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March 23, 2010

Mr. Francis J. Hanney, Traffic Services Manager
PennDOT Engineering District 6-0
7000 Geerdes Boulevard
King of Prussia, PA 19406-1525

RE: Marple Township, Delaware County
Point of Access Study
SR0003 (West Chester Pike) at I-476
Marple Associates Site
Traffic Log No. D09-039XP

Dear Mr. Hanney:

This letter is to submit a Point of Access Study prepared on behalf of Marple Township by Orth-Rodgers and Associates, Inc. The study analyzes the impact of a proposed change to the I-476 southbound off ramp to West Chester Pike, associated with development of the Marple Associates site adjacent to the I-476 interchange.

Your review and consideration of this report is appreciated.

Very truly yours,

Anthony T. Hamaday
Township Manager

cc: Board of Commissioners
J. Romano
J. Nawn, P.E.

Orth-Rodgers & Associates, Inc.
TRANSPORTATION ENGINEERS AND PLANNERS

POINT OF ACCESS STUDY
I-476 INTERCHANGE 9
SOUTHBOUND RAMP AT
WEST CHESTER PIKE (PA ROUTE 3)

Prepared for
Marple Township, Delaware County

March 29, 2010

Prepared by

Orth-Rodgers & Associates Inc.

H. RICHARD ORTH, PE037755R
Senior Consultant

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Executive Summary

This Point of Access study analyzes roadway improvements at I-476 interchange 9 with West Chester Pike (PA Route 3) that are proposed in conjunction with the development of a 26-acre site owned by Marple Associates located in the southwest quadrant of the interchange in Marple Township, Delaware County. The study area for this Point of Access Study includes West Chester Pike from New Ardmore Avenue to South Lawrence Road.

Proposed improvements include creation of a full-movement signalized intersection at the intersection of Langford Run Road and West Chester Pike, so that Langford Run Road can serve as the main access to the Marple Associates development site. Also, Langford Run Road as proposed will serve a 'public' function by providing an attractive alternate to a number of motorists traveling between the west on West Chester Pike and the south on Lawrence Road -- diverting traffic from the heavily traveled section of West Chester Pike between the I-476 interchange and Lawrence Road.

Proposed modifications at Langford Run Road include:

- a 'break' in the median along West Chester Pike at the site access drive so as to permit left-turn entry and exit in addition to right-turns,
- construction of a westbound left-turn lane on West Chester Pike at the proposed median 'break',
- construction of a third eastbound through lane and a right turn lane on West Chester Pike approaching the intersection, and
- signalization of the modified intersection; this new signal would be located approximately 665 feet east of the signal at New Ardmore Avenue and 675 feet west of the signal at the I-476 southbound off ramp.

Proposed modifications at the I-476 southbound off ramp (Ramp S-WC), as shown in the aerial photo which follows, include elimination of the existing channelized right-turn yield roadway, widening of other portions of the ramp to provide for additional lanes and storage length, and routing of all southbound exiting traffic to Ramp S-WC Spur at its signalized intersection with West Chester Pike. This will enable traffic exiting from southbound I-476 via Ramp S-WC Spur to turn right onto westbound West Chester Pike and to safely move to the left lane in order to turn left into Langford Run Road. In addition, southbound I-476 traffic wishing to travel west on West Chester Pike will be able to enter that route with traffic signal protection vs. an existing merge movement involving conflict with westbound local traffic on West Chester Pike which turns right onto Mather Avenue, a local street providing residential access.

This Point of Access analysis projects Design Year peak hourly volumes to 2032 and shows that a signalized full movement access at Langford Run Road is superior to the existing right-in, right out driveway when considering overall network operation and safety. A full movement signalized access on

West Chester Pike at Langford Run Road and the modification to the I-476 ramp, as proposed, provide the following advantages to the area roadway network:

- Enhances access to 26-acre Marple Associates site, making successful development feasible
- Helps prevent overloading and capacity/queuing problems that would occur at other intersections resulting from drivers traveling to/from the development via indirect access.
- Provides an alternate route (i.e., a bypass) via Langford Run Road of a congested area of West Chester Pike for motorists traveling between the west on West Chester Pike and the south on Lawrence Road.
- Addresses an existing conflict between traffic exiting southbound I-476 via Ramp S-WC Spur and oriented to the west on West Chester Pike with westbound West Chester Pike traffic turning right into Mather Avenue, a local road providing access to residential development, which intersects West Chester Pike just west of the existing ramp merge point.

Several alternatives were analyzed for the Design Year that aligned the I-476 off ramp and Langford Run Road into one signalized 4-way intersection. These alternatives require relocating Ramp S-WC Spur to the west and Langford Run Road to the east. As illustrated in the sketch plans attached to this report, the potential location of a combined 4-way intersection is constrained by the residential neighborhood on the north side of West Chester Pike adjacent to the off ramp and by the existing I-476 south on-ramp on the south side of West Chester Pike. All of the 4-way intersection alternatives require a retaining wall for the off ramp and also require Langford Run Road to pass through the limited access right of way.

The analysis of all the alternatives shows that the proposed roadway improvements, with separate signalized intersections at Langford Run Road and at the I-476 southbound off ramp, represent the only alternative that provides satisfactory levels of service for Langford Run Road and the I-476 southbound off ramp as well as all movements on West Chester Pike at those intersections. The level of service comparison is shown in the table that follows. It is a PennDOT requirement that all movements at a site access driveway intersection operate at a Level of Service D or better in order to obtain a Highway Occupancy Permit.

The proposed interchange is not a new interchange or major modification to the existing interchange. There is no change to the ramp access points on the main line. The distances between the adjacent upstream and downstream interchanges on I-476 will not change. The proposed condition is the existing interchange with several modifications to the southbound off ramp, and some modifications on West Chester Pike. It is important to note that the proposed modifications have no impact on main line I-476.

The proposed point of access modifications create a full movement access on West Chester Pike for the proposed Marple Associates development that will accommodate future traffic sufficiently and safely without deteriorating the traffic operation at the adjacent intersections or roadway network in the project area.

Project Site and Area Description

The I-476 interchange with West Chester Pike (SR 0003) is located within Marple Township, Delaware County. The Marple Township border with Haverford Township is the Darby Creek, located just east of South Lawrence Road (SR 1020).

As illustrated in Figure 1, the proposed development is of an approximate 26-acre site located in the southwest quadrant of the interchange of I-476 and West Chester Pike (PA Route 3). The site has been vacant for the past 30 years and is zoned as "O-1" according to the Township's zoning map. Fronted by West Chester Pike in the north, the site is immediately surrounded by wooded areas plus a residential development of single-family detached houses in the west. Land use in the area adjacent to the site is mainly single-family detached homes. A mixed use development of the site is proposed that could include up to 400,000 sq ft retail/office floor space plus about 150 residential units.

The site currently has a right in, right out only access on West Chester Pike. The access was located as far west as possible within the site's West Chester Pike frontage, in order to maximize the distance from the I-476 interchange.

The site also has access to South Lawrence Road via Langford Run Road just south of the Lawrence Road overpass of I-476. The intersection of Langford Run Road with South Lawrence Road was placed at the only feasible location. Due to constraints to the north from the bridge over I-476, the intersection cannot be moved further north. Due to a vertical curve crest on South Lawrence Road to the south, the present intersection location maximizes available sight distance. Langford Run Road at South Lawrence Road provides both left turn and right turn entry movements. However, all exiting movements from the site must turn right to southbound South Lawrence Road for safety reasons. Allowing left turn exits would require a traffic signal, and PennDOT has previously determined that the intersection should not be signalized due to the downgrade on South Lawrence Road approaching from the south.

The following changes are being proposed in order to improve access to the site:

- Create a full-movement signalized intersection at the intersection of Langford Run Road and West Chester Pike, so that Langford Run Road can serve as the main access to the Marple Associates development site. Proposed modifications include
    - a 'break' in the median along West Chester Pike at the site access drive so as to permit left-turn entry and exit in addition to right-turns,
    - construction of a westbound left-turn lane on West Chester Pike at the proposed median 'break'
    - construction of a third eastbound through lane and a right turn lane on West Chester Pike approaching the intersection, and

- Signalization of the modified intersection.

- Extend the access roadway within the site southeastwardly to an intersection with relocated Langford Run Road and then connect to the existing intersection with Lawrence Road at a point about 0.35 miles south of PA Route 3, per the sketch shown in Figure 1. The extended access roadway will be the new Langford Run Road;

- Utilize the existing intersection of Langford Run Road with South Lawrence Road including the existing separate northbound left-turn lane but with no signalization and with left-turns prohibited from Langford Run Road to northbound South Lawrence Road – all of which are existing conditions. This location will serve as a secondary access point to the site.

- Eliminate the existing southbound yield right-turn off-ramp from I-476 (Ramp S-WC) and direct all southbound exiting traffic to Ramp S-WC Spur and its signalized intersection with West Chester Pike; the signalized ramp will be widened to add the right turns lane and necessary storage length.

Purpose of the Proposed Point of Access (POA)

The proposed modifications have several benefits, both to the potential development of the Marple Associates site and to the roadway network.

Improve access to the 26-acre development site

Access to the Marple Associates site is poor due to the limitations at both of its two access points. The current limitations on site access have a negative impact on the feasibility of development and the potential economic benefit to Marple Township.

With the current site access, there is no direct entry to the Marple Associates site from the east on West Chester Pike, including from I-476. Traffic originating from the east and from I-476 is expected to comprise 68% of all traffic entering the development. Similarly, with the current site access, there is no way to exit the site to West Chester Pike westbound. The exit to West Chester Pike is restricted to right turns toward the east. The intersection at the Lawrence Road end of Langford Run Road does not allow left-turns 'out' to northbound Lawrence Road (i.e., toward Route 3). As noted earlier, PennDOT has stated that a traffic signal would not be approved at the intersection of Lawrence Road and Langford Run Road, due to the steep downgrade on Lawrence Road approaching the intersection in the northbound direction.

The only route of travel from the development to West Chester Pike west would be via a right turn exit from Langford Run Road to Lawrence Road, travel south on Lawrence Road 1.1 miles to Route 320 Sproul Road, turn right and travel on Sproul Road and Springfield Road 1.7 miles north to West Chester Pike.

Prevent undesirable movements by motorists attempting to access the site

With no direct left turn entry to the development from West Chester Pike, some motorists are likely to take the shortest available route. This would involve travelling 700 feet further west to New Ardmore Avenue and making a U-turn at that signal using the existing left turn lane and left turn signal arrow, or entering New Ardmore Avenue (a residential street) to make the turnaround. The substantial additional volume would create level of service and queue problems in the westbound left turn lane at New Ardmore Avenue. In addition, a truck that attempts to make a U-turn to return east would not be able to complete it within the available lanes and shoulder area.

The only other access to the development from the east is to make a left turn from westbound West Chester Pike at the intersection of South Lawrence Road, travel south and enter the development at South Lawrence Road and Langford Run Road. This requires that the motorist make the turn ½ mile before the visible development frontage on West Chester Pike. The westbound West Chester Pike left turn movement at South Lawrence Road has double left turn lanes and protected-only left turn signal, but the left turn volume is already very heavy, especially in the PM peak hour. Adding development traffic to this left turn would degrade the levels of service.

Bypass for non-development traffic

The proposed Langford Run Road, when completed, will connect West Chester Pike and South Lawrence Road. With a full movement signalized access on West Chester Pike, the roadway will serve a 'public' function by providing an attractive alternate to a number of motorists traveling between the west on West Chester Pike and the south on Lawrence Road -- diverting traffic from the heavily traveled and congested intersection of West Chester Pike and Lawrence Road as well as the section of West Chester through the I-476 interchange area. It is estimated that two-thirds of traffic traveling between the west and the south will divert to this new roadway.

Eliminate conflicts between ramp traffic and right turns into Mather Avenue

An additional advantage to the general roadway network of the proposed POA modification is to address an existing merge issue involving southbound I-476 off-ramp right turns to westbound West Chester Pike. The right turn ramp is currently a separate large radius yield ramp with a short 130’ full width acceleration lane on West Chester Pike. The acceleration lane ends just before the unsignalized ‘T’ intersection of Mather Avenue, a two-way residential street. To enter Mather Avenue, residents must travel in the right lane of westbound West Chester Pike through the merge area of ramp traffic. Within this area, right turns into Mather Avenue are decelerating in the lane in which ramp traffic is accelerating and concentrating on merging into the traffic stream coming from behind. Township police have noted that this is a safety concern. The ramp modification proposed in this POA will eliminate the separate large radius yield ramp and bring the right turns to the existing ramp traffic signal on West Chester Pike. Right turns from the ramp will then enter West Chester Pike under protection of a traffic signal, and drivers entering Mather Avenue will not be required to weave across ramp traffic. It is

noted that the respective volumes of ramp right turns and westbound West Chester Pike through traffic meet both the peak hour and four-hour warrants for a traffic signal.

