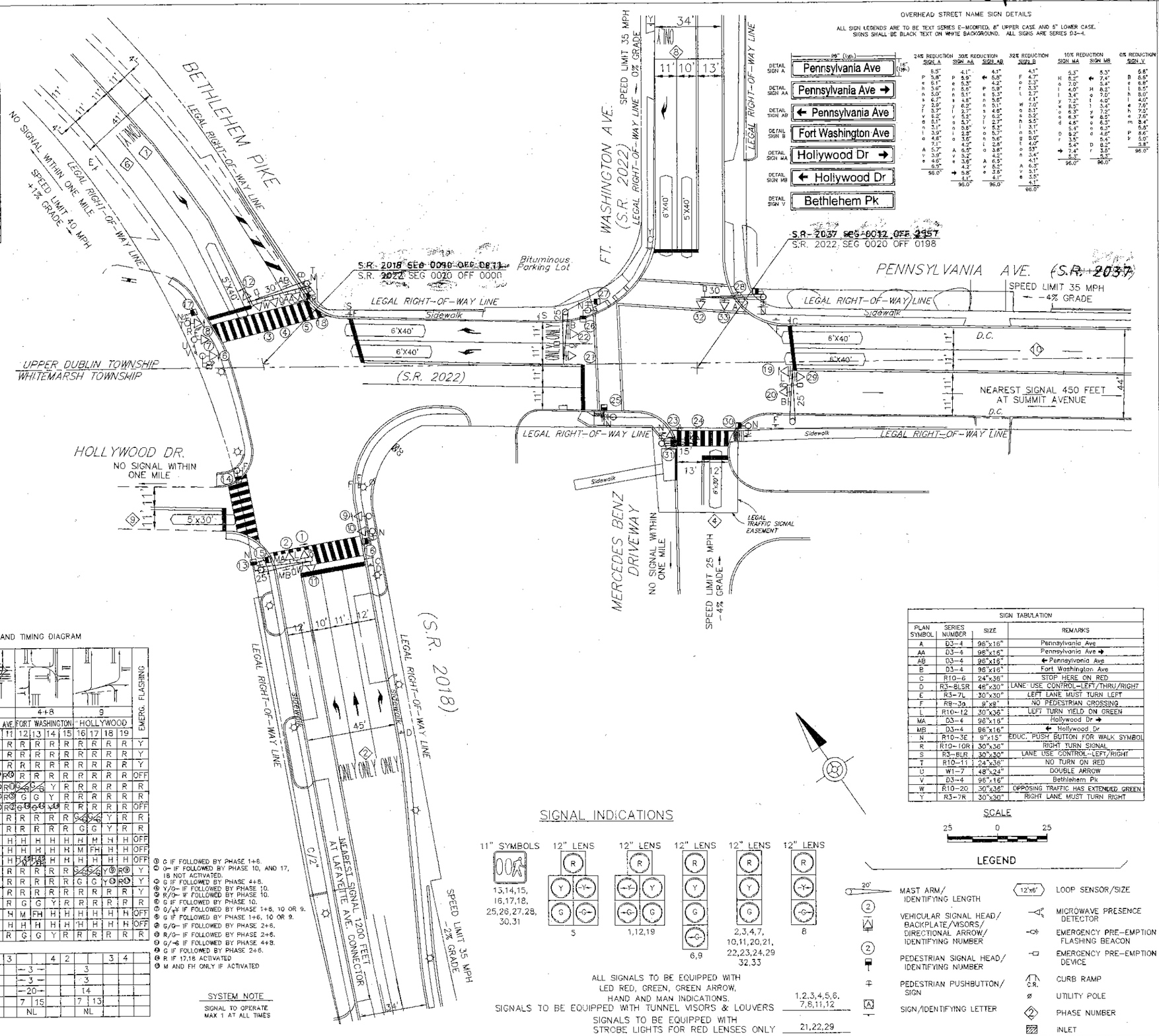
IF THE SIGNALS, WHEN ACTIVATED BY AN EMERGENCY VEHICLE, ARE FLASHING, ALL SIGNALS SHALL REMAIN FLASHING.

UPON COMPLETION OF PRE-EMPTION PHASE 2, 6, & OR 10 IN RETURNING TO NORMAL OPERATION, PHASE 2+6, INTERVAL 1 SHALL FOLLOW.

IN EMERGENCY PRE-EMPTION, NO PRIORITY SHALL BE ESTABLISHED. PRE-EMPTION SHALL BE A "FIRST COME, FIRST SERVE" OPERATION.

IF PRE-EMPTION EQUIPMENT HAS ENCODING CAPABILITIES FOR VEHICLE IDENTIFICATION, IT IS RECOMMENDED TO HAVE THE ZERO "00" FEATURE ON TO GIVE UNCODED EMITTERS THE ABILITY TO ACTIVATE THE EMERGENCY PRE-EMPTION.

(5) G WHEN RETURNING TO NORMAL OPERATION.
(6) G/G- WHEN RETURNING TO NORMAL OPERATION.
(7) G/-G WHEN RETURNING TO NORMAL OPERATION.
(8) G/Y- WHEN RETURNING TO NORMAL OPERATION.
(9) G/-Y WHEN RETURNING TO NORMAL OPERATION.



MOVEMENT, SEQUENCE, AND TIMING DIAGRAM

PHASE	2+6				1+6				10				4+8				9				EMERG. FLASHING
	BETHLEHEM PK.				BL WK LEFT PA. AVE. SUMMIT				PENNSYLVANIA AVE.				FORT WASHINGTON				HOLLYWOOD				
INTERVAL / SIGNALS	1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	
1,12	G	G	Y⑥	R⑦	G	Y	R		R	R	R	R	R	R	R	R	R	R	R	R	Y
2	G	G	Y⑥	R⑦	G	Y	R		R	R	R	R	R	R	R	R	R	R	R	R	Y
3,4,11	G	G	Y	R	R	R	R		R	R	R	R	R	R	R	R	R	R	R	R	Y
5	G	G	Y⑥	R⑦	R	R	R		R	R	R	R	R	R	R	R	R	R	R	R	OFF
6	R	R	R	R	R	R	R		G	Y	R	G	G	Y	R	R	R	R	R	R	R
7	R	R	R	R	R	R	R		G	G	Y⑤	R⑥	G	G	Y	R	R	R	R	R	R
8	R	R	R	R	G	Y	R		G	G	Y⑤	R⑥	G	G	Y	R	R	R	R	R	OFF
9	R	R	R	R	R	R	R		R	R	R	R	R	R	R	R	G	G	Y	R	R
10	R	R	R	R	R	R	R		R	R	R	R	R	R	R	R	G	G	Y	R	R
13,14	M	FH	H	H	R	R	R		H	H	H	H	H	H	H	H	H	H	H	H	OFF
15,16	H	H	H	H	H	H	H		H	H	H	H	H	H	H	H	M	FH	H	H	OFF
17,18	H	H	H	H	H	H	H		H	H	H	H	H	H	H	H	H	H	H	H	OFF
19	G	G	Y⑥	R⑦	G	Y⑥	R⑦		G	G	Y	R	R	R	R	R	G	G	Y⑥	R⑦	Y
20	G	G	Y⑥	R⑦	G	Y⑥	R⑦		G	G	Y	R	R	R	R	R	G	G	Y⑥	R⑦	Y
21,22,29	R	R	R	R	G	Y⑥	R⑦		G	G	Y	R	R	R	R	R	R	R	R	R	Y
23,24	R	R	R	R	R	R	R		R	R	R	R	G	G	Y	R	R	R	R	R	R
25,26	H	H	H	H	H	H	H		H	H	H	H	M	FH	H	H	H	H	H	H	OFF
27,28,30,31	H	H	H	H	H	H	H		M	FH	H	H	H	H	H	H	H	H	H	H	OFF
32,33	R	R	R	R	R	R	R		R	R	R	R	G	G	Y	R	R	R	R	R	R
FIXED			4	3		4	2				4	3			4	2			3	4	
MINIMUM	10				3				4				3				3				
PASSAGE					3				4				3				3				
MAXIMUM	20				7				25				20				14				
* PEDESTRIAN	7	9							7	17			7	15			7	13			
MEMORY	MN				NL				NL				NL				NL				

* UPON PEDESTRIAN ACTUATION ONLY.

(1) G IF FOLLOWED BY PHASE 1+6.
(2) G- IF FOLLOWED BY PHASE 10, AND 17, 18 NOT ACTIVATED.
(3) G IF FOLLOWED BY PHASE 4+8.
(4) Y/G- IF FOLLOWED BY PHASE 10.
(5) R/G- IF FOLLOWED BY PHASE 10.
(6) G IF FOLLOWED BY PHASE 10.
(7) G/-Y IF FOLLOWED BY PHASE 1+6, 10 OR 9.
(8) G IF FOLLOWED BY PHASE 1+6, 10 OR 9.
(9) G/G- IF FOLLOWED BY PHASE 2+6.
(10) R/G- IF FOLLOWED BY PHASE 2+6.
(11) G/-6 IF FOLLOWED BY PHASE 4+8.
(12) G IF FOLLOWED BY PHASE 2+6.
(13) R IF 17,18 ACTIVATED
(14) M AND FH ONLY IF ACTIVATED

SYSTEM NOTE

SIGNAL TO OPERATE MAX 1 AT ALL TIMES

SIGNAL INDICATIONS

11" SYMBOLS: 13,14,15, 16,17,18, 25,26,27,28, 30,31

12" LENS: 5; 1,12,19; 6,9; 2,3,4,7, 10,11,20,21, 22,23,24,29 32,33; 8

ALL SIGNALS TO BE EQUIPPED WITH LED RED, GREEN, GREEN ARROW, HAND AND MAN INDICATIONS. 1,2,3,4,5,6, 7,8,11,12

SIGNALS TO BE EQUIPPED WITH TUNNEL VISORS & LOUVERS

SIGNALS TO BE EQUIPPED WITH STROBE LIGHTS FOR RED LENSES ONLY 21,22,29

SIGN TABULATION

PLAN SYMBOL	SERIES NUMBER	SIZE	REMARKS
A	D3-4	96"x16"	Pennsylvania Ave
AA	D3-4	96"x16"	Pennsylvania Ave →
AB	D3-4	96"x16"	← Pennsylvania Ave
B	D3-4	96"x16"	Fort Washington Ave
C	R10-6	24"x36"	STOP HERE ON RED
D	R3-8LSR	48"x30"	LANE USE CONTROL-LEFT/THRU/RIGHT
E	R3-7L	30"x30"	LEFT LANE MUST TURN LEFT
F	R9-3a	9"x9"	NO PEDESTRIAN CROSSING
L	R10-12	30"x36"	LEFT TURN YIELD ON GREEN
MA	D3-4	96"x16"	Hollywood Dr →
MB	D3-4	96"x16"	← Hollywood Dr
N	R10-3E	9"x15"	EDUC. PUSH BUTTON FOR WALK SYMBOL
R	R10-10R	30"x36"	RIGHT TURN SIGNAL
S	R3-8LR	30"x30"	LANE USE CONTROL-LEFT/RIGHT
T	R10-11	24"x36"	NO TURN ON RED
U	W1-7	48"x24"	DOUBLE ARROW
V	D3-4	96"x16"	Bethlehem Pk
W	R10-20	30"x36"	OPPOSING TRAFFIC HAS EXTENDED GREEN
Y	R3-7R	30"x30"	RIGHT LANE MUST TURN RIGHT

SCALE: 25 0 25

LEGEND

- MAST ARM/ IDENTIFYING LENGTH
- VEHICULAR SIGNAL HEAD/ BACKPLATE/VISORS/ DIRECTIONAL ARROW/ IDENTIFYING NUMBER
- PEDESTRIAN SIGNAL HEAD/ IDENTIFYING NUMBER
- PEDESTRIAN PUSHBUTTON/ SIGN
- SIGN/IDENTIFYING LETTER
- LOOP SENSOR/SIZE
- MICROWAVE PRESENCE DETECTOR
- EMERGENCY PRE-EMPTION FLASHING BEACON
- EMERGENCY PRE-EMPTION DEVICE
- CURB RAMP
- UTILITY POLE
- PHASE NUMBER
- INLET

GENERAL NOTES

NO MODIFICATIONS OF THIS INSTALLATION ARE PERMITTED PRIOR APPROVAL IS GRANTED IN WRITING BY A REPRESENTA THE DEPARTMENT OF TRANSPORTATION.

ALL MAINTENANCE WORK INCLUDING TRIMMING OF TREES, NECESSARY FOR PROPER VISIBILITY OF THE SIGNALS IS THE RESPONSIBILITY OF THE PERMITTEE.

ALL SIGNS AND PAVEMENT MARKINGS INDICATED ON THIS ARE CONSIDERED PART OF THE PERMIT AND SHALL BE INST AND MAINTAINED IN ACCORDANCE WITH PUBLICATION NO. 21,

POST MOUNTED SIGNALS SHALL BE INSTALLED WITH THE S HEADS A MINIMUM OF 2 FEET BEHIND THE FACE OF CURB O EDGE OF THE SHOULDER. SUPPORT POLES FOR OVERHEAD SHALL ALSO HAVE A MINIMUM CLEARANCE HORIZONTALLY OF

SIGNALS ERECTED OVER THE ROADWAY SHALL HAVE A MI VERTICAL CLEARANCE OF 16 FT. ABOVE THE ROADWAY. PO MOUNTED SIGNALS SHALL BE A MINIMUM OF 8 FT. ABOVE T SIDEWALK OR PAVEMENT.

ALL OVERHEAD SIGNALS MUST BE RIGIDLY MOUNTED, TOP BOTTOM, AND EQUIPPED WITH BACKPLATES.

THE MINIMUM HORIZONTAL DISTANCE BETWEEN SIGNALS ME AT RIGHT ANGLES TO THE APPROACH SHALL BE 8 FEET.

EXACT LOCATION OF DETECTORS SHALL BE DETERMINED P INSTALLATION BY A REPRESENTATIVE OF PENNDOT.

CURBING TO BE INSTALLED BY MUNICIPALITY AND WHERE SHALL BE PLAIN CEMENT CONCRETE CURB OR GRANITE CUR INSTALLED IN ACCORDANCE WITH DEPARTMENT SPECIFICATIO FORM 408.

PRIOR TO INSTALLATION THE CONTRACTOR SHALL CONSUL THE LOCAL OFFICIALS AND UTILITY COMPANIES TO RESOLVE PROBLEMS WHICH MAY BE CREATED DUE TO THE LOCATION UTILITIES.

THIS DRAWING CANNOT BE USED AS A CONSTRUCTION DR UNLESS THE PERMITTEE COMPLIES WITH THE PROVISIONS OF LATEST AMENDMENT TO ACT 287, PREVENTION OF DAMAGE UNDERGROUND UTILITIES, DATED DECEMBER 10, 1974.

WHEN LIQUID FUELS MONEY IS USED, SIGNAL INSTALLATIO CONFORM TO FORM 408 AND A COPY OF THE PROPOSED SPECIFICATIONS MUST BE SUBMITTED TO THE DISTRICT TRA UNIT, FOR REVIEW, PRIOR TO BIDDING.

PERMITTEE SHALL OBTAIN A HIGHWAY OCCUPANCY PERMI ANY CHANGES IN INTERSECTION GEOMETRY REGARDING EXC

CONDUIT INSTALLED IN BITUMINOUS ROADWAY LESS THAN OLD, OR CONCRETE ROADWAY REGARDLESS OF AGE, MUST OR JACKED UNDER THE ROADWAY. INSTALL IN ACCORDAN TRAFFIC SIGNAL STANDARDS TC-8800 SERIES.

SYSTEM PERMIT # 1-0038

PENNSYLVANIA DEPARTMENT OF TRANSPO
ENGINEERING DISTRICT 6-0

COUNTY: MONTGOMERY

MUNICIPALITY: UPPER DUBLIN TOWNSHIP

INTERSECTION: BETHLEHEM PIKE (S.R. 2018), PEN AVENUE (S.R. 2037), AND FORT WASHINGTON AVENUE (S

REVIEWED:

MUNICIPAL OFFICIAL 6/2

RECOMMENDED:

PAUL LUTZ 1/

DISTRICT TRAFFIC ENGINEER

NO.	REVISION	DES./ REVW.	DATE	REVW.	DATE
1	ADDED STROBE LIGHTS TO SIGNAL 21+22	BJD	3/20/06	MK	3/27/06
2	REVISED M.S.T. FOR PED 17+18	BPP	10/25/07	AP	11/1/07
3	MODIFIED M.S.T. AND SIGNAL INDICATION, NEW DWG.	JJA	7/23/08	DLA	7/24/08
4	REVISED M.S.T. TIMINGS AND PRE-EMPTION NOTES.	JLH	2/24/10	DLA	3/4/10
5	ADDED MERCEDES BENZ DWY.	H&K	4/11/11	DWL	6/29/11
6					
7					
8					

SHEET 2 OF 2 | PERMIT # 64-0681 | FILE #

APPENDIX C

PennDOT iTMS Data

SITE NO: 2596	
County	MONTGOMERY (46)
Route	2037
Segment	0012
Dir	N
Current Avg Daily Traffic	10525
Current Avg Daily Truck Volume	526
K Factor	11
D Factor	50
T Factor	3
Truck Percent	5
Base Traffic Year	2010
Traffic Pattern Group	URBAN - MINOR ARTERIALS, COLLECTORS, LOCAL ROADS

Online VideoLog

SITE NO: 2596	
County	MONTGOMERY (46)
Route	2037
Segment	0013
Dir	S
Current Avg Daily Traffic	10525
Current Avg Daily Truck Volume	842
K Factor	11
D Factor	50
T Factor	3
Truck Percent	8
Base Traffic Year	2010
Traffic Pattern Group	URBAN - MINOR ARTERIALS, COLLECTORS, LOCAL ROADS

Online VideoLog

SITE NO: 18224	
County	MONTGOMERY (46)
Route	2018
Segment	0090
Dir	B
Current Avg Daily Traffic	16202
Current Avg Daily Truck Volume	486
K Factor	11
D Factor	55
T Factor	2
Truck Percent	3
Base Traffic Year	2012
Traffic Pattern Group	URBAN - MINOR ARTERIALS, COLLECTORS, LOCAL ROADS

Online VideoLog

SITE NO: 18442	
County	MONTGOMERY (46)
Route	2022
Segment	0020
Dir	B
Current Avg Daily Traffic	3987
Current Avg Daily Truck Volume	199
K Factor	11
D Factor	55
T Factor	3
Truck Percent	5
Base Traffic Year	2012
Traffic Pattern Group	URBAN - MINOR ARTERIALS, COLLECTORS, LOCAL ROADS

Online VideoLog

APPENDIX D

Manual Turning Movement (MTM) Count Data

McMahon Associates Inc.

425 Commerce Drive, Suite 200
Fort Washington, PA 19034

Municipality: Upper Dublin Township
Location: Bethlehem Pike &
Pennsylvania Avenue
Counter/Board #: M

File Name : toners01s
Site Code :
Start Date : 7/20/2013
Page No : 1

Groups Printed- Passenger Vehicles - Heavy Vehicles

	Bethlehem Pk Southbound		Pennsylvania Ave Westbound		Bethlehem Pk Northbound		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
11:00	36	49	61	36	45	45	272
11:15	40	50	46	17	48	46	247
11:30	37	37	56	26	57	42	255
11:45	27	47	50	41	34	46	245
Total	140	183	213	120	184	179	1019
12:00	33	44	62	26	47	53	265
12:15	38	38	47	40	56	55	274
12:30	27	48	51	25	49	52	252
12:45	35	40	59	29	58	45	266
Total	133	170	219	120	210	205	1057
Grand Total	273	353	432	240	394	384	2076
Apprch %	43.6	56.4	64.3	35.7	50.6	49.4	
Total %	13.2	17	20.8	11.6	19	18.5	
Passenger Vehicles	267	344	427	236	389	379	2042
% Passenger Vehicles	97.8	97.5	98.8	98.3	98.7	98.7	98.4
Heavy Vehicles	6	9	5	4	5	5	34
% Heavy Vehicles	2.2	2.5	1.2	1.7	1.3	1.3	1.6

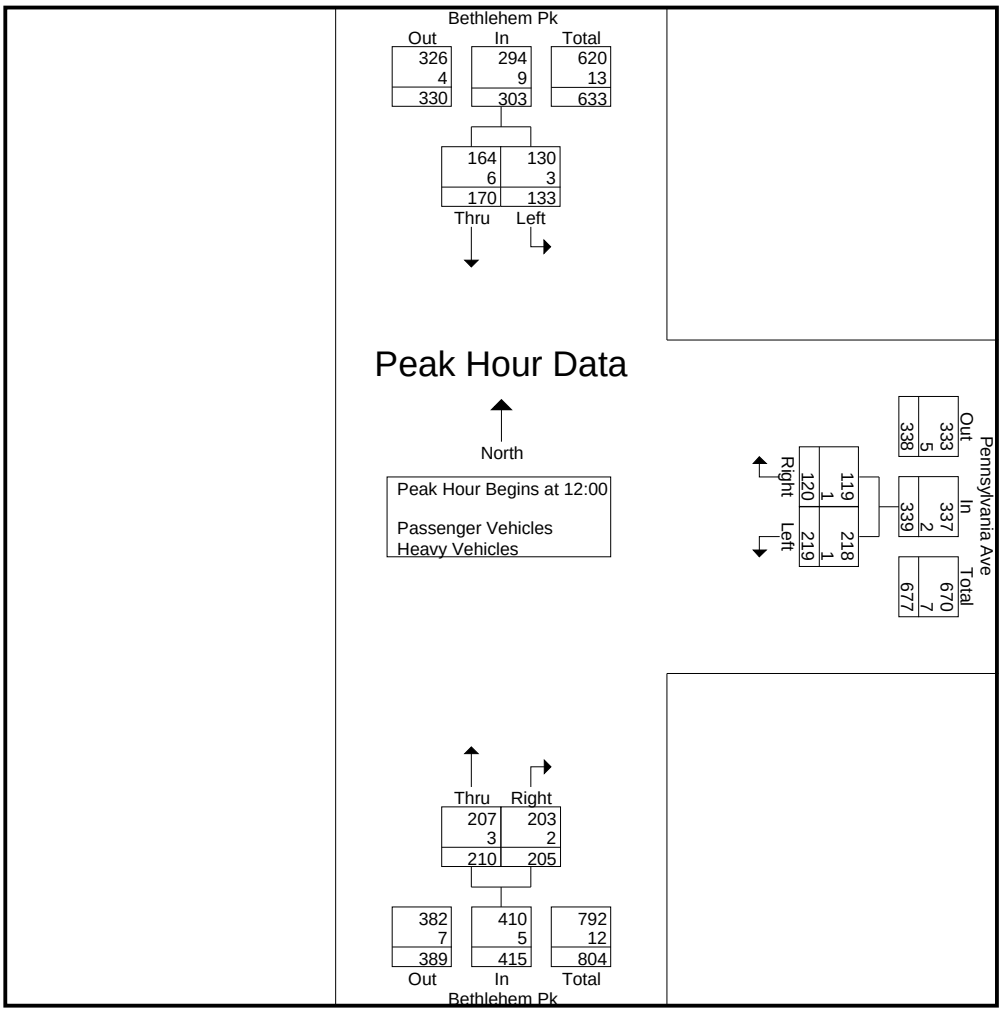
McMahon Associates Inc.

425 Commerce Drive, Suite 200
Fort Washington, PA 19034

Municipality: Upper Dublin Township
Location: Bethlehem Pike &
Pennsylvania Avenue
Counter/Board #: M

File Name : toners01s
Site Code :
Start Date : 7/20/2013
Page No : 2

	Bethlehem Pk Southbound			Pennsylvania Ave Westbound			Bethlehem Pk Northbound			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 11:00 to 12:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 12:00										
12:00	33	44	**77**	**62**	26	**88**	47	53	100	265
12:15	**38**	38	76	47	**40**	87	56	**55**	**111**	**274**
12:30	27	**48**	75	51	25	76	49	52	101	252
12:45	35	40	75	59	29	88	**58**	45	103	266
Total Volume	133	170	303	219	120	339	210	205	415	1057
% App. Total	43.9	56.1		64.6	35.4		50.6	49.4		
PHF	.875	.885	.984	.883	.750	.963	.905	.932	.935	.964
Passenger Vehicles	130	164	294	218	119	337	207	203	410	1041
% Passenger Vehicles	97.7	96.5	97.0	99.5	99.2	99.4	98.6	99.0	98.8	98.5
Heavy Vehicles	3	6	9	1	1	2	3	2	5	16
% Heavy Vehicles	2.3	3.5	3.0	0.5	0.8	0.6	1.4	1.0	1.2	1.5



McMahon Associates Inc.

425 Commerce Drive, Suite 200
Fort Washington, PA 19034

Municipality: Upper Dublin Township
Location: Bethlehem Pike &
Pennsylvania Avenue
Counter/Board #: M

File Name : toners01w
Site Code :
Start Date : 7/23/2013
Page No : 1

Groups Printed- Passenger Vehicles - Heavy Vehicles

	Bethlehem Pk Southbound		Pennsylvania Ave Westbound		Bethlehem Pk Northbound		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
08:00	44	78	146	31	44	114	457
08:15	49	96	120	33	40	131	469
08:30	50	78	168	32	44	130	502
08:45	37	98	184	37	54	127	537
Total	180	350	618	133	182	502	1965
09:00	44	92	101	26	48	126	437
09:15	32	54	80	38	34	108	346
09:30	43	64	58	26	37	70	298
09:45	34	48	75	31	40	71	299
Total	153	258	314	121	159	375	1380
16:00	36	58	107	37	80	120	438
16:15	25	67	134	40	74	120	460
16:30	39	62	139	40	60	121	461
16:45	37	63	151	48	71	138	508
Total	137	250	531	165	285	499	1867
17:00	43	71	153	59	68	120	514
17:15	37	67	154	47	85	132	522
17:30	30	55	162	40	85	148	520
17:45	28	53	149	52	62	152	496
Total	138	246	618	198	300	552	2052
Grand Total	608	1104	2081	617	926	1928	7264
Apprch %	35.5	64.5	77.1	22.9	32.4	67.6	
Total %	8.4	15.2	28.6	8.5	12.7	26.5	
Passenger Vehicles	581	1068	2030	587	903	1889	7058
% Passenger Vehicles	95.6	96.7	97.5	95.1	97.5	98	97.2
Heavy Vehicles	27	36	51	30	23	39	206
% Heavy Vehicles	4.4	3.3	2.5	4.9	2.5	2	2.8

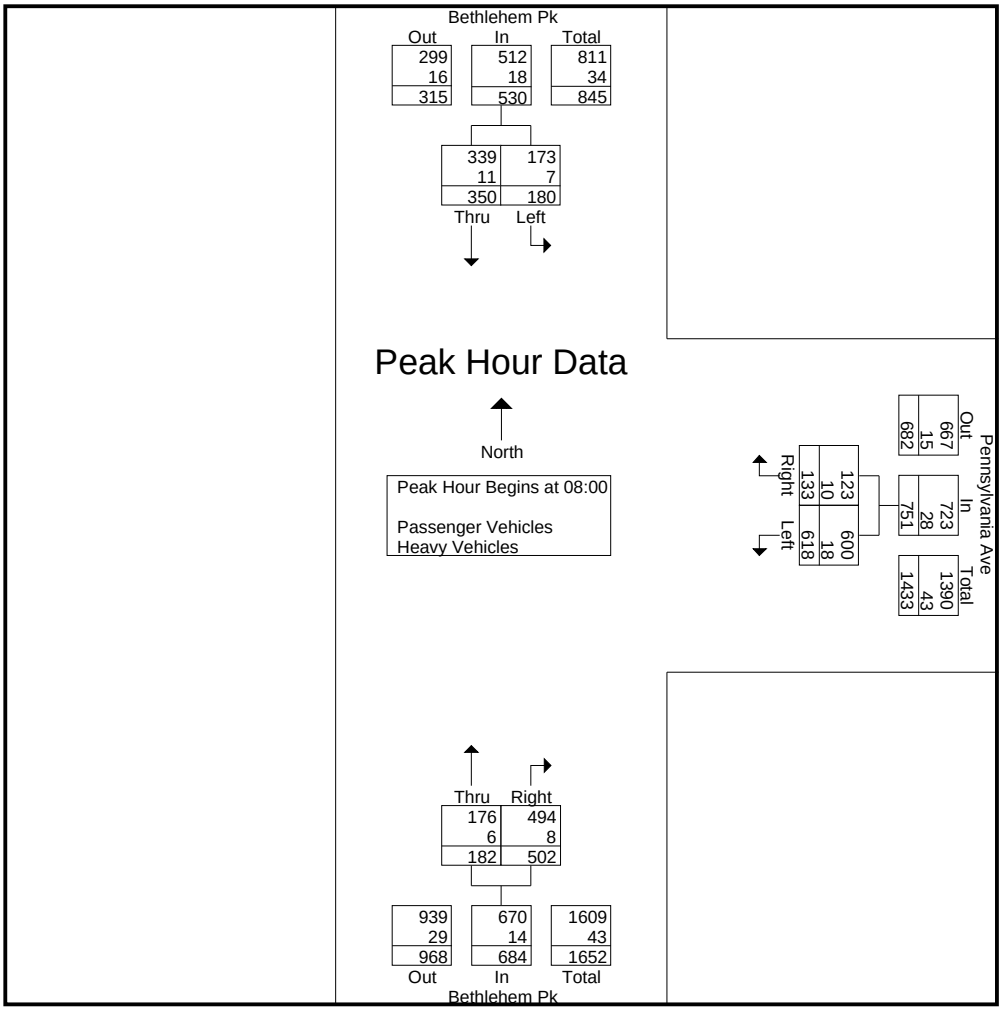
McMahon Associates Inc.