In summary, the full movement signalized access on West Chester Pike at Langford Run Road and the modification to the I-476 ramp provide the following advantages to the area roadway network:

- Enhances access to Marple Associates development
- By providing direct access, it prevents undesirable movements by drivers attempting to reach the development
- By providing direct access, it helps prevent overloading and capacity/queuing problems that would occur at other intersections resulting from drivers traveling to the development via indirect access.
- Provides a bypass of a congested area of West Chester Pike for motorists traveling between the west and the south.
- Addresses an existing conflict between ramp merge traffic and right turns into Mather Avenue.

Planned Improvements and Projects in the Area

The Marple Associates development and road improvements previously described are the most significant planned projects. There is one other potential development at the former Gamma Swim Club property located within the residential area north of West Chester Pike and between Brookthorpe Avenue and the I-476 southbound off ramp right of way. This property has been proposed for development with a 52,000 sq. ft. synagogue. The proposed development is going through the Marple Township review process. Access to the synagogue from the west on West Chester Pike would be via the signalized intersection of New Ardmore Avenue; access from the east would be via Mather Avenue.

Description of Existing Interchange

The existing interchange for West Chester Pike is Exit 9 on I-476, illustrated on the aerial photo in Figure 2. The interchange serves traffic from/to both directions of West Chester Pike (PA Route 3). The adjacent exit to the north on mainline I-476 is Exit 13 at Lancaster Avenue (PA Route 30) and the distance between the two exits is four miles. The adjacent exit to the south on mainline I-476 is Exit 5 at Media Bypass (PA Route 1) and the distance between the two exits is four miles.

Southbound Off-ramp

Between Exit 13 Lancaster Avenue and Exit 9 West Chester Pike, I-476 southbound main line has three lanes. About 2,400 feet in advance of the Exit 9 gore area, the rightmost southbound lane becomes an 'Exit Only' lane for the off ramp to West Chester Pike, while the two left lanes continue south on I-476. The off ramp is a single lane for 325 feet past the gore of the diverge point from the main line. The off ramp then widens to a two-lane section which continues for 410 feet, and then the right lane splits off and becomes the yield lane for the traffic heading west on West Chester Pike. The left lane of the off ramp widens to two lanes after the split point and then to three lanes as it continues to a signalized intersection at West Chester Pike. The southbound ramp at the traffic signal is painted with three lanes: two exclusive left turn lanes for turns to West Chester Pike east and one through lane lining up with the on ramp to I-476 South. The storage length for the through lane is about 180 feet. The effective storage length of the dual left turn lanes (painted lanes and unpainted two-lane width) is 420 feet per lane to stack the dual left turn vehicles. Overall, the distance from the stop bar of the southbound off ramp at the signalized intersection to the tip of the gore at the ramp's diverge from the main line is 1,260 feet.

The length of the southbound off ramp's existing right turn slip ramp to West Chester Pike west is about 930 feet from the split point on the off ramp to where traffic can start to merge onto West Chester Pike. The slip ramp traffic is controlled by a YIELD sign at the end of the ramp. There is a short full width acceleration lane of 130 feet before traffic has to merge onto West Chester Pike.

The intersection of West Chester Pike and the I-476 southbound off ramp left turn and through lanes is controlled by a semi-actuated two-phase signal, with one phase for through movements in both directions on West Chester Pike and one phase for the off ramp. A crosswalk and pedestrian signals are provided for crossing West Chester Pike on the west side of the intersection. The nearest signal to the west is located about 1,340 feet away at New Ardmore Avenue. The nearest signal to the east is located about 775 feet away at the I-476 northbound ramps. The signals along West Chester Pike are all coordinated in the same system, using a 100 second cycle during the morning peak hours and a 120 second cycle during the evening peak hours.

Southbound On-ramp

Each direction of West Chester Pike has its own on ramp to enter I-476 southbound. An on ramp in the southwest quadrant of the interchange intersects West Chester Pike at the traffic signal for the southbound off ramp, allowing through movements from the off ramp to the on ramp. There are no left turns from West Chester Pike at this signal. This ramp has a channelized right turn yield connection from eastbound West Chester Pike for eastbound traffic entering I-476 South. A loop ramp in the northwest quadrant of the interchange serves the westbound traffic on West Chester Pike entering I-476 South.

Northbound Ramps

The northbound I-476 on and off ramps have a diamond interchange configuration; the northbound on and off ramps intersect West Chester Pike at a traffic signal located 775 feet east of the southbound ramp signal. Eastbound West Chester Pike traffic enters the northbound on ramp via a protected only left turn signal.

West Chester Pike Existing Conditions

West Chester Pike is PA State Route 3 and is a major suburban east-west arterial. The study area for purposes of this POA is (from east to west) South Lawrence Road to New Ardmore Avenue. The posted speed limit in the area is 40 mph for both directions. Traffic signals are located at intersections of South Lawrence Road, I-476 northbound on/off ramps, I-476 southbound off ramp, and New Ardmore Avenue.

Just east of South Lawrence Road, West Chester Pike is on a 108-foot wide, 200 foot long diagonal bridge structure over Darby Creek. Proceeding in the westbound direction, West Chester Pike approaching the signalized intersection of South Lawrence Road has a dual left turn lane and two though lanes. Just west of the South Lawrence Road signal, the channelized right turn on ramp to I-476 North begins. There is no deceleration lane in advance of the ramp.

West Chester Pike has three westbound lanes plus shoulder on the bridge over I-476 main line approaching the signalized intersection of the I-476 southbound off ramp. The right most lane is signed for I-476 South only, and exits to the loop ramp before the traffic signal. Two westbound through lanes continue on West Chester Pike through the signals at the I-476 South off ramp and at New Ardmore Avenue.

In the eastbound direction, West Chester Pike has two through lanes at New Ardmore Avenue and approaching the intersection of I-476 southbound off ramp. 325 feet before the I-476 southbound ramp signal, the eastbound approach widens within the median area to provide a third through lane through the signal. Also, a channelized right turn is provided for the eastbound West Chester Pike traffic to enter the I-476 southbound on ramp. No right turn deceleration lane is provided.

Continuing east, West Chester Pike provides three eastbound through lanes plus shoulder across the bridge over I-476 main line, plus one separate channelized left turn lane for left turns into the I-476 northbound on ramp. East of the I-476 North ramp signal, West Chester Pike carries four eastbound lanes --- three through lanes plus a right turn lane for turns into South Lawrence Road.

Currently, three SEPTA bus routes operate along West Chester Pike through the study area. Two of the routes, Route 104 (69th Street Terminal to West Chester University) and Route 120 (69th Street Terminal to Cheyney University) travel straight through the study area on West Chester Pike. The Route 123 (69th Street Terminal to King of Prussia) travels between the east on West Chester Pike and the north on I-476. The total number of SEPTA buses on West Chester Pike during the peak hours totals 6 to 7 buses in each direction.

Description of Proposed Interchange

The proposed interchange is not a new interchange or major modification to the existing interchange. There is no change to the ramp access points at the main line. The distances between the adjacent upstream and downstream interchanges on I-476 will not change. The proposed condition is the existing interchange with several modifications to the southbound off ramp, and some modifications on West Chester Pike. The proposed conditions are illustrated in Figure 17 attached to this report and are described below.

The changes to the I-476 southbound off ramp consist of:

- Shifting of the existing ramp right turn terminus to the east along West Chester Pike
- Configuring the right turn lane adjacent to the other southbound off ramp lanes as an additional lane at the signalized intersection, and eliminating the existing channelized right turn yield. At the traffic signal, the ramp will provide two left turn lanes, a through- and- right turn lane, and a right turn only lane.
- Providing a corner radius to accommodate truck right turns
- Widening of the southbound off ramp to extend the existing three-lane section of the off ramp to 900 feet in length, approximately where the current two-lane section starts. This is to increase storage space for the off ramp traffic.

The southbound off ramp after these modifications will look very similar to the existing I-476 northbound off ramp to West Chester Pike. Originally constructed with a large radius right turn yield lane as shown in the old aerial photo below, the northbound off ramp was modified to bring the right turn lane into the signalized intersection.

Photo shows northbound off ramp as originally constructed before removing channelized right turn. This POA study proposes a similar change for the southbound off ramp right turn.

No changes are proposed to the southbound on ramp.

Proposed modifications on West Chester Pike include improvements needed to provide a full movement signalized intersection at Langford Run Road. These improvements consist of:

- a 'break' in the median along West Chester Pike so as to permit left-turn entry and exit in addition to right-turns,
- construction of a 450' long westbound left-turn lane on West Chester Pike,
- construction of a third eastbound through lane on West Chester Pike in the median area, beginning approximately 470 feet west of Langford Run Road and extending to the existing third eastbound through lane that begins west of the I-476 southbound ramp intersection,
- construction of a right turn lane on eastbound West Chester Pike approaching the Langford Run Road intersection, and
- signalization of the modified intersection and inclusion in the existing interconnected signal system along West Chester Pike

With the proposed Marple Associates development in place and a full movement intersection at Langford Run Road, a new signal will be located approximately 675 feet to the west of the off ramp signal and 665 feet east of the signal at new Ardmore Avenue.

Traffic Analysis

Existing Traffic Volumes

The Average Daily Traffic volume on I-476 is 118,000 vehicles north of West Chester Pike and 104,000 vehicles south of West Chester Pike. The ADT on West Chester Pike is 34,000 vehicles west of the I-476 interchange and 38,000 vehicles east of the interchange. In the road segment from South Lawrence Road to the next signalized intersection to the east (North Lawrence Road), the ADT on West Chester Pike rises to 51,000 vehicles and then further east is reduced to 42,000 vehicles.

Peak hour volumes at the signalized intersections on West Chester Pike in the study area were obtained by conducting manual turning movement counts:

- New Ardmore Avenue
- I-476 southbound ramps
- I-476 northbound ramps
- South Lawrence Road

The counts were balanced between intersections to equalize the volume departing an intersection and the volume entering the adjacent intersection. The existing AM and PM peak hour turning volumes at the intersection are illustrated in Figures 3 and 4.

The morning peak hour count at West Chester Pike and the southbound off ramp was performed on a Thursday, January 21, 2010. The count data reveal that the morning peak hour at the intersection was between 7:15 AM and 8:15 AM. During the morning peak hour, there were a total of 925 vehicles coming off the southbound ramp with 674 left turns, 250 right turns, and one through. Six percent of the ramp traffic was classified as heavy vehicles. From the eastbound West Chester Pike approach, 1,180 vehicles traveled through the intersection and 275 vehicles entered I-476 southbound ramp through the channelized right turn. From the westbound approach, 946 vehicles traveled straight and 427 vehicles entered I-476 southbound by the reverse jug handle ramp before the signalized intersection. In total, 2,803 vehicles traveled through the signalized intersection during the morning peak hour.

The evening peak hour count at West Chester Pike and the southbound off ramp was conducted on a Wednesday, March 31, 2009. The data reveal that the evening peak hour occurred from 4:45 PM to 5:45 PM. During the evening peak hour, there were a total of 1,837 vehicles coming off the I-476 southbound ramp with 1,446 left turns, 382 right turns, and nine through. Less than one percent of these vehicles were heavy vehicles. From the eastbound approach, 1,432 vehicles traveled straight through the intersection and 181 entered the I-476 southbound on ramp. From the westbound approach, 1,177 vehicles traveled straight through the intersection and 261 vehicles entered the reverse jug handle ramp to I-476 southbound. In total, 4,090 vehicles travelled through the signalized intersection during the evening peak hour.

The counts indicate that the hour of highest traffic volume, both for the I-476 southbound off ramp and for West Chester Pike, is the PM peak hour.

Existing Level of Service Conditions

Capacity analysis was conducted for signalized study area intersections along West Chester Pike from New Ardmore Avenue to South Lawrence Road. In addition, the intersection of North Lawrence Road was included in the analysis because of its proximity to South Lawrence Road and heavy turn movements between the two intersections. Since the studied intersections are all semi-actuated and coordinated, the software program Synchro version 7 was used to conduct the analysis. Levels of Service (LOS) results were reported using Synchro's Highway Capacity Manual reports. In the analysis, West Chester Pike is designated as an east-west street while the side streets are regarded as north-south.

The coordinated signals operate at a cycle length of 100 seconds during the morning peak hours and 120 seconds during the evening peak hours. Offsets are referenced to TS2 first green on West Chester Pike. Existing peak hour intersection service levels are illustrated in Figures 5 and 6.

During the morning peak hour, of the four study intersections all operate at overall LOS 'C' or better, except the intersection of South Lawrence Road which operates at LOS 'E'. At South Lawrence Road the westbound through movement operates at LOS 'F' and the westbound left turn operate at LOS 'E'. At the intersection of I-476 southbound off ramp and West Chester Pike, where modifications are being proposed for the future build conditions, all the movements are operating at LOS 'D' and the overall intersection is at LOS 'B'.

During the evening peak hour, the study intersections operate at overall LOS 'D' or better except the intersection of South Lawrence Road which operates at an overall LOS 'E' due to its eastbound through movement on West Chester Pike which operate at LOS 'F' with two minutes delay. At the intersection of I-476 northbound ramps, the eastbound left turn from West Chester Pike and the right turn from the northbound off ramp are at LOS 'F' with a minute and a half delay although the intersection overall is at LOS 'C'.