425 Commerce Drive, Suite 200
Fort Washington, PA 19034

Municipality: Upper Dublin Township
Location: Bethlehem Pike &
Pennsylvania Avenue
Counter/Board #: M

File Name : toners01w
Site Code :
Start Date : 7/23/2013
Page No : 2

	Bethlehem Pk Southbound			Pennsylvania Ave Westbound			Bethlehem Pk Northbound			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 08:00 to 11:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 08:00										
08:00	44	78	122	146	31	177	44	114	158	457
08:15	49	96	**145**	120	33	153	40	**131**	171	469
08:30	**50**	78	128	168	32	200	44	130	174	502
08:45	37	**98**	135	**184**	**37**	**221**	**54**	127	**181**	**537**
Total Volume	180	350	530	618	133	751	182	502	684	1965
% App. Total	34	66		82.3	17.7		26.6	73.4		
PHF	.900	.893	.914	.840	.899	.850	.843	.958	.945	.915
Passenger Vehicles	173	339	512	600	123	723	176	494	670	1905
% Passenger Vehicles	96.1	96.9	96.6	97.1	92.5	96.3	96.7	98.4	98.0	96.9
Heavy Vehicles	7	11	18	18	10	28	6	8	14	60
% Heavy Vehicles	3.9	3.1	3.4	2.9	7.5	3.7	3.3	1.6	2.0	3.1



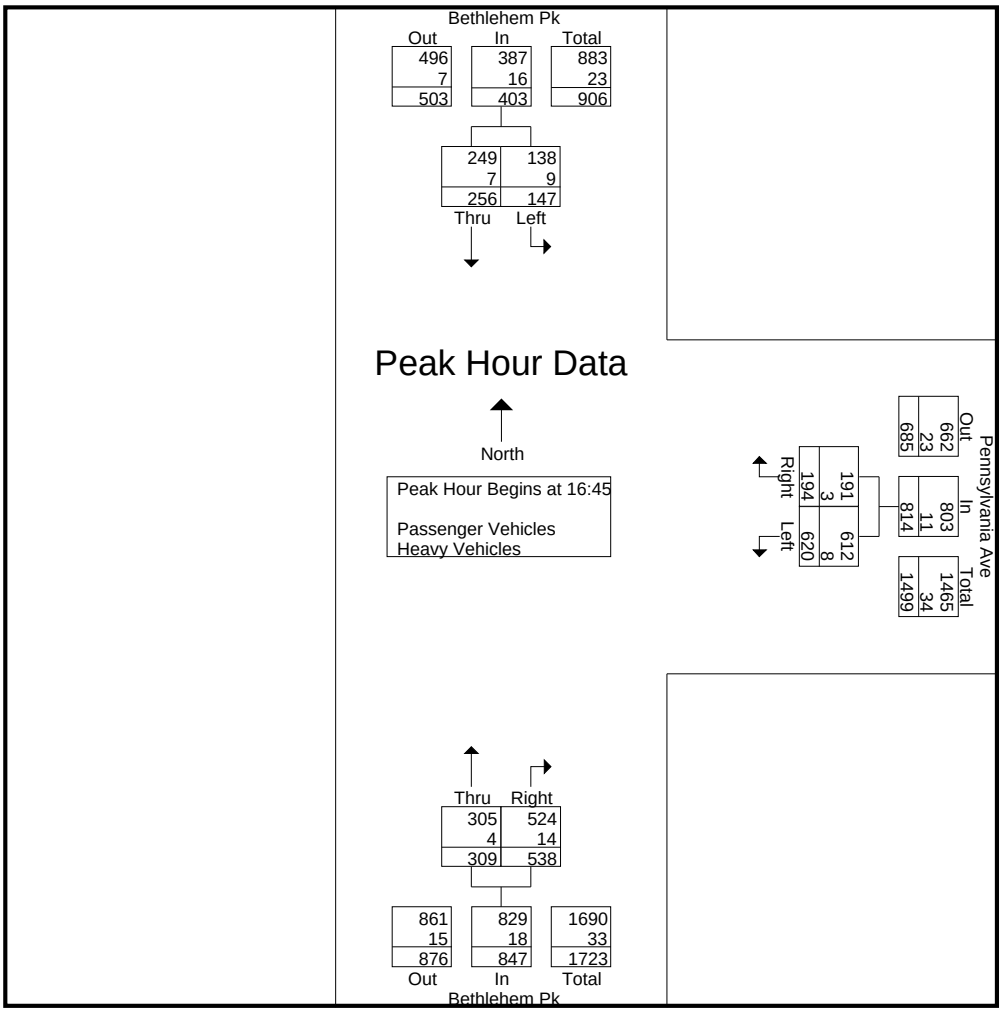
McMahon Associates Inc.

425 Commerce Drive, Suite 200
Fort Washington, PA 19034

Municipality: Upper Dublin Township
Location: Bethlehem Pike &
Pennsylvania Avenue
Counter/Board #: M

File Name : toners01w
Site Code :
Start Date : 7/23/2013
Page No : 3

	Bethlehem Pk Southbound			Pennsylvania Ave Westbound			Bethlehem Pk Northbound			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 12:00 to 17:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 16:45										
16:45	37	63	100	151	48	199	71	138	209	508
17:00	**43**	**71**	**114**	153	**59**	**212**	68	120	188	514
17:15	37	67	104	154	47	201	**85**	132	217	**522**
17:30	30	55	85	**162**	40	202	85	**148**	**233**	520
Total Volume	147	256	403	620	194	814	309	538	847	2064
% App. Total	36.5	63.5		76.2	23.8		36.5	63.5		
PHF	.855	.901	.884	.957	.822	.960	.909	.909	.909	.989
Passenger Vehicles	138	249	387	612	191	803	305	524	829	2019
% Passenger Vehicles	93.9	97.3	96.0	98.7	98.5	98.6	98.7	97.4	97.9	97.8
Heavy Vehicles	9	7	16	8	3	11	4	14	18	45
% Heavy Vehicles	6.1	2.7	4.0	1.3	1.5	1.4	1.3	2.6	2.1	2.2



McMahon Associates Inc.

425 Commerce Drive, Suite 200
Fort Washington, PA 19034

Municipality: Upper Dublin Township
Location: Pennsylvania Avenue &
Fort Washington Avenue & Mercedes Benz
Counter/Board #: DD

File Name : toners02s
Site Code : 81347802
Start Date : 7/20/2013
Page No : 1

Groups Printed- Passenger Vehicles - Heavy Vehicles

	Fort Washington Ave Southbound				Pennsylvania Ave Westbound				Mercedes Benz Northbound				Pennsylvania Ave Eastbound				
Start Time	Left	Thru	ROR	Right	Left	Thru	ROR	Right	Left	Thru	ROR	Right	Left	Thru	ROR	Right	Int. Total
11:00	8	2	9	13	4	72	0	5	1	1	2	2	13	68	0	3	203
11:15	6	1	4	9	1	57	0	12	3	0	2	0	21	67	0	1	184
11:30	8	1	9	7	0	61	0	2	0	1	2	0	14	68	0	1	174
11:45	9	0	11	11	7	60	1	4	0	3	2	2	11	62	0	1	184
Total	31	4	33	40	12	250	1	23	4	5	8	4	59	265	0	6	745
12:00	10	1	10	6	6	72	0	6	0	0	1	2	11	61	0	2	188
12:15	9	0	13	4	3	73	1	4	1	0	0	1	19	72	0	0	200
12:30	4	3	10	9	2	65	1	9	1	1	1	5	13	71	0	1	196
12:45	4	1	16	3	1	62	1	2	3	0	1	2	21	69	0	4	190
Total	27	5	49	22	12	272	3	21	5	1	3	10	64	273	0	7	774
Grand Total	58	9	82	62	24	522	4	44	9	6	11	14	123	538	0	13	1519
Apprch %	27.5	4.3	38.9	29.4	4	87.9	0.7	7.4	22.5	15	27.5	35	18.2	79.8	0	1.9	
Total %	3.8	0.6	5.4	4.1	1.6	34.4	0.3	2.9	0.6	0.4	0.7	0.9	8.1	35.4	0	0.9	
Passenger Vehicles	58	9	82	62	24	522	4	44	9	6	11	14	122	537	0	13	1517
% Passenger Vehicles	100	100	100	100	100	100	100	100	100	100	100	100	99.2	99.8	0	100	99.9
Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
% Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0.2	0	0	0.1

Zero Pedestrians were observed during this study.

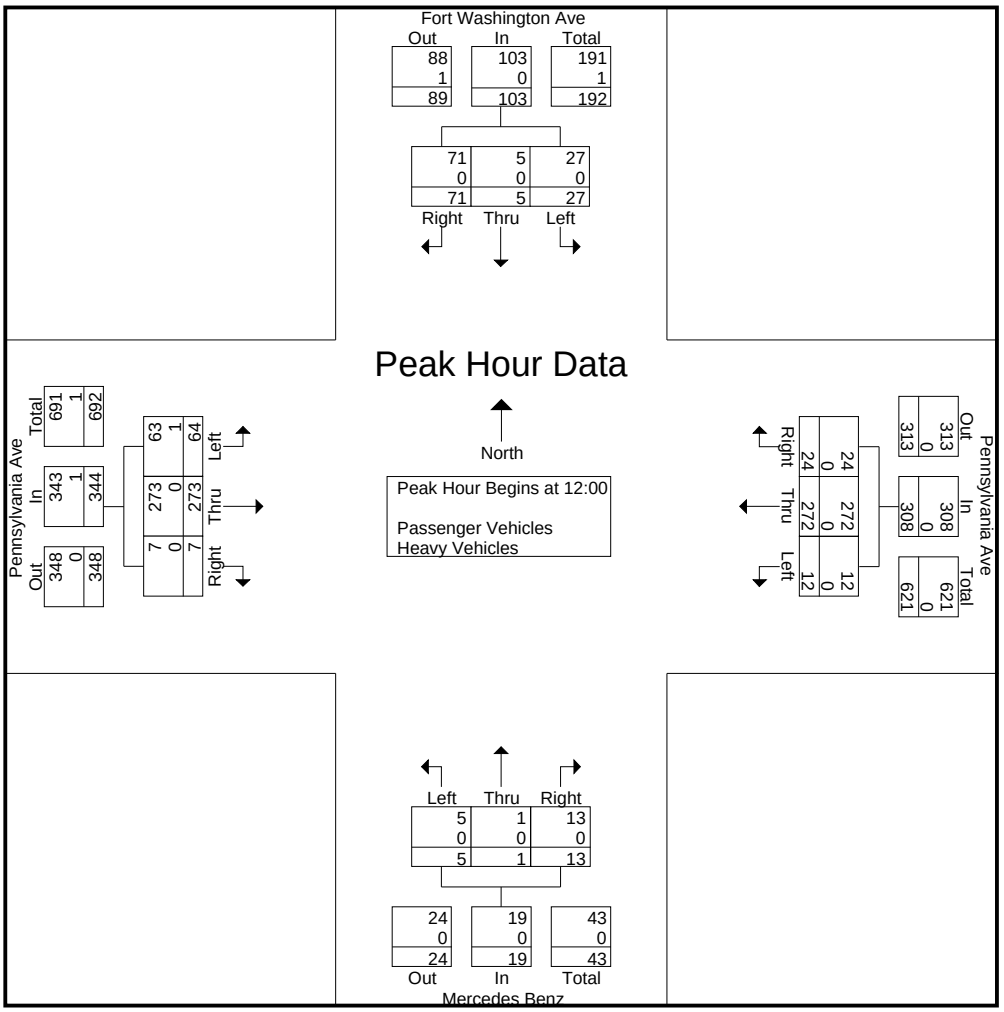
McMahon Associates Inc.

425 Commerce Drive, Suite 200
Fort Washington, PA 19034

Municipality: Upper Dublin Township
Location: Pennsylvania Avenue &
Fort Washington Avenue & Mercedes Benz
Counter/Board #: DD

File Name : toners02s
Site Code : 81347802
Start Date : 7/20/2013
Page No : 2

	Fort Washington Ave Southbound					Pennsylvania Ave Westbound					Mercedes Benz Northbound					Pennsylvania Ave Eastbound					
Start Time	Left	Thru	ROR	Right	App. Total	Left	Thru	ROR	Right	App. Total	Left	Thru	ROR	Right	App. Total	Left	Thru	ROR	Right	App. Total	Int. Total
Peak Hour Analysis From 11:00 to 12:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 12:00																					
12:00	**10**	1	10	6	**27**	**6**	72	0	6	**84**	0	0	**1**	2	3	11	61	0	2	74	188
12:15	9	0	13	4	26	3	**73**	**1**	4	81	1	0	0	1	2	19	**72**	0	0	91	**200**
12:30	4	**3**	10	**9**	26	2	65	1	**9**	77	1	**1**	1	**5**	**8**	13	71	0	1	85	196
12:45	4	1	**16**	3	24	1	62	1	2	66	**3**	0	1	2	6	**21**	69	0	**4**	**94**	190
Total Volume	27	5	49	22	103	12	272	3	21	308	5	1	3	10	19	64	273	0	7	344	774
% App. Total	26.2	4.9	47.6	21.4		3.9	88.3	1	6.8		26.3	5.3	15.8	52.6		18.6	79.4	0	2		
PHF	.675	.417	.766	.611	.954	.500	.932	.750	.583	.917	.417	.250	.750	.500	.594	.762	.948	.000	.438	.915	.968
Passenger Vehicles																					
% Passenger Vehicles	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	98.4	100	0	100	99.7	99.9
Heavy Vehicles																					
% Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.6	0	0	0	0.3	0.1



McMahon Associates Inc.

425 Commerce Drive, Suite 200
Fort Washington, PA 19034

Municipality: Upper Dublin Township
Location: Pennsylvania Avenue &
Fort Washington Avenue / Mercedes Benz
Counter/Board #: AB/JB

File Name : toners02w
Site Code : 81347802
Start Date : 7/23/2013
Page No : 1

Groups Printed- Passenger Vehicles - Heavy Vehicles

	Fort Washingon Ave Southbound				Pennsylvania Ave Westbound				Mercedes Benz Access Northbound				Pennsylvania Ave Eastbound				
Start Time	Left	Thru	ROR	Right	Left	Thru	ROR	Right	Left	Thru	ROR	Right	Left	Thru	ROR	Right	Int. Total
08:00	24	0	19	35	3	108	1	2	3	0	3	0	14	149	0	1	362
08:15	22	1	16	16	0	122	1	2	1	1	1	1	25	155	0	1	365
08:30	18	0	19	45	1	136	2	2	0	1	1	2	15	172	0	3	417
08:45	12	2	30	43	0	151	1	5	1	1	0	0	19	138	0	3	406
Total	76	3	84	139	4	517	5	11	5	3	5	3	73	614	0	8	1550
09:00	13	0	22	17	1	101	0	3	0	2	0	2	24	156	0	2	343
09:15	7	2	13	4	2	92	0	3	2	0	4	1	14	133	0	2	279
09:30	10	1	14	7	0	68	0	3	3	1	0	1	14	99	0	3	224
09:45	14	2	15	6	2	84	0	11	2	1	2	1	17	101	0	3	261
Total	44	5	64	34	5	345	0	20	7	4	6	5	69	489	0	10	1107
*** BREAK ***																	
16:00	8	2	9	9	1	116	0	7	3	1	0	3	41	125	0	1	326
16:15	9	0	16	16	3	147	1	4	2	0	1	0	30	118	0	1	348
16:30	9	2	20	5	2	150	1	6	4	0	0	1	28	129	0	2	359
16:45	13	0	10	6	1	179	1	14	2	1	4	1	33	135	0	2	402
Total	39	4	55	36	7	592	3	31	11	2	5	5	132	507	0	6	1435
17:00	13	0	9	20	2	171	0	11	5	1	3	1	32	128	0	3	399
17:15	9	1	16	18	1	152	0	14	3	0	0	1	59	121	0	0	395
17:30	5	2	13	18	3	155	0	4	2	1	4	1	50	137	0	3	398
17:45	6	1	19	18	0	173	1	17	1	0	0	0	51	120	0	3	410
Total	33	4	57	74	6	651	1	46	11	2	7	3	192	506	0	9	1602
Grand Total	192	16	260	283	22	2105	9	108	34	11	23	16	466	2116	0	33	5694
Apprch %	25.6	2.1	34.6	37.7	1	93.8	0.4	4.8	40.5	13.1	27.4	19	17.8	80.9	0	1.3	
Total %	3.4	0.3	4.6	5	0.4	37	0.2	1.9	0.6	0.2	0.4	0.3	8.2	37.2	0	0.6	
Passenger Vehicles	185	16	260	274	22	2034	9	103	34	11	23	15	462	2043	0	33	5524
% Passenger Vehicles	96.4	100	100	96.8	100	96.6	100	95.4	100	100	100	93.8	99.1	96.6	0	100	97
Heavy Vehicles	7	0	0	9	0	71	0	5	0	0	0	1	4	73	0	0	170
% Heavy Vehicles	3.6	0	0	3.2	0	3.4	0	4.6	0	0	0	6.2	0.9	3.4	0	0	3

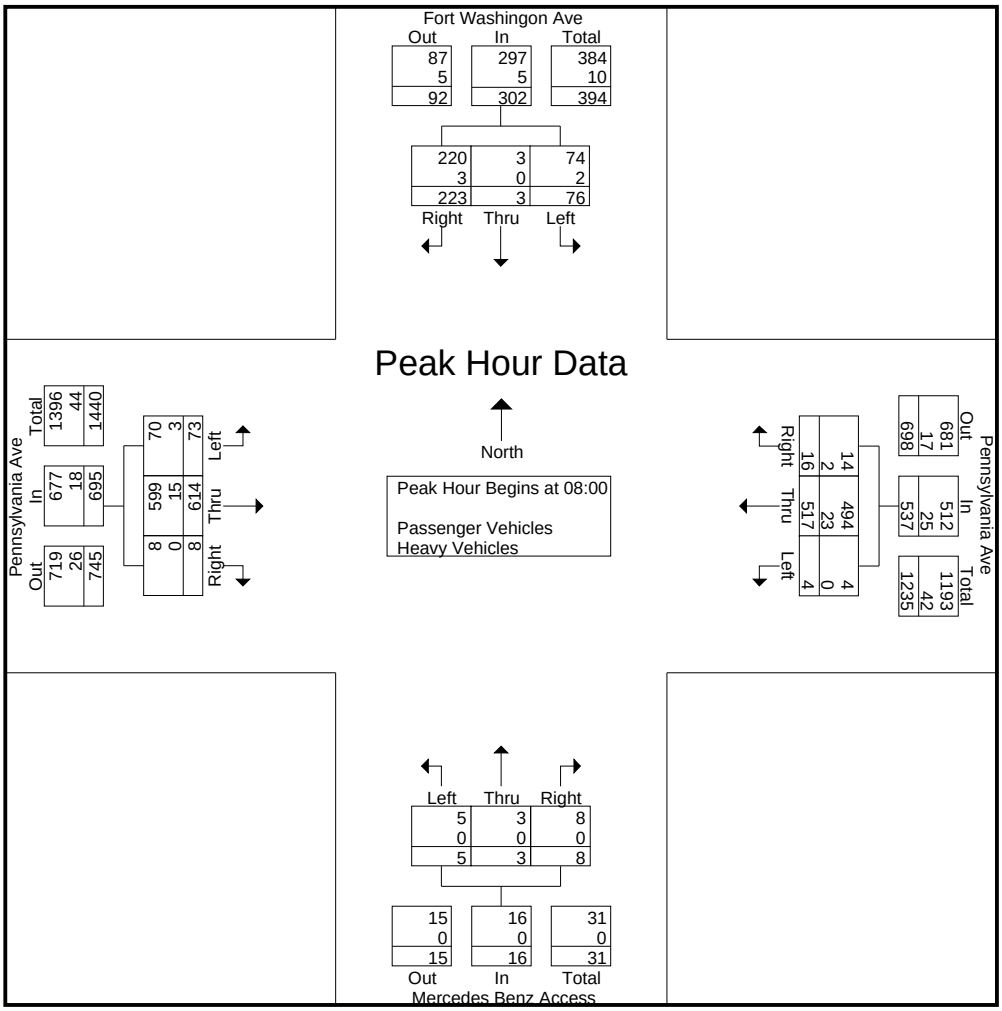
McMahon Associates Inc.

425 Commerce Drive, Suite 200
Fort Washington, PA 19034

Municipality: Upper Dublin Township
Location: Pennsylvania Avenue &
Fort Washington Avenue / Mercedes Benz
Counter/Board #: AB/JB

File Name : toners02w
Site Code : 81347802
Start Date : 7/23/2013
Page No : 2

	Fort Washingon Ave Southbound					Pennsylvania Ave Westbound					Mercedes Benz Access Northbound					Pennsylvania Ave Eastbound					
Start Time	Left	Thru	ROR	Right	App. Total	Left	Thru	ROR	Right	App. Total	Left	Thru	ROR	Right	App. Total	Left	Thru	ROR	Right	App. Total	Int. Total
Peak Hour Analysis From 08:00 to 11:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00																					
08:00	**24**	0	19	35	78	**3**	108	1	2	114	**3**	0	**3**	0	**6**	14	149	0	1	164	362
08:15	22	1	16	16	55	0	122	1	2	125	1	**1**	1	1	4	**25**	155	0	1	181	365
08:30	18	0	19	**45**	82	1	136	**2**	2	141	0	1	1	**2**	4	15	**172**	0	**3**	**190**	**417**
08:45	12	**2**	**30**	43	**87**	0	**151**	1	**5**	**157**	1	1	0	0	2	19	138	0	3	160	406
Total Volume	76	3	84	139	302	4	517	5	11	537	5	3	5	3	16	73	614	0	8	695	1550
% App. Total	25.2	1	27.8	46		0.7	96.3	0.9	2		31.2	18.8	31.2	18.8		10.5	88.3	0	1.2		
PHF	.792	.375	.700	.772	.868	.333	.856	.625	.550	.855	.417	.750	.417	.375	.667	.730	.892	.000	.667	.914	.929
Passenger Vehicles																					
% Passenger Vehicles	97.4	100	100	97.8	98.3	100	95.6	100	81.8	95.3	100	100	100	100	100	95.9	97.6	0	100	97.4	96.9
Heavy Vehicles																					
% Heavy Vehicles	2.6	0	0	2.2	1.7	0	4.4	0	18.2	4.7	0	0	0	0	0	4.1	2.4	0	0	2.6	3.1



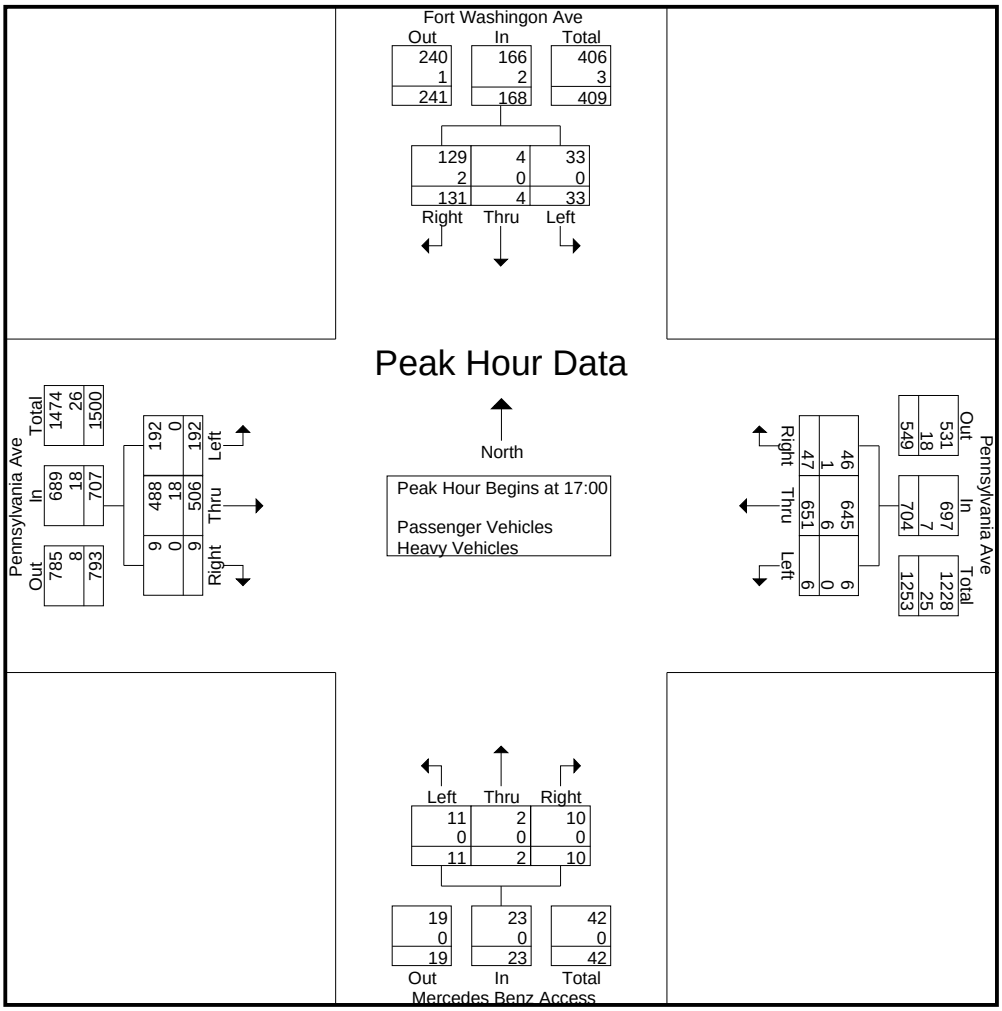
McMahon Associates Inc.

425 Commerce Drive, Suite 200
Fort Washington, PA 19034

Municipality: Upper Dublin Township
Location: Pennsylvania Avenue &
Fort Washington Avenue / Mercedes Benz
Counter/Board #: AB/JB

File Name : toners02w
Site Code : 81347802
Start Date : 7/23/2013
Page No : 3

	Fort Washingon Ave Southbound					Pennsylvania Ave Westbound					Mercedes Benz Access Northbound					Pennsylvania Ave Eastbound					
Start Time	Left	Thru	ROR	Right	App. Total	Left	Thru	ROR	Right	App. Total	Left	Thru	ROR	Right	App. Total	Left	Thru	ROR	Right	App. Total	Int. Total
Peak Hour Analysis From 12:00 to 17:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 17:00																					
17:00	**13**	0	9	**20**	42	2	171	0	11	184	**5**	**1**	3	**1**	**10**	32	128	0	**3**	163	399
17:15	9	1	16	18	**44**	1	152	0	14	167	3	0	0	1	4	**59**	121	0	0	180	395
17:30	5	**2**	13	18	38	**3**	155	0	4	162	2	1	**4**	1	8	50	**137**	0	3	**190**	398
17:45	6	1	**19**	18	44	0	**173**	**1**	**17**	**191**	1	0	0	0	1	51	120	0	3	174	**410**
Total Volume	33	4	57	74	168	6	651	1	46	704	11	2	7	3	23	192	506	0	9	707	1602
% App. Total	19.6	2.4	33.9	44		0.9	92.5	0.1	6.5		47.8	8.7	30.4	13		27.2	71.6	0	1.3		
PHF	.635	.500	.750	.925	.955	.500	.941	.250	.676	.921	.550	.500	.438	.750	.575	.814	.923	.000	.750	.930	.977
Passenger Vehicles % Passenger Vehicles	100	100	100	97.3	98.8	100	99.1	100	97.8	99.0	100	100	100	100	100	100	96.4	0	100	97.5	98.3
Heavy Vehicles % Heavy Vehicles	0	0	0	2.7	1.2	0	0.9	0	2.2	1.0	0	0	0	0	0	0	3.6	0	0	2.5	1.7



Toner's Beef and Ale House Access Counts

Saturday, July 20th 11am -1pm

	Bethelehem Pike				Fort Washington Avenue				Pennsylvania Avenue			
	Left In	Left Out	Right In	Right Out	Left In	Left Out	Right In	Right Out	Left In	Left Out	Right In	Right Out
11:00		1			1							
11:15					2	2	1					
11:30												
11:45												
12:00					1		1	1			1	
12:15												
12:30	1				1		1	2				
12:45				1				1				

Tuesday, July 23rd 8-10am and 4-6pm

	Bethelehem Pike				Fort Washington Avenue				Pennsylvania Avenue			
	Left In	Left Out	Right In	Right Out	Left In	Left Out	Right In	Right Out	Left In	Left Out	Right In	Right Out
8:00												
8:15												
8:30												
8:45												
9:00												
9:15												
9:30					1							
9:45												
	Bethelehem Pike				Fort Washington Avenue				Pennsylvania Avenue			
	Left In	Left Out	Right In	Right Out	Left In	Left Out	Right In	Right Out	Left In	Left Out	Right In	Right Out
4:00												
4:15			1									
4:30						1						
4:45												
5:00				1	1							
5:15	1											
5:30					1		1					
5:45								1				

APPENDIX E

HCM Methodology

CAPACITY/LEVEL-OF-SERVICE ANALYSIS METHODOLOGY

The detailed capacity/level-of-service analysis contained in this transportation impact study was performed in accordance with the standard techniques contained in the *Highway Capacity Manual 2010.* By definition, capacity represents "the maximum sustainable hourly flow rate at which persons or vehicles reasonably can be expected to traverse a point or a uniform section of a lane or roadway during a given time period under prevailing roadway, environmental, traffic, and control conditions." The level at which an intersection or a uniform section of a lane or roadway function can be expressed in terms of a level of service. Level of service (LOS) is defined as "a quantitative stratification of a performance measure or measures that represent quality of service, measured on an A-F scale, with LOS A representing the best operating conditions from the traveler's perspective and LOS F the worst."

Stop-Controlled Intersections

At unsignalized stop-controlled intersections, such as two-way stop-controlled (TWSC) or all-way stop-controlled (AWSC), a methodology for evaluating the relative functioning of these intersections is based upon the control delay. For these types of unsignalized intersections, the analysis of the control delay is based upon the following data:

- Number and configuration of lanes on each approach;
- Percentage of heavy vehicles on each approach;
- Demand flow rate for each entering vehicular movement and pedestrian crossing movement;
- Unique geometric factors such as, channelization aspects; two-way left-turn lanes, raised or striped median storage; approach grades, flared approaches on the minor street; and upstream signals within 0.25 miles.

At TWSC intersections, only drivers on the minor street approaches are required to stop before proceeding into the intersection and left-turning drivers from the major street may have to yield to on-coming major street through or right-turning traffic, but are not required to stop in the absence of on-coming traffic. The capacity at stop-controlled legs is based primarily on three factors: the distribution of gaps in the major stream, driver judgment in selecting the gaps, and the follow-up headways required by each driver in a queue.

At AWSC intersections, every vehicle is required to stop at the intersection before proceeding, and as a result, the decision to proceed is a function of the traffic conditions on the other approaches. Each driver proceeds only after determining that no vehicles are currently in the intersection and that it is the driver's turn to proceed. Capacity at an AWSC intersection is described by the saturation headway or time between departures of successive vehicles on a given approach for a particular case assuming a continuous queue; departure headway or the average time between departures of successive vehicles on a given approach accounting for the probability of each possible case; and service time or the average time sent by a vehicle in first position waiting to depart.

At both TWSC and AWSC intersections, the level of service is based upon the control delay, as well as the corresponding volume-to-capacity ratio for each movement/lane group. For TWSC intersections, the level of service is not calculated for major-street approaches or for the intersection as a whole; however, the intersection-wide level of service is calculated for AWSC intersections. The following table provides a summary of the relationship between the level of service, control delay, and volume-to-capacity ratio for TWSC and AWSC intersections.

Control Delay (Sec/Veh)	LOS by Volume-to-Capacity Ratio	
	v/c ≤ 1.0	**v/c > 1.0**
≤ 10	A	F
> 10 – 15	B	F
> 15 – 25	C	F
> 25 – 35	D	F
> 35 – 50	E	F
> 50	F	F

Signalized Intersections

At three or four-legged signalized intersections, a methodology for evaluating the capacity and quality of service provided to road users traveling through the signalized intersection. For signalized intersections, the level of service can be characterized for the entire intersection, each approach, and each lane group. The level of service is based upon the control delay and volume-to-capacity ratio. The delay quantifies the increase in travel time due to the traffic signal control and is a surrogate measure of driver discomfort and fuel consumption, while the volume-to-capacity ratio quantifies the degree to which a phase's capacity is utilized by a lane group. Input data in determining the delay and volume-to-capacity ratio include:

- Demand flow rate for each entering vehicular movement and pedestrian crossing movement, including right-turn on red volumes and percent of heavy vehicles;
- Initial queue for each lane group;
- Number and configuration of lanes on each approach;
- Type of signal control and phase sequence;
- Allocation of minimum/maximum green times and clearance intervals (Yellow plus All Red phases); and
- Phase recall.

At signalized intersections, the level of service is based upon the control delay, as well as the corresponding volume-to-capacity ratio for each movement/lane group. The following table provides a summary of the relationship between the level of service, control delay, and volume-to-capacity ratio for signalized intersections.

Control Delay (Sec/Veh)	LOS by Volume-to-Capacity Ratio	
	v/c ≤ 1.0	**v/c > 1.0**
≤ 10	A	F
> 10 – 20	B	F
> 20 – 35	C	F
> 35 – 55	D	F
> 55 – 80	E	F
> 80	F	F

APPENDIX F

2013 Existing
Capacity/Level-of-Service Analysis Worksheets

Lanes, Volumes, Timings
1: Bethlehem Pike (S.R. 2018) & Toner's Tavern

8/21/2013

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	0	0	315	0	0	530
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%		0%			1%
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	1863	0	1863	0	0	1853
Flt Permitted						
Satd. Flow (perm)	1863	0	1863	0	0	1853
Link Speed (mph)	25		30			40
Link Distance (ft)	100		146			414
Travel Time (s)	2.7		3.3			7.1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	342	0	0	576
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	342	0	0	576
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		11			11
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.01	1.01
Turning Speed (mph)	15	9		9	15	
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 31.2%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
1: Bethlehem Pike (S.R. 2018) & Toner's Tavern

8/21/2013

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	0	315	0	0	530
Sign Control	Stop		Free			Free
Grade	0%		0%			1%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	342	0	0	576
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			146			
pX, platoon unblocked	0.90	0.90			0.90	
vC, conflicting volume	918	342			342	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	851	209			209	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	296	745			1221	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	0	342	576
Volume Left	0	0	0
Volume Right	0	0	0
cSH	1700	1700	1221
Volume to Capacity	0.00	0.20	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.0	0.0
Lane LOS	A		
Approach Delay (s)	0.0	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	31.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	2	3	8	618	0	133	2	182	502	180	350	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	12	11	12	11	12	11	11	12
Grade (%)		0%			-4%			-2%			1%	
Storage Length (ft)	0		0	0		0	100		100	115		0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.913				0.850			0.850		0.999	
Flt Protected		0.993		0.950			0.950			0.950		
Satd. Flow (prot)	0	1665	0	1728	0	1474	1823	1801	1599	1669	1773	0
Flt Permitted		0.993		0.950			0.241			0.500		
Satd. Flow (perm)	0	1665	0	1728	0	1474	462	1801	1599	879	1773	0
Right Turn on Red			Yes			No			No			Yes
Satd. Flow (RTOR)		9										
Link Speed (mph)		25			35			35			40	
Link Distance (ft)		173			115			625			146	
Travel Time (s)		4.7			2.2			12.2			2.5	
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%	3%	0%	8%	0%	3%	2%	4%	3%	0%
Adj. Flow (vph)	2	3	9	672	0	145	2	198	546	196	380	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	14	0	672	0	145	2	198	546	196	382	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			11			12			12	
Link Offset(ft)		70			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes				
Headway Factor	1.04	1.04	1.04	1.02	0.97	1.02	0.99	1.03	0.99	1.05	1.05	1.01
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	1		1		1	0	0	0	1	0	
Detector Template	Left											
Leading Detector (ft)	20	25		35		35	0	0	0	35	0	
Trailing Detector (ft)	0	-5		-5		-5	0	0	0	-5	0	
Detector 1 Position(ft)	0	-5		-5		-5	0	0	0	-5	0	
Detector 1 Size(ft)	20	30		40		40	20	6	6	40	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Turn Type	Perm	NA		Prot		custom	Perm	NA	custom	pm+pt	NA	
Protected Phases		9		10 4		1 10		2	10	1	6	
Permitted Phases	9					10 4	2		2	6		
Detector Phase	9	9		10 4		1 10	2	2	10	1	6	
Switch Phase												
Minimum Initial (s)	3.0	3.0					10.0	10.0	4.0	3.0	10.0	

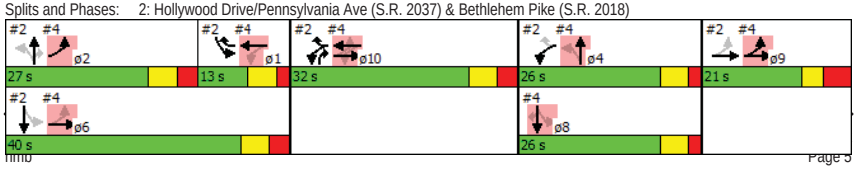
Lane Group	ø4	ø8
Lane Configurations		
Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Turn Type		
Protected Phases	4	8
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	3.0	3.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	10.0	10.0					17.0	17.0	11.0	9.0	17.0	
Total Split (s)	21.0	21.0					27.0	27.0	32.0	13.0	40.0	
Total Split (%)	17.6%	17.6%					22.7%	22.7%	26.9%	10.9%	33.6%	
Maximum Green (s)	14.0	14.0					20.0	20.0	25.0	7.0	33.0	
Yellow Time (s)	3.0	3.0					4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	4.0	4.0					3.0	3.0	3.0	2.0	3.0	
Lost Time Adjust (s)		0.0					0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		7.0					7.0	7.0	7.0	6.0	7.0	
Lead/Lag							Lead	Lead		Lag		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0					3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None					Min	Min	None	None	Min	
Act Effct Green (s)		13.3		49.4		63.6	16.6	16.6	41.8	30.8	29.8	
Actuated g/C Ratio		0.12		0.43		0.56	0.15	0.15	0.37	0.27	0.26	
v/c Ratio		0.07		0.89		0.18	0.03	0.75	0.93	0.68	0.82	
Control Delay		30.4		36.0		3.9	43.0	65.2	50.5	52.9	55.6	
Queue Delay		0.0		29.5		0.8	0.0	0.0	0.0	0.0	0.0	
Total Delay		30.4		65.5		4.6	43.0	65.2	50.5	52.9	55.6	
LOS		C		E		A	D	E	D	D	E	
Approach Delay		30.4						54.4			54.7	
Approach LOS		C						D			D	
Queue Length 50th (ft)		3		528		16	1	144	277	122	271	
Queue Length 95th (ft)		24		#730		19	9	226	#493	193	#411	
Internal Link Dist (ft)		93			35			545			66	
Turn Bay Length (ft)							100		100	115		
Base Capacity (vph)		213		779		825	81	318	587	287	517	
Starvation Cap Reductn		0		138		451	0	0	0	0	0	
Spillback Cap Reductn		0		0		0	0	0	0	0	0	
Storage Cap Reductn		0		0		0	0	0	0	0	0	
Reduced v/c Ratio		0.07		1.05		0.39	0.02	0.62	0.93	0.68	0.74	

Intersection Summary

Area Type: Other
Cycle Length: 119
Actuated Cycle Length: 113.6
Natural Cycle: 75
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.93
Intersection Signal Delay: 54.4 Intersection LOS: D
Intersection Capacity Utilization 82.8% ICU Level of Service E
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Hollywood Drive/Pennsylvania Ave (S.R. 2037) & Bethlehem Pike (S.R. 2018)



Lane Group	ø4	ø8
Minimum Split (s)	9.0	9.0
Total Split (s)	26.0	26.0
Total Split (%)	22%	22%
Maximum Green (s)	20.0	20.0
Yellow Time (s)	4.0	4.0
All-Red Time (s)	2.0	2.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	None	None
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

Lanes, Volumes, Timings
3: Pennsylvania Ave (S.R. 2037) & Toner's Tavern

8/21/2013

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	685	751	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)		4%	-4%		0%	
Lane Util. Factor	0.95	0.95	0.95	0.95	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	0	3468	3610	0	1863	0
Flt Permitted						
Satd. Flow (perm)	0	3468	3610	0	1863	0
Link Speed (mph)		35	35		25	
Link Distance (ft)		115	107		93	
Travel Time (s)		2.2	2.1		2.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	745	816	0	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	745	816	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.03	1.03	0.97	0.97	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 24.1%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
3: Pennsylvania Ave (S.R. 2037) & Toner's Tavern

8/21/2013

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	685	751	0	0	0
Sign Control		Free	Free		Stop	
Grade		4%	-4%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	745	816	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		115	107			
pX, platoon unblocked	0.87				0.87	0.87
vC, conflicting volume	816				1189	408
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	483				912	13
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	933				237	923

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	248	496	544	272	0
Volume Left	0	0	0	0	0
Volume Right	0	0	0	0	0
cSH	933	1700	1700	1700	1700
Volume to Capacity	0.00	0.29	0.32	0.16	0.00
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0
Lane LOS					A
Approach Delay (s)	0.0		0.0		0.0
Approach LOS					A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	24.1%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	73	614	8	4	517	16	5	3	8	76	3	223
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	11	11	12	12	12	10	10	11
Grade (%)		4%			-4%			-4%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		100
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.996			0.929				0.850
Flt Protected		0.995						0.986			0.954	
Satd. Flow (prot)	0	3323	0	0	3401	0	0	1775	0	0	1644	1546
Flt Permitted		0.765			0.950			0.927			0.721	
Satd. Flow (perm)	0	2555	0	0	3231	0	0	1669	0	0	1243	1546
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3			3			9				240
Link Speed (mph)		35			35			25			35	
Link Distance (ft)		107			918			414			138	
Travel Time (s)		2.1			17.9			11.3			2.7	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	4%	2%	0%	0%	4%	13%	0%	0%	0%	3%	0%	1%
Adj. Flow (vph)	78	660	9	4	556	17	5	3	9	82	3	240
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	747	0	0	577	0	0	17	0	0	85	240
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.02	1.02	1.02	0.97	0.97	0.97	1.09	1.09	1.04
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	0		1	1		1	1		1	1	1
Detector Template	Left			Left			Left			Left		
Leading Detector (ft)	20	0		20	35		20	25		20	35	35
Trailing Detector (ft)	0	0		0	-5		0	-5		0	-5	-5
Detector 1 Position(ft)	0	0		0	-5		0	-5		0	-5	-5
Detector 1 Size(ft)	20	6		20	40		20	30		20	40	40
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Turn Type	custom	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	2 9	6 9 10			1 10			4			8	
Permitted Phases	6 10			1 10			4			8		8
Detector Phase	2 9	6 9 10		1 10	1 10		4	4		8	8	8
Switch Phase												
Minimum Initial (s)								3.0	3.0		3.0	3.0

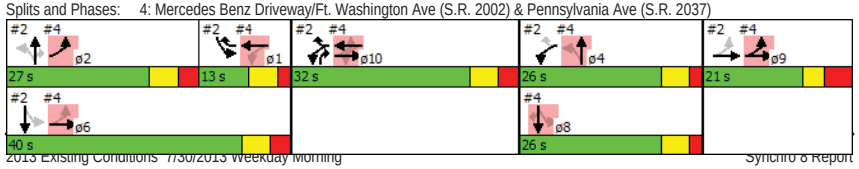
Lane Group	ø1	ø2	ø6	ø9	ø10
Lane Configurations					
Volume (vph)					
Ideal Flow (vphpl)					
Lane Width (ft)					
Grade (%)					
Storage Length (ft)					
Storage Lanes					
Taper Length (ft)					
Lane Util. Factor					
Frt					
Flt Protected					
Satd. Flow (prot)					
Flt Permitted					
Satd. Flow (perm)					
Right Turn on Red					
Satd. Flow (RTOR)					
Link Speed (mph)					
Link Distance (ft)					
Travel Time (s)					
Peak Hour Factor					
Heavy Vehicles (%)					
Adj. Flow (vph)					
Shared Lane Traffic (%)					
Lane Group Flow (vph)					
Enter Blocked Intersection					
Lane Alignment					
Median Width(ft)					
Link Offset(ft)					
Crosswalk Width(ft)					
Two way Left Turn Lane					
Headway Factor					
Turning Speed (mph)					
Number of Detectors					
Detector Template					
Leading Detector (ft)					
Trailing Detector (ft)					
Detector 1 Position(ft)					
Detector 1 Size(ft)					
Detector 1 Type					
Detector 1 Channel					
Detector 1 Extend (s)					
Detector 1 Queue (s)					
Detector 1 Delay (s)					
Turn Type					
Protected Phases	1	2	6	9	10
Permitted Phases					
Detector Phase					
Switch Phase					
Minimum Initial (s)	3.0	10.0	10.0	3.0	4.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)							9.0	9.0		9.0	9.0	9.0
Total Split (s)							26.0	26.0		26.0	26.0	26.0
Total Split (%)							21.8%	21.8%		21.8%	21.8%	21.8%
Maximum Green (s)							20.0	20.0		20.0	20.0	20.0
Yellow Time (s)							4.0	4.0		4.0	4.0	4.0
All-Red Time (s)							2.0	2.0		2.0	2.0	2.0
Lost Time Adjust (s)								0.0			0.0	0.0
Total Lost Time (s)								6.0			6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)							3.0	3.0		3.0	3.0	3.0
Recall Mode							None	None		None	None	None
Act Effct Green (s)		82.2			39.3			18.3			18.3	18.3
Actuated g/C Ratio		0.72			0.35			0.16			0.16	0.16
v/c Ratio		0.36			0.52			0.06			0.43	0.53
Control Delay		1.7			32.5			28.4			51.1	10.2
Queue Delay		1.1			0.6			0.0			0.0	0.1
Total Delay		2.8			33.1			28.4			51.1	10.4
LOS		A			C			C			D	B
Approach Delay		2.8			33.1			28.4			21.0	
Approach LOS		A			C			C			C	
Queue Length 50th (ft)		8			183			5			58	0
Queue Length 95th (ft)		m25			247			27			111	72
Internal Link Dist (ft)		27			838			334			58	
Turn Bay Length (ft)												100
Base Capacity (vph)		2043			1118			302			219	470
Starvation Cap Reductn		985			0			0			0	0
Spillback Cap Reductn		0			236			0			0	17
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		0.71			0.65			0.06			0.39	0.53

Intersection Summary

Area Type: Other
Cycle Length: 119
Actuated Cycle Length: 113.6
Natural Cycle: 75
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.93
Intersection Signal Delay: 17.1 Intersection LOS: B
Intersection Capacity Utilization 61.1% ICU Level of Service B
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Mercedes Benz Driveway/Ft. Washington Ave (S.R. 2002) & Pennsylvania Ave (S.R. 2037)



Lane Group	ø1	ø2	ø6	ø9	ø10
Minimum Split (s)	9.0	17.0	17.0	10.0	11.0
Total Split (s)	13.0	27.0	40.0	21.0	32.0
Total Split (%)	11%	23%	34%	18%	27%
Maximum Green (s)	7.0	20.0	33.0	14.0	25.0
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	2.0	3.0	3.0	4.0	3.0
Lost Time Adjust (s)					
Total Lost Time (s)					
Lead/Lag	Lag	Lead			
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	Min	Min	None	None
Act Effct Green (s)					
Actuated g/C Ratio					
v/c Ratio					
Control Delay					
Queue Delay					
Total Delay					
LOS					
Approach Delay					
Approach LOS					
Queue Length 50th (ft)					
Queue Length 95th (ft)					
Internal Link Dist (ft)					
Turn Bay Length (ft)					
Base Capacity (vph)					
Starvation Cap Reductn					
Spillback Cap Reductn					
Storage Cap Reductn					
Reduced v/c Ratio					

Intersection Summary

Lanes, Volumes, Timings
5: Ft. Washington Ave (S.R. 2002) & Toner's Tavern

8/21/2013

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	0	0	1	91	302	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	1863	0	0	1863	1863	0
Flt Permitted						
Satd. Flow (perm)	1863	0	0	1863	1863	0
Link Speed (mph)	25			30	35	
Link Distance (ft)	65			138	278	
Travel Time (s)	1.8			3.1	5.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	1	99	328	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	100	328	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 19.2%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
5: Ft. Washington Ave (S.R. 2002) & Toner's Tavern

8/21/2013

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	0	1	91	302	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	1	99	328	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				138		
pX, platoon unblocked						
vC, conflicting volume	429	328	328			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	429	328	328			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	582	713	1231			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	0	100	328
Volume Left	0	1	0
Volume Right	0	0	0
cSH	1700	1231	1700
Volume to Capacity	0.00	0.00	0.19
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.1	0.0
Lane LOS	A	A	
Approach Delay (s)	0.0	0.1	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	19.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lanes, Volumes, Timings
1: Bethlehem Pike (S.R. 2018) & Toner's Tavern

8/21/2013

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	0	1	503	0	1	405
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%		0%			1%
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.865					
Flt Protected						
Satd. Flow (prot)	1611	0	1863	0	0	1853
Flt Permitted						
Satd. Flow (perm)	1611	0	1863	0	0	1853
Link Speed (mph)	25		30			40
Link Distance (ft)	100		146			414
Travel Time (s)	2.7		3.3			7.1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1	547	0	1	440
Shared Lane Traffic (%)						
Lane Group Flow (vph)	1	0	547	0	0	441
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		11			11
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.01	1.01
Turning Speed (mph)	15	9		9	15	
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 36.5%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
1: Bethlehem Pike (S.R. 2018) & Toner's Tavern

8/21/2013

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	1	503	0	1	405
Sign Control	Stop		Free			Free
Grade	0%		0%			1%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	1	547	0	1	440
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			146			
pX, platoon unblocked	0.83	0.83			0.83	
vC, conflicting volume	989	547			547	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	886	355			355	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	262	574			1002	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	1	547	441
Volume Left	0	0	1
Volume Right	1	0	0
cSH	574	1700	1002
Volume to Capacity	0.00	0.32	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	11.3	0.0	0.0
Lane LOS	B		A
Approach Delay (s)	11.3	0.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	36.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	1	3	620	0	194	4	309	538	147	258	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	12	11	12	11	12	11	11	12
Grade (%)		0%			-4%			-2%			1%	
Storage Length (ft)	0		0	0		0	100		100	115		0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.919				0.850			0.850		0.998	
Flt Protected		0.990		0.950			0.950			0.950		
Satd. Flow (prot)	0	1671	0	1762	0	1561	1823	1837	1584	1638	1771	0
Flt Permitted		0.990		0.950			0.385			0.300		
Satd. Flow (perm)	0	1671	0	1762	0	1561	739	1837	1584	517	1771	0
Right Turn on Red			Yes			No			No			Yes
Satd. Flow (RTOR)		3									1	
Link Speed (mph)		25			35			35			40	
Link Distance (ft)		173			115			625			146	
Travel Time (s)		4.7			2.2			12.2			2.5	
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Heavy Vehicles (%)	0%	0%	0%	1%	0%	2%	0%	1%	3%	6%	3%	0%
Adj. Flow (vph)	1	1	3	626	0	196	4	312	543	148	261	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	5	0	626	0	196	4	312	543	148	265	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			11			12			12	
Link Offset(ft)		70			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes				
Headway Factor	1.04	1.04	1.04	1.02	0.97	1.02	0.99	1.03	0.99	1.05	1.05	1.01
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	1		1		1	0	0	0	1	0	
Detector Template	Left											
Leading Detector (ft)	20	25		35		35	0	0	0	35	0	
Trailing Detector (ft)	0	-5		-5		-5	0	0	0	-5	0	
Detector 1 Position(ft)	0	-5		-5		-5	0	0	0	-5	0	
Detector 1 Size(ft)	20	30		40		40	20	6	6	40	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Turn Type	Perm	NA		Prot		custom	Perm	NA	custom	pm+pt	NA	
Protected Phases		9		10 4		1 10		2	10	1	6	
Permitted Phases	9					10 4	2		2	6		
Detector Phase	9	9		10 4		1 10	2	2	10	1	6	
Switch Phase												
Minimum Initial (s)	3.0	3.0					10.0	10.0	4.0	3.0	10.0	

Lane Group	ø4	ø8
Lane Configurations		
Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Turn Type		
Protected Phases	4	8
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	3.0	3.0

Lanes, Volumes, Timings
2: Hollywood Drive/Pennsylvania Ave (S.R. 2037) & Bethlehem Pike (S.R. 2018)

8/21/2013

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	10.0	10.0					17.0	17.0	11.0	9.0	17.0	
Total Split (s)	21.0	21.0					27.0	27.0	32.0	13.0	40.0	
Total Split (%)	17.6%	17.6%					22.7%	22.7%	26.9%	10.9%	33.6%	
Maximum Green (s)	14.0	14.0					20.0	20.0	25.0	7.0	33.0	
Yellow Time (s)	3.0	3.0					4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	4.0	4.0					3.0	3.0	3.0	2.0	3.0	
Lost Time Adjust (s)		0.0					0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		7.0					7.0	7.0	7.0	6.0	7.0	
Lead/Lag							Lead	Lead		Lag		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0					3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None					Min	Min	None	None	Min	
Act Effct Green (s)		12.8		47.9		62.0	20.0	20.0	45.1	34.1	33.1	
Actuated g/C Ratio		0.11		0.42		0.54	0.17	0.17	0.39	0.30	0.29	
v/c Ratio		0.03		0.85		0.23	0.03	0.97	0.87	0.67	0.52	
Control Delay		35.6		30.4		3.8	42.5	93.1	40.7	57.4	39.5	
Queue Delay		0.0		45.1		1.3	0.0	0.0	0.0	0.0	0.0	
Total Delay		35.6		75.5		5.1	42.5	93.1	40.7	57.4	39.5	
LOS		D		E		A	D	F	D	E	D	
Approach Delay		35.6						59.8			45.9	
Approach LOS		D						E			D	
Queue Length 50th (ft)		1		497		17	3	~246	275	89	172	
Queue Length 95th (ft)		14		#639		25	13	#432	#500	#165	260	
Internal Link Dist (ft)		93			35			545			66	
Turn Bay Length (ft)							100		100	115		
Base Capacity (vph)		206		784		841	129	320	621	221	510	
Starvation Cap Reductn		0		207		461	0	0	0	0	0	
Spillback Cap Reductn		0		0		0	0	0	0	0	0	
Storage Cap Reductn		0		0		0	0	0	0	0	0	
Reduced v/c Ratio		0.02		1.08		0.52	0.03	0.97	0.87	0.67	0.52	

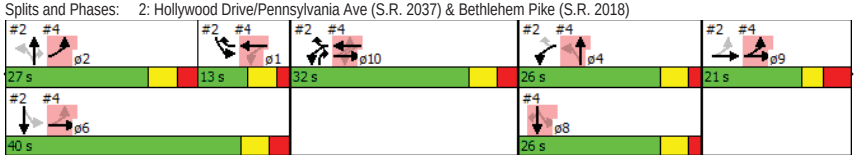
Intersection Summary

Area Type: Other
Cycle Length: 119
Actuated Cycle Length: 114.9
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.97
Intersection Signal Delay: 56.6 — Intersection LOS: E
Intersection Capacity Utilization 79.6% — ICU Level of Service D
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Hollywood Drive/Pennsylvania Ave (S.R. 2037) & Bethlehem Pike (S.R. 2018)



Lanes, Volumes, Timings
2: Hollywood Drive/Pennsylvania Ave (S.R. 2037) & Bethlehem Pike (S.R. 2018)

8/21/2013

Lane Group	ø4	ø8
Minimum Split (s)	9.0	9.0
Total Split (s)	26.0	26.0
Total Split (%)	22%	22%
Maximum Green (s)	20.0	20.0
Yellow Time (s)	4.0	4.0
All-Red Time (s)	2.0	2.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	None	None
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

Lanes, Volumes, Timings
3: Pennsylvania Ave (S.R. 2037) & Toner's Tavern

8/21/2013

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	686	814	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)		4%	-4%		0%	
Lane Util. Factor	0.95	0.95	0.95	0.95	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	0	3468	3610	0	1863	0
Flt Permitted						
Satd. Flow (perm)	0	3468	3610	0	1863	0
Link Speed (mph)		35	35		25	
Link Distance (ft)		115	107		93	
Travel Time (s)		2.2	2.1		2.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	746	885	0	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	746	885	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.03	1.03	0.97	0.97	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 25.8%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
3: Pennsylvania Ave (S.R. 2037) & Toner's Tavern

8/21/2013

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	686	814	0	0	0
Sign Control		Free	Free		Stop	
Grade		4%	-4%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	746	885	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		115	107			
pX, platoon unblocked	0.83				0.83	0.83
vC, conflicting volume	885				1258	442
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	451				900	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	918				231	900

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	249	497	590	295	0
Volume Left	0	0	0	0	0
Volume Right	0	0	0	0	0
cSH	918	1700	1700	1700	1700
Volume to Capacity	0.00	0.29	0.35	0.17	0.00
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0
Lane LOS					A
Approach Delay (s)	0.0		0.0		0.0
Approach LOS					A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	25.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	192	506	9	6	651	47	11	2	10	33	4	131
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	11	11	12	12	12	10	10	11
Grade (%)		4%			-4%			-4%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		100
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.990			0.941				0.850
Flt Protected		0.987						0.977			0.957	
Satd. Flow (prot)	0	3275	0	0	3487	0	0	1782	0	0	1697	1531
Flt Permitted		0.530			0.948			0.878			0.745	
Satd. Flow (perm)	0	1759	0	0	3306	0	0	1601	0	0	1321	1531
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3			7			10				229
Link Speed (mph)		35			35			25			35	
Link Distance (ft)		107			918			414			138	
Travel Time (s)		2.1			17.9			11.3			2.7	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	0%	4%	0%	0%	1%	2%	0%	0%	0%	0%	0%	2%
Adj. Flow (vph)	196	516	9	6	664	48	11	2	10	34	4	134
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	721	0	0	718	0	0	23	0	0	38	134
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.02	1.02	1.02	0.97	0.97	0.97	1.09	1.09	1.04
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	0		1	1		1	1		1	1	1
Detector Template	Left			Left			Left			Left		
Leading Detector (ft)	20	0		20	35		20	25		20	35	35
Trailing Detector (ft)	0	0		0	-5		0	-5		0	-5	-5
Detector 1 Position(ft)	0	0		0	-5		0	-5		0	-5	-5
Detector 1 Size(ft)	20	6		20	40		20	30		20	40	40
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Turn Type	custom	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	2 9	6 9 10			1 10			4			8	
Permitted Phases	6 10			1 10			4			8		8
Detector Phase	2 9	6 9 10		1 10	1 10		4	4		8	8	8
Switch Phase												
Minimum Initial (s)								3.0	3.0		3.0	3.0