Queue analysis was performed to compare average and 95th percentile queues against the available storage length. This comparison reveals that during the morning peak hour the available storages are sufficient to accommodate the queuing at each of the intersections. In the evening peak hour, the available storages are generally sufficient at most of the locations, except for the eastbound through movement on West Chester Pike at the intersection of South Lawrence Road.

Future Years Traffic Volumes

The annual traffic growth rate in Delaware County is 0.21 percent according to the most recent PennDOT Traffic Data Report. Therefore, the background traffic (traffic without proposed development in place) at the interchange in the implementation year 2012 will be 0.6 percent higher than the existing volumes, and in the design year 2032 (20 years after the implementation year) background traffic will be five percent higher than existing volumes.

In addition to the background traffic growth, the proposed Marple Associate development will generate new trips. The procedure used for trip generation and assignment is summarized as follows:

- Trips for the individual uses were generated individually in accordance with ITE Trip Generation 8th Edition.
- Passby trips were calculated. These trips were deducted from total trips to determine the New Trips added to the roadway network.
- Trips that could be expected to be generated by the other uses along Langford Run Road were estimated using the procedure for mixed use development internal trips in the Trip Generation Handbook, Second Edition.

- The 'internal' retail trips were deducted from the passby trips.
- The remaining passby trips were routed from the roadway network into and out of Langford Run Road (acting as diverted link trips rather than new trips on the roadway network).

Overall, the proposed development is projected to generate a total of 609 new vehicle trips on the roadway network in the morning peak hour (355 entering trips and 254 exiting trips) and 1253 new vehicle trips in the evening peak hour (597 entering trips and 656 exiting trips). Please refer to Table 1 for the detailed trip generation.

The direction of approach and departure of Marple Associates development traffic was estimated based on two factors. For retail uses, the population distribution within five miles of the site was utilized. For residential and office/commercial, the existing traffic patterns on the road network during the peak hours were utilized. The resulting estimate is shown below:

Direction of Approach/Departure	Retail	Office/Residential
East on West Chester Pike	32%	21%
East on North Lawrence Road	6%	11%
West on West Chester Pike	16%	22%
North on I-476	15%	26%
South on I-476	15%	10%
South on South Lawrence Road	16%	10%

For traffic approaching the development from the east on West Chester Pike or from the south on I-476, the site traffic was routed either to the West Chester Pike entrance or the Lawrence Road entrance based on the proposed location of the particular use within the site along Langford Run Road. All site traffic from the west on West Chester Pike and from the north on I-476 were routed to the West Chester Pike entrance, and all traffic from the south on Lawrence Road was routed to the Lawrence Road entrance. This results in a distribution of peak hour site traffic as illustrated in the Appendix.

With the proposed development in place, during the morning peak hour there will be 312 site trips going through the intersection of the I-476 southbound off ramp, 141 eastbound trips, 99 westbound trips, and 72 trips coming off the ramp. During the evening peak hour, there will be 698 site trips going through the southbound off ramp intersection, 367 eastbound trips, 222 westbound trips, and 109 trips coming off the ramp. Figures 7 and 8 illustrate the AM and PM peak hour site-generated traffic volumes for the design year.

Diversion of Public Traffic

The maximum number of trips that could potentially divert to Langford Run Road as a bypass route is based solely on origin and destination. The number of trips between the west on West Chester Pike and the south on South Lawrence Road were determined from license plate studies. The remaining question is how many of those motorists will actually divert to Langford Run Road. The distance is 0.35 miles shorter and there are four fewer traffic signals on the diversion route.

Travel time estimates were performed using SimTraffic for both the existing route and the Langford Run Road diversion route, for the eastbound and westbound directions, in the AM and PM peak hours. A design speed of 30 mph was used for Langford Run Road.

The Eastbound travel time on the diversion route is 42 seconds (33%) shorter in the AM and 133 seconds (50%) shorter in the PM than the route using West Chester Pike to Lawrence Road.

The Westbound travel time on the diversion route is 36 seconds (24%) shorter in the AM and 39 seconds (20%) shorter in the PM than the route using Lawrence Road to West Chester Pike.

It was estimated that 67% of the motorists whose trip origin-destination could be served by using Langford Run Road will actually divert to Langford Run Road. Regular commuters (and anyone navigating by GPS) will use the diversion route; infrequent travelers will tend to stay on the main roads.

The volume of AM and PM diverted traffic is illustrated in Figures 9 and 10.

Future Year 2032 Conditions with No Ramp and Access Modifications

In order to illustrate the benefit to the general motoring public of constructing the proposed POA modifications, it is necessary to illustrate conditions under a 'No Build' alternative, i.e. keeping the existing right in, right out only access to the Marple Associates development and leaving the existing I-476 southbound off ramp in place.

The distribution of Marple Associates development traffic would change. A direct left turn entry from the east would not be possible. For the 46% of site traffic approaching on West Chester Pike from east of South Lawrence Road, it was assumed these drivers would turn left onto South Lawrence Road and enter the site via a right turn into Langford Run Road at its intersection with South Lawrence Road. For the 26% of site traffic approaching on I-476 south, most drivers would not turn left on West Chester Pike, travel to South Lawrence Road and turn right to get to Langford Run Road. This route would involve an extra mile of travel. Instead, it is likely that these drivers will use the yield ramp to westbound West Chester Pike and make a U-turn at the traffic signal at New Ardmore Avenue, and return east to enter the development via the right in only entrance. Some of these motorists, instead of making a U turn, might turn left or right into New Ardmore Avenue (a residential street), turn around and exit New Ardmore Avenue at the signal to return east to the development. The U-turn movement is not possible for a truck.

PM peak hour traffic volumes for the No-Build condition are illustrated on Figure 11. The associated Levels of Service are illustrated on Figure 12.

The enforced routing of traffic from the east due to lack of a direct left turn entry will degrade PM traffic operations as follows:

- At West Chester Pike and New Ardmore Avenue, the westbound left turn, which today has only 16 vehicles in the PM peak hour, will add about 100 vehicles and the level of service will degrade from 'F' (103) to 'F' (676).

- At West Chester Pike and South Lawrence Road, the about 160 vehicles will be added to the westbound double left turn to South Lawrence Road and the level of service will degrade from LOS 'D' to LOS 'E' with an additional half minute delay.

- Langford Run Road cannot serve as a public bypass of the signals on West Chester Pike at South Lawrence Road and the I-476 ramps for motorists traveling between the south and the west. The northbound left turn from South Lawrence Road to West Chester Pike will increase by about 80 vehicles and the LOS will degrade to Level 'F'.

- In addition, without the direct left turn exit from Langford Run Road, approximately 200 vehicles exiting the development and destined to the west on West Chester Pike will be diverted to the South Lawrence Road/Sproul Road intersection and other intersections outside the scope of this POA study area. The impact of those trips is therefore not accounted for in the analysis.

Design Year (2032) Proposed Conditions

Design year volumes were derived for the AM and PM peak hours by applying the annual background growth factor and adding the Marple Associates development traffic, assuming the proposed roadway improvements as previously described. The 20-year future AM and PM peak hour volumes are illustrated on Figures 13 and 14.

A capacity analysis of projected future volumes was conducted for the AM and PM peak hours In order to demonstrate that the proposed POA will be able to serve both local conditions and regional travel demand.

In year 2032, in addition to the modified I-476 southbound off ramp interchange and full movement Langford Run Road intersection described earlier, one other minor improvement was assumed at the I-476 northbound off ramp. Under existing conditions, the northbound right turn at the I-476 northbound off ramp fails at LOS 'F' with a minute and a half delay during the evening peak hour. Therefore, it is proposed that the northbound middle lane, which is currently operating as a shared left and through lane, be converted to a shared left, through, and right turn lane. The signal timings and offsets are optimized for the Year 2032 analysis.

The optimized future peak hour cycle lengths are the same as existing --- 100 seconds during the morning peak hour and 120 seconds during the evening peak hour. Future AM and PM peak hour intersection service levels are illustrated in Figures 15 and 16.

The capacity analysis of year 2032 shows that during the morning peak hour, all the intersections will operate at overall LOS 'D' or better (except for North Lawrence Road east of the study area). Several movements at other intersections will experience long delays. At the intersection of South Lawrence Road and West Chester Pike, the westbound through movement on West Chester Pike will be at LOS 'F' but with a shorter delay than under the existing conditions.

During the evening peak hour, all the intersections will operate at overall LOS 'D' or better with the proposed improvements and optimized signal timings. Some of the individual intersection movements will operate at lower levels of service.

Table 2 presents a detailed comparison between existing levels of service, Future Year 2032 levels of service without the proposed POA modifications, and Future Year 2032 levels of service with proposed POA modifications. In addition, queuing analysis was performed using both the results from Synchro and the results of five SimTraffic runs. The queue lengths for existing and proposed conditions are illustrated on Tables 3 and 4. The SimTraffic results for Year 2032 with the proposed improvements show that the queues are within the available storage except at South Lawrence Road, which is an existing condition.

Pedestrians and Transit Access

A pedestrian crossing of West Chester Pike is provided at the existing I-476 south ramp signal, but there is little demand for a crossing because there are no pedestrian destinations. However, Langford Run Road will serve a mixed use development. Two SEPTA bus routes run along West Chester Pike, and the Marple Associates development should be accessible to people riding transit. In particular, some of the office or retail employees will travel to work by transit.

The proposed signal at a 'T' intersection of Langford Run Road and West Chester Pike allows a pedestrian crossing on the west side of the intersection with sufficient signal time to cross West Chester Pike in one stage (although a median refuge of 12 feet or wider would be available). When actuated by a pedestrian, westbound through traffic on West Chester Pike could be stopped during the westbound left turn/ Langford Run Road right turn phase and the pedestrian crossing would operate with no vehicular conflict. Westbound through traffic would overlap the westbound left turn/Langford Run Road right turn phase whenever there is no pedestrian call.

If the Langford Run Road site access remains right in, right out only with no signal, the nearest bus stop would be at Mather Avenue and some pedestrians might attempt to cross West Chester Pike there, resulting in an unsafe condition.

Alternatives Examined

Alternative configurations were examined with a goal of combining the southbound I-476 off ramp into one signalized intersection with Langford Run Road. Under these alternatives, the existing I-476 southbound off ramp would be relocated west and the existing Langford Run Road would be relocated east to align and form one four-leg intersection. This would avoid adding a new signalized intersection on West Chester Pike. Traffic from the I-476 southbound off ramp entering Langford Run Road would proceed straight rather than making a right turn followed by a left turn. The volume of left turns from westbound West Chester Pike into Langford Run Road would be reduced correspondingly.

Six different intersection configurations for this concept were studied. Capacity and queuing analyses were performed for the Year 2032 PM peak hour. The PM peak hour represents the highest volume hour for the off ramp, for West Chester Pike, and for trip generation of the development. The alternatives and their results are described below. A sketch plan of each alternative is drawn on the aerial photo of the existing conditions in order to illustrate location of the roadways and configuration of travel lanes (Figures 18 – 23 attached to this report). The plans also show the 95th percentile queues from Synchro and SimTraffic analyses. Table 2 shows the level of service results for the alternatives. Tables 3 – 10 show queue results for existing conditions, the proposed improvements, and each of the six alternatives. The table for each condition shows the average and 95th percentile queues from Synchro and SimTraffic along with the available storage length. Finally, Tables 11 and 12 compare the alternatives with respect to whether intersection movement 95th percentile queues are within the available storage. The supporting Synchro and SimTraffic reports are found in the Appendix.

- Alternative 1
  In Alternative 1, a four-leg intersection is formed with the following lanes as illustrated in Figure 18:

  - Eastbound West Chester Pike - Three through lanes (one is a new lane), and one new dedicated right turn lane for turns to Langford Run Road
  - Westbound West Chester Pike - Two though lanes and two new left turn lanes
  - Southbound I-476 Ramp - Two left turn lanes, one through lane, and one right turn lane
  - Langford Run Road - One left turn lane and two right turn lanes

  The traffic signal operation has three phases. The westbound left turn into Langford Run Road and right turn exit from Langford Run Road operate on the same phase. The southbound off ramp through traffic volume consists of new trips generated by the Marple Development plus some diverted through traffic to South Lawrence Road. According to the existing traffic pattern, it is estimated that 396 southbound off ramp vehicles are destined to South Lawrence Road in the PM peak hour. Due to the advantage of both shorter travel distance and travel time, two-thirds of this traffic (265 vehicles) was diverted from the ramp's left turn movement to the southbound through movement. The optimized cycle length for the intersection is 120 seconds (same as the existing cycle length), and the timing split was optimized. Volume and capacity analysis reveals that the eastbound West Chester Pike through movement as well as the traffic coming out of the proposed

Langford Run Road would operate at level of service 'F' and the Overall intersection level of service is 'E'.

- Alternative 2
  This alternative, illustrated in Figure 19, uses the same lane configuration as Alternative 1. To address failed level of service of the northbound left turn, the phasing is revised to add a leading protected left turn phase for northbound Langford Run Road. The I-476 ramp double left turn overlaps this phase, so the split time and level of service of the ramp left turn is not affected. The ramp's through lane and right turn lane receive less time. It turns out that the northbound left turn level of service is worse, not better, with the protected-permitted phasing, and overall level of service is worse than Alternative 1.