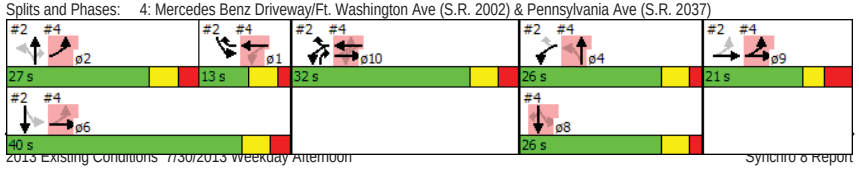
Lane Group	ø1	ø2	ø6	ø9	ø10
Lane Configurations					
Volume (vph)					
Ideal Flow (vphpl)					
Lane Width (ft)					
Grade (%)					
Storage Length (ft)					
Storage Lanes					
Taper Length (ft)					
Lane Util. Factor					
Frt					
Flt Protected					
Satd. Flow (prot)					
Flt Permitted					
Satd. Flow (perm)					
Right Turn on Red					
Satd. Flow (RTOR)					
Link Speed (mph)					
Link Distance (ft)					
Travel Time (s)					
Peak Hour Factor					
Heavy Vehicles (%)					
Adj. Flow (vph)					
Shared Lane Traffic (%)					
Lane Group Flow (vph)					
Enter Blocked Intersection					
Lane Alignment					
Median Width(ft)					
Link Offset(ft)					
Crosswalk Width(ft)					
Two way Left Turn Lane					
Headway Factor					
Turning Speed (mph)					
Number of Detectors					
Detector Template					
Leading Detector (ft)					
Trailing Detector (ft)					
Detector 1 Position(ft)					
Detector 1 Size(ft)					
Detector 1 Type					
Detector 1 Channel					
Detector 1 Extend (s)					
Detector 1 Queue (s)					
Detector 1 Delay (s)					
Turn Type					
Protected Phases	1	2	6	9	10
Permitted Phases					
Detector Phase					
Switch Phase					
Minimum Initial (s)	3.0	10.0	10.0	3.0	4.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)							9.0	9.0		9.0	9.0	9.0
Total Split (s)							26.0	26.0		26.0	26.0	26.0
Total Split (%)							21.8%	21.8%		21.8%	21.8%	21.8%
Maximum Green (s)							20.0	20.0		20.0	20.0	20.0
Yellow Time (s)							4.0	4.0		4.0	4.0	4.0
All-Red Time (s)							2.0	2.0		2.0	2.0	2.0
Lost Time Adjust (s)								0.0			0.0	0.0
Total Lost Time (s)								6.0			6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)							3.0	3.0		3.0	3.0	3.0
Recall Mode							None	None		None	None	None
Act Effct Green (s)		85.0			39.1			16.8			16.8	16.8
Actuated g/C Ratio		0.74			0.34			0.15			0.15	0.15
v/c Ratio		0.39			0.64			0.09			0.20	0.32
Control Delay		2.3			35.4			29.9			45.4	2.0
Queue Delay		1.0			1.3			0.0			0.0	0.0
Total Delay		3.4			36.7			29.9			45.4	2.0
LOS		A			D			C			D	A
Approach Delay		3.4			36.7			29.9			11.6	
Approach LOS		A			D			C			B	
Queue Length 50th (ft)		13			245			9			25	0
Queue Length 95th (ft)		m31			313			33			59	0
Internal Link Dist (ft)		27			838			334			58	
Turn Bay Length (ft)												100
Base Capacity (vph)		1778			1129			287			230	455
Starvation Cap Reductn		753			0			0			0	0
Spillback Cap Reductn		0			216			0			0	14
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		0.70			0.79			0.08			0.17	0.30

Intersection Summary	
Area Type:	Other
Cycle Length: 119	
Actuated Cycle Length: 114.9	
Natural Cycle: 80	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.97	
Intersection Signal Delay: 19.3	Intersection LOS: B
Intersection Capacity Utilization 63.3%	ICU Level of Service B
Analysis Period (min) 15	

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Mercedes Benz Driveway/Ft. Washington Ave (S.R. 2002) & Pennsylvania Ave (S.R. 2037)



Lane Group	ø1	ø2	ø6	ø9	ø10
Minimum Split (s)	9.0	17.0	17.0	10.0	11.0
Total Split (s)	13.0	27.0	40.0	21.0	32.0
Total Split (%)	11%	23%	34%	18%	27%
Maximum Green (s)	7.0	20.0	33.0	14.0	25.0
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	2.0	3.0	3.0	4.0	3.0
Lost Time Adjust (s)					
Total Lost Time (s)					
Lead/Lag	Lag	Lead			
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	Min	Min	None	None
Act Effct Green (s)					
Actuated g/C Ratio					
v/c Ratio					
Control Delay					
Queue Delay					
Total Delay					
LOS					
Approach Delay					
Approach LOS					
Queue Length 50th (ft)					
Queue Length 95th (ft)					
Internal Link Dist (ft)					
Turn Bay Length (ft)					
Base Capacity (vph)					
Starvation Cap Reductn					
Spillback Cap Reductn					
Storage Cap Reductn					
Reduced v/c Ratio					

Intersection Summary

Lanes, Volumes, Timings
5: Ft. Washington Ave (S.R. 2002) & Toner's Tavern

8/21/2013

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	0	1	2	239	167	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.865				0.999	
Flt Protected						
Satd. Flow (prot)	1611	0	0	1863	1861	0
Flt Permitted						
Satd. Flow (perm)	1611	0	0	1863	1861	0
Link Speed (mph)	25			30	35	
Link Distance (ft)	65			138	278	
Travel Time (s)	1.8			3.1	5.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1	2	260	182	1
Shared Lane Traffic (%)						
Lane Group Flow (vph)	1	0	0	262	183	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 24.2%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
5: Ft. Washington Ave (S.R. 2002) & Toner's Tavern

8/21/2013

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	1	2	239	167	1
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	1	2	260	182	1
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				138		
pX, platoon unblocked						
vC, conflicting volume	446	182	183			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	446	182	183			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	569	860	1392			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	1	262	183
Volume Left	0	2	0
Volume Right	1	0	1
cSH	860	1392	1700
Volume to Capacity	0.00	0.00	0.11
Queue Length 95th (ft)	0	0	0
Control Delay (s)	9.2	0.1	0.0
Lane LOS	A	A	
Approach Delay (s)	9.2	0.1	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	24.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lanes, Volumes, Timings
1: Bethlehem Pike (S.R. 2018) & Toner's Tavern

8/21/2013

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	0	1	330	0	1	303
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%		0%			1%
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.865					
Flt Protected						
Satd. Flow (prot)	1611	0	1863	0	0	1853
Flt Permitted						
Satd. Flow (perm)	1611	0	1863	0	0	1853
Link Speed (mph)	25		30			40
Link Distance (ft)	100		146			414
Travel Time (s)	2.7		3.3			7.1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1	359	0	1	329
Shared Lane Traffic (%)						
Lane Group Flow (vph)	1	0	359	0	0	330
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		11			11
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.01	1.01
Turning Speed (mph)	15	9		9	15	
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 27.4%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
1: Bethlehem Pike (S.R. 2018) & Toner's Tavern

8/21/2013

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	1	330	0	1	303
Sign Control	Stop		Free			Free
Grade	0%		0%			1%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	1	359	0	1	329
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			146			
pX, platoon unblocked	0.89	0.89			0.89	
vC, conflicting volume	690	359			359	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	589	217			217	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	418	732			1203	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	1	359	330
Volume Left	0	0	1
Volume Right	1	0	0
cSH	732	1700	1203
Volume to Capacity	0.00	0.21	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	9.9	0.0	0.0
Lane LOS	A		A
Approach Delay (s)	9.9	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	27.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	2	3	4	219	0	120	5	210	205	133	170	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	12	11	12	11	12	11	11	12
Grade (%)		0%			-4%			-2%			1%	
Storage Length (ft)	0		0	0		0	100		100	115		0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.940				0.850			0.850		0.996	
Flt Protected		0.989		0.950			0.950			0.950		
Satd. Flow (prot)	0	1707	0	1762	0	1577	1823	1837	1615	1702	1752	0
Flt Permitted		0.989		0.950			0.643			0.533		
Satd. Flow (perm)	0	1707	0	1762	0	1577	1234	1837	1615	955	1752	0
Right Turn on Red			Yes			No			No			Yes
Satd. Flow (RTOR)		4									1	
Link Speed (mph)		25			35			35			40	
Link Distance (ft)		173			115			625			146	
Travel Time (s)		4.7			2.2			12.2			2.5	
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
Heavy Vehicles (%)	0%	0%	0%	1%	0%	1%	0%	1%	1%	2%	4%	0%
Adj. Flow (vph)	2	3	4	228	0	125	5	219	214	139	177	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	9	0	228	0	125	5	219	214	139	182	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			11			12			12	
Link Offset(ft)		70			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes				
Headway Factor	1.04	1.04	1.04	1.02	0.97	1.02	0.99	1.03	0.99	1.05	1.05	1.01
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	1		1		1	0	0	0	1	0	
Detector Template	Left											
Leading Detector (ft)	20	25		35		35	0	0	0	35	0	
Trailing Detector (ft)	0	-5		-5		-5	0	0	0	-5	0	
Detector 1 Position(ft)	0	-5		-5		-5	0	0	0	-5	0	
Detector 1 Size(ft)	20	30		40		40	20	6	6	40	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Turn Type	Perm	NA		Prot		custom	Perm	NA	custom	pm+pt	NA	
Protected Phases		9		10 4		1 10		2	10	1	6	
Permitted Phases	9					10 4	2		2	6		
Detector Phase	9	9		10 4		1 10	2	2	10	1	6	
Switch Phase												
Minimum Initial (s)	3.0	3.0					10.0	10.0	4.0	3.0	10.0	

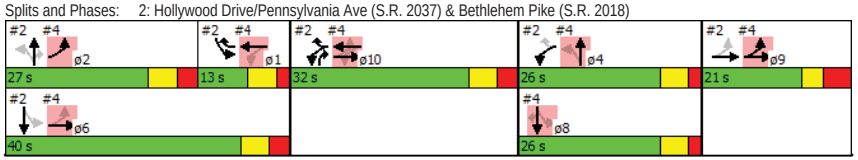
Lane Group	ø4	ø8
Lane Configurations		
Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Turn Type		
Protected Phases	4	8
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	3.0	3.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	10.0	10.0					17.0	17.0	11.0	9.0	17.0	
Total Split (s)	21.0	21.0					27.0	27.0	32.0	13.0	40.0	
Total Split (%)	17.6%	17.6%					22.7%	22.7%	26.9%	10.9%	33.6%	
Maximum Green (s)	14.0	14.0					20.0	20.0	25.0	7.0	33.0	
Yellow Time (s)	3.0	3.0					4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	4.0	4.0					3.0	3.0	3.0	2.0	3.0	
Lost Time Adjust (s)		0.0					0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		7.0					7.0	7.0	7.0	6.0	7.0	
Lead/Lag							Lead	Lead		Lag		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0					3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None					Min	Min	None	None	Min	
Act Effct Green (s)		8.1		31.3		45.5	15.5	15.5	32.7	29.8	28.8	
Actuated g/C Ratio		0.09		0.35		0.51	0.17	0.17	0.37	0.33	0.32	
v/c Ratio		0.06		0.37		0.16	0.02	0.69	0.36	0.37	0.32	
Control Delay		34.6		13.4		3.4	33.8	48.0	12.9	28.9	26.3	
Queue Delay		0.0		0.4		0.6	0.0	0.0	0.0	0.0	0.0	
Total Delay		34.6		13.7		4.0	33.8	48.0	12.9	28.9	26.3	
LOS		C		B		A	C	D	B	C	C	
Approach Delay		34.6						30.7			27.4	
Approach LOS		C						C			C	
Queue Length 50th (ft)		3		106		9	2	115	51	56	75	
Queue Length 95th (ft)		19		189		16	13	218	96	119	154	
Internal Link Dist (ft)		93			35			545			66	
Turn Bay Length (ft)							100		100	115		
Base Capacity (vph)		274		845		804	280	417	739	377	657	
Starvation Cap Reductn		0		267		435	0	0	0	0	0	
Spillback Cap Reductn		0		0		0	0	0	0	0	0	
Storage Cap Reductn		0		0		0	0	0	0	0	0	
Reduced v/c Ratio		0.03		0.39		0.34	0.02	0.53	0.29	0.37	0.28	

Intersection Summary

Area Type: Other
Cycle Length: 119
Actuated Cycle Length: 89.5
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.69
Intersection Signal Delay: 23.4 Intersection LOS: C
Intersection Capacity Utilization 51.4% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 2: Hollywood Drive/Pennsylvania Ave (S.R. 2037) & Bethlehem Pike (S.R. 2018)



Lane Group	ø4	ø8
Minimum Split (s)	9.0	9.0
Total Split (s)	26.0	26.0
Total Split (%)	22%	22%
Maximum Green (s)	20.0	20.0
Yellow Time (s)	4.0	4.0
All-Red Time (s)	2.0	2.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	None	None
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

Lanes, Volumes, Timings
3: Pennsylvania Ave (S.R. 2037) & Toner's Tavern

8/21/2013

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	341	339	1	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)		4%	-4%		0%	
Lane Util. Factor	0.95	0.95	0.95	0.95	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	0	3468	3610	0	1863	0
Flt Permitted						
Satd. Flow (perm)	0	3468	3610	0	1863	0
Link Speed (mph)		35	35		25	
Link Distance (ft)		115	107		93	
Travel Time (s)		2.2	2.1		2.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	371	368	1	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	371	369	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.03	1.03	0.97	0.97	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 12.8%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
3: Pennsylvania Ave (S.R. 2037) & Toner's Tavern

8/21/2013

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	341	339	1	0	0
Sign Control		Free	Free		Stop	
Grade		4%	-4%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	371	368	1	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		115	107			
pX, platoon unblocked	0.94				0.94	0.94
vC, conflicting volume	370				554	185
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	207				403	10
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1282				542	1006

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	124	247	246	124	0
Volume Left	0	0	0	0	0
Volume Right	0	0	0	1	0
cSH	1282	1700	1700	1700	1700
Volume to Capacity	0.00	0.15	0.14	0.07	0.00
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0
Lane LOS					A
Approach Delay (s)	0.0		0.0		0.0
Approach LOS					A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	12.8%	ICU Level of Service	A
Analysis Period (min)	15		

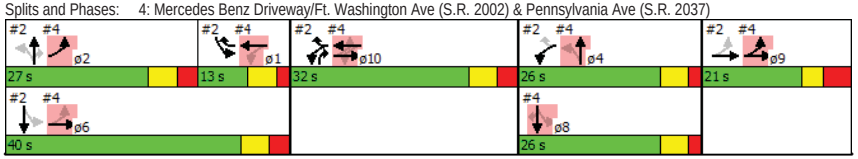
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	64	273	7	12	272	24	5	1	13	27	5	71
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	11	11	12	12	12	10	10	11
Grade (%)		4%			-4%			-4%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		100
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.997			0.988			0.908				0.850
Flt Protected		0.991			0.998			0.987			0.959	
Satd. Flow (prot)	0	3366	0	0	3510	0	0	1737	0	0	1701	1561
Flt Permitted		0.859			0.936			0.904			0.745	
Satd. Flow (perm)	0	2918	0	0	3292	0	0	1591	0	0	1321	1561
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			8			13				229
Link Speed (mph)		35			35			25			35	
Link Distance (ft)		107			918			414			138	
Travel Time (s)		2.1			17.9			11.3			2.7	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	66	281	7	12	280	25	5	1	13	28	5	73
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	354	0	0	317	0	0	19	0	0	33	73
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.02	1.02	1.02	0.97	0.97	0.97	1.09	1.09	1.04
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	0		1	1		1	1		1	1	1
Detector Template	Left			Left			Left			Left		
Leading Detector (ft)	20	0		20	35		20	25		20	35	35
Trailing Detector (ft)	0	0		0	-5		0	-5		0	-5	-5
Detector 1 Position(ft)	0	0		0	-5		0	-5		0	-5	-5
Detector 1 Size(ft)	20	6		20	40		20	30		20	40	40
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Turn Type	custom	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	2 9	6 9 10			1 10			4			8	
Permitted Phases	6 10			1 10			4			8		8
Detector Phase	2 9	6 9 10		1 10	1 10		4	4		8	8	8
Switch Phase												
Minimum Initial (s)								3.0	3.0		3.0	3.0

Lane Group	ø1	ø2	ø6	ø9	ø10
Lane Configurations					
Volume (vph)					
Ideal Flow (vphpl)					
Lane Width (ft)					
Grade (%)					
Storage Length (ft)					
Storage Lanes					
Taper Length (ft)					
Lane Util. Factor					
Frt					
Flt Protected					
Satd. Flow (prot)					
Flt Permitted					
Satd. Flow (perm)					
Right Turn on Red					
Satd. Flow (RTOR)					
Link Speed (mph)					
Link Distance (ft)					
Travel Time (s)					
Peak Hour Factor					
Heavy Vehicles (%)					
Adj. Flow (vph)					
Shared Lane Traffic (%)					
Lane Group Flow (vph)					
Enter Blocked Intersection					
Lane Alignment					
Median Width(ft)					
Link Offset(ft)					
Crosswalk Width(ft)					
Two way Left Turn Lane					
Headway Factor					
Turning Speed (mph)					
Number of Detectors					
Detector Template					
Leading Detector (ft)					
Trailing Detector (ft)					
Detector 1 Position(ft)					
Detector 1 Size(ft)					
Detector 1 Type					
Detector 1 Channel					
Detector 1 Extend (s)					
Detector 1 Queue (s)					
Detector 1 Delay (s)					
Turn Type					
Protected Phases	1	2	6	9	10
Permitted Phases					
Detector Phase					
Switch Phase					
Minimum Initial (s)	3.0	10.0	10.0	3.0	4.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)							9.0	9.0		9.0	9.0	9.0
Total Split (s)							26.0	26.0		26.0	26.0	26.0
Total Split (%)							21.8%	21.8%		21.8%	21.8%	21.8%
Maximum Green (s)							20.0	20.0		20.0	20.0	20.0
Yellow Time (s)							4.0	4.0		4.0	4.0	4.0
All-Red Time (s)							2.0	2.0		2.0	2.0	2.0
Lost Time Adjust (s)								0.0			0.0	0.0
Total Lost Time (s)								6.0			6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)							3.0	3.0		3.0	3.0	3.0
Recall Mode							None	None		None	None	None
Act Effct Green (s)		68.3			31.4			8.0			8.0	8.0
Actuated g/C Ratio		0.76			0.35			0.09			0.09	0.09
v/c Ratio		0.15			0.27			0.12			0.28	0.21
Control Delay		0.8			21.6			27.1			48.0	1.4
Queue Delay		0.2			0.0			0.0			0.0	0.0
Total Delay		0.9			21.6			27.1			48.0	1.4
LOS		A			C			C			D	A
Approach Delay		0.9			21.6			27.1			15.9	
Approach LOS		A			C			C			B	
Queue Length 50th (ft)		4			64			3			18	0
Queue Length 95th (ft)		5			110			27			52	0
Internal Link Dist (ft)		27			838			334			58	
Turn Bay Length (ft)												100
Base Capacity (vph)		2551			1463			371			300	531
Starvation Cap Reductn		1400			0			0			0	0
Spillback Cap Reductn		0			62			0			0	4
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		0.31			0.23			0.05			0.11	0.14

Intersection Summary	
Area Type:	Other
Cycle Length: 119	
Actuated Cycle Length: 89.5	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.69	
Intersection Signal Delay: 11.8	Intersection LOS: B
Intersection Capacity Utilization 39.8%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 4: Mercedes Benz Driveway/Ft. Washington Ave (S.R. 2002) & Pennsylvania Ave (S.R. 2037)



Lane Group	ø1	ø2	ø6	ø9	ø10
Minimum Split (s)	9.0	17.0	17.0	10.0	11.0
Total Split (s)	13.0	27.0	40.0	21.0	32.0
Total Split (%)	11%	23%	34%	18%	27%
Maximum Green (s)	7.0	20.0	33.0	14.0	25.0
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	2.0	3.0	3.0	4.0	3.0
Lost Time Adjust (s)					
Total Lost Time (s)					
Lead/Lag	Lag	Lead			
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	Min	Min	None	None
Act Effct Green (s)					
Actuated g/C Ratio					
v/c Ratio					
Control Delay					
Queue Delay					
Total Delay					
LOS					
Approach Delay					
Approach LOS					
Queue Length 50th (ft)					
Queue Length 95th (ft)					
Internal Link Dist (ft)					
Turn Bay Length (ft)					
Base Capacity (vph)					
Starvation Cap Reductn					
Spillback Cap Reductn					
Storage Cap Reductn					
Reduced v/c Ratio					

Intersection Summary

Lanes, Volumes, Timings
5: Ft. Washington Ave (S.R. 2002) & Toner's Tavern

8/21/2013

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	0	4	2	87	99	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.865				0.998	
Flt Protected				0.999		
Satd. Flow (prot)	1611	0	0	1861	1859	0
Flt Permitted				0.999		
Satd. Flow (perm)	1611	0	0	1861	1859	0
Link Speed (mph)	25			30	35	
Link Distance (ft)	65			138	278	
Travel Time (s)	1.8			3.1	5.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	4	2	95	108	2
Shared Lane Traffic (%)						
Lane Group Flow (vph)	4	0	0	97	110	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	16.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: Ft. Washington Ave (S.R. 2002) & Toner's Tavern

8/21/2013

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	4	2	87	99	2
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	4	2	95	108	2
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				138		
pX, platoon unblocked						
vC, conflicting volume	208	109	110			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	208	109	110			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	780	945	1480			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	4	97	110
Volume Left	0	2	0
Volume Right	4	0	2
cSH	945	1480	1700
Volume to Capacity	0.00	0.00	0.06
Queue Length 95th (ft)	0	0	0
Control Delay (s)	8.8	0.2	0.0
Lane LOS	A	A	
Approach Delay (s)	8.8	0.2	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	16.2%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX G

Lane Warrant Worksheets

Bethlehem Pike (S.R. 2018) and Proposed Access

2014 Future Peak Hour Traffic Volumes with Development

Weekday Morning (7:00 AM to 9:00 AM) Peak Hour

Description	Southbound		Northbound		Westbound	
	Bethlehem Pike		Bethlehem Pike		Proposed Access	
	Left	Through	Through	Right	Left	Right
Initial Volume	5	534	317	6	30	30
$P_{Heavy\ Vehicles}$	2%	3%	3%	2%	2%	2%
Terrain	Level		Level		Level	
$E_{Terrain}$	1.5		1.5		1.5	
$T_{adjustment}$	1.010	1.015	1.015	1.010	1.010	1.010
Adjusted Volume	5	542	322	6	30	30
P_{Lefts}	1%		n/a		50%	
P_{Rights}	n/a		2%		50%	
$V_{Approach}$	547		328		61	

Weekday Afternoon (4:00 PM to 6:00 PM) Peak Hour

Description	Southbound		Northbound		Westbound	
	Bethlehem Pike		Bethlehem Pike		Proposed Access	
	Left	Through	Through	Right	Left	Right
Initial Volume	10	402	502	10	10	10
$P_{Heavy\ Vehicles}$	2%	3%	1%	2%	2%	2%
Terrain	Level		Level		Level	
$E_{Terrain}$	1.5		1.5		1.5	
$T_{adjustment}$	1.010	1.015	1.005	1.010	1.010	1.010
Adjusted Volume	10	408	505	10	10	10
P_{Lefts}	2%		n/a		50%	
P_{Rights}	n/a		2%		50%	
$V_{Approach}$	418		515		20	

Bethlehem Pike (S.R. 2018) and Proposed Access

2014 Future Peak Hour Traffic Volumes with Development

Saturday Midday (11:00 AM to 2:00 PM) Peak Hour Traffic Volumes

Description	Southbound		Northbound		Westbound	
	Bethlehem Pike		Bethlehem Pike		Proposed Access	
	Left	Through	Through	Right	Left	Right
Initial Volume	11	300	327	11	11	11
$P_{Heavy\ Vehicles}$	2%	4%	1%	2%	2%	2%
Terrain	Level		Level		Level	
$E_{Terrain}$	1.5		1.5		1.5	
$T_{adjustment}$	1.010	1.020	1.005	1.010	1.010	1.010
Adjusted Volume	11	306	329	11	11	11
P_{Lefts}	4%		n/a		50%	
P_{Rights}	n/a		3%		50%	
$V_{Approach}$	317		340		22	

Bethlehem Pike (S.R. 2018) and Proposed Access

2014 Future Peak Hour Traffic Volumes with Development

Auxilary Left-Turn Lane Warrants [1]

Description	Southbound		
	Bethlehem Pike		
	Weekday		Saturday
	AM	PM	Midday
V_{Left}	5	10	11
$V_{Approach}$	547	418	317
$V_{Opposing}$	328	515	340
P_{Lefts}	1%	2%	4%
Approach Lanes	1		
Posted Speed Limit	35		
Turn Lane Chart	Figure 1		
Is a Separate Left-Turn Lane Warranted?	No	No	No

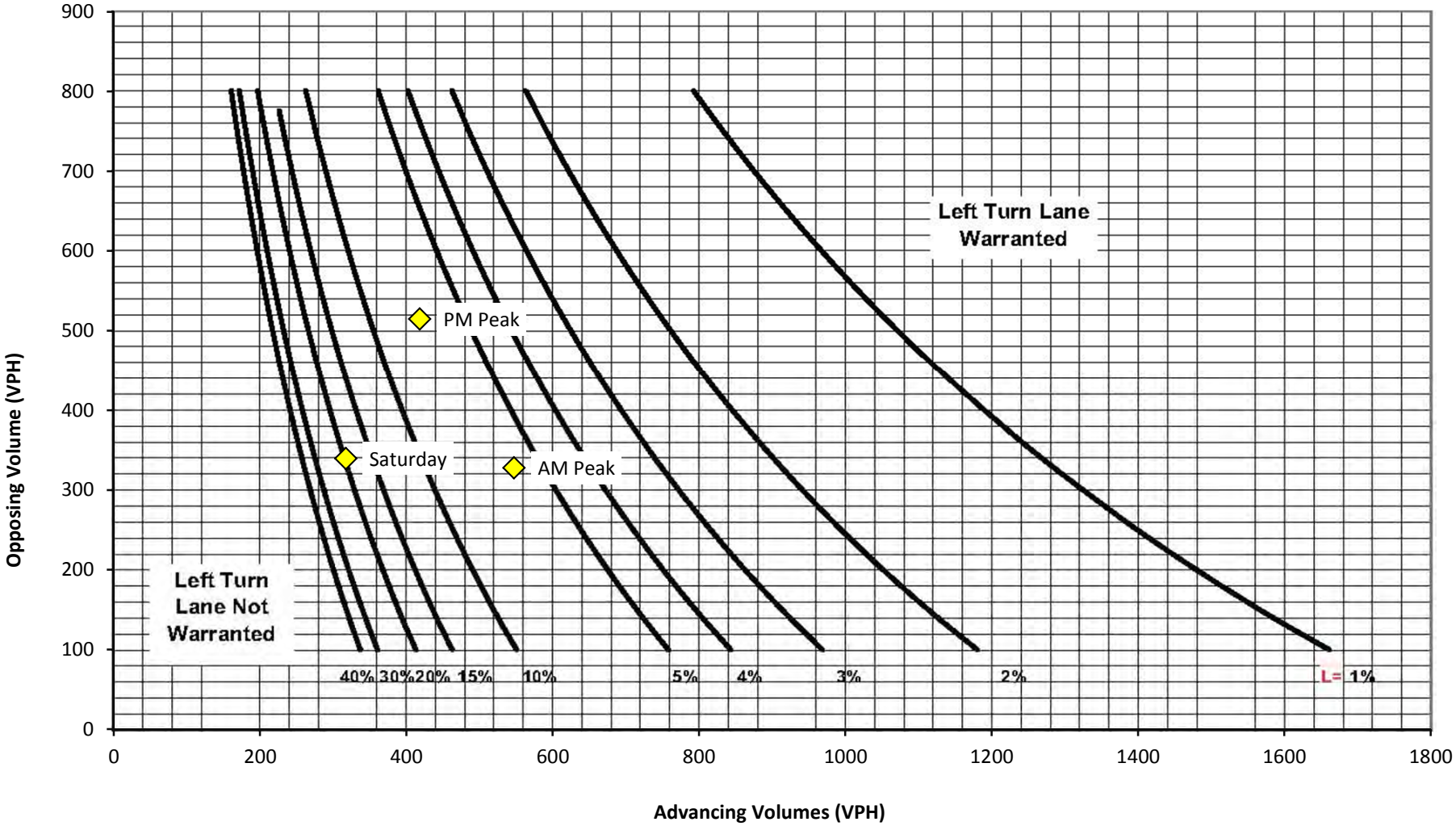
Bethlehem Pike (S.R. 2018) and Proposed Access

2014 Future Peak Hour Traffic Volumes with Development

Southbound Approach of Bethlehem Pike

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)



Bethlehem Pike (S.R. 2018) and Proposed Access

2014 Future Peak Hour Traffic Volumes with Development

Auxilary Right-Turn Lane Warrants [1]

Description	Northbound		
	Bethlehem Pike		
	Weekday		Saturday
	AM	PM	Midday
V_{Right}	6	10	11
$V_{Approach}$	328	515	340
P_{Rights}	2%	2%	3%
Approach Lanes	1		
Posted Speed Limit	35		
Turn Lane Chart	Figure 9		
Is a Separate Left-Turn Lane Warranted?	No	No	No

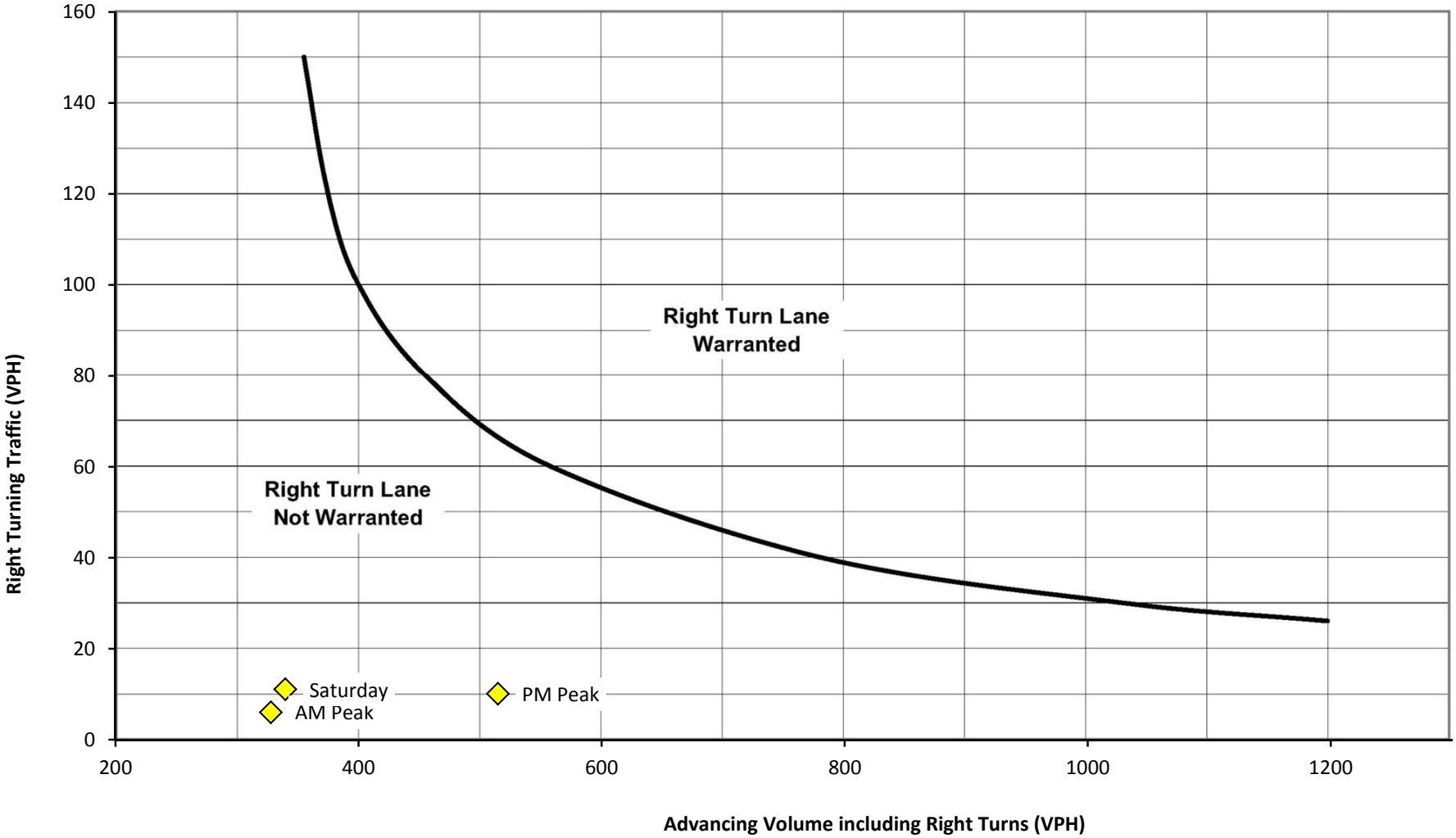
Bethlehem Pike (S.R. 2018) and Proposed Access

2014 Future Peak Hour Traffic Volumes with Development

Northbound Approach of Bethlehem Pike

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

(L = % Left Turns in Advancing Volume)



Ft. Washington Ave (S.R. 2022) and Proposed Access

2014 Future Peak Hour Traffic Volumes with Development

Weekday Morning (7:00 AM to 9:00 AM) Peak Hour

Description	Northbound		Southbound		Eastbound	
	Ft. Washington Ave		Ft. Washington Ave		Proposed Access	
	Left	Through	Through	Right	Left	Right
Initial Volume	8	92	304	2	2	5
$P_{Heavy\ Vehicles}$	2%	2%	0%	2%	2%	2%
Terrain	Level		Level		Level	
$E_{Terrain}$	1.5		1.5		1.5	
$T_{adjustment}$	1.010	1.010	1.000	1.010	1.010	1.010
Adjusted Volume	8	93	304	2	2	5
P_{Lefts}	8%		n/a		29%	
P_{Rights}	n/a		1%		71%	
$V_{Approach}$	101		306		7	

Weekday Afternoon (4:00 PM to 6:00 PM) Peak Hour

Description	Northbound		Southbound		Eastbound	
	Ft. Washington Ave		Ft. Washington Ave		Proposed Access	
	Left	Through	Through	Right	Left	Right
Initial Volume	11	238	166	4	5	10
$P_{Heavy\ Vehicles}$	2%	2%	0%	2%	2%	2%
Terrain	Level		Level		Level	
$E_{Terrain}$	1.5		1.5		1.5	
$T_{adjustment}$	1.010	1.010	1.000	1.010	1.010	1.010
Adjusted Volume	11	240	166	4	5	10
P_{Lefts}	4%		n/a		33%	
P_{Rights}	n/a		2%		67%	
$V_{Approach}$	251		170		15	

Ft. Washington Ave (S.R. 2022) and Proposed Access

2014 Future Peak Hour Traffic Volumes with Development

Saturday Midday (11:00 AM to 2:00 PM) Peak Hour Traffic Volumes

Description	Northbound		Southbound		Eastbound	
	Ft. Washington Ave		Ft. Washington Ave		Proposed Access	
	Left	Through	Through	Right	Left	Right
Initial Volume	12	86	98	5	5	11
$P_{Heavy\ Vehicles}$	2%	2%	0%	2%	2%	2%
Terrain	Level		Level		Level	
$E_{Terrain}$	1.5		1.5		1.5	
$T_{adjustment}$	1.010	1.010	1.000	1.010	1.010	1.010
Adjusted Volume	12	87	98	5	5	11
P_{Lefts}	12%		n/a		31%	
P_{Rights}	n/a		5%		69%	
$V_{Approach}$	99		103		16	

Ft. Washington Ave (S.R. 2022) and Proposed Access

2014 Future Peak Hour Traffic Volumes with Development

Auxilary Left-Turn Lane Warrants [1]

Description	Northbound		
	Ft. Washington Ave		
	Weekday		Saturday
	AM	PM	Midday
V_{Left}	8	11	12
$V_{Approach}$	101	251	99
$V_{Opposing}$	306	170	103
P_{Lefts}	8%	4%	12%
Approach Lanes	1		
Posted Speed Limit	35		
Turn Lane Chart	Figure 1		
Is a Separate Left-Turn Lane Warranted?	No	No	No

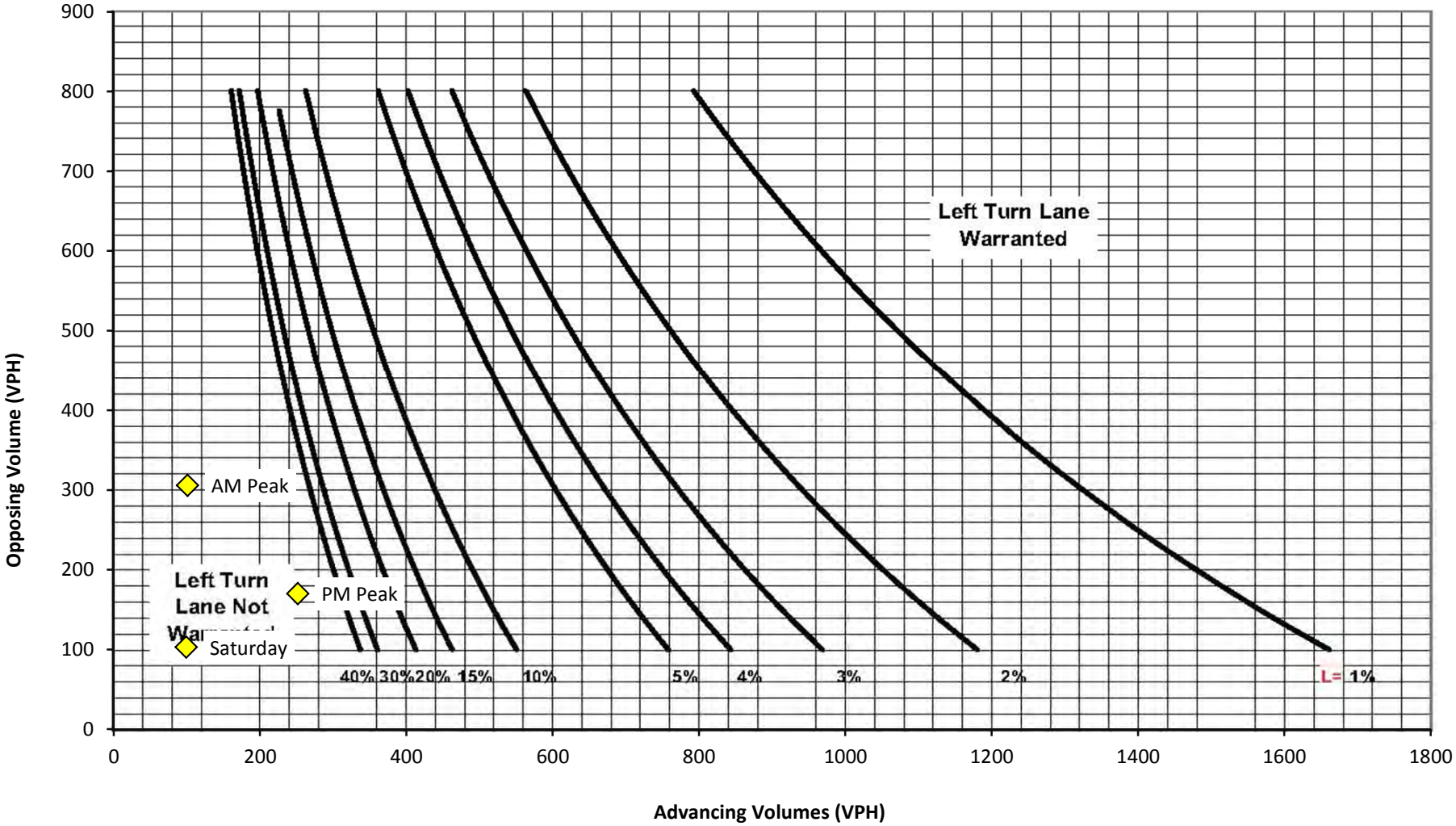
Ft. Washington Ave (S.R. 2022) and Proposed Access

2014 Future Peak Hour Traffic Volumes with Development

Northbound Approach of Ft. Washington Ave

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)



Ft. Washington Ave (S.R. 2022) and Proposed Access

2014 Future Peak Hour Traffic Volumes with Development

Auxilary Right-Turn Lane Warrants [1]

Description	Southbound		
	Ft. Washington Ave		
	Weekday		Saturday
	AM	PM	Midday
V_{Right}	2	4	5
$V_{Approach}$	306	170	103
P_{Rights}	1%	2%	5%
Approach Lanes	1		
Posted Speed Limit	35		
Turn Lane Chart	Figure 9		
Is a Separate Left-Turn Lane Warranted?	No	No	No

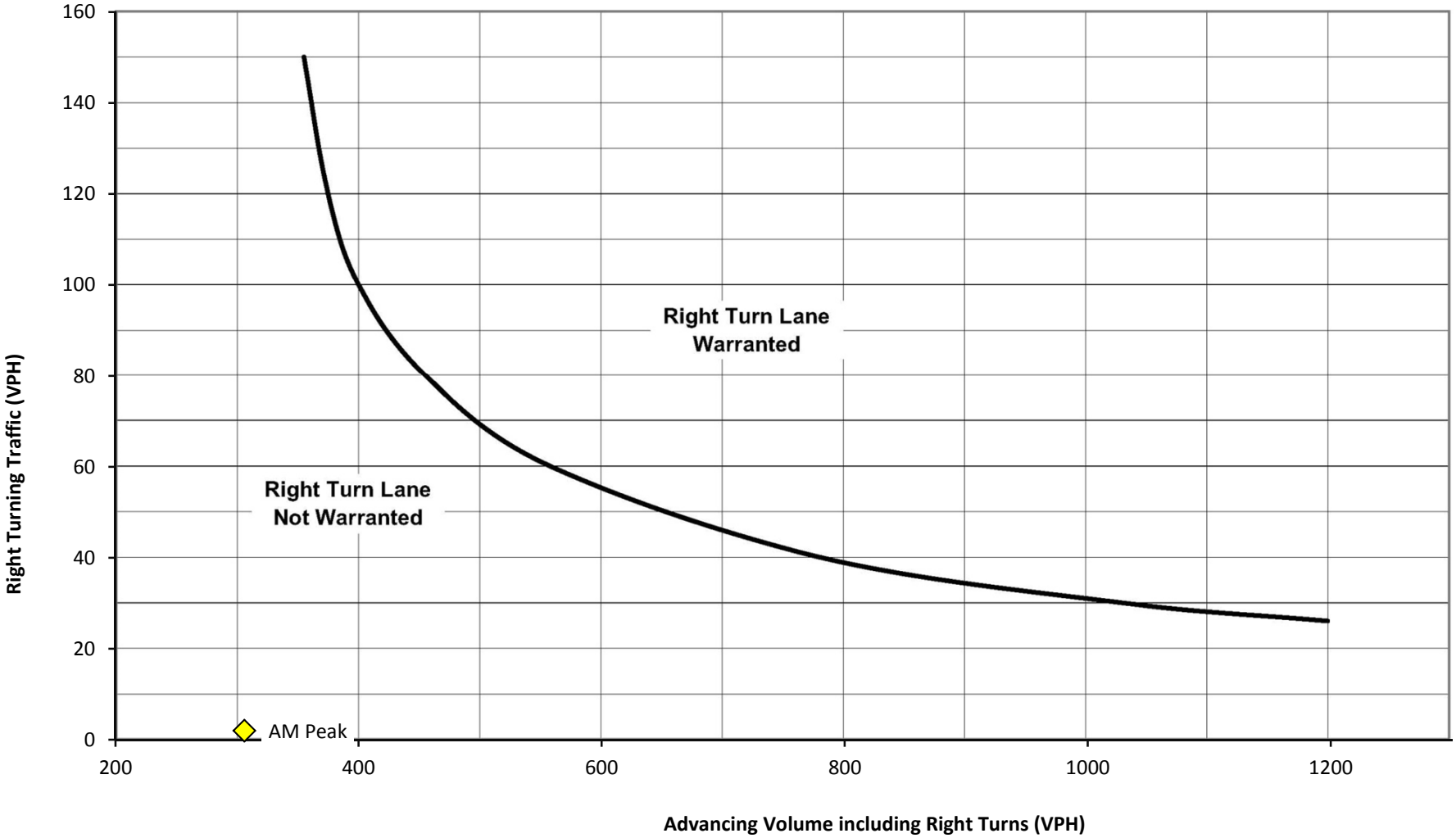
Ft. Washington Ave (S.R. 2022) and Proposed Access

2014 Future Peak Hour Traffic Volumes with Development

Southbound Approach of Ft. Washington Ave

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

(L = % Left Turns in Advancing Volume)



APPENDIX H

2014 Future without Development Capacity/Level-of-Service Analysis Worksheets

Lanes, Volumes, Timings
1: Bethlehem Pike (S.R. 2018) & Toner's Tavern

8/21/2013

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	0	0	317	0	0	534
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%		0%			1%
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	1863	0	1863	0	0	1853
Flt Permitted						
Satd. Flow (perm)	1863	0	1863	0	0	1853
Link Speed (mph)	25		30			40
Link Distance (ft)	100		146			414
Travel Time (s)	2.7		3.3			7.1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	345	0	0	580
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	345	0	0	580
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 31.4%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
1: Bethlehem Pike (S.R. 2018) & Toner's Tavern

8/21/2013

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	0	317	0	0	534
Sign Control	Stop		Free			Free
Grade	0%		0%			1%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	345	0	0	580
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			146			
pX, platoon unblocked	0.90	0.90			0.90	
vC, conflicting volume	925	345			345	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	859	211			211	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	293	743			1219	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	0	345	580
Volume Left	0	0	0
Volume Right	0	0	0
cSH	1700	1700	1219
Volume to Capacity	0.00	0.20	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.0	0.0
Lane LOS	A		
Approach Delay (s)	0.0	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	31.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	2	3	8	623	0	134	2	183	506	181	353	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	12	11	12	11	12	11	11	12
Grade (%)		0%			-4%			-2%			1%	
Storage Length (ft)	0		0	0		0	100		100	115		0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.913				0.850			0.850		0.999	
Flt Protected		0.993		0.950			0.950			0.950		
Satd. Flow (prot)	0	1665	0	1728	0	1474	1823	1801	1599	1669	1773	0
Flt Permitted		0.993		0.950			0.231			0.506		
Satd. Flow (perm)	0	1665	0	1728	0	1474	443	1801	1599	889	1773	0
Right Turn on Red			Yes			No			No			Yes
Satd. Flow (RTOR)		9										
Link Speed (mph)		25			35			35			40	
Link Distance (ft)		173			115			625			146	
Travel Time (s)		4.7			2.2			12.2			2.5	
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%	3%	0%	8%	0%	3%	2%	4%	3%	0%
Adj. Flow (vph)	2	3	9	677	0	146	2	199	550	197	384	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	14	0	677	0	146	2	199	550	197	386	0
Number of Detectors	1	1		1		1	0	0	0	1	0	
Detector Template	Left											
Leading Detector (ft)	20	25		35		35	0	0	0	35	0	
Trailing Detector (ft)	0	-5		-5		-5	0	0	0	-5	0	
Detector 1 Position(ft)	0	-5		-5		-5	0	0	0	-5	0	
Detector 1 Size(ft)	20	30		40		40	20	6	6	40	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Turn Type	Perm	NA		Prot		custom	Perm	NA	custom	pm+pt	NA	
Protected Phases		9		10 4		1 10		2	10	1	6	
Permitted Phases	9					10 4	2		2	6		
Detector Phase	9	9		10 4		1 10	2	2	10	1	6	
Switch Phase												
Minimum Initial (s)	3.0	3.0					10.0	10.0	4.0	3.0	10.0	
Minimum Split (s)	10.0	10.0					17.0	17.0	11.0	9.0	17.0	
Total Split (s)	10.0	10.0					30.0	30.0	43.0	18.0	48.0	
Total Split (%)	8.4%	8.4%					25.2%	25.2%	36.1%	15.1%	40.3%	
Maximum Green (s)	3.0	3.0					23.0	23.0	36.0	12.0	41.0	
Yellow Time (s)	3.0	3.0					4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	4.0	4.0					3.0	3.0	3.0	2.0	3.0	
Lost Time Adjust (s)		0.0					0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		7.0					7.0	7.0	7.0	6.0	7.0	

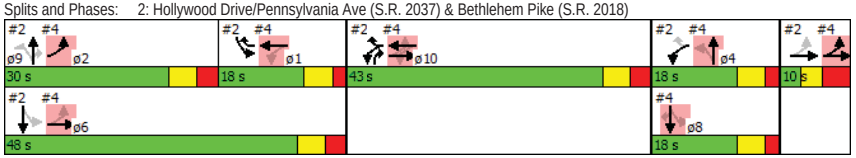
Lane Group	ø4	ø8
Lane Configurations		
Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Turn Type		
Protected Phases	4	8
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	3.0	3.0
Minimum Split (s)	9.0	9.0
Total Split (s)	18.0	18.0
Total Split (%)	15%	15%
Maximum Green (s)	12.0	12.0
Yellow Time (s)	4.0	4.0
All-Red Time (s)	2.0	2.0
Lost Time Adjust (s)		
Total Lost Time (s)		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag							Lead	Lead		Lag		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0					3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None					Min	Min	None	None	Min	
Act Effct Green (s)		3.0		53.6		72.6	17.3	17.3	53.3	36.3	35.3	
Actuated g/C Ratio		0.03		0.47		0.64	0.15	0.15	0.47	0.32	0.31	
v/c Ratio		0.26		0.83		0.15	0.03	0.72	0.73	0.53	0.70	
Control Delay		47.9		30.3		2.9	40.5	60.8	19.6	39.7	41.6	
Queue Delay		0.0		6.0		0.7	0.0	0.0	0.0	0.0	0.0	
Total Delay		47.9		36.3		3.6	40.5	60.8	19.6	39.7	41.6	
LOS		D		D		A	D	E	B	D	D	
Approach Delay		47.9						30.6			40.9	
Approach LOS		D						C			D	
Queue Length 50th (ft)		4		482		12	1	140	169	110	247	
Queue Length 95th (ft)		27		#679		20	9	220	242	175	356	
Internal Link Dist (ft)		93			35			545			66	
Turn Bay Length (ft)							100		100	115		
Base Capacity (vph)		53		827		947	90	367	755	369	644	
Starvation Cap Reductn		0		107		552	0	0	0	0	0	
Spillback Cap Reductn		0		0		0	0	0	0	0	0	
Storage Cap Reductn		0		0		0	0	0	0	0	0	
Reduced v/c Ratio		0.26		0.94		0.37	0.02	0.54	0.73	0.53	0.60	

Intersection Summary

Area Type: Other
Cycle Length: 119
Actuated Cycle Length: 112.9
Natural Cycle: 75
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 33.4 Intersection LOS: C
Intersection Capacity Utilization 83.2% ICU Level of Service E
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Hollywood Drive/Pennsylvania Ave (S.R. 2037) & Bethlehem Pike (S.R. 2018)



Lane Group	ø4	ø8
Lead/Lag		
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	None	None
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

Lanes, Volumes, Timings
3: Pennsylvania Ave (S.R. 2037) & Toner's Tavern

8/21/2013

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	690	756	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)		4%	-4%		0%	
Lane Util. Factor	0.95	0.95	0.95	0.95	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	0	3468	3610	0	1863	0
Flt Permitted						
Satd. Flow (perm)	0	3468	3610	0	1863	0
Link Speed (mph)		35	35		25	
Link Distance (ft)		115	107		93	
Travel Time (s)		2.2	2.1		2.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	750	822	0	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	750	822	0	0	0
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 24.2%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
3: Pennsylvania Ave (S.R. 2037) & Toner's Tavern

8/21/2013

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	690	756	0	0	0
Sign Control		Free	Free		Stop	
Grade		4%	-4%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	750	822	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		115	107			
pX, platoon unblocked	0.90				0.90	0.90
vC, conflicting volume	822				1197	411
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	568				987	110
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	896				219	827

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	250	500	548	274	0
Volume Left	0	0	0	0	0
Volume Right	0	0	0	0	0
cSH	896	1700	1700	1700	1700
Volume to Capacity	0.00	0.29	0.32	0.16	0.00
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0
Lane LOS					A
Approach Delay (s)	0.0		0.0		0.0
Approach LOS					A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	24.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	74	618	8	4	521	16	5	3	8	77	3	225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	11	11	12	12	12	10	10	11
Grade (%)		4%			-4%			-4%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		100
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.996			0.929				0.850
Flt Protected		0.995						0.986			0.954	
Satd. Flow (prot)	0	3323	0	0	3401	0	0	1775	0	0	1644	1546
Flt Permitted		0.794			0.951			0.902			0.721	
Satd. Flow (perm)	0	2652	0	0	3234	0	0	1624	0	0	1243	1546
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3			3			9				242
Link Speed (mph)		35			35			25			35	
Link Distance (ft)		107			918			414			138	
Travel Time (s)		2.1			17.9			11.3			2.7	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	4%	2%	0%	0%	4%	13%	0%	0%	0%	3%	0%	1%
Adj. Flow (vph)	80	665	9	4	560	17	5	3	9	83	3	242
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	754	0	0	581	0	0	17	0	0	86	242
Number of Detectors	1	0		1	1		1	1		1	1	1
Detector Template	Left			Left			Left			Left		
Leading Detector (ft)	20	0		20	35		20	25		20	35	35
Trailing Detector (ft)	0	0		0	-5		0	-5		0	-5	-5
Detector 1 Position(ft)	0	0		0	-5		0	-5		0	-5	-5
Detector 1 Size(ft)	20	6		20	40		20	30		20	40	40
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Turn Type	custom	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	2 9	6 9 10			1 10			4			8	
Permitted Phases	6 10			1 10			4			8		8
Detector Phase	2 9	6 9 10		1 10	1 10		4	4		8	8	8
Switch Phase												
Minimum Initial (s)							3.0	3.0		3.0	3.0	3.0
Minimum Split (s)							9.0	9.0		9.0	9.0	9.0
Total Split (s)							18.0	18.0		18.0	18.0	18.0
Total Split (%)							15.1%	15.1%		15.1%	15.1%	15.1%
Maximum Green (s)							12.0	12.0		12.0	12.0	12.0
Yellow Time (s)							4.0	4.0		4.0	4.0	4.0
All-Red Time (s)							2.0	2.0		2.0	2.0	2.0
Lost Time Adjust (s)								0.0			0.0	0.0
Total Lost Time (s)								6.0			6.0	6.0

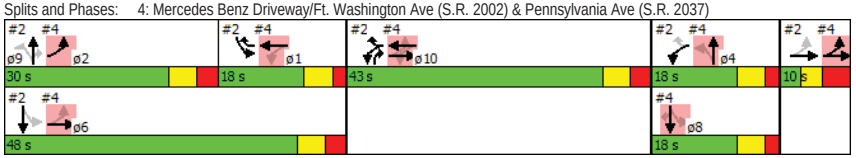
Lane Group	ø1	ø2	ø6	ø9	ø10
Lane Configurations					
Volume (vph)					
Ideal Flow (vphpl)					
Lane Width (ft)					
Grade (%)					
Storage Length (ft)					
Storage Lanes					
Taper Length (ft)					
Lane Util. Factor					
Frt					
Flt Protected					
Satd. Flow (prot)					
Flt Permitted					
Satd. Flow (perm)					
Right Turn on Red					
Satd. Flow (RTOR)					
Link Speed (mph)					
Link Distance (ft)					
Travel Time (s)					
Peak Hour Factor					
Heavy Vehicles (%)					
Adj. Flow (vph)					
Shared Lane Traffic (%)					
Lane Group Flow (vph)					
Number of Detectors					
Detector Template					
Leading Detector (ft)					
Trailing Detector (ft)					
Detector 1 Position(ft)					
Detector 1 Size(ft)					
Detector 1 Type					
Detector 1 Channel					
Detector 1 Extend (s)					
Detector 1 Queue (s)					
Detector 1 Delay (s)					
Turn Type					
Protected Phases	1	2	6	9	10
Permitted Phases					
Detector Phase					
Switch Phase					
Minimum Initial (s)	3.0	10.0	10.0	3.0	4.0
Minimum Split (s)	9.0	17.0	17.0	10.0	11.0
Total Split (s)	18.0	30.0	48.0	10.0	43.0
Total Split (%)	15%	25%	40%	8%	36%
Maximum Green (s)	12.0	23.0	41.0	3.0	36.0
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	2.0	3.0	3.0	4.0	3.0
Lost Time Adjust (s)					
Total Lost Time (s)					

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)							3.0	3.0		3.0	3.0	3.0
Recall Mode							None	None		None	None	None
Act Effct Green (s)		88.4			55.1			11.5			11.5	11.5
Actuated g/C Ratio		0.78			0.49			0.10			0.10	0.10
v/c Ratio		0.34			0.37			0.10			0.68	0.65
Control Delay		0.9			19.4			33.5			77.1	15.0
Queue Delay		0.4			0.2			0.0			0.0	0.6
Total Delay		1.3			19.6			33.5			77.1	15.6
LOS		A			B			C			E	B
Approach Delay		1.3			19.6			33.5			31.7	
Approach LOS		A			B			C			C	
Queue Length 50th (ft)		8			135			5			61	0
Queue Length 95th (ft)		10			195			29			#144	80
Internal Link Dist (ft)		27			838			334			58	
Turn Bay Length (ft)												100
Base Capacity (vph)		2210			1579			180			132	380
Starvation Cap Reductn		876			0			0			0	0
Spillback Cap Reductn		0			302			0			0	22
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		0.57			0.45			0.09			0.65	0.68

Intersection Summary	
Area Type:	Other
Cycle Length: 119	
Actuated Cycle Length: 112.9	
Natural Cycle: 75	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.83	
Intersection Signal Delay: 13.9	Intersection LOS: B
Intersection Capacity Utilization 61.4%	ICU Level of Service B
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 4: Mercedes Benz Driveway/Ft. Washington Ave (S.R. 2002) & Pennsylvania Ave (S.R. 2037)



Lane Group	ø1	ø2	ø6	ø9	ø10
Lead/Lag	Lag	Lead			
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	Min	Min	None	None
Act Effct Green (s)					
Actuated g/C Ratio					
v/c Ratio					
Control Delay					
Queue Delay					
Total Delay					
LOS					
Approach Delay					
Approach LOS					
Queue Length 50th (ft)					
Queue Length 95th (ft)					
Internal Link Dist (ft)					
Turn Bay Length (ft)					
Base Capacity (vph)					
Starvation Cap Reductn					
Spillback Cap Reductn					
Storage Cap Reductn					
Reduced v/c Ratio					

Intersection Summary

Lanes, Volumes, Timings
5: Ft. Washington Ave (S.R. 2002) & Toner's Tavern

8/21/2013

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	0	0	1	92	304	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	1863	0	0	1863	1863	0
Flt Permitted						
Satd. Flow (perm)	1863	0	0	1863	1863	0
Link Speed (mph)	25			30	35	
Link Distance (ft)	65			138	278	
Travel Time (s)	1.8			3.1	5.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	1	100	330	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	101	330	0
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 19.3%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
5: Ft. Washington Ave (S.R. 2002) & Toner's Tavern

8/21/2013

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	0	1	92	304	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	1	100	330	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				138		
pX, platoon unblocked						
vC, conflicting volume	433	330	330			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	433	330	330			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	580	711	1229			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	0	101	330
Volume Left	0	1	0
Volume Right	0	0	0
cSH	1700	1229	1700
Volume to Capacity	0.00	0.00	0.19
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.1	0.0
Lane LOS	A	A	
Approach Delay (s)	0.0	0.1	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	19.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lanes, Volumes, Timings
1: Bethlehem Pike (S.R. 2018) & Toner's Tavern

8/21/2013

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	0	1	507	0	1	408
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%		0%			1%
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.865					
Flt Protected						
Satd. Flow (prot)	1611	0	1863	0	0	1853
Flt Permitted						
Satd. Flow (perm)	1611	0	1863	0	0	1853
Link Speed (mph)	25		30			40
Link Distance (ft)	100		146			414
Travel Time (s)	2.7		3.3			7.1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1	551	0	1	443
Shared Lane Traffic (%)						
Lane Group Flow (vph)	1	0	551	0	0	444
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 36.7%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
1: Bethlehem Pike (S.R. 2018) & Toner's Tavern