- Alternative 3
  This alternative, illustrated in Figure 20, returns to the same phase sequence as Alternative 1, but a second through lane is added on the southbound ramp as a different way to address failed level of service of the northbound left turn. The northbound left turn improves to level of service 'E'. The eastbound West Chester Pike through movement and the Langford Run Road right turn would operate at level of service 'F' and the Overall intersection level of service is 'E'.

- Alternative 4
  This alternative, illustrated in Figure 21, tries to address the failing level of service for the eastbound West Chester Pike through movement. The major difference from Alternative 3 is that the eastbound right turn lane continues through to the I-476 southbound on ramp, where it becomes an exclusive right turn lane. This configuration shifts some eastbound traffic at the four-way signal out of the through lanes to the right lane. The result of this shift is that the through lanes, which had been Level F, operate at Level D, but the right lane which had been Level C becomes Level F. Level of service F remains at the right turn out of Langford Run Road. The northbound and southbound left turns are Level of Service 'E' and the Overall level of service is Level 'E' with the lowest average delay of the six 4-way intersection alternatives.

- Alternative 5
  In Alternative 5, illustrated in Figure 22, a different intersection concept is tried. The westbound left turn movement into Langford Run Road is eliminated. Instead, a westbound reverse jug handle is assumed for purposes of the traffic analysis. Westbound West Chester Pike has four lanes going through the intersection, with the right-most through lane for the jug handle traffic only. Eastbound West Chester Pike uses the same configuration as in Alternative 4. The southbound off ramp and Langford Run Road operate with split phases. The ramp has two left turn lanes, two through lanes and one right turn lane. With this configuration, eastbound and westbound through movements along West Chester Pike operate at Level 'D'. The eastbound right turn lane operates at Level 'F'. The I-476 southbound off ramp double left turn fails due to reduced split time. The double left would have to become a triple left in order to address all ramp movements. The double right turns out of Langford Run Road still operate at level of service 'F'. The overall intersection level of service is Level 'E' with about the same average delay as Alternative 3.

Another concern with Alternative 5 relates to the ability for reverse jug handle traffic to merge into the southbound ramp through lane. The Synchro analysis shows that the average queue length for the southbound right turn movement is 260 feet, and the southbound through movement average queue is 230 feet. Because of physical constraints of the adjacent residential neighborhood, it does not appear to be possible to achieve a jug handle design that provides an acceptable merge onto the ramp.

- Alternative 6

  Alternative 6, illustrated in Figure 23, is a modified Continuous Flow Intersection (CFI). This scheme eliminates the conflict between the left turn exit from Langford Run Road and the opposing through traffic from the I-476 southbound ramp. The lanes on West Chester Pike and on the I-476 off ramp are configured similar to Alternative 2. Langford Run Road is configured so that exiting left turns cross over the opposing inbound traffic at a separate two-phase signal within the site. The interior signal would be green for inbound traffic whenever the West Chester Pike westbound left turn arrow or the I-476 ramp through movement had a green light. Entering right turns would have their own driveway entrance lane that merges into the main driveway south of the interior signal. This separate right turn entry lane is needed in order to avoid a condition in which right turns mistakenly enter the left turn exit. At the intersection with West Chester Pike, Langford Run Road would have a right turn entry cartway, a left turn exit cartway, an inbound cartway receiving left turn and through movements, and a two-lane right turn exit. Each of these cartways would be separated by raised islands. The traffic signal phasing has a westbound left turn phase with Langford Run Road right turn overlap; a phase for West Chester Pike, and a phase for the I-476 ramp movements and the Langford Road Run left turn exit.

  While this intersection configuration provides a good level of service for the Langford Run Road left turn exit, other movements are not improved. The modified CFI concept does not remove the conflict between the double left turn from the off ramp and the right turn from Langford Run Road. These two high volume movements must still operate on separate phases. A 'typical' CFI treatment would have the Langford Run Road right turn move into a channelized lane alongside West Chester Pike so that right turns could move simultaneously with the ramp's double left turn, and then the right turn would merge into West Chester Pike. The typical treatment is not possible at this location because of the I-476 southbound on-ramp immediately adjacent to the intersection.

Table 2 provides the level of service results for all movements at the study intersections for each of the alternatives. When compared with the levels of service under the proposed improvements shown in Figure 17, none of the six alternatives provides better levels of service; in fact they are significantly worse. Also, from the perspective of the developer, the alternatives would not meet the PennDOT criteria for a Highway Occupancy Permit that all movements at the site access intersection must operate at Level of Service 'D' or better.

Physical Aspects of Alternates

As illustrated in the sketch plans attached to this report, the potential location of a combined four-way intersection is constrained by the residential neighborhood on the north side of West Chester Pike adjacent to the off ramp and by the existing I-476 south on-ramp on the south side of West Chester Pike. All of the four-way intersection alternatives require a retaining wall, either for the off ramp or the on ramp depending on where the intersection is placed along West Chester Pike. All the alternatives require Langford Run Road to pass through the limited access right of way. The jug handle alternative is not feasible from a physical standpoint because it would encroach into the residential neighborhood.

Another physical factor is the grading of Langford Run Road. The topography of the site drops 87 feet between West Chester Pike and the low point at Langford Run Creek. The existing site access on West Chester Pike has been constructed at a level grade, as is appropriate. The developer and his engineer have worked closely to come up with a profile for the road extension that accomplishes the elevation change, and the grades are over 6%. Moving the road to the east would shorten the road. With a shorter road, it will be more difficult to get the same elevation change without making the road too steep.

Improving the Langford Run Road and the I-476 southbound off ramp intersections at their existing offset locations as proposed requires less dramatic and costly changes to the existing roadway conditions, and good levels of service are provided for all movements at both intersections.

Conclusion

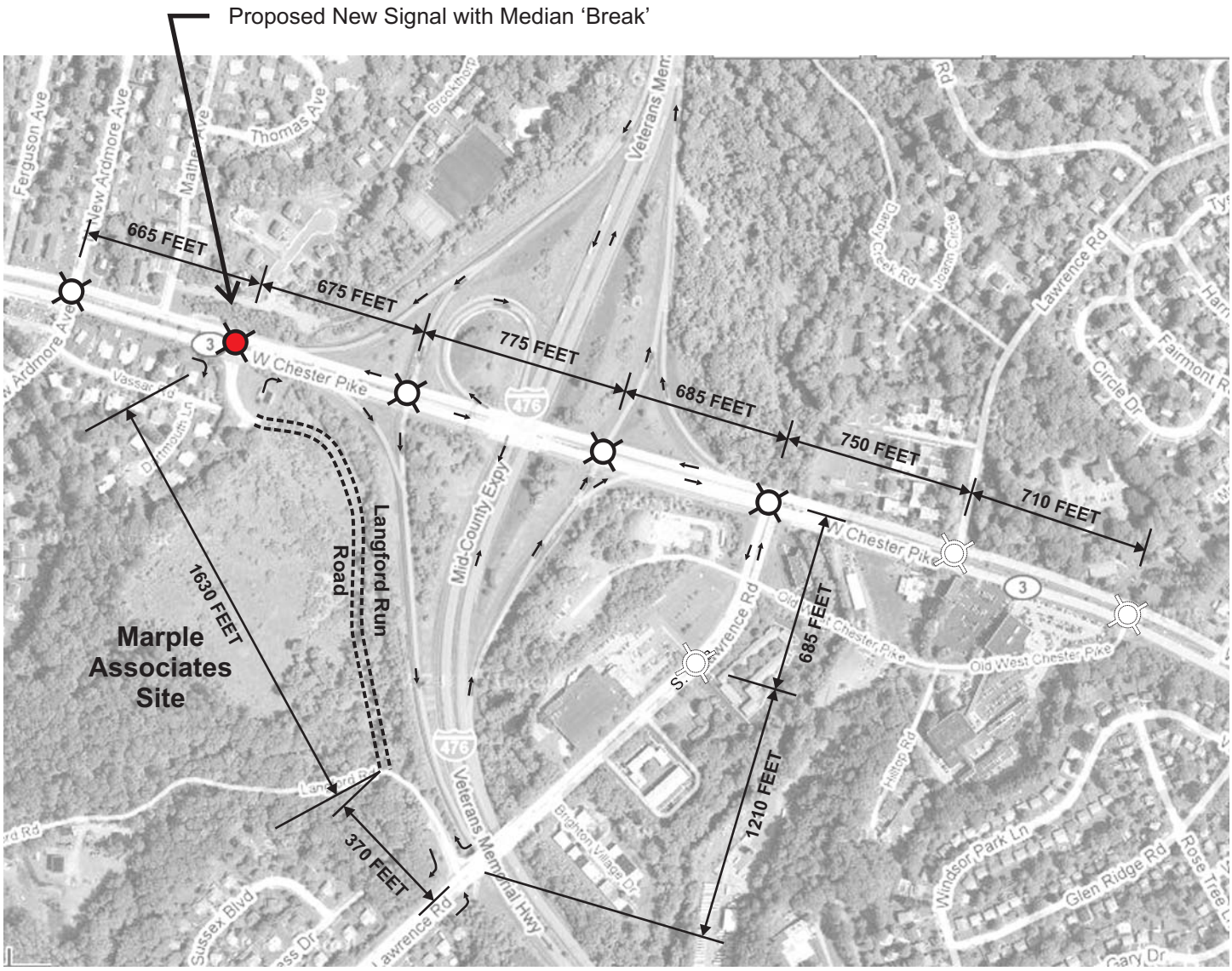
A full movement signalized access at Langford Run Road will provide a number of benefits to the road network operation when compared with the existing right in, right out access. It also will enhance access to the 26-acre Marple Associates site, making successful development feasible.

The proposed point of access modifications at the I-476 southbound off ramp and along West Chester Pike will accommodate future traffic sufficiently and safely without deteriorating the traffic operation at the adjacent intersections or roadway network in the project area.

Project Area

Point of Access Study - I-476 and West Chester Pike

MARPLE TOWNSHIP, DELAWARE COUNTY, PENNSYLVANIA



LEGEND

- *EXISTING TRAFFIC SIGNAL (STUDY INTERSECTION)*
- *OTHER EXISTING TRAFFIC SIGNAL*
- *PROPOSED TRAFFIC SIGNAL*
- *CURRENTLY PERMITTED MOVEMENT*
- *PROPOSED ROADWAY*

FIGURE 2 – EXISTING ROADWAY CONFIGURATIONS

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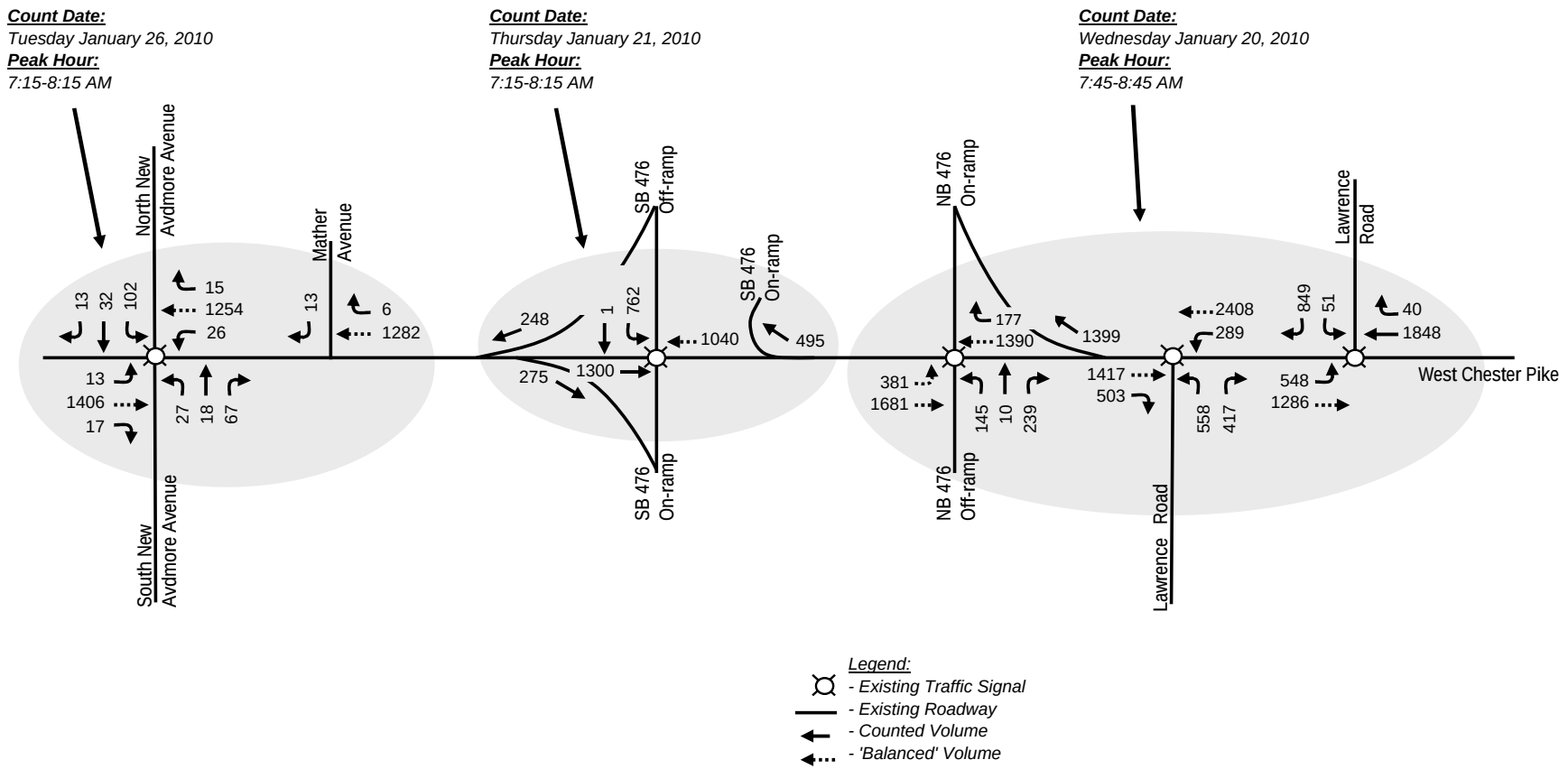
TRANSPORTATION ENGINEERS AND PLANNERS