8/21/2013

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	1	507	0	1	408
Sign Control	Stop		Free			Free
Grade	0%		0%			1%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	1	551	0	1	443
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			146			
pX, platoon unblocked	0.84	0.84			0.84	
vC, conflicting volume	997	551			551	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	898	366			366	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	259	568			998	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	1	551	445
Volume Left	0	0	1
Volume Right	1	0	0
cSH	568	1700	998
Volume to Capacity	0.00	0.32	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	11.3	0.0	0.0
Lane LOS	B		A
Approach Delay (s)	11.3	0.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	36.7%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	1	3	625	0	195	4	311	542	148	260	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	12	11	12	11	12	11	11	12
Grade (%)		0%			-4%			-2%			1%	
Storage Length (ft)	0		0	0		0	100		100	115		0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.919				0.850			0.850		0.998	
Flt Protected		0.990		0.950			0.950			0.950		
Satd. Flow (prot)	0	1671	0	1762	0	1561	1823	1837	1584	1638	1771	0
Flt Permitted		0.990		0.950			0.450			0.346		
Satd. Flow (perm)	0	1671	0	1762	0	1561	864	1837	1584	597	1771	0
Right Turn on Red			Yes			No			No			Yes
Satd. Flow (RTOR)		3									1	
Link Speed (mph)		25			35			35			40	
Link Distance (ft)		173			115			625			146	
Travel Time (s)		4.7			2.2			12.2			2.5	
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Heavy Vehicles (%)	0%	0%	0%	1%	0%	2%	0%	1%	3%	6%	3%	0%
Adj. Flow (vph)	1	1	3	631	0	197	4	314	547	149	263	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	5	0	631	0	197	4	314	547	149	267	0
Number of Detectors	1	1		1		1	0	0	0	1	0	
Detector Template	Left											
Leading Detector (ft)	20	25		35		35	0	0	0	35	0	
Trailing Detector (ft)	0	-5		-5		-5	0	0	0	-5	0	
Detector 1 Position(ft)	0	-5		-5		-5	0	0	0	-5	0	
Detector 1 Size(ft)	20	30		40		40	20	6	6	40	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Turn Type	Perm	NA		Prot		custom	Perm	NA	custom	pm+pt	NA	
Protected Phases		9		10 4		1 10		2	10	1	6	
Permitted Phases	9					10 4	2		2	6		
Detector Phase	9	9		10 4		1 10	2	2	10	1	6	
Switch Phase												
Minimum Initial (s)	3.0	3.0					10.0	10.0	4.0	3.0	10.0	
Minimum Split (s)	10.0	10.0					17.0	17.0	11.0	9.0	17.0	
Total Split (s)	10.0	10.0					36.0	36.0	42.0	17.0	53.0	
Total Split (%)	8.4%	8.4%					30.3%	30.3%	35.3%	14.3%	44.5%	
Maximum Green (s)	3.0	3.0					29.0	29.0	35.0	11.0	46.0	
Yellow Time (s)	3.0	3.0					4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	4.0	4.0					3.0	3.0	3.0	2.0	3.0	
Lost Time Adjust (s)		0.0					0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		7.0					7.0	7.0	7.0	6.0	7.0	

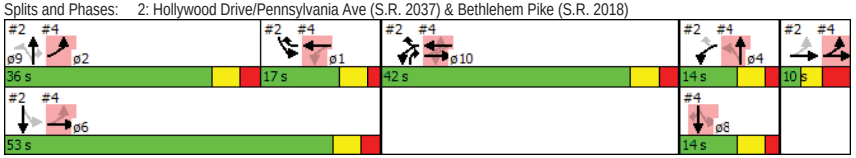
Lane Group	ø4	ø8
Lane Configurations		
Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Turn Type		
Protected Phases	4	8
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	3.0	3.0
Minimum Split (s)	9.0	9.0
Total Split (s)	14.0	14.0
Total Split (%)	12%	12%
Maximum Green (s)	8.0	8.0
Yellow Time (s)	4.0	4.0
All-Red Time (s)	2.0	2.0
Lost Time Adjust (s)		
Total Lost Time (s)		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag							Lead	Lead		Lag		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0					3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None					Min	Min	None	None	Min	
Act Effct Green (s)		3.0		49.1		67.1	23.6	23.6	58.7	41.6	40.6	
Actuated g/C Ratio		0.03		0.43		0.59	0.21	0.21	0.52	0.37	0.36	
v/c Ratio		0.11		0.83		0.21	0.02	0.82	0.67	0.47	0.42	
Control Delay		47.4		30.1		3.2	35.0	61.3	14.9	36.6	29.6	
Queue Delay		0.0		7.4		0.6	0.0	0.0	0.0	0.0	0.0	
Total Delay		47.4		37.5		3.8	35.0	61.3	14.9	36.6	29.6	
LOS		D		D		A	C	E	B	D	C	
Approach Delay		47.4						31.8			32.1	
Approach LOS		D						C			C	
Queue Length 50th (ft)		1		447		15	2	221	145	75	146	
Queue Length 95th (ft)		16		#668		24	12	325	209	125	220	
Internal Link Dist (ft)		93			35			545			66	
Turn Bay Length (ft)							100		100	115		
Base Capacity (vph)		47		760		921	220	469	816	319	718	
Starvation Cap Reductn		0		97		436	0	0	0	0	0	
Spillback Cap Reductn		0		0		0	0	0	0	0	0	
Storage Cap Reductn		0		0		0	0	0	0	0	0	
Reduced v/c Ratio		0.11		0.95		0.41	0.02	0.67	0.67	0.47	0.37	

Intersection Summary

Area Type: Other
Cycle Length: 119
Actuated Cycle Length: 113.8
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 31.0 Intersection LOS: C
Intersection Capacity Utilization 80.0% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Hollywood Drive/Pennsylvania Ave (S.R. 2037) & Bethlehem Pike (S.R. 2018)



Lane Group	ø4	ø8
Lead/Lag		
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	None	None
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

Lanes, Volumes, Timings
3: Pennsylvania Ave (S.R. 2037) & Toner's Tavern

8/21/2013

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	691	820	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)		4%	-4%		0%	
Lane Util. Factor	0.95	0.95	0.95	0.95	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	0	3468	3610	0	1863	0
Flt Permitted						
Satd. Flow (perm)	0	3468	3610	0	1863	0
Link Speed (mph)		35	35		25	
Link Distance (ft)		115	107		93	
Travel Time (s)		2.2	2.1		2.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	751	891	0	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	751	891	0	0	0
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 26.0%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
3: Pennsylvania Ave (S.R. 2037) & Toner's Tavern

8/21/2013

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	691	820	0	0	0
Sign Control		Free	Free		Stop	
Grade		4%	-4%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	751	891	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		115	107			
pX, platoon unblocked	0.86				0.86	0.86
vC, conflicting volume	891				1267	446
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	552				988	35
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	874				210	888

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	250	501	594	297	0
Volume Left	0	0	0	0	0
Volume Right	0	0	0	0	0
cSH	874	1700	1700	1700	1700
Volume to Capacity	0.00	0.29	0.35	0.17	0.00
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0
Lane LOS					A
Approach Delay (s)	0.0		0.0		0.0
Approach LOS					A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	26.0%	ICU Level of Service	A
Analysis Period (min)	15		

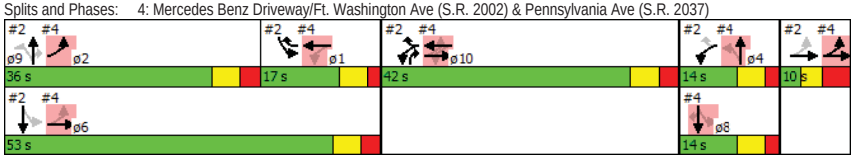
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	193	510	9	6	656	47	11	2	10	33	4	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	11	11	12	12	12	10	10	11
Grade (%)		4%			-4%			-4%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		100
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.990			0.941				0.850
Flt Protected		0.987						0.977			0.957	
Satd. Flow (prot)	0	3275	0	0	3487	0	0	1782	0	0	1697	1531
Flt Permitted		0.563			0.949			0.829			0.732	
Satd. Flow (perm)	0	1868	0	0	3309	0	0	1512	0	0	1298	1531
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			8			10				229
Link Speed (mph)		35			35			25			35	
Link Distance (ft)		107			918			414			138	
Travel Time (s)		2.1			17.9			11.3			2.7	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	0%	4%	0%	0%	1%	2%	0%	0%	0%	0%	0%	2%
Adj. Flow (vph)	197	520	9	6	669	48	11	2	10	34	4	135
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	726	0	0	723	0	0	23	0	0	38	135
Number of Detectors	1	0		1	1		1	1		1	1	1
Detector Template	Left			Left			Left			Left		
Leading Detector (ft)	20	0		20	35		20	25		20	35	35
Trailing Detector (ft)	0	0		0	-5		0	-5		0	-5	-5
Detector 1 Position(ft)	0	0		0	-5		0	-5		0	-5	-5
Detector 1 Size(ft)	20	6		20	40		20	30		20	40	40
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Turn Type	custom	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	2 9	6 9 10			1 10			4			8	
Permitted Phases	6 10			1 10			4			8		8
Detector Phase	2 9	6 9 10		1 10	1 10		4	4		8	8	8
Switch Phase												
Minimum Initial (s)							3.0	3.0		3.0	3.0	3.0
Minimum Split (s)							9.0	9.0		9.0	9.0	9.0
Total Split (s)							14.0	14.0		14.0	14.0	14.0
Total Split (%)							11.8%	11.8%		11.8%	11.8%	11.8%
Maximum Green (s)							8.0	8.0		8.0	8.0	8.0
Yellow Time (s)							4.0	4.0		4.0	4.0	4.0
All-Red Time (s)							2.0	2.0		2.0	2.0	2.0
Lost Time Adjust (s)								0.0			0.0	0.0
Total Lost Time (s)								6.0			6.0	6.0

Lane Group	ø1	ø2	ø6	ø9	ø10
Lane Configurations					
Volume (vph)					
Ideal Flow (vphpl)					
Lane Width (ft)					
Grade (%)					
Storage Length (ft)					
Storage Lanes					
Taper Length (ft)					
Lane Util. Factor					
Frt					
Flt Protected					
Satd. Flow (prot)					
Flt Permitted					
Satd. Flow (perm)					
Right Turn on Red					
Satd. Flow (RTOR)					
Link Speed (mph)					
Link Distance (ft)					
Travel Time (s)					
Peak Hour Factor					
Heavy Vehicles (%)					
Adj. Flow (vph)					
Shared Lane Traffic (%)					
Lane Group Flow (vph)					
Number of Detectors					
Detector Template					
Leading Detector (ft)					
Trailing Detector (ft)					
Detector 1 Position(ft)					
Detector 1 Size(ft)					
Detector 1 Type					
Detector 1 Channel					
Detector 1 Extend (s)					
Detector 1 Queue (s)					
Detector 1 Delay (s)					
Turn Type					
Protected Phases	1	2	6	9	10
Permitted Phases					
Detector Phase					
Switch Phase					
Minimum Initial (s)	3.0	10.0	10.0	3.0	4.0
Minimum Split (s)	9.0	17.0	17.0	10.0	11.0
Total Split (s)	17.0	36.0	53.0	10.0	42.0
Total Split (%)	14%	30%	45%	8%	35%
Maximum Green (s)	11.0	29.0	46.0	3.0	35.0
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	2.0	3.0	3.0	4.0	3.0
Lost Time Adjust (s)					
Total Lost Time (s)					

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)							3.0	3.0		3.0	3.0	3.0
Recall Mode							None	None		None	None	None
Act Effct Green (s)		92.8			53.1			8.0			8.0	8.0
Actuated g/C Ratio		0.82			0.47			0.07			0.07	0.07
v/c Ratio		0.37			0.47			0.20			0.42	0.42
Control Delay		1.1			22.3			40.2			66.8	4.0
Queue Delay		0.4			0.2			0.0			0.0	0.2
Total Delay		1.5			22.5			40.2			66.8	4.3
LOS		A			C			D			E	A
Approach Delay		1.5			22.5			40.2			18.0	
Approach LOS		A			C			D			B	
Queue Length 50th (ft)		11			185			9			27	0
Queue Length 95th (ft)		13			255			37			66	0
Internal Link Dist (ft)		27			838			334			58	
Turn Bay Length (ft)												100
Base Capacity (vph)		1910			1548			115			91	320
Starvation Cap Reductn		611			0			0			0	0
Spillback Cap Reductn		0			274			0			0	18
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		0.56			0.57			0.20			0.42	0.45

Intersection Summary			
Area Type:	Other		
Cycle Length: 119			
Actuated Cycle Length: 113.8			
Natural Cycle: 80			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.83			
Intersection Signal Delay: 13.0		Intersection LOS: B	
Intersection Capacity Utilization 63.6%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 4: Mercedes Benz Driveway/Ft. Washington Ave (S.R. 2002) & Pennsylvania Ave (S.R. 2037)



Lane Group	ø1	ø2	ø6	ø9	ø10
Lead/Lag	Lag	Lead			
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	Min	Min	None	None
Act Effct Green (s)					
Actuated g/C Ratio					
v/c Ratio					
Control Delay					
Queue Delay					
Total Delay					
LOS					
Approach Delay					
Approach LOS					
Queue Length 50th (ft)					
Queue Length 95th (ft)					
Internal Link Dist (ft)					
Turn Bay Length (ft)					
Base Capacity (vph)					
Starvation Cap Reductn					
Spillback Cap Reductn					
Storage Cap Reductn					
Reduced v/c Ratio					

Intersection Summary

Lanes, Volumes, Timings
5: Ft. Washington Ave (S.R. 2002) & Toner's Tavern

8/21/2013

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	0	1	2	241	168	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.865				0.999	
Flt Protected						
Satd. Flow (prot)	1611	0	0	1863	1861	0
Flt Permitted						
Satd. Flow (perm)	1611	0	0	1863	1861	0
Link Speed (mph)	25			30	35	
Link Distance (ft)	65			138	278	
Travel Time (s)	1.8			3.1	5.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1	2	262	183	1
Shared Lane Traffic (%)						
Lane Group Flow (vph)	1	0	0	264	184	0
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 24.3%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
5: Ft. Washington Ave (S.R. 2002) & Toner's Tavern

8/21/2013

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	1	2	241	168	1
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	1	2	262	183	1
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				138		
pX, platoon unblocked						
vC, conflicting volume	449	183	184			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	449	183	184			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	566	859	1391			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	1	264	184
Volume Left	0	2	0
Volume Right	1	0	1
cSH	859	1391	1700
Volume to Capacity	0.00	0.00	0.11
Queue Length 95th (ft)	0	0	0
Control Delay (s)	9.2	0.1	0.0
Lane LOS	A	A	
Approach Delay (s)	9.2	0.1	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	24.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lanes, Volumes, Timings
1: Bethlehem Pike (S.R. 2018) & Toner's Tavern

8/21/2013

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	0	1	332	0	1	305
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%		0%			1%
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.865					
Flt Protected						
Satd. Flow (prot)	1611	0	1863	0	0	1853
Flt Permitted						
Satd. Flow (perm)	1611	0	1863	0	0	1853
Link Speed (mph)	25		30			40
Link Distance (ft)	100		146			414
Travel Time (s)	2.7		3.3			7.1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1	361	0	1	332
Shared Lane Traffic (%)						
Lane Group Flow (vph)	1	0	361	0	0	333
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 27.5%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
1: Bethlehem Pike (S.R. 2018) & Toner's Tavern

8/21/2013

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	1	332	0	1	305
Sign Control	Stop		Free			Free
Grade	0%		0%			1%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	1	361	0	1	332
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			146			
pX, platoon unblocked	0.89	0.89			0.89	
vC, conflicting volume	695	361			361	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	594	219			219	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	415	730			1201	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	1	361	333
Volume Left	0	0	1
Volume Right	1	0	0
cSH	730	1700	1201
Volume to Capacity	0.00	0.21	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	9.9	0.0	0.0
Lane LOS	A		A
Approach Delay (s)	9.9	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	27.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	2	3	4	221	0	121	5	212	206	134	171	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	12	11	12	11	12	11	11	12
Grade (%)		0%			-4%			-2%			1%	
Storage Length (ft)	0		0	0		0	100		100	115		0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.940				0.850			0.850		0.996	
Flt Protected		0.989		0.950			0.950			0.950		
Satd. Flow (prot)	0	1707	0	1762	0	1577	1823	1837	1615	1702	1752	0
Flt Permitted		0.989		0.950			0.642			0.531		
Satd. Flow (perm)	0	1707	0	1762	0	1577	1232	1837	1615	951	1752	0
Right Turn on Red			Yes			No			No			Yes
Satd. Flow (RTOR)		4									2	
Link Speed (mph)		25			35			35			40	
Link Distance (ft)		173			115			625			146	
Travel Time (s)		4.7			2.2			12.2			2.5	
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
Heavy Vehicles (%)	0%	0%	0%	1%	0%	1%	0%	1%	1%	2%	4%	0%
Adj. Flow (vph)	2	3	4	230	0	126	5	221	215	140	178	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	9	0	230	0	126	5	221	215	140	183	0
Number of Detectors	1	1		1		1	0	0	0	1	0	
Detector Template	Left											
Leading Detector (ft)	20	25		35		35	0	0	0	35	0	
Trailing Detector (ft)	0	-5		-5		-5	0	0	0	-5	0	
Detector 1 Position(ft)	0	-5		-5		-5	0	0	0	-5	0	
Detector 1 Size(ft)	20	30		40		40	20	6	6	40	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Turn Type	Perm	NA		Prot		custom	Perm	NA	custom	pm+pt	NA	
Protected Phases		9		10 4		1 10		2	10	1	6	
Permitted Phases	9					10 4	2		2	6		
Detector Phase	9	9		10 4		1 10	2	2	10	1	6	
Switch Phase												
Minimum Initial (s)	3.0	3.0					10.0	10.0	4.0	3.0	10.0	
Minimum Split (s)	10.0	10.0					17.0	17.0	11.0	9.0	17.0	
Total Split (s)	12.0	12.0					43.0	43.0	28.0	19.0	62.0	
Total Split (%)	10.1%	10.1%					36.1%	36.1%	23.5%	16.0%	52.1%	
Maximum Green (s)	5.0	5.0					36.0	36.0	21.0	13.0	55.0	
Yellow Time (s)	3.0	3.0					4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	4.0	4.0					3.0	3.0	3.0	2.0	3.0	
Lost Time Adjust (s)		0.0					0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		7.0					7.0	7.0	7.0	6.0	7.0	

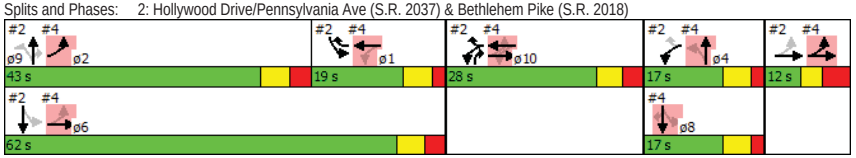
Lane Group	ø4	ø8
Lane Configurations		
Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Turn Type		
Protected Phases	4	8
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	3.0	3.0
Minimum Split (s)	9.0	9.0
Total Split (s)	17.0	17.0
Total Split (%)	14%	14%
Maximum Green (s)	11.0	11.0
Yellow Time (s)	4.0	4.0
All-Red Time (s)	2.0	2.0
Lost Time Adjust (s)		
Total Lost Time (s)		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag							Lead	Lead		Lag		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0					3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None					Min	Min	None	None	Min	
Act Effct Green (s)		5.1		30.8		49.2	16.6	16.6	33.1	35.0	34.0	
Actuated g/C Ratio		0.06		0.34		0.54	0.18	0.18	0.36	0.38	0.37	
v/c Ratio		0.09		0.39		0.15	0.02	0.66	0.37	0.31	0.28	
Control Delay		39.4		16.9		3.0	32.8	46.1	12.7	23.5	21.7	
Queue Delay		0.0		1.8		1.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		39.4		18.7		4.0	32.8	46.1	12.7	23.5	21.7	
LOS		D		B		A	C	D	B	C	C	
Approach Delay		39.4						29.6			22.5	
Approach LOS		D						C			C	
Queue Length 50th (ft)		3		111		8	2	121	46	53	72	
Queue Length 95th (ft)		20		206		16	13	213	83	104	134	
Internal Link Dist (ft)		93			35			545			66	
Turn Bay Length (ft)							100		100	115		
Base Capacity (vph)		98		639		805	495	738	671	493	1076	
Starvation Cap Reductn		0		266		483	0	0	0	0	0	
Spillback Cap Reductn		0		0		0	0	0	0	0	0	
Storage Cap Reductn		0		0		0	0	0	0	0	0	
Reduced v/c Ratio		0.09		0.62		0.39	0.01	0.30	0.32	0.28	0.17	

Intersection Summary

Area Type: Other
Cycle Length: 119
Actuated Cycle Length: 91.2
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.66
Intersection Signal Delay: 22.6 Intersection LOS: C
Intersection Capacity Utilization 51.7% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 2: Hollywood Drive/Pennsylvania Ave (S.R. 2037) & Bethlehem Pike (S.R. 2018)



Lane Group	ø4	ø8
Lead/Lag		
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	None	None
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

Lanes, Volumes, Timings
3: Pennsylvania Ave (S.R. 2037) & Toner's Tavern

8/21/2013

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	343	341	1	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)		4%	-4%		0%	
Lane Util. Factor	0.95	0.95	0.95	0.95	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	0	3468	3610	0	1863	0
Flt Permitted						
Satd. Flow (perm)	0	3468	3610	0	1863	0
Link Speed (mph)		35	35		25	
Link Distance (ft)		115	107		93	
Travel Time (s)		2.2	2.1		2.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	373	371	1	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	373	372	0	0	0
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 12.8%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
3: Pennsylvania Ave (S.R. 2037) & Toner's Tavern

8/21/2013

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	343	341	1	0	0
Sign Control		Free	Free		Stop	
Grade		4%	-4%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	373	371	1	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		115	107			
pX, platoon unblocked	0.94				0.94	0.94
vC, conflicting volume	372				558	186
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	217				413	20
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1275				535	995

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	124	249	247	125	0
Volume Left	0	0	0	0	0
Volume Right	0	0	0	1	0
cSH	1275	1700	1700	1700	1700
Volume to Capacity	0.00	0.15	0.15	0.07	0.00
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0
Lane LOS					A
Approach Delay (s)	0.0		0.0		0.0
Approach LOS					A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	12.8%	ICU Level of Service	A
Analysis Period (min)	15		

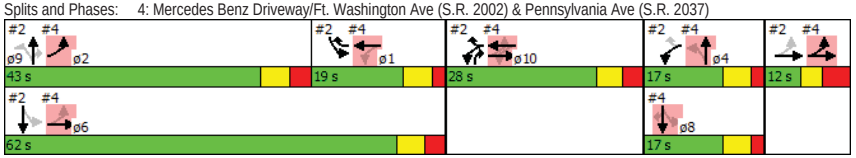
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	64	275	7	12	274	24	5	1	13	27	5	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	11	11	12	12	12	10	10	11
Grade (%)		4%			-4%			-4%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		100
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.997			0.988			0.908				0.850
Flt Protected		0.991			0.998			0.987			0.959	
Satd. Flow (prot)	0	3366	0	0	3510	0	0	1737	0	0	1701	1561
Flt Permitted		0.855			0.936			0.905			0.745	
Satd. Flow (perm)	0	2904	0	0	3292	0	0	1593	0	0	1321	1561
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			8			13				229
Link Speed (mph)		35			35			25			35	
Link Distance (ft)		107			918			414			138	
Travel Time (s)		2.1			17.9			11.3			2.7	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	66	284	7	12	282	25	5	1	13	28	5	74
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	357	0	0	319	0	0	19	0	0	33	74
Number of Detectors	1	0		1	1		1	1		1	1	1
Detector Template	Left			Left			Left			Left		
Leading Detector (ft)	20	0		20	35		20	25		20	35	35
Trailing Detector (ft)	0	0		0	-5		0	-5		0	-5	-5
Detector 1 Position(ft)	0	0		0	-5		0	-5		0	-5	-5
Detector 1 Size(ft)	20	6		20	40		20	30		20	40	40
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Turn Type	custom	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	2 9	6 9 10			1 10			4			8	
Permitted Phases	6 10			1 10			4			8		8
Detector Phase	2 9	6 9 10		1 10	1 10		4	4		8	8	8
Switch Phase												
Minimum Initial (s)							3.0	3.0		3.0	3.0	3.0
Minimum Split (s)							9.0	9.0		9.0	9.0	9.0
Total Split (s)							17.0	17.0		17.0	17.0	17.0
Total Split (%)							14.3%	14.3%		14.3%	14.3%	14.3%
Maximum Green (s)							11.0	11.0		11.0	11.0	11.0
Yellow Time (s)							4.0	4.0		4.0	4.0	4.0
All-Red Time (s)							2.0	2.0		2.0	2.0	2.0
Lost Time Adjust (s)								0.0			0.0	0.0
Total Lost Time (s)								6.0			6.0	6.0

Lane Group	ø1	ø2	ø6	ø9	ø10
Lane Configurations					
Volume (vph)					
Ideal Flow (vphpl)					
Lane Width (ft)					
Grade (%)					
Storage Length (ft)					
Storage Lanes					
Taper Length (ft)					
Lane Util. Factor					
Frt					
Flt Protected					
Satd. Flow (prot)					
Flt Permitted					
Satd. Flow (perm)					
Right Turn on Red					
Satd. Flow (RTOR)					
Link Speed (mph)					
Link Distance (ft)					
Travel Time (s)					
Peak Hour Factor					
Heavy Vehicles (%)					
Adj. Flow (vph)					
Shared Lane Traffic (%)					
Lane Group Flow (vph)					
Number of Detectors					
Detector Template					
Leading Detector (ft)					
Trailing Detector (ft)					
Detector 1 Position(ft)					
Detector 1 Size(ft)					
Detector 1 Type					
Detector 1 Channel					
Detector 1 Extend (s)					
Detector 1 Queue (s)					
Detector 1 Delay (s)					
Turn Type					
Protected Phases	1	2	6	9	10
Permitted Phases					
Detector Phase					
Switch Phase					
Minimum Initial (s)	3.0	10.0	10.0	3.0	4.0
Minimum Split (s)	9.0	17.0	17.0	10.0	11.0
Total Split (s)	19.0	43.0	62.0	12.0	28.0
Total Split (%)	16%	36%	52%	10%	24%
Maximum Green (s)	13.0	36.0	55.0	5.0	21.0
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	2.0	3.0	3.0	4.0	3.0
Lost Time Adjust (s)					
Total Lost Time (s)					

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)							3.0	3.0		3.0	3.0	3.0
Recall Mode							None	None		None	None	None
Act Effct Green (s)		69.9			35.0			8.1			8.1	8.1
Actuated g/C Ratio		0.77			0.38			0.09			0.09	0.09
v/c Ratio		0.15			0.25			0.12			0.28	0.21
Control Delay		0.7			19.9			27.4			49.0	1.4
Queue Delay		0.2			0.0			0.0			0.0	0.0
Total Delay		0.9			19.9			27.4			49.0	1.4
LOS		A			B			C			D	A
Approach Delay		0.9			19.9			27.4			16.1	
Approach LOS		A			B			C			B	
Queue Length 50th (ft)		3			62			3			18	0
Queue Length 95th (ft)		5			108			27			52	0
Internal Link Dist (ft)		27			838			334			58	
Turn Bay Length (ft)												100
Base Capacity (vph)		2541			1366			206			162	392
Starvation Cap Reductn		1398			0			0			0	0
Spillback Cap Reductn		0			92			0			0	6
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		0.31			0.25			0.09			0.20	0.19

Intersection Summary	
Area Type:	Other
Cycle Length: 119	
Actuated Cycle Length: 91.2	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.66	
Intersection Signal Delay: 11.1	Intersection LOS: B
Intersection Capacity Utilization 39.9%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 4: Mercedes Benz Driveway/Ft. Washington Ave (S.R. 2002) & Pennsylvania Ave (S.R. 2037)



Lane Group	ø1	ø2	ø6	ø9	ø10
Lead/Lag	Lag	Lead			
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	Min	Min	None	None
Act Effct Green (s)					
Actuated g/C Ratio					
v/c Ratio					
Control Delay					
Queue Delay					
Total Delay					
LOS					
Approach Delay					
Approach LOS					
Queue Length 50th (ft)					
Queue Length 95th (ft)					
Internal Link Dist (ft)					
Turn Bay Length (ft)					
Base Capacity (vph)					
Starvation Cap Reductn					
Spillback Cap Reductn					
Storage Cap Reductn					
Reduced v/c Ratio					

Intersection Summary

Lanes, Volumes, Timings
5: Ft. Washington Ave (S.R. 2002) & Toner's Tavern

8/21/2013

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	0	4	2	88	100	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.865				0.998	
Flt Protected				0.999		
Satd. Flow (prot)	1611	0	0	1861	1859	0
Flt Permitted				0.999		
Satd. Flow (perm)	1611	0	0	1861	1859	0
Link Speed (mph)	25			30	35	
Link Distance (ft)	65			138	278	
Travel Time (s)	1.8			3.1	5.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	4	2	96	109	2
Shared Lane Traffic (%)						
Lane Group Flow (vph)	4	0	0	98	111	0
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 16.2%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
5: Ft. Washington Ave (S.R. 2002) & Toner's Tavern

8/21/2013

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	4	2	88	100	2
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	4	2	96	109	2
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				138		
pX, platoon unblocked						
vC, conflicting volume	210	110	111			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	210	110	111			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	777	944	1479			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	4	98	111
Volume Left	0	2	0
Volume Right	4	0	2
cSH	944	1479	1700
Volume to Capacity	0.00	0.00	0.07
Queue Length 95th (ft)	0	0	0
Control Delay (s)	8.8	0.2	0.0
Lane LOS	A	A	
Approach Delay (s)	8.8	0.2	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	16.2%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX I

2014 Future with Development
Capacity/Level-of-Service Analysis Worksheets

Lanes, Volumes, Timings
1: Bethlehem Pike (S.R. 2018) & Toner's Tavern

8/21/2013

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	4	4	317	6	5	534
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%		0%			1%
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.932		0.997			
Flt Protected	0.976					0.999
Satd. Flow (prot)	1694	0	1857	0	0	1852
Flt Permitted	0.976					0.999
Satd. Flow (perm)	1694	0	1857	0	0	1852
Link Speed (mph)	25		30			40
Link Distance (ft)	100		146			414
Travel Time (s)	2.7		3.3			7.1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	4	4	352	7	6	593
Shared Lane Traffic (%)						
Lane Group Flow (vph)	8	0	359	0	0	599
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 42.1%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
1: Bethlehem Pike (S.R. 2018) & Toner's Tavern

8/21/2013

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	4	4	317	6	5	534
Sign Control	Stop		Free			Free
Grade	0%		0%			1%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	4	4	352	7	6	593
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			146			
pX, platoon unblocked	0.89	0.89			0.89	
vC, conflicting volume	960	356			359	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	895	219			222	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	99			100	
cM capacity (veh/h)	276	733			1203	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	9	359	599
Volume Left	4	0	6
Volume Right	4	7	0
cSH	402	1700	1203
Volume to Capacity	0.02	0.21	0.00
Queue Length 95th (ft)	2	0	0
Control Delay (s)	14.2	0.0	0.1
Lane LOS	B		A
Approach Delay (s)	14.2	0.0	0.1
Approach LOS	B		

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	2	3	8	623	0	134	2	189	507	181	357	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	12	11	12	11	12	11	11	12
Grade (%)		0%			-4%			-2%			1%	
Storage Length (ft)	0		0	0		0	100		100	115		0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.913				0.850			0.850		0.999	
Flt Protected		0.993		0.950			0.950			0.950		
Satd. Flow (prot)	0	1665	0	1728	0	1474	1823	1801	1599	1669	1773	0
Flt Permitted		0.993		0.950			0.227			0.494		
Satd. Flow (perm)	0	1665	0	1728	0	1474	436	1801	1599	868	1773	0
Right Turn on Red			Yes			No			No			Yes
Satd. Flow (RTOR)		9										
Link Speed (mph)		25			35			35			40	
Link Distance (ft)		173			115			625			146	
Travel Time (s)		4.7			2.2			12.2			2.5	
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%	3%	0%	8%	0%	3%	2%	4%	3%	0%
Adj. Flow (vph)	2	3	9	677	0	146	2	205	551	197	388	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	14	0	677	0	146	2	205	551	197	390	0
Turn Type	Perm	NA		Prot		custom	Perm	NA	custom	pm+pt	NA	
Protected Phases		9		10 4		1 10		2	10	1	6	
Permitted Phases	9					10 4	2		2	6		
Detector Phase	9	9		10 4		1 10	2	2	10	1	6	
Switch Phase												
Minimum Initial (s)	3.0	3.0					10.0	10.0	4.0	3.0	10.0	
Minimum Split (s)	10.0	10.0					17.0	17.0	11.0	9.0	17.0	
Total Split (s)	10.0	10.0					30.0	30.0	43.0	18.0	48.0	
Total Split (%)	8.4%	8.4%					25.2%	25.2%	36.1%	15.1%	40.3%	
Maximum Green (s)	3.0	3.0					23.0	23.0	36.0	12.0	41.0	
Yellow Time (s)	3.0	3.0					4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	4.0	4.0					3.0	3.0	3.0	2.0	3.0	
Lost Time Adjust (s)		0.0					0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		7.0					7.0	7.0	7.0	6.0	7.0	
Lead/Lag							Lead	Lead		Lag		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0					3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None					Min	Min	None	None	Min	
Act Effct Green (s)		3.0		53.7		72.7	17.6	17.6	53.7	36.6	35.6	
Actuated g/C Ratio		0.03		0.47		0.64	0.16	0.16	0.47	0.32	0.31	
v/c Ratio		0.27		0.83		0.15	0.03	0.73	0.73	0.54	0.70	
Control Delay		48.1		30.5		2.9	41.0	61.6	19.5	40.1	41.7	
Queue Delay		0.0		6.4		0.7	0.0	0.0	0.0	0.0	0.0	
Total Delay		48.1		36.8		3.6	41.0	61.6	19.5	40.1	41.7	
LOS		D		D		A	D	E	B	D	D	

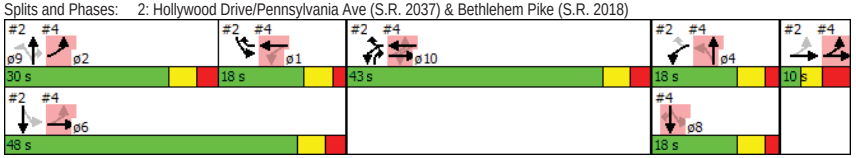
Lane Group	ø4	ø8
Lane Configurations		
Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	4	8
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	3.0	3.0
Minimum Split (s)	9.0	9.0
Total Split (s)	18.0	18.0
Total Split (%)	15%	15%
Maximum Green (s)	12.0	12.0
Yellow Time (s)	4.0	4.0
All-Red Time (s)	2.0	2.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	None	None
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay		48.1						31.0			41.2	
Approach LOS		D						C			D	
Queue Length 50th (ft)		4		485		12	1	145	170	110	250	
Queue Length 95th (ft)		27		#680		m20	9	227	243	175	360	
Internal Link Dist (ft)		93			35			545			66	
Turn Bay Length (ft)							100		100	115		
Base Capacity (vph)		52		824		945	88	366	756	365	642	
Starvation Cap Reductn		0		107		550	0	0	0	0	0	
Spillback Cap Reductn		0		0		0	0	0	0	0	0	
Storage Cap Reductn		0		0		0	0	0	0	0	0	
Reduced v/c Ratio		0.27		0.94		0.37	0.02	0.56	0.73	0.54	0.61	

Intersection Summary	
Area Type:	Other
Cycle Length: 119	
Actuated Cycle Length: 113.4	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.83	
Intersection Signal Delay: 33.8	Intersection LOS: C
Intersection Capacity Utilization 83.4%	ICU Level of Service E
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Hollywood Drive/Pennsylvania Ave (S.R. 2037) & Bethlehem Pike (S.R. 2018)



Lane Group	ø4	ø8
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	618	8	4	521	22	5	3	8	82	3	225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	11	11	12	12	12	10	10	11
Grade (%)		4%			-4%			-4%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		100
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.994			0.929				0.850
Flt Protected		0.995						0.986			0.954	
Satd. Flow (prot)	0	3323	0	0	3391	0	0	1775	0	0	1644	1546
Flt Permitted		0.788			0.951			0.901			0.721	
Satd. Flow (perm)	0	2632	0	0	3225	0	0	1622	0	0	1243	1546
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3			5			9				242
Link Speed (mph)		35			35			25			35	
Link Distance (ft)		107			918			414			138	
Travel Time (s)		2.1			17.9			11.3			2.7	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	4%	2%	0%	0%	4%	13%	0%	0%	0%	3%	0%	1%
Adj. Flow (vph)	81	665	9	4	560	24	5	3	9	88	3	242
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	755	0	0	588	0	0	17	0	0	91	242
Turn Type	custom	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	2 9	6 9 10			1 10			4			8	
Permitted Phases	6 10			1 10			4			8		8
Detector Phase	2 9	6 9 10		1 10	1 10		4	4		8	8	8
Switch Phase												
Minimum Initial (s)							3.0	3.0		3.0	3.0	3.0
Minimum Split (s)							9.0	9.0		9.0	9.0	9.0
Total Split (s)							18.0	18.0		18.0	18.0	18.0
Total Split (%)							15.1%	15.1%		15.1%	15.1%	15.1%
Maximum Green (s)							12.0	12.0		12.0	12.0	12.0
Yellow Time (s)							4.0	4.0		4.0	4.0	4.0
All-Red Time (s)							2.0	2.0		2.0	2.0	2.0
Lost Time Adjust (s)								0.0			0.0	0.0
Total Lost Time (s)								6.0			6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)							3.0	3.0		3.0	3.0	3.0
Recall Mode							None	None		None	None	None
Act Effct Green (s)		88.8			55.1			11.6			11.6	11.6
Actuated g/C Ratio		0.78			0.49			0.10			0.10	0.10
v/c Ratio		0.34			0.37			0.10			0.72	0.65
Control Delay		1.0			19.6			33.5			80.5	14.9
Queue Delay		0.4			0.2			0.0			0.0	0.6
Total Delay		1.4			19.8			33.5			80.5	15.5
LOS		A			B			C			F	B

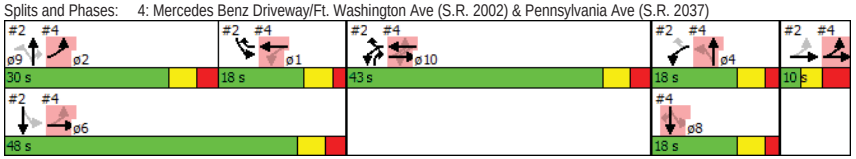
Lane Group	ø1	ø2	ø6	ø9	ø10
Lane Configurations					
Volume (vph)					
Ideal Flow (vphpl)					
Lane Width (ft)					
Grade (%)					
Storage Length (ft)					
Storage Lanes					
Taper Length (ft)					
Lane Util. Factor					
Frt					
Flt Protected					
Satd. Flow (prot)					
Flt Permitted					
Satd. Flow (perm)					
Right Turn on Red					
Satd. Flow (RTOR)					
Link Speed (mph)					
Link Distance (ft)					
Travel Time (s)					
Peak Hour Factor					
Heavy Vehicles (%)					
Adj. Flow (vph)					
Shared Lane Traffic (%)					
Lane Group Flow (vph)					
Turn Type					
Protected Phases	1	2	6	9	10
Permitted Phases					
Detector Phase					
Switch Phase					
Minimum Initial (s)	3.0	10.0	10.0	3.0	4.0
Minimum Split (s)	9.0	17.0	17.0	10.0	11.0
Total Split (s)	18.0	30.0	48.0	10.0	43.0
Total Split (%)	15%	25%	40%	8%	36%
Maximum Green (s)	12.0	23.0	41.0	3.0	36.0
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	2.0	3.0	3.0	4.0	3.0
Lost Time Adjust (s)					
Total Lost Time (s)					
Lead/Lag	Lag	Lead			
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	Min	Min	None	None
Act Effct Green (s)					
Actuated g/C Ratio					
v/c Ratio					
Control Delay					
Queue Delay					
Total Delay					
LOS					

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay		1.4			19.8			33.5			33.3	
Approach LOS		A			B			C			C	
Queue Length 50th (ft)		8			138			5			66	0
Queue Length 95th (ft)		10			197			29			#154	80
Internal Link Dist (ft)		27			838			334			58	
Turn Bay Length (ft)												100
Base Capacity (vph)		2196			1570			180			131	380
Starvation Cap Reductn		871			0			0			0	0
Spillback Cap Reductn		0			301			0			0	22
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		0.57			0.46			0.09			0.69	0.68

Intersection Summary	
Area Type:	Other
Cycle Length: 119	
Actuated Cycle Length: 113.4	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.83	
Intersection Signal Delay: 14.4	Intersection LOS: B
Intersection Capacity Utilization 61.9%	ICU Level of Service B
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 4: Mercedes Benz Driveway/Ft. Washington Ave (S.R. 2002) & Pennsylvania Ave (S.R. 2037)



Lane Group	ø1	ø2	ø6	ø9	ø10
Approach Delay					
Approach LOS					
Queue Length 50th (ft)					
Queue Length 95th (ft)					
Internal Link Dist (ft)					
Turn Bay Length (ft)					
Base Capacity (vph)					
Starvation Cap Reductn					
Spillback Cap Reductn					
Storage Cap Reductn					
Reduced v/c Ratio					

Intersection Summary

Lanes, Volumes, Timings
5: Ft. Washington Ave (S.R. 2002) & Toner's Tavern

8/21/2013

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	2	5	8	92	304	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.899				0.999	
Flt Protected	0.988			0.996		
Satd. Flow (prot)	1655	0	0	1855	1861	0
Flt Permitted	0.988			0.996		
Satd. Flow (perm)	1655	0	0	1855	1861	0
Link Speed (mph)	25			30	35	
Link Distance (ft)	65			138	278	
Travel Time (s)	1.8			3.1	5.4	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	2	6	9	102	338	2
Shared Lane Traffic (%)						
Lane Group Flow (vph)	8	0	0	111	340	0
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 26.1%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
5: Ft. Washington Ave (S.R. 2002) & Toner's Tavern

8/21/2013

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	2	5	8	92	304	2
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	6	9	102	338	2
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				138		
pX, platoon unblocked						
vC, conflicting volume	459	339	340			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	459	339	340			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	99	99			
cM capacity (veh/h)	556	703	1219			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	8	111	340
Volume Left	2	9	0
Volume Right	6	0	2
cSH	654	1219	1700
Volume to Capacity	0.01	0.01	0.20
Queue Length 95th (ft)	1	1	0
Control Delay (s)	10.6	0.7	0.0
Lane LOS	B	A	
Approach Delay (s)	10.6	0.7	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	26.1%	ICU Level of Service	A
Analysis Period (min)	15		

Lanes, Volumes, Timings
1: Bethlehem Pike (S.R. 2018) & Toner's Tavern

8/21/2013

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	10	10	502	10	10	402
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%		0%			1%
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.932		0.997			
Flt Protected	0.976					0.999
Satd. Flow (prot)	1694	0	1857	0	0	1852
Flt Permitted	0.976					0.999
Satd. Flow (perm)	1694	0	1857	0	0	1852
Link Speed (mph)	25		30			40
Link Distance (ft)	100		146			414
Travel Time (s)	2.7		3.3			7.1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	11	11	558	11	11	447
Shared Lane Traffic (%)						
Lane Group Flow (vph)	22	0	569	0	0	458
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 39.2%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
1: Bethlehem Pike (S.R. 2018) & Toner's Tavern

8/21/2013

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	10	10	502	10	10	402
Sign Control	Stop		Free			Free
Grade	0%		0%			1%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	11	11	558	11	11	447
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			146			
pX, platoon unblocked	0.83	0.83			0.83	
vC, conflicting volume	1032	563			569	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	939	376			383	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	95	98			99	
cM capacity (veh/h)	242	559			980	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	22	569	458
Volume Left	11	0	11
Volume Right	11	11	0
cSH	337	1700	980
Volume to Capacity	0.07	0.33	0.01
Queue Length 95th (ft)	5	0	1
Control Delay (s)	16.4	0.0	0.3
Lane LOS	C		A
Approach Delay (s)	16.4	0.0	0.3
Approach LOS	C		

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	39.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	1	3	624	0	195	4	316	543	146	266	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	12	11	12	11	12	11	11	12
Grade (%)		0%			-4%			-2%			1%	
Storage Length (ft)	0		0	0		0	100		100	115		0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.919				0.850			0.850		0.998	
Flt Protected		0.990		0.950			0.950			0.950		
Satd. Flow (prot)	0	1671	0	1762	0	1561	1823	1837	1584	1638	1771	0
Flt Permitted		0.990		0.950			0.441			0.339		
Satd. Flow (perm)	0	1671	0	1762	0	1561	846	1837	1584	584	1771	0
Right Turn on Red			Yes			No			No			Yes
Satd. Flow (RTOR)		3									1	
Link Speed (mph)		25			35			35			40	
Link Distance (ft)		173			115			625			146	
Travel Time (s)		4.7			2.2			12.2			2.5	
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Heavy Vehicles (%)	0%	0%	0%	1%	0%	2%	0%	1%	3%	6%	3%	0%
Adj. Flow (vph)	1	1	3	630	0	197	4	319	548	147	269	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	5	0	630	0	197	4	319	548	147	273	0
Turn Type	Perm	NA		Prot		custom	Perm	NA	custom	pm+pt	NA	
Protected Phases		9		10 4		1 10		2	10	1	6	
Permitted Phases	9					10 4	2		2	6		
Detector Phase	9	9		10 4		1 10	2	2	10	1	6	
Switch Phase												
Minimum Initial (s)	3.0	3.0					10.0	10.0	4.0	3.0	10.0	
Minimum Split (s)	10.0	10.0					17.0	17.0	11.0	9.0	17.0	
Total Split (s)	10.0	10.0					36.0	36.0	42.0	17.0	53.0	
Total Split (%)	8.4%	8.4%					30.3%	30.3%	35.3%	14.3%	44.5%	
Maximum Green (s)	3.0	3.0					29.0	29.0	35.0	11.0	46.0	
Yellow Time (s)	3.0	3.0					4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	4.0	4.0					3.0	3.0	3.0	2.0	3.0	
Lost Time Adjust (s)		0.0					0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		7.0					7.0	7.0	7.0	6.0	7.0	
Lead/Lag							Lead	Lead		Lag		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0					3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None					Min	Min	None	None	Min	
Act Effct Green (s)		3.0		49.1		67.1	23.9	23.9	58.9	41.9	40.9	
Actuated g/C Ratio		0.03		0.43		0.59	0.21	0.21	0.52	0.37	0.36	
v/c Ratio		0.11		0.83		0.21	0.02	0.83	0.67	0.47	0.43	
Control Delay		47.6		29.3		2.5	35.0	61.7	14.9	36.6	29.8	
Queue Delay		0.0		7.8		0.5	0.0	0.0	0.0	0.0	0.0	
Total Delay		47.6		37.1		3.1	35.0	61.7	14.9	36.6	29.8	
LOS		D		D		A	C	E	B	D	C	

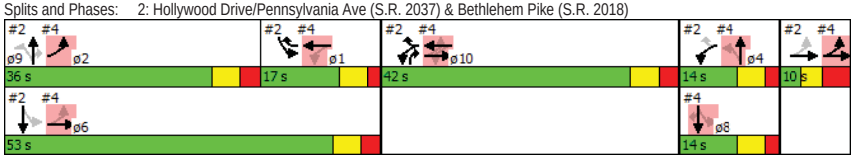
Lane Group	ø4	ø8
Lane Configurations		
Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	4	8
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	3.0	3.0
Minimum Split (s)	9.0	9.0
Total Split (s)	14.0	14.0
Total Split (%)	12%	12%
Maximum Green (s)	8.0	8.0
Yellow Time (s)	4.0	4.0
All-Red Time (s)	2.0	2.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	None	None
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay		47.6						32.1			32.2	
Approach LOS		D						C			C	
Queue Length 50th (ft)		1		451		11	2	225	146	74	150	
Queue Length 95th (ft)		16		#667		18	12	331	209	123	225	
Internal Link Dist (ft)		93			35			545			66	
Turn Bay Length (ft)							100		100	115		
Base Capacity (vph)		47		758		918	215	468	818	316	716	
Starvation Cap Reductn		0		98		420	0	0	0	0	0	
Spillback Cap Reductn		0		0		0	0	0	0	0	0	
Storage Cap Reductn		0		0		0	0	0	0	0	0	
Reduced v/c Ratio		0.11		0.95		0.40	0.02	0.68	0.67	0.47	0.38	

Intersection Summary	
Area Type:	Other
Cycle Length: 119	
Actuated Cycle Length: 114	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.83	
Intersection Signal Delay: 30.9	Intersection LOS: C
Intersection Capacity Utilization 80.1%	ICU Level of Service D
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Hollywood Drive/Pennsylvania Ave (S.R. 2037) & Bethlehem Pike (S.R. 2018)



Lane Group	ø4	ø8
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	194	508	9	6	656	52	11	2	10	42	4	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	11	11	12	12	12	10	10	11
Grade (%)		4%			-4%			-4%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		100
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.989			0.941				0.850
Flt Protected		0.987						0.977			0.956	
Satd. Flow (prot)	0	3275	0	0	3483	0	0	1782	0	0	1695	1531
Flt Permitted		0.561			0.949			0.824			0.727	
Satd. Flow (perm)	0	1862	0	0	3306	0	0	1503	0	0	1289	1531
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			9			10				229
Link Speed (mph)		35			35			25			35	
Link Distance (ft)		107			918			414			138	
Travel Time (s)		2.1			17.9			11.3			2.7	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	0%	4%	0%	0%	1%	2%	0%	0%	0%	0%	0%	2%
Adj. Flow (vph)	198	518	9	6	669	53	11	2	10	43	4	133
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	725	0	0	728	0	0	23	0	0	47	133
Turn Type	custom	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	2 9	6 9 10			1 10			4			8	
Permitted Phases	6 10			1 10			4			8		8
Detector Phase	2 9	6 9 10		1 10	1 10		4	4		8	8	8
Switch Phase												
Minimum Initial (s)							3.0	3.0		3.0	3.0	3.0
Minimum Split (s)							9.0	9.0		9.0	9.0	9.0
Total Split (s)							14.0	14.0		14.0	14.0	14.0
Total Split (%)							11.8%	11.8%		11.8%	11.8%	11.8%
Maximum Green (s)							8.0	8.0		8.0	8.0	8.0
Yellow Time (s)							4.0	4.0		4.0	4.0	4.0
All-Red Time (s)							2.0	2.0		2.0	2.0	2.0
Lost Time Adjust (s)								0.0			0.0	0.0
Total Lost Time (s)								6.0			6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)							3.0	3.0		3.0	3.0	3.0
Recall Mode							None	None		None	None	None
Act Effct Green (s)		93.0			53.1			8.0			8.0	8.0
Actuated g/C Ratio		0.82			0.47			0.07			0.07	0.07
v/c Ratio		0.37			0.47			0.20			0.52	0.42
Control Delay		1.1			22.5			40.3			73.8	3.9
Queue Delay		0.3			0.2			0.0			0.0	0.2
Total Delay		1.4			22.7			40.3			73.8	4.1
LOS		A			C			D			E	A

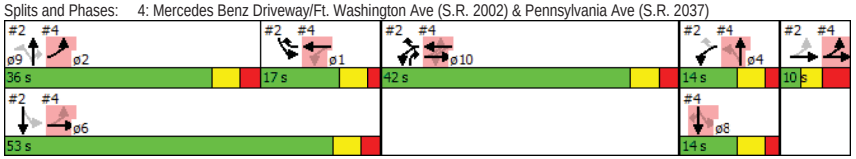
Lane Group	ø1	ø2	ø6	ø9	ø10
Lane Configurations					
Volume (vph)					
Ideal Flow (vphpl)					
Lane Width (ft)					
Grade (%)					
Storage Length (ft)					
Storage Lanes					
Taper Length (ft)					
Lane Util. Factor					
Frt					
Flt Protected					
Satd. Flow (prot)					
Flt Permitted					
Satd. Flow (perm)					
Right Turn on Red					
Satd. Flow (RTOR)					
Link Speed (mph)					
Link Distance (ft)					
Travel Time (s)					
Peak Hour Factor					
Heavy Vehicles (%)					
Adj. Flow (vph)					
Shared Lane Traffic (%)					
Lane Group Flow (vph)					
Turn Type					
Protected Phases	1	2	6	9	10
Permitted Phases					
Detector Phase					
Switch Phase					
Minimum Initial (s)	3.0	10.0	10.0	3.0	4.0
Minimum Split (s)	9.0	17.0	17.0	10.0	11.0
Total Split (s)	17.0	36.0	53.0	10.0	42.0
Total Split (%)	14%	30%	45%	8%	35%
Maximum Green (s)	11.0	29.0	46.0	3.0	35.0
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	2.0	3.0	3.0	4.0	3.0
Lost Time Adjust (s)					
Total Lost Time (s)					
Lead/Lag	Lag	Lead			
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	Min	Min	None	None
Act Effct Green (s)					
Actuated g/C Ratio					
v/c Ratio					
Control Delay					
Queue Delay					
Total Delay					
LOS					

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay		1.4			22.7			40.3			22.3	
Approach LOS		A			C			D			C	
Queue Length 50th (ft)		10			187			9			34	0
Queue Length 95th (ft)		12			258			37			#87	0
Internal Link Dist (ft)		27			838			334			58	
Turn Bay Length (ft)												100
Base Capacity (vph)		1908			1544			114			90	320
Starvation Cap Reductn		599			0			0			0	0
Spillback Cap Reductn		0			263			0			0	18
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		0.55			0.57			0.20			0.52	0.44

Intersection Summary	
Area Type:	Other
Cycle Length: 119	
Actuated Cycle Length: 114	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.83	
Intersection Signal Delay: 13.6	Intersection LOS: B
Intersection Capacity Utilization 63.8%	ICU Level of Service B
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 4: Mercedes Benz Driveway/Ft. Washington Ave (S.R. 2002) & Pennsylvania Ave (S.R. 2037)



Lane Group	ø1	ø2	ø6	ø9	ø10
Approach Delay					
Approach LOS					
Queue Length 50th (ft)					
Queue Length 95th (ft)					
Internal Link Dist (ft)					
Turn Bay Length (ft)					
Base Capacity (vph)					
Starvation Cap Reductn					
Spillback Cap Reductn					
Storage Cap Reductn					
Reduced v/c Ratio					

Intersection Summary

Lanes, Volumes, Timings
5: Ft. Washington Ave (S.R. 2002) & Toner's Tavern

8/21/2013

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	5	10	11	238	166	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.913				0.997	
Flt Protected	0.983			0.998		
Satd. Flow (prot)	1672	0	0	1859	1857	0
Flt Permitted	0.983			0.998		
Satd. Flow (perm)	1672	0	0	1859	1857	0
Link Speed (mph)	25			30	35	
Link Distance (ft)	65			138	278	
Travel Time (s)	1.8			3.1	5.4	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	6	11	12	264	184	4
Shared Lane Traffic (%)						
Lane Group Flow (vph)	17	0	0	276	188	0
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 31.5%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
5: Ft. Washington Ave (S.R. 2002) & Toner's Tavern

8/21/2013

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	5	10	11	238	166	4
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	11	12	264	184	4
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				138		
pX, platoon unblocked						
vC, conflicting volume	476	187	189			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	476	187	189			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	99	99			
cM capacity (veh/h)	543	855	1385			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	17	277	189
Volume Left	6	12	0
Volume Right	11	0	4
cSH	718	1385	1700
Volume to Capacity	0.02	0.01	0.11
Queue Length 95th (ft)	2	1	0
Control Delay (s)	10.1	0.4	0.0
Lane LOS	B	A	
Approach Delay (s)	10.1	0.4	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	31.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lanes, Volumes, Timings
1: Bethlehem Pike (S.R. 2018) & Toner's Tavern

8/21/2013

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	11	11	327	11	11	300
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%		0%			1%
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.932		0.996			
Flt Protected	0.976					0.998
Satd. Flow (prot)	1694	0	1855	0	0	1850
Flt Permitted	0.976					0.998
Satd. Flow (perm)	1694	0	1855	0	0	1850
Link Speed (mph)	25		30			40
Link Distance (ft)	100		146			414
Travel Time (s)	2.7		3.3			7.1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	12	12	363	12	12	333
Shared Lane Traffic (%)						
Lane Group Flow (vph)	24	0	375	0	0	345
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 34.7%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
1: Bethlehem Pike (S.R. 2018) & Toner's Tavern

8/21/2013

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	11	11	327	11	11	300
Sign Control	Stop		Free			Free
Grade	0%		0%			1%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	12	12	363	12	12	333
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			146			
pX, platoon unblocked	0.89	0.89			0.89	
vC, conflicting volume	727	369			376	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	628	224			231	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	97	98			99	
cM capacity (veh/h)	392	723			1185	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	24	376	346
Volume Left	12	0	12
Volume Right	12	12	0
cSH	508	1700	1185
Volume to Capacity	0.05	0.22	0.01
Queue Length 95th (ft)	4	0	1
Control Delay (s)	12.4	0.0	0.4
Lane LOS	B		A
Approach Delay (s)	12.4	0.0	0.4
Approach LOS	B		

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	34.7%	ICU Level of Service	A
Analysis Period (min)	15		

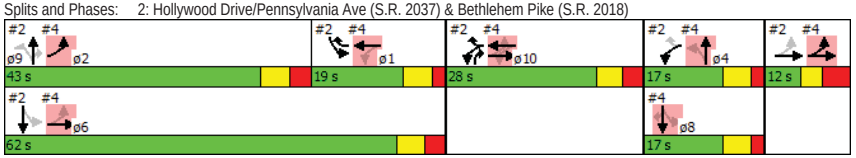
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	2	3	4	220	0	121	5	218	207	132	179	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	12	11	12	11	12	11	11	12
Grade (%)		0%			-4%			-2%			1%	
Storage Length (ft)	0		0	0		0	100		100	115		0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.940				0.850			0.850		0.996	
Flt Protected		0.989		0.950			0.950			0.950		
Satd. Flow (prot)	0	1707	0	1762	0	1577	1823	1837	1615	1702	1752	0
Flt Permitted		0.989		0.950			0.637			0.519		
Satd. Flow (perm)	0	1707	0	1762	0	1577	1222	1837	1615	930	1752	0
Right Turn on Red			Yes			No			No			Yes
Satd. Flow (RTOR)		4									2	
Link Speed (mph)		25			35			35			40	
Link Distance (ft)		173			115			625			146	
Travel Time (s)		4.7			2.2			12.2			2.5	
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
Heavy Vehicles (%)	0%	0%	0%	1%	0%	1%	0%	1%	1%	2%	4%	0%
Adj. Flow (vph)	2	3	4	229	0	126	5	227	216	138	186	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	9	0	229	0	126	5	227	216	138	191	0
Turn Type	Perm	NA		Prot		custom	Perm	NA	custom	pm+pt	NA	
Protected Phases		9		10 4		1 10		2	10	1	6	
Permitted Phases	9					10 4	2		2	6		
Detector Phase	9	9		10 4		1 10	2	2	10	1	6	
Switch Phase												
Minimum Initial (s)	3.0	3.0					10.0	10.0	4.0	3.0	10.0	
Minimum Split (s)	10.0	10.0					17.0	17.0	11.0	9.0	17.0	
Total Split (s)	12.0	12.0					43.0	43.0	28.0	19.0	62.0	
Total Split (%)	10.1%	10.1%					36.1%	36.1%	23.5%	16.0%	52.1%	
Maximum Green (s)	5.0	5.0					36.0	36.0	21.0	13.0	55.0	
Yellow Time (s)	3.0	3.0					4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	4.0	4.0					3.0	3.0	3.0	2.0	3.0	
Lost Time Adjust (s)		0.0					0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		7.0					7.0	7.0	7.0	6.0	7.0	
Lead/Lag							Lead	Lead		Lag		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0					3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None					Min	Min	None	None	Min	
Act Effct Green (s)		5.1		31.2		49.7	17.0	17.0	33.5	35.5	34.4	
Actuated g/C Ratio		0.06		0.34		0.54	0.18	0.18	0.36	0.39	0.37	
v/c Ratio		0.09		0.38		0.15	0.02	0.67	0.37	0.30	0.29	
Control Delay		39.8		16.5		2.8	32.8	46.5	12.8	23.7	22.0	
Queue Delay		0.0		1.9		0.9	0.0	0.0	0.0	0.0	0.0	
Total Delay		39.8		18.5		3.7	32.8	46.5	12.8	23.7	22.0	
LOS		D		B		A	C	D	B	C	C	