FIGURE 3

Existing AM Peak Hour Traffic Volumes

Point of Access Study - I-476 and West Chester Pike

MARPLE TOWNSHIP, DELAWARE COUNTY, PENNSYLVANIA



Legend:
- Existing Traffic Signal
- Existing Roadway
- Counted Volume
- 'Balanced' Volume

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FIGURE 4

Existing PM Peak Hour Traffic Volumes

Point of Access Study - I-476 and West Chester Pike

MARPLE TOWNSHIP, DELAWARE COUNTY, PENNSYLVANIA

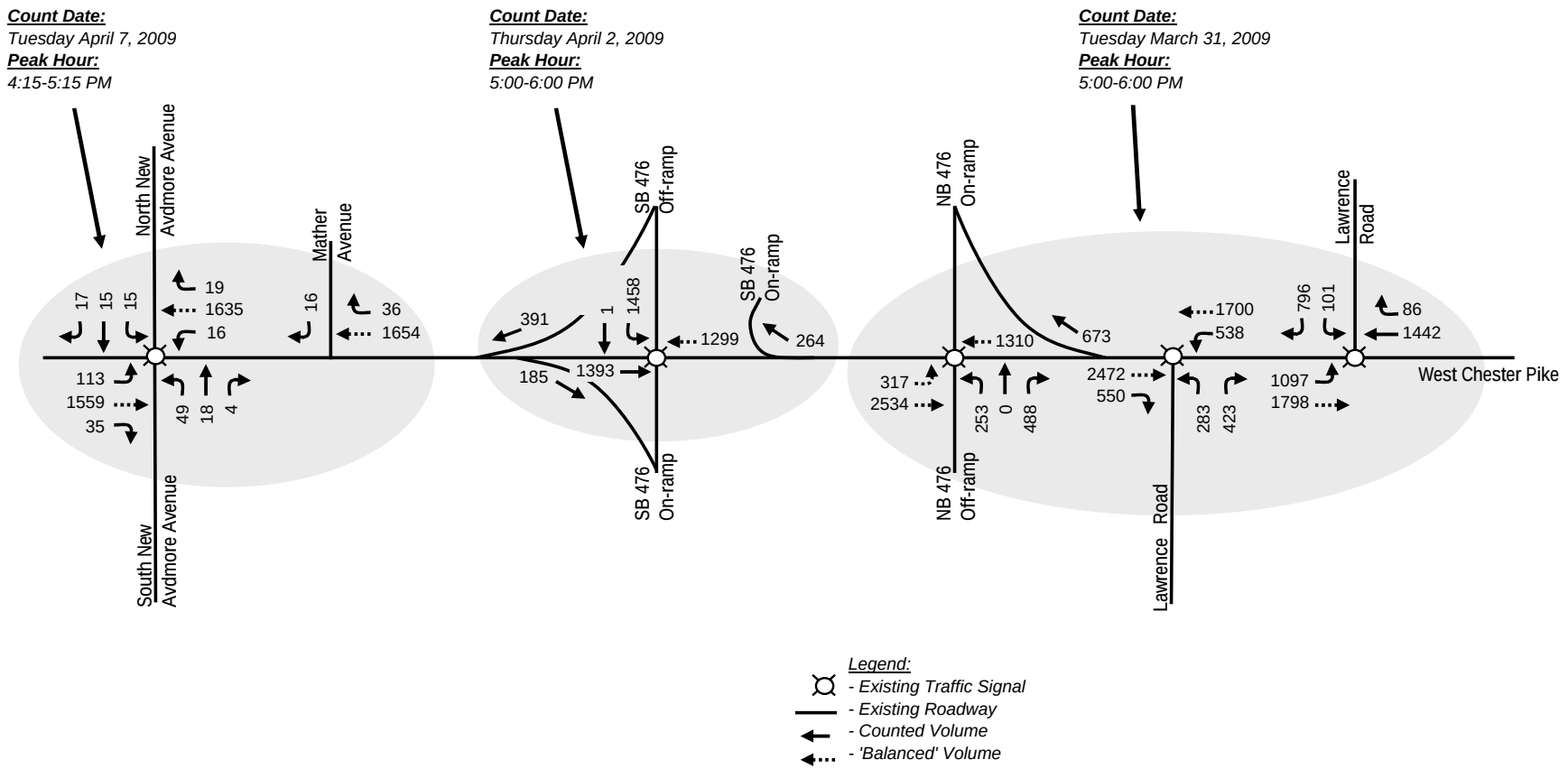

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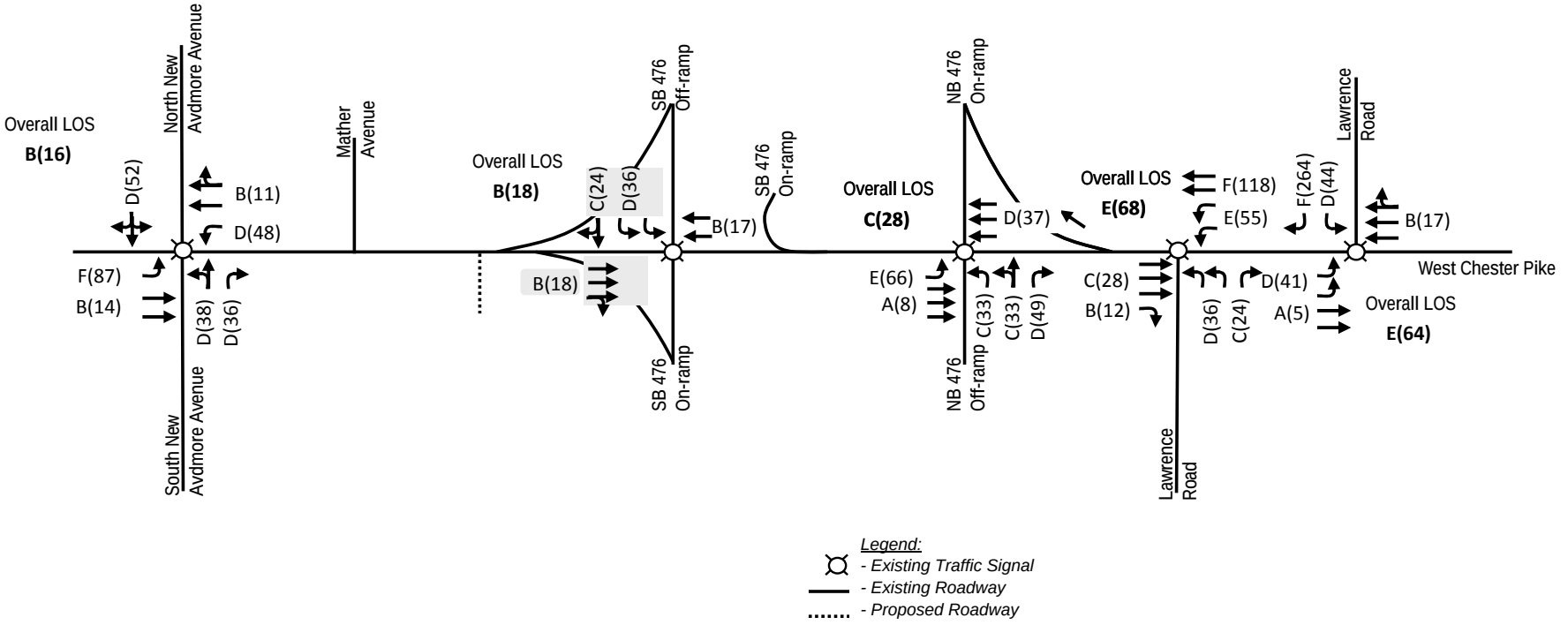
FIGURE 5

Existing AM Peak Hour Levels of Service

Point of Access Study - I-476 and West Chester Pike

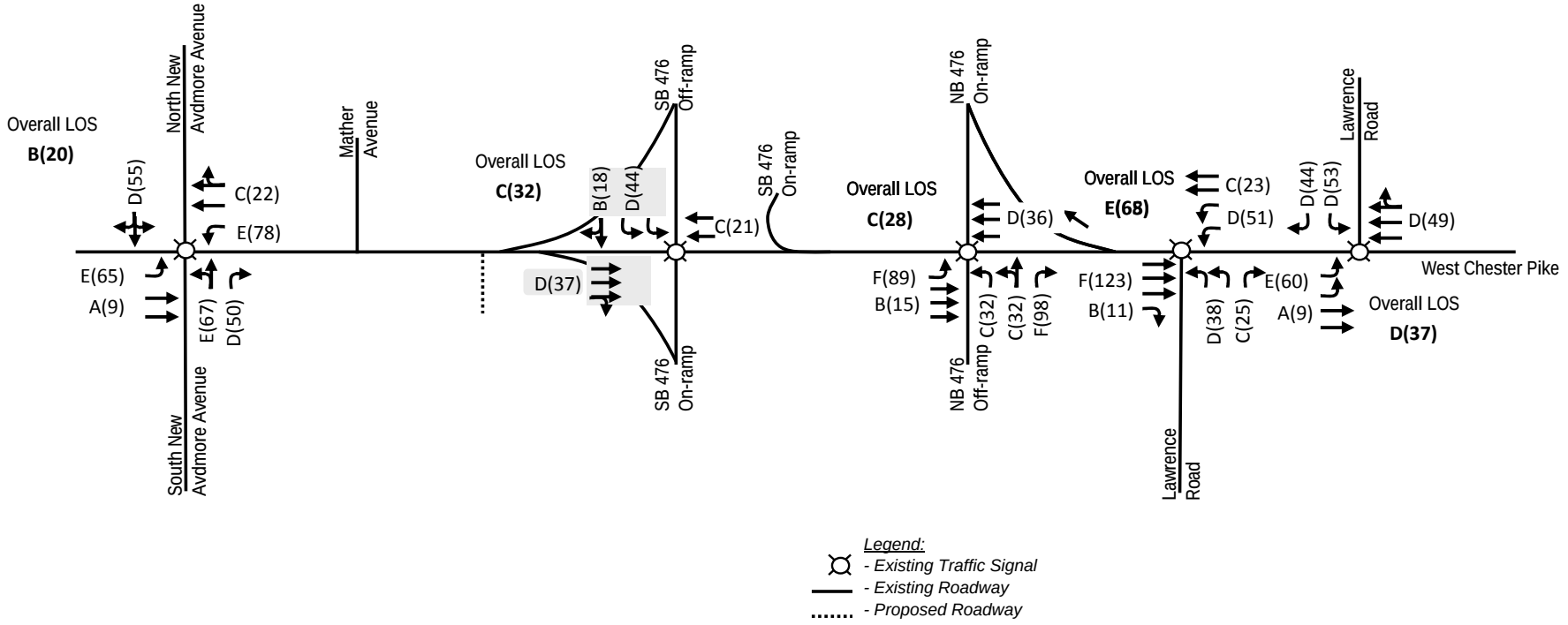
MARPLE TOWNSHIP, DELAWARE COUNTY, PENNSYLVANIA



Existing PM Peak Hour Levels of Service

Point of Access Study - I-476 and West Chester Pike

MARPLE TOWNSHIP, DELAWARE COUNTY, PENNSYLVANIA

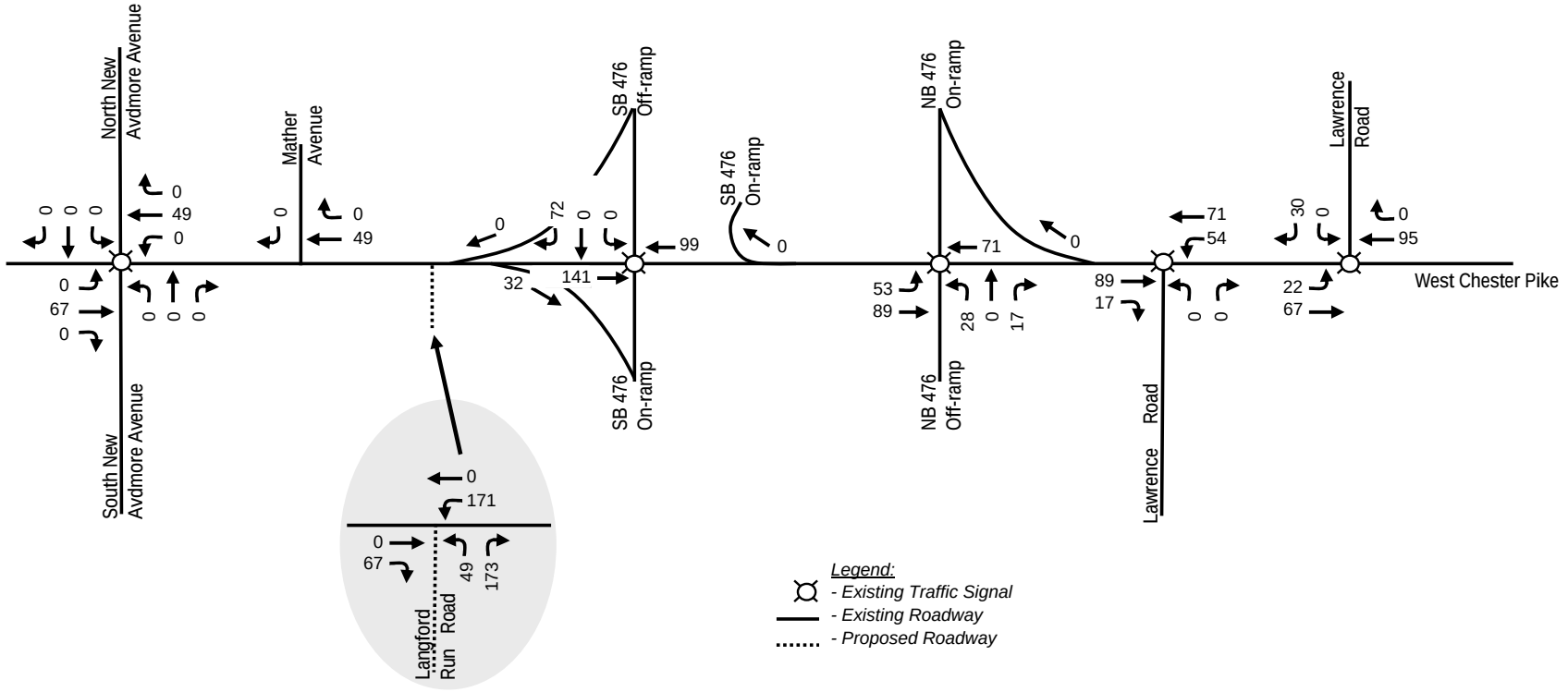


AM Peak Hour Site Generated Traffic Volumes

Point of Access Study - I-476 and West Chester Pike

MARPLE TOWNSHIP, DELAWARE COUNTY, PENNSYLVANIA

Note: All site traffic is new trips.



PM Peak Hour Site Generated Traffic Volumes

Point of Access Study - I-476 and West Chester Pike

MARPLE TOWNSHIP, DELAWARE COUNTY, PENNSYLVANIA

Note: Includes both new and pass-by trips.

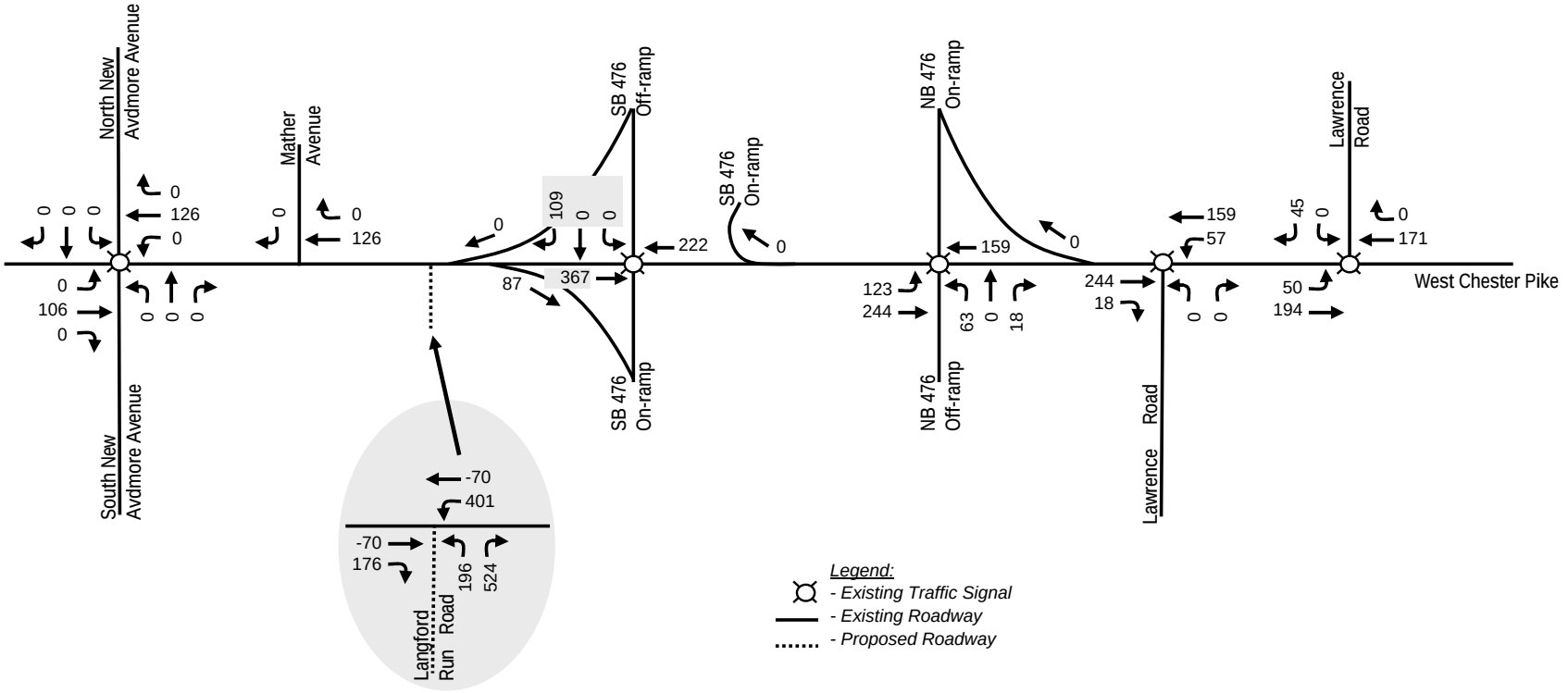


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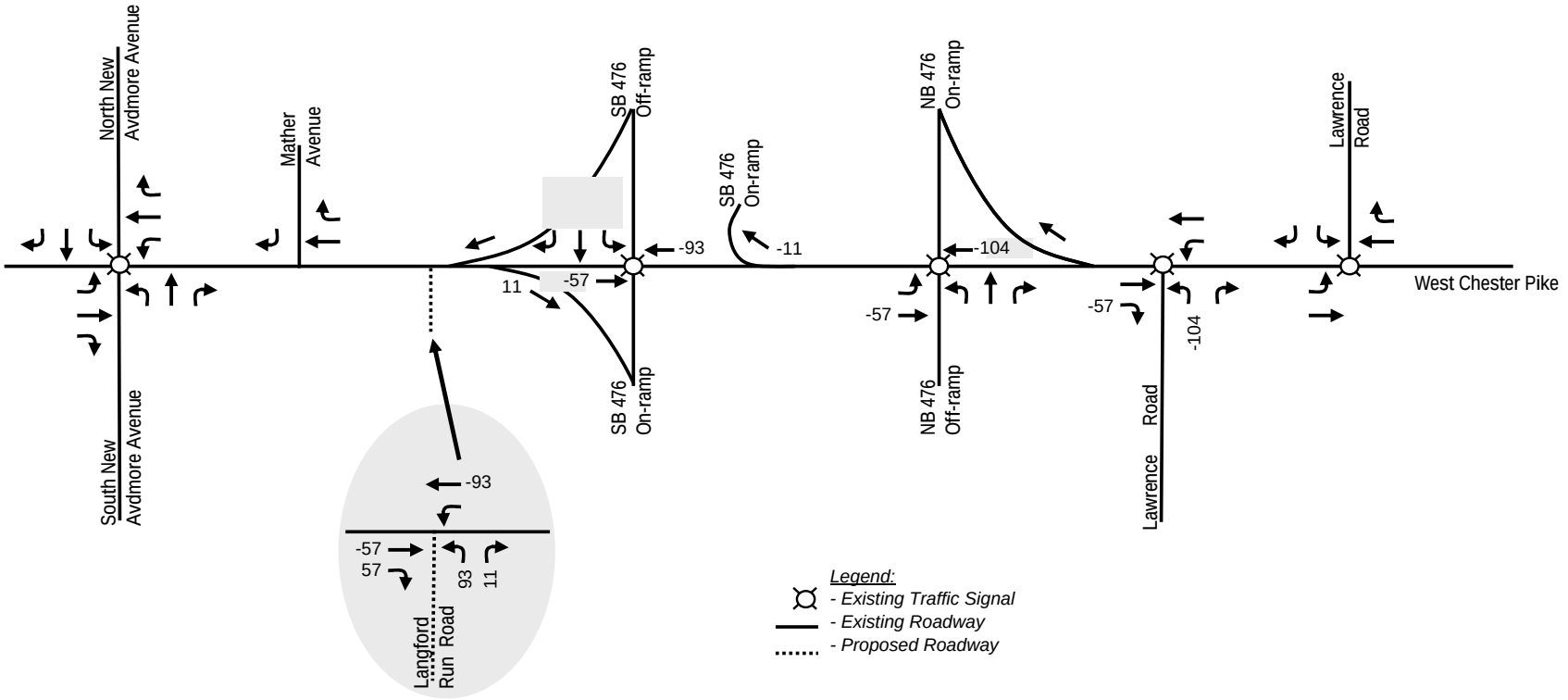
FIGURE 9