Lane Group	ø4	ø8
Lane Configurations		
Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	4	8
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	3.0	3.0
Minimum Split (s)	9.0	9.0
Total Split (s)	17.0	17.0
Total Split (%)	14%	14%
Maximum Green (s)	11.0	11.0
Yellow Time (s)	4.0	4.0
All-Red Time (s)	2.0	2.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	None	None
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay		39.8						30.1			22.7	
Approach LOS		D						C			C	
Queue Length 50th (ft)		3		113		7	2	126	48	53	77	
Queue Length 95th (ft)		21		206		14	13	218	83	103	139	
Internal Link Dist (ft)		93			35			545			66	
Turn Bay Length (ft)							100		100	115		
Base Capacity (vph)		98		634		805	486	731	672	487	1066	
Starvation Cap Reductn		0		267		480	0	0	0	0	0	
Spillback Cap Reductn		0		0		0	0	0	0	0	0	
Storage Cap Reductn		0		0		0	0	0	0	0	0	
Reduced v/c Ratio		0.09		0.62		0.39	0.01	0.31	0.32	0.28	0.18	

Intersection Summary	
Area Type:	Other
Cycle Length: 119	
Actuated Cycle Length: 92.1	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.67	
Intersection Signal Delay: 22.8	Intersection LOS: C
Intersection Capacity Utilization 51.9%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 2: Hollywood Drive/Pennsylvania Ave (S.R. 2037) & Bethlehem Pike (S.R. 2018)



Lane Group	ø4	ø8
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

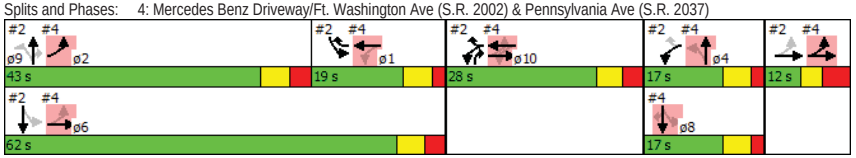
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	65	273	7	12	273	31	5	1	13	36	5	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	11	11	12	12	12	10	10	11
Grade (%)		4%			-4%			-4%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		100
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.997			0.985			0.908				0.850
Flt Protected		0.991			0.998			0.987			0.958	
Satd. Flow (prot)	0	3366	0	0	3499	0	0	1737	0	0	1699	1561
Flt Permitted		0.851			0.937			0.905			0.738	
Satd. Flow (perm)	0	2891	0	0	3285	0	0	1593	0	0	1309	1561
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			11			13				229
Link Speed (mph)		35			35			25			35	
Link Distance (ft)		107			918			414			138	
Travel Time (s)		2.1			17.9			11.3			2.7	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	67	281	7	12	281	32	5	1	13	37	5	70
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	355	0	0	325	0	0	19	0	0	42	70
Turn Type	custom	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	2 9	6 9 10			1 10			4			8	
Permitted Phases	6 10			1 10			4			8		8
Detector Phase	2 9	6 9 10		1 10	1 10		4	4		8	8	8
Switch Phase												
Minimum Initial (s)							3.0	3.0		3.0	3.0	3.0
Minimum Split (s)							9.0	9.0		9.0	9.0	9.0
Total Split (s)							17.0	17.0		17.0	17.0	17.0
Total Split (%)							14.3%	14.3%		14.3%	14.3%	14.3%
Maximum Green (s)							11.0	11.0		11.0	11.0	11.0
Yellow Time (s)							4.0	4.0		4.0	4.0	4.0
All-Red Time (s)							2.0	2.0		2.0	2.0	2.0
Lost Time Adjust (s)								0.0			0.0	0.0
Total Lost Time (s)								6.0			6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)							3.0	3.0		3.0	3.0	3.0
Recall Mode							None	None		None	None	None
Act Effct Green (s)		70.4			35.1			8.5			8.5	8.5
Actuated g/C Ratio		0.76			0.38			0.09			0.09	0.09
v/c Ratio		0.15			0.26			0.12			0.35	0.20
Control Delay		0.7			20.1			27.3			51.1	1.3
Queue Delay		0.2			0.0			0.0			0.0	0.0
Total Delay		0.9			20.1			27.3			51.1	1.3
LOS		A			C			C			D	A

Lane Group	ø1	ø2	ø6	ø9	ø10
Lane Configurations					
Volume (vph)					
Ideal Flow (vphpl)					
Lane Width (ft)					
Grade (%)					
Storage Length (ft)					
Storage Lanes					
Taper Length (ft)					
Lane Util. Factor					
Frt					
Flt Protected					
Satd. Flow (prot)					
Flt Permitted					
Satd. Flow (perm)					
Right Turn on Red					
Satd. Flow (RTOR)					
Link Speed (mph)					
Link Distance (ft)					
Travel Time (s)					
Peak Hour Factor					
Heavy Vehicles (%)					
Adj. Flow (vph)					
Shared Lane Traffic (%)					
Lane Group Flow (vph)					
Turn Type					
Protected Phases	1	2	6	9	10
Permitted Phases					
Detector Phase					
Switch Phase					
Minimum Initial (s)	3.0	10.0	10.0	3.0	4.0
Minimum Split (s)	9.0	17.0	17.0	10.0	11.0
Total Split (s)	19.0	43.0	62.0	12.0	28.0
Total Split (%)	16%	36%	52%	10%	24%
Maximum Green (s)	13.0	36.0	55.0	5.0	21.0
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	2.0	3.0	3.0	4.0	3.0
Lost Time Adjust (s)					
Total Lost Time (s)					
Lead/Lag	Lag	Lead			
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	Min	Min	None	None
Act Effct Green (s)					
Actuated g/C Ratio					
v/c Ratio					
Control Delay					
Queue Delay					
Total Delay					
LOS					

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay		0.9			20.1			27.3			20.0	
Approach LOS		A			C			C			B	
Queue Length 50th (ft)		0			64			3			24	0
Queue Length 95th (ft)		0			111			27			64	0
Internal Link Dist (ft)		27			838			334			58	
Turn Bay Length (ft)												100
Base Capacity (vph)		2525			1353			205			159	391
Starvation Cap Reductn		1378			0			0			0	0
Spillback Cap Reductn		0			91			0			0	6
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		0.31			0.26			0.09			0.26	0.18

Intersection Summary	
Area Type:	Other
Cycle Length: 119	
Actuated Cycle Length: 92.1	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.67	
Intersection Signal Delay: 11.8	Intersection LOS: B
Intersection Capacity Utilization 40.6%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 4: Mercedes Benz Driveway/Ft. Washington Ave (S.R. 2002) & Pennsylvania Ave (S.R. 2037)



Lane Group	ø1	ø2	ø6	ø9	ø10
Approach Delay					
Approach LOS					
Queue Length 50th (ft)					
Queue Length 95th (ft)					
Internal Link Dist (ft)					
Turn Bay Length (ft)					
Base Capacity (vph)					
Starvation Cap Reductn					
Spillback Cap Reductn					
Storage Cap Reductn					
Reduced v/c Ratio					

Intersection Summary

Lanes, Volumes, Timings
5: Ft. Washington Ave (S.R. 2002) & Toner's Tavern

8/21/2013

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	5	11	12	86	98	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.910				0.993	
Flt Protected	0.984			0.994		
Satd. Flow (prot)	1668	0	0	1852	1850	0
Flt Permitted	0.984			0.994		
Satd. Flow (perm)	1668	0	0	1852	1850	0
Link Speed (mph)	25			30	35	
Link Distance (ft)	65			138	278	
Travel Time (s)	1.8			3.1	5.4	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	6	12	13	96	109	6
Shared Lane Traffic (%)						
Lane Group Flow (vph)	18	0	0	109	115	0
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 21.9%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
5: Ft. Washington Ave (S.R. 2002) & Toner's Tavern

8/21/2013

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	5	11	12	86	98	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	12	13	96	109	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				138		
pX, platoon unblocked						
vC, conflicting volume	234	112	114			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	234	112	114			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	99	99			
cM capacity (veh/h)	747	941	1475			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	18	109	114
Volume Left	6	13	0
Volume Right	12	0	6
cSH	871	1475	1700
Volume to Capacity	0.02	0.01	0.07
Queue Length 95th (ft)	2	1	0
Control Delay (s)	9.2	1.0	0.0
Lane LOS	A	A	
Approach Delay (s)	9.2	1.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	21.9%	ICU Level of Service	A
Analysis Period (min)	15		

Lanes, Volumes, Timings
2: Hollywood Drive/Pennsylvania Ave (S.R. 2037) & Bethlehem Pike (S.R. 2018)

8/21/2013

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	2	3	8	623	0	134	2	189	507	181	357	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	12	11	12	11	12	11	11	12
Grade (%)		0%			-4%			-2%			1%	
Storage Length (ft)	0		0	0		0	100		100	115		0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.913				0.850			0.850		0.999	
Flt Protected		0.993		0.950			0.950			0.950		
Satd. Flow (prot)	0	1665	0	1728	0	1474	1823	1801	1599	1669	1773	0
Flt Permitted		0.993		0.950			0.227			0.495		
Satd. Flow (perm)	0	1665	0	1728	0	1474	436	1801	1599	870	1773	0
Right Turn on Red			Yes			No			No			Yes
Satd. Flow (RTOR)		9										
Link Speed (mph)		25			35			35			40	
Link Distance (ft)		173			115			625			146	
Travel Time (s)		4.7			2.2			12.2			2.5	
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%	3%	0%	8%	0%	3%	2%	4%	3%	0%
Adj. Flow (vph)	2	3	9	677	0	146	2	205	551	197	388	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	14	0	677	0	146	2	205	551	197	390	0
Turn Type	Perm	NA		Prot		custom	Perm	NA	custom	pm+pt	NA	
Protected Phases		9		10 4		1 10		2	10	1	6	
Permitted Phases	9					10 4	2		2	6		
Detector Phase	9	9		10 4		1 10	2	2	10	1	6	
Switch Phase												
Minimum Initial (s)	3.0	3.0					10.0	10.0	4.0	3.0	10.0	
Minimum Split (s)	10.0	10.0					17.0	17.0	11.0	9.0	17.0	
Total Split (s)	10.0	10.0					30.0	30.0	42.0	18.0	48.0	
Total Split (%)	8.4%	8.4%					25.2%	25.2%	35.3%	15.1%	40.3%	
Maximum Green (s)	3.0	3.0					23.0	23.0	35.0	12.0	41.0	
Yellow Time (s)	3.0	3.0					4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	4.0	4.0					3.0	3.0	3.0	2.0	3.0	
Lost Time Adjust (s)		0.0					0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		7.0					7.0	7.0	7.0	6.0	7.0	
Lead/Lag							Lead	Lead		Lag		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0					3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None					Min	Min	None	None	Min	
Act Effct Green (s)		3.0		53.2		72.3	17.6	17.6	52.7	36.6	35.6	
Actuated g/C Ratio		0.03		0.47		0.64	0.16	0.16	0.47	0.32	0.32	
v/c Ratio		0.26		0.83		0.15	0.03	0.73	0.74	0.54	0.70	
Control Delay		48.0		30.6		2.8	41.0	61.2	20.5	39.9	41.4	
Queue Delay		0.0		6.5		0.7	0.0	0.0	0.0	0.0	0.0	
Total Delay		48.0		37.1		3.5	41.0	61.2	20.5	39.9	41.4	
LOS		D		D		A	D	E	C	D	D	

Lanes, Volumes, Timings
2: Hollywood Drive/Pennsylvania Ave (S.R. 2037) & Bethlehem Pike (S.R. 2018)

8/21/2013

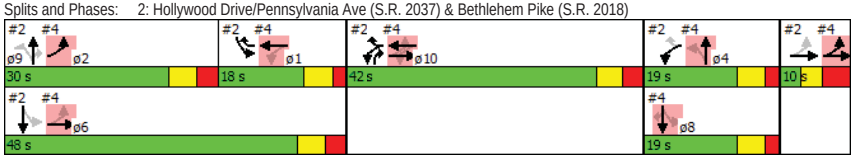
Lane Group	ø4	ø8
Lane Configurations		
Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	4	8
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	3.0	3.0
Minimum Split (s)	9.0	9.0
Total Split (s)	19.0	19.0
Total Split (%)	16%	16%
Maximum Green (s)	13.0	13.0
Yellow Time (s)	4.0	4.0
All-Red Time (s)	2.0	2.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	None	None
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay		48.0						31.6			40.9	
Approach LOS		D						C			D	
Queue Length 50th (ft)		4		490		12	1	145	175	110	250	
Queue Length 95th (ft)		27		#680		18	9	227	251	175	360	
Internal Link Dist (ft)		93			35			545			66	
Turn Bay Length (ft)							100		100	115		
Base Capacity (vph)		53		828		943	89	368	745	367	645	
Starvation Cap Reductn		0		111		548	0	0	0	0	0	
Spillback Cap Reductn		0		0		0	0	0	0	0	0	
Storage Cap Reductn		0		0		0	0	0	0	0	0	
Reduced v/c Ratio		0.26		0.94		0.37	0.02	0.56	0.74	0.54	0.60	

Intersection Summary	
Area Type:	Other
Cycle Length: 119	
Actuated Cycle Length: 112.9	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.83	
Intersection Signal Delay: 34.0	Intersection LOS: C
Intersection Capacity Utilization 83.4%	ICU Level of Service E
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Hollywood Drive/Pennsylvania Ave (S.R. 2037) & Bethlehem Pike (S.R. 2018)



Lane Group	ø4	ø8
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	618	8	4	521	22	5	3	8	82	3	225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	11	11	12	12	12	10	10	11
Grade (%)		4%			-4%			-4%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		100
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	75			75			75			75		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.994			0.929				0.850
Flt Protected		0.995						0.986			0.954	
Satd. Flow (prot)	0	3323	0	0	3391	0	0	1775	0	0	1644	1546
Flt Permitted		0.787			0.951			0.904			0.721	
Satd. Flow (perm)	0	2628	0	0	3225	0	0	1628	0	0	1243	1546
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3			5			9				242
Link Speed (mph)		35			35			25			35	
Link Distance (ft)		107			918			414			138	
Travel Time (s)		2.1			17.9			11.3			2.7	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	4%	2%	0%	0%	4%	13%	0%	0%	0%	3%	0%	1%
Adj. Flow (vph)	81	665	9	4	560	24	5	3	9	88	3	242
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	755	0	0	588	0	0	17	0	0	91	242
Turn Type	custom	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	2 9	6 9 10			1 10			4			8	
Permitted Phases	6 10			1 10			4			8		8
Detector Phase	2 9	6 9 10		1 10	1 10		4	4		8	8	8
Switch Phase												
Minimum Initial (s)							3.0	3.0		3.0	3.0	3.0
Minimum Split (s)							9.0	9.0		9.0	9.0	9.0
Total Split (s)							19.0	19.0		19.0	19.0	19.0
Total Split (%)							16.0%	16.0%		16.0%	16.0%	16.0%
Maximum Green (s)							13.0	13.0		13.0	13.0	13.0
Yellow Time (s)							4.0	4.0		4.0	4.0	4.0
All-Red Time (s)							2.0	2.0		2.0	2.0	2.0
Lost Time Adjust (s)								0.0			0.0	0.0
Total Lost Time (s)								6.0			6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)							3.0	3.0		3.0	3.0	3.0
Recall Mode							None	None		None	None	None
Act Effct Green (s)		87.7			54.1			12.1			12.1	12.1
Actuated g/C Ratio		0.78			0.48			0.11			0.11	0.11
v/c Ratio		0.34			0.38			0.09			0.68	0.64
Control Delay		1.0			20.1			32.8			75.5	14.3
Queue Delay		0.4			0.2			0.0			0.0	0.5
Total Delay		1.4			20.3			32.8			75.5	14.8
LOS		A			C			C			E	B

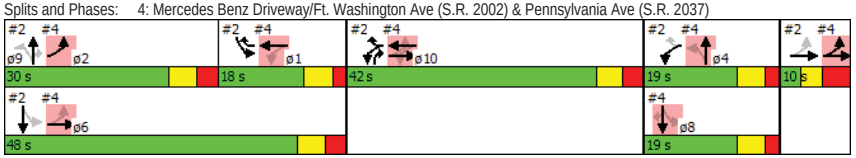
Lane Group	ø1	ø2	ø6	ø9	ø10
Lane Configurations					
Volume (vph)					
Ideal Flow (vphpl)					
Lane Width (ft)					
Grade (%)					
Storage Length (ft)					
Storage Lanes					
Taper Length (ft)					
Lane Util. Factor					
Frt					
Flt Protected					
Satd. Flow (prot)					
Flt Permitted					
Satd. Flow (perm)					
Right Turn on Red					
Satd. Flow (RTOR)					
Link Speed (mph)					
Link Distance (ft)					
Travel Time (s)					
Peak Hour Factor					
Heavy Vehicles (%)					
Adj. Flow (vph)					
Shared Lane Traffic (%)					
Lane Group Flow (vph)					
Turn Type					
Protected Phases	1	2	6	9	10
Permitted Phases					
Detector Phase					
Switch Phase					
Minimum Initial (s)	3.0	10.0	10.0	3.0	4.0
Minimum Split (s)	9.0	17.0	17.0	10.0	11.0
Total Split (s)	18.0	30.0	48.0	10.0	42.0
Total Split (%)	15%	25%	40%	8%	35%
Maximum Green (s)	12.0	23.0	41.0	3.0	35.0
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	2.0	3.0	3.0	4.0	3.0
Lost Time Adjust (s)					
Total Lost Time (s)					
Lead/Lag	Lag	Lead			
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	Min	Min	None	None
Act Effct Green (s)					
Actuated g/C Ratio					
v/c Ratio					
Control Delay					
Queue Delay					
Total Delay					
LOS					

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay		1.4			20.3			32.8			31.4	
Approach LOS		A			C			C			C	
Queue Length 50th (ft)		8			141			5			65	0
Queue Length 95th (ft)		10			200			29			#146	79
Internal Link Dist (ft)		27			838			334			58	
Turn Bay Length (ft)												100
Base Capacity (vph)		2180			1549			195			143	392
Starvation Cap Reductn		859			0			0			0	0
Spillback Cap Reductn		0			299			0			0	22
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		0.57			0.47			0.09			0.64	0.65

Intersection Summary	
Area Type:	Other
Cycle Length: 119	
Actuated Cycle Length: 112.9	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.83	
Intersection Signal Delay: 14.2	Intersection LOS: B
Intersection Capacity Utilization 61.9%	ICU Level of Service B
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 4: Mercedes Benz Driveway/Ft. Washington Ave (S.R. 2002) & Pennsylvania Ave (S.R. 2037)



Lane Group	ø1	ø2	ø6	ø9	ø10
Approach Delay					
Approach LOS					
Queue Length 50th (ft)					
Queue Length 95th (ft)					
Internal Link Dist (ft)					
Turn Bay Length (ft)					
Base Capacity (vph)					
Starvation Cap Reductn					
Spillback Cap Reductn					
Storage Cap Reductn					
Reduced v/c Ratio					

Intersection Summary

APPENDIX J

Gap Study

McMahon Associates Inc.

425 Commerce Drive, Suite 200
Fort Washington, PA 19034

Municipality: Upper Dublin Township
Location: Bethlehem Pike &
Existing Toners Access
Counter/Board #: BW

File Name : toners04aGAP
Site Code : 00000002
Start Date : 7/23/2013
Page No : 1

Directions Printed: Northbound

Start Time	Volume	2 - 3	4 - 5	6 - 7	8 - 9	10 - 11	12 - 13	14 - 15	16 - 17	18 - 19	20 - 21	22 - 23	24 - 25	26 - 27	28 - 29	>29	Int. Total	Average
08:00	0	5	2	5	3	2	4	3	1	5	0	1	0	0	1	8	40	12 - 13
08:15	0	8	4	0	3	5	4	0	1	0	0	5	2	2	0	7	41	12 - 13
08:30	0	3	4	0	2	2	1	1	0	2	4	2	1	2	1	8	33	20 - 21
08:45	0	5	6	2	2	2	2	0	1	3	2	1	3	0	2	7	38	16 - 17
Total	0	21	16	7	10	11	11	4	3	10	6	9	6	4	4	30	152	14 - 15
09:00	0	4	7	2	0	1	2	1	3	1	4	2	1	0	1	8	37	16 - 17
09:15	0	5	1	4	2	4	0	3	2	2	4	0	1	1	2	7	38	16 - 17
09:30	0	10	5	2	4	2	0	2	1	4	2	1	1	0	4	7	45	10 - 11
09:45	0	5	3	3	1	1	0	0	4	2	2	1	1	3	0	9	35	18 - 19
Total	0	24	16	11	7	8	2	6	10	9	12	4	4	4	7	31	155	16 - 17
Grand Total	0	45	32	18	17	19	13	10	13	19	18	13	10	8	11	61	307	14 - 15
Total %		14.7	10.4	5.9	5.5	6.2	4.2	3.3	4.2	6.2	5.9	4.2	3.3	2.6	3.6	19.9		

McMahon Associates Inc.

425 Commerce Drive, Suite 200
Fort Washington, PA 19034

Municipality: Upper Dublin Township
Location: Bethlehem Pike &
Existing Toners Access
Counter/Board #: BW

File Name : toners04aGAP
Site Code : 00000002
Start Date : 7/23/2013
Page No : 1

Directions Printed: Southbound

Start Time	Volume	2 - 3	4 - 5	6 - 7	8 - 9	10 - 11	12 - 13	14 - 15	16 - 17	18 - 19	20 - 21	22 - 23	24 - 25	26 - 27	28 - 29	>29	Int. Total	Average
08:00	0	5	10	3	3	0	1	1	2	0	0	0	1	0	0	0	26	4 - 5
08:15	0	10	4	1	2	2	0	2	0	0	2	3	0	1	0	3	30	8 - 9
08:30	0	10	4	1	4	4	0	0	0	0	1	0	0	0	1	2	27	4 - 5
08:45	0	15	7	3	2	1	4	0	0	0	0	1	1	1	0	2	37	4 - 5
Total	0	40	25	8	11	7	5	3	2	0	3	4	2	2	1	7	120	4 - 5
09:00	0	3	9	6	3	1	2	1	0	1	1	0	1	0	0	4	32	6 - 7
09:15	0	8	4	5	6	3	4	4	2	3	1	2	2	1	0	2	47	10 - 11
09:30	0	9	8	8	5	1	4	3	1	1	1	0	0	1	1	6	49	6 - 7
09:45	0	5	7	6	3	3	3	2	0	1	0	1	0	0	1	5	37	8 - 9
Total	0	25	28	25	17	8	13	10	3	6	3	3	3	2	2	17	165	8 - 9
Grand Total	0	65	53	33	28	15	18	13	5	6	6	7	5	4	3	24	285	6 - 7
Total %		22.8	18.6	11.6	9.8	5.3	6.3	4.6	1.8	2.1	2.1	2.5	1.8	1.4	1.1	8.4		

McMahon Associates Inc.

425 Commerce Drive, Suite 200
Fort Washington, PA 19034

Municipality: Upper Dublin Township
Location: Bethlehem Pike &
Existing Toners Access
Counter/Board #: BW

File Name : toners04pGAP
Site Code : 00000003
Start Date : 7/23/2013
Page No : 1

Directions Printed: Northbound

Start Time	Volume	2 - 3	4 - 5	6 - 7	8 - 9	10 - 11	12 - 13	14 - 15	16 - 17	18 - 19	20 - 21	22 - 23	24 - 25	26 - 27	28 - 29	>29	Int. Total	Average
16:00	0	13	2	4	1	1	4	2	2	4	3	0	1	1	0	7	45	12 - 13
16:15	0	9	4	3	3	1	4	2	2	1	2	1	2	0	1	8	43	12 - 13
16:30	0	11	6	3	5	5	4	4	3	2	1	1	0	0	0	7	52	10 - 11
16:45	0	8	4	4	3	3	3	2	0	1	2	0	1	2	1	6	40	10 - 11
Total	0	41	16	14	12	10	15	10	7	8	8	2	4	3	2	28	180	10 - 11
17:00	0	6	4	5	1	3	2	5	2	1	1	0	1	1	0	8	40	12 - 13
17:15	0	11	7	2	1	9	3	7	1	3	1	0	1	0	0	3	49	10 - 11
17:30	0	9	5	1	0	3	4	1	2	4	1	1	2	1	1	5	40	12 - 13
17:45	0	7	6	4	5	2	2	1	5	1	2	1	2	5	1	3	47	10 - 11
Total	0	33	22	12	7	17	11	14	10	9	5	2	6	7	2	19	176	10 - 11
Grand Total	0	74	38	26	19	27	26	24	17	17	13	4	10	10	4	47	356	10 - 11
Total %		20.8	10.7	7.3	5.3	7.6	7.3	6.7	4.8	4.8	3.7	1.1	2.8	2.8	1.1	13.2		

McMahon Associates Inc.

425 Commerce Drive, Suite 200
Fort Washington, PA 19034

Municipality: Upper Dublin Township
Location: Bethlehem Pike &
Existing Toners Access
Counter/Board #: BW

File Name : toners04pGAP
Site Code : 00000003
Start Date : 7/23/2013
Page No : 1

Directions Printed: Southbound

Start Time	Volume	2 - 3	4 - 5	6 - 7	8 - 9	10 - 11	12 - 13	14 - 15	16 - 17	18 - 19	20 - 21	22 - 23	24 - 25	26 - 27	28 - 29	>29	Int. Total	Average
16:00	0	5	3	4	1	3	3	2	1	0	5	1	1	0	1	5	35	12 - 13
16:15	0	6	7	3	4	3	4	1	3	1	4	3	0	0	1	2	42	10 - 11
16:30	0	6	5	4	4	1	4	1	3	2	5	1	2	1	1	1	41	12 - 13
16:45	0	4	4	4	2	0	1	0	1	2	2	2	1	0	1	3	27	8 - 9
Total	0	21	19	15	11	7	12	4	8	5	16	7	4	1	4	11	145	10 - 11
17:00	0	5	9	4	3	1	2	1	4	0	2	0	1	1	0	2	35	6 - 7
17:15	0	6	4	8	3	3	6	2	1	1	0	0	1	0	0	4	39	8 - 9
17:30	0	11	7	9	5	4	0	2	1	2	3	1	0	1	0	5	51	6 - 7
17:45	0	9	4	3	3	3	1	2	3	3	1	2	0	0	1	6	41	10 - 11
Total	0	31	24	24	14	11	9	7	9	6	6	3	2	2	1	17	166	8 - 9
Grand Total	0	52	43	39	25	18	21	11	17	11	22	10	6	3	5	28	311	8 - 9
Total %		16.7	13.8	12.5	8.0	5.8	6.8	3.5	5.5	3.5	7.1	3.2	1.9	1.0	1.6	9.0		

McMahon Associates Inc.

425 Commerce Drive, Suite 200
Fort Washington, PA 19034

Municipality: Upper Dublin Township
Location: Bethlehem Pike &
Existing Toners Access
Counter/Board #: BW

File Name : toners04sGAP
Site Code : 00000001
Start Date : 7/20/2013
Page No : 1

Directions Printed: Northbound

Start Time	Volume	2 - 3	4 - 5	6 - 7	8 - 9	10 - 11	12 - 13	14 - 15	16 - 17	18 - 19	20 - 21	22 - 23	24 - 25	26 - 27	28 - 29	>29	Int. Total	Average
11:00	0	1	1	1	4	2	5	1	5	2	3	1	0	2	1	8	37	16 - 17
11:15	0	2	4	5	1	1	2	1	0	0	1	2	2	0	0	11	32	20 - 21
11:30	0	4	6	2	0	1	3	1	3	3	2	1	1	1	1	8	37	16 - 17
11:45	0	1	3	3	4	3	1	1	0	2	1	0	4	2	2	9	36	20 - 21
Total	0	8	14	11	9	7	11	4	8	7	7	4	7	5	4	36	142	16 - 17
12:00	0	3	2	7	2	4	1	1	2	1	1	1	0	2	1	11	39	14 - 15
12:15	0	5	5	0	3	2	0	3	1	2	1	2	0	1	3	10	38	18 - 19
12:30	0	1	4	3	2	2	3	2	4	3	1	1	0	1	1	9	37	16 - 17
12:45	0	2	4	4	4	2	1	2	2	3	2	2	1	0	2	8	39	16 - 17
Total	0	11	15	14	11	10	5	8	9	9	5	6	1	4	7	38	153	16 - 17
Grand Total	0	19	29	25	20	17	16	12	17	16	12	10	8	9	11	74	295	16 - 17
Total %		6.4	9.8	8.5	6.8	5.8	5.4	4.1	5.8	5.4	4.1	3.4	2.7	3.1	3.7	25.1		

McMahon Associates Inc.

425 Commerce Drive, Suite 200
Fort Washington, PA 19034

Municipality: Upper Dublin Township
Location: Bethlehem Pike &
Existing Toners Access
Counter/Board #: BW

File Name : toners04sGAP
Site Code : 00000001
Start Date : 7/20/2013
Page No : 1

Directions Printed: Southbound

Start Time	Volume	2 - 3	4 - 5	6 - 7	8 - 9	10 - 11	12 - 13	14 - 15	16 - 17	18 - 19	20 - 21	22 - 23	24 - 25	26 - 27	28 - 29	>29	Int. Total	Average
11:00	0	6	5	3	5	5	4	0	2	2	0	1	1	2	1	3	40	10 - 11
11:15	0	5	4	5	1	7	1	1	3	1	3	1	0	0	0	7	39	10 - 11
11:30	0	5	7	6	2	3	3	3	2	3	2	3	1	0	0	7	47	12 - 13
11:45	0	4	6	4	5	1	2	6	6	2	0	2	2	3	0	4	47	14 - 15
Total	0	20	22	18	13	16	10	10	13	8	5	7	4	5	1	21	173	10 - 11
12:00	0	6	9	4	2	3	4	4	3	1	1	1	2	0	1	6	47	10 - 11
12:15	0	8	1	6	4	2	2	3	3	2	0	0	1	0	1	8	41	10 - 11
12:30	0	5	12	7	3	4	5	0	4	0	1	1	0	2	3	5	52	8 - 9
12:45	0	4	5	2	7	3	1	1	0	1	2	2	1	1	1	9	40	10 - 11
Total	0	23	27	19	16	12	12	8	10	4	4	4	4	3	6	28	180	10 - 11
Grand Total	0	43	49	37	29	28	22	18	23	12	9	11	8	8	7	49	353	10 - 11
Total %		12.2	13.9	10.5	8.2	7.9	6.2	5.1	6.5	3.4	2.5	3.1	2.3	2.3	2.0	13.9		