AM Peak Hour Diversion of Public Traffic to Langford Run Road

Point of Access Study - I-476 and West Chester Pike

MARPLE TOWNSHIP, DELAWARE COUNTY, PENNSYLVANIA



PM Peak Hour Diversion of Public Traffic to Langford Run Road

Point of Access Study - I-476 and West Chester Pike

MARPLE TOWNSHIP, DELAWARE COUNTY, PENNSYLVANIA

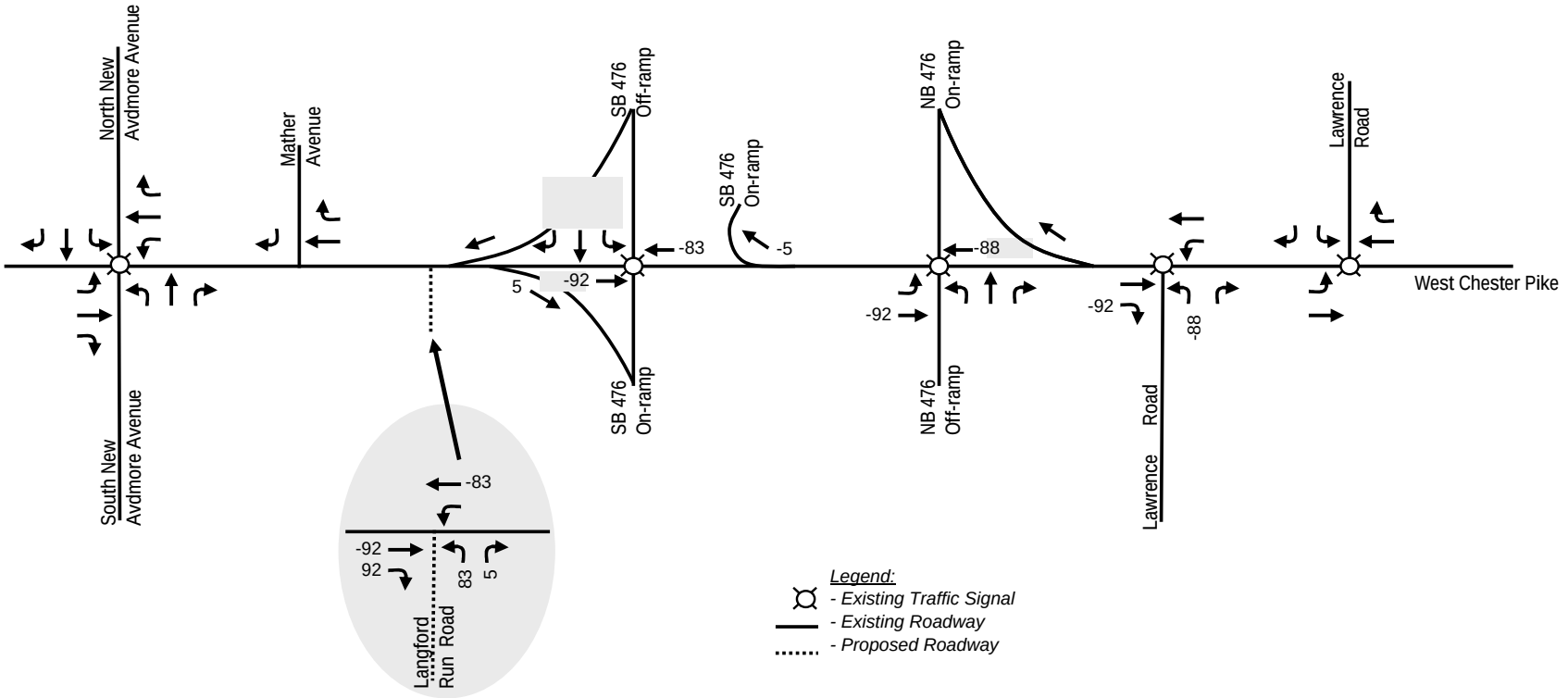


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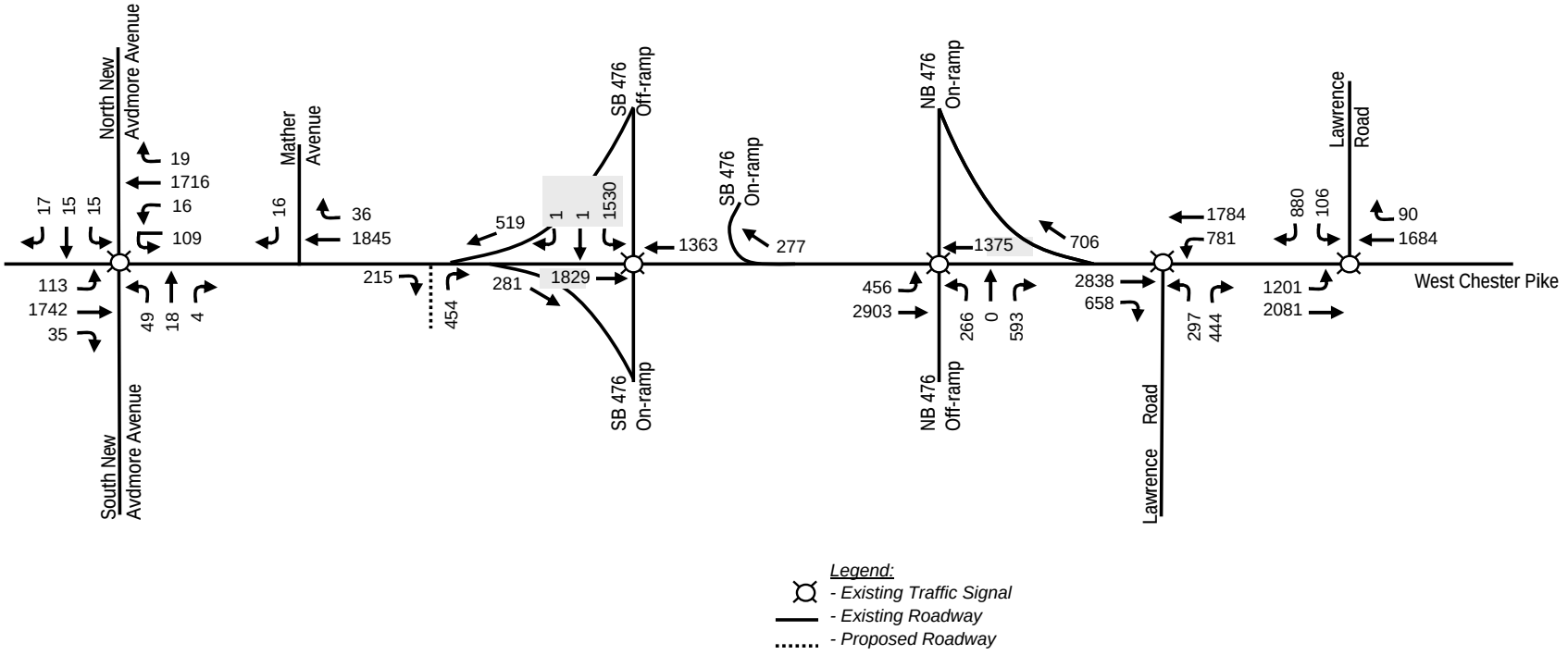
FIGURE 11

Year 2032 PM Peak Hour Volumes with Development and Existing Roadway Conditions

Point of Access Study - I-476 and West Chester Pike

MARPLE TOWNSHIP, DELAWARE COUNTY, PENNSYLVANIA



Year 2032 PM Peak Hour Levels of Service with Development and Existing Roadway Conditions
Point of Access Study - I-476 and West Chester Pike
MARPLE TOWNSHIP, DELAWARE COUNTY, PENNSYLVANIA

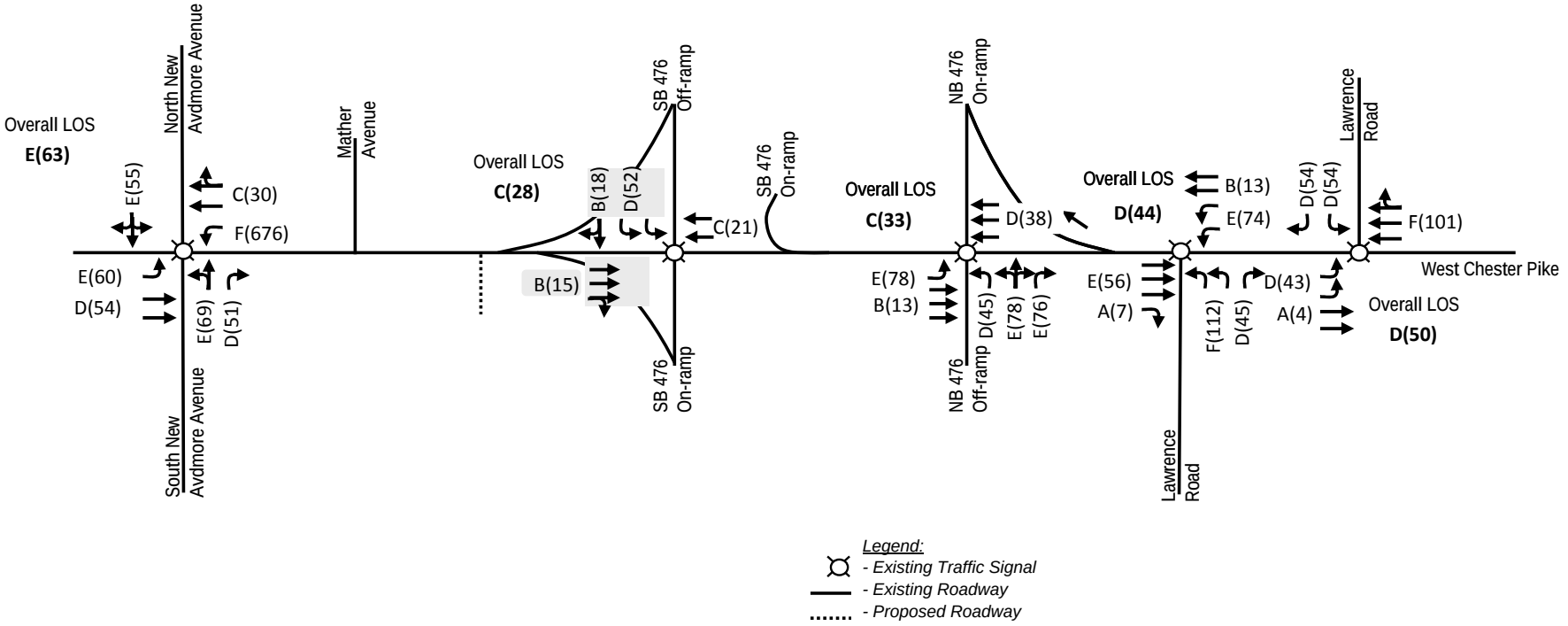


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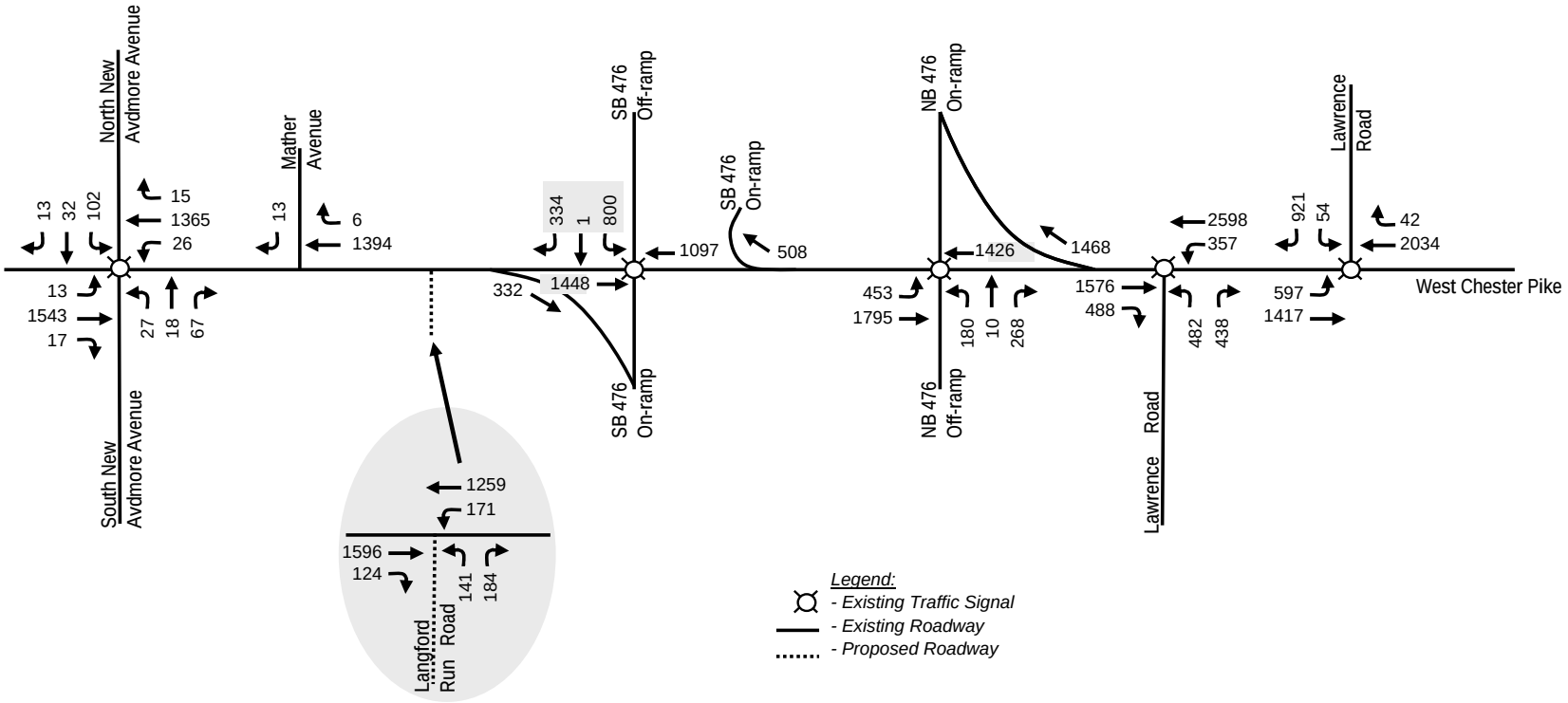
FIGURE 13

2032 AM Peak Hour Traffic Volumes with Development Proposed Roadway Improvements and I-476 Ramp Modification

Point of Access Study - I-476 and West Chester Pike

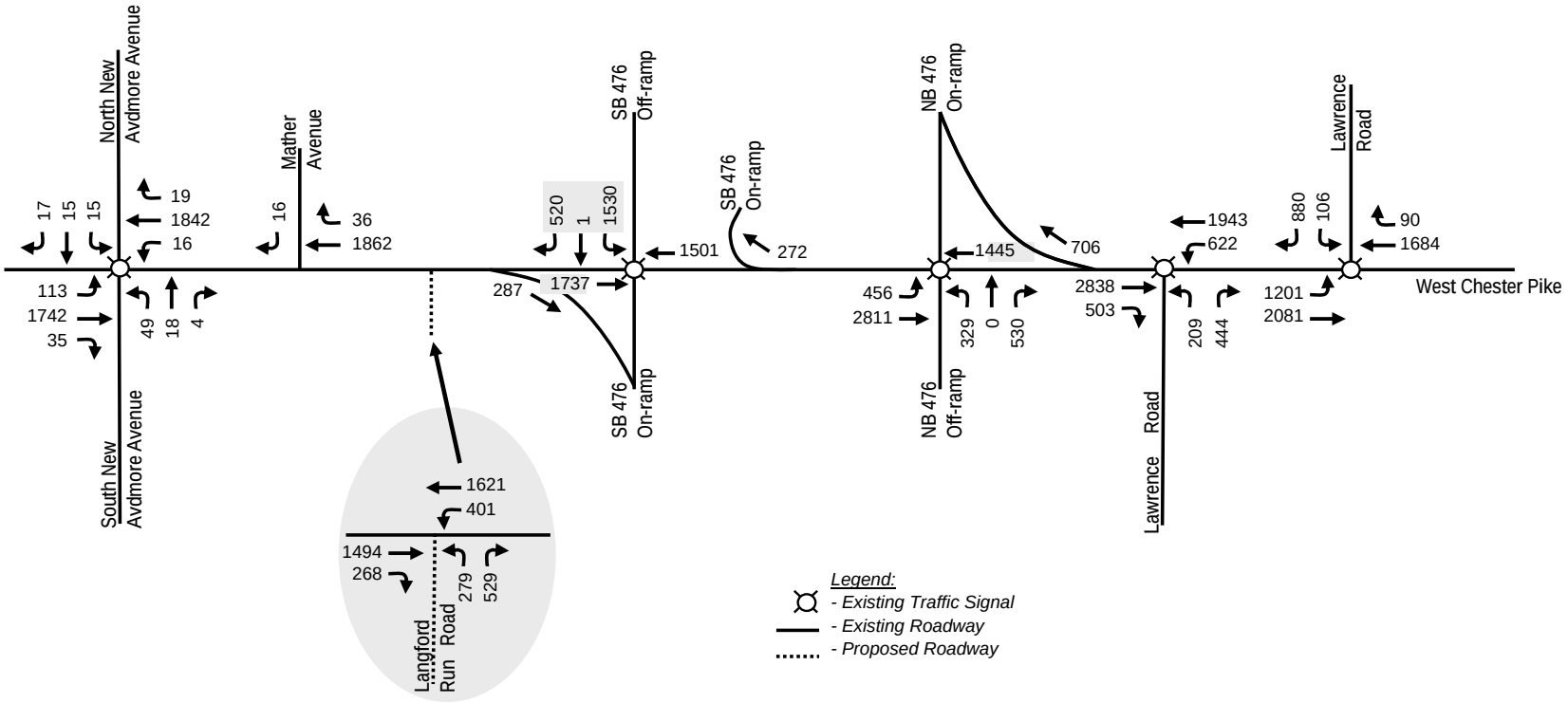
MARPLE TOWNSHIP, DELAWARE COUNTY, PENNSYLVANIA



2032 PM Peak Hour Traffic Volumes with Development
Proposed Roadway Improvements and I-476 Ramp Modification

Point of Access Study - I-476 and West Chester Pike

MARPLE TOWNSHIP, DELAWARE COUNTY, PENNSYLVANIA



2032 AM Peak Hour Levels of Service with Development
Proposed Roadway Improvements and I-476 Ramp Modification

Point of Access Study - I-476 and West Chester Pike

MARPLE TOWNSHIP, DELAWARE COUNTY, PENNSYLVANIA

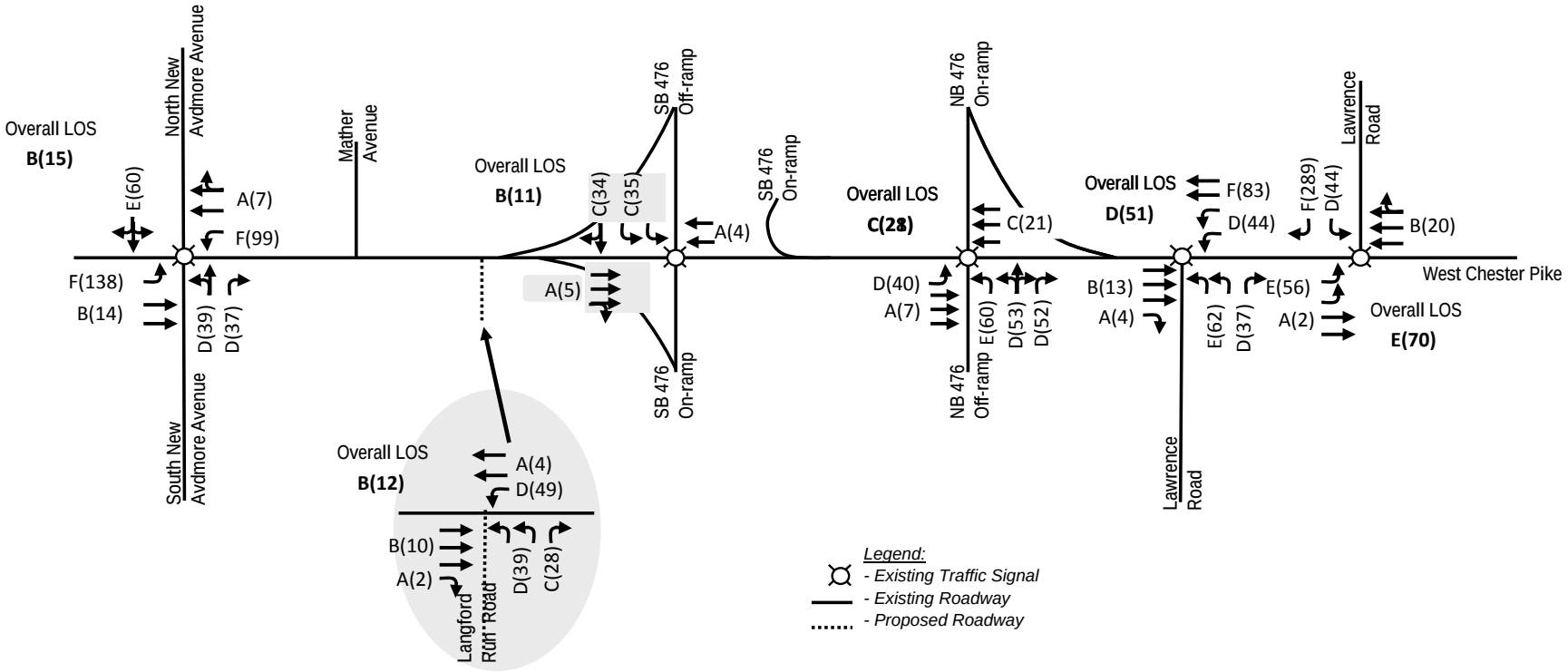


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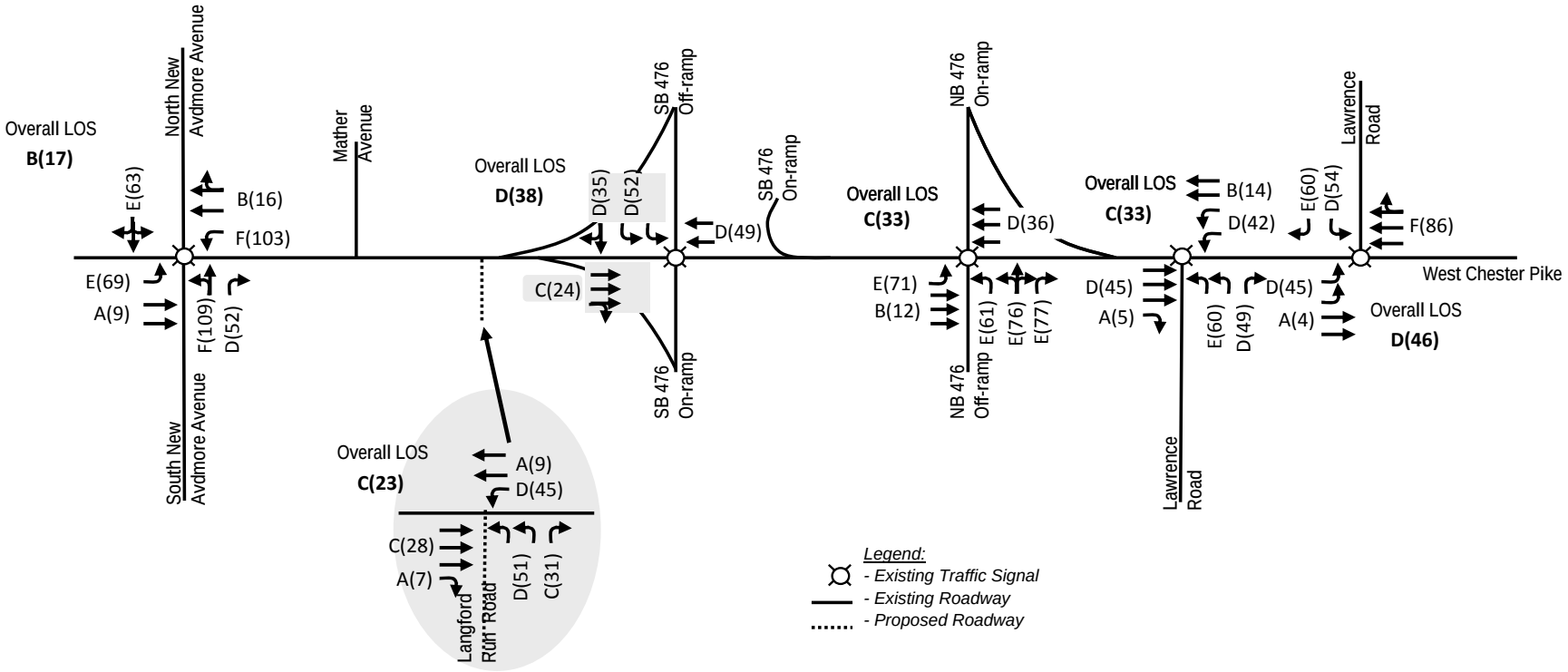
FIGURE 16

2032 PM Peak Hour Levels of Service with Development
Proposed Roadway Improvements and I-476 Ramp Modification
Point of Access Study - I-476 and West Chester Pike
MARPLE TOWNSHIP, DELAWARE COUNTY, PENNSYLVANIA



N

ELIMINATE I-476 SB SLIP RAMP; PROPOSED PROPOSED LANE CONFIGURATION: (2) LEFT-TURN LANES, (1) SHARED THROUGH/ RIGHT-TURN LANE, AND (1) RIGHT-TURN LANE.

I-476 SB OFF-RAMP

PROPOSED LANE CONFIGURATION: (1) LEFT-TURN LANE AND (2) THROUGH LANES

WEST CHESTER PIKE PA ROUTE 3

I-476 SB ON-RAMP

INTERSTATE 476 BLUE ROUTE

I-476 NB ON-RAMP

PROPOSED LANE CONFIGURATION: (3) THROUGH LANES AND (1) RIGHT-TURN LANE

LANGFORD RUN RD

PROPOSED LANE CONFIGURATION: (2) LEFT-TURN LANES AND (1) RIGHT-TURN LANE

WEST CHESTER PIKE PA ROUTE 3

INTERSTATE 476 BLUE ROUTE

I-476 NB OFF-RAMP

PROPOSED LANE CONFIGURATION: (1) LEFT-TURN LANE, (1) SHARED LEFT/RIGHT-TURN LANE, AND (1) RIGHT-TURN LANE

LANGFORD RUN RD

DESIGN YEAR 2032 PM PEAK HOUR MAXIMUM QUEUE

SYNCHRO

SIMTRAFFIC

* – SimTraffic results are the average values of five runs.
* – The queue length reported is the one for the lane with the highest queue in the lane group.

SCALE IN FEET
0 80 160

FIGURE 17 – PROPOSED ROADWAY IMPROVEMENTS

Orth – Rodgers & Associates, Inc.
TRANSPORTATION ENGINEERS and PLANNERS

N

RELOCATE I-476 SB OFF-RAMP TO ALIGN WITH PROPOSED LANGFORD RUN RD. PROPOSED LANE CONFIGURATION: (2) LEFT-TURN LANES, (1) THROUGH LANE, AND (1) RIGHT-TURN LANE.

I-476 SB OFF-RAMP

PROPOSED LANE CONFIGURATION: (2) LEFT-TURN LANES AND (2) THROUGH LANES

I-476 SB ON-RAMP

INTERSTATE 476 BLUE ROUTE

I-476 NB ON-RAMP

WEST CHESTER PIKE PA ROUTE 3

PROPOSED LANE CONFIGURATION: (3) THROUGH LANES AND (1) RIGHT-TURN LANE

LANGFORD RUN RD

PROPOSED LANE CONFIGURATION: (1) LEFT-TURN LANE AND (2) RIGHT-TURN LANES

TIGHTEN RADIUS; ON-RAMP FOR RIGHT-TURNS ONLY

DOUBLE RIGHT-TURN LANE QUEUE LENGTH EQUALS 1008'

I-476 SB ON-RAMP

INTERSTATE 476 BLUE ROUTE

I-476 NB OFF-RAMP

WEST CHESTER PIKE PA ROUTE 3

DESIGN YEAR 2032
PM PEAK HOUR
MAXIMUM QUEUE

SYNCHRO

SIMTRAFFIC

* – SimTraffic results are the average values of five runs.
* – The queue length reported is the one for the lane with the highest queue in the lane group.

SCALE IN FEET
0 80 160

FIGURE 18
ALTERNATIVE 1

OR&A
Orth – Rodgers & Associates, Inc.
TRANSPORTATION ENGINEERS and PLANNERS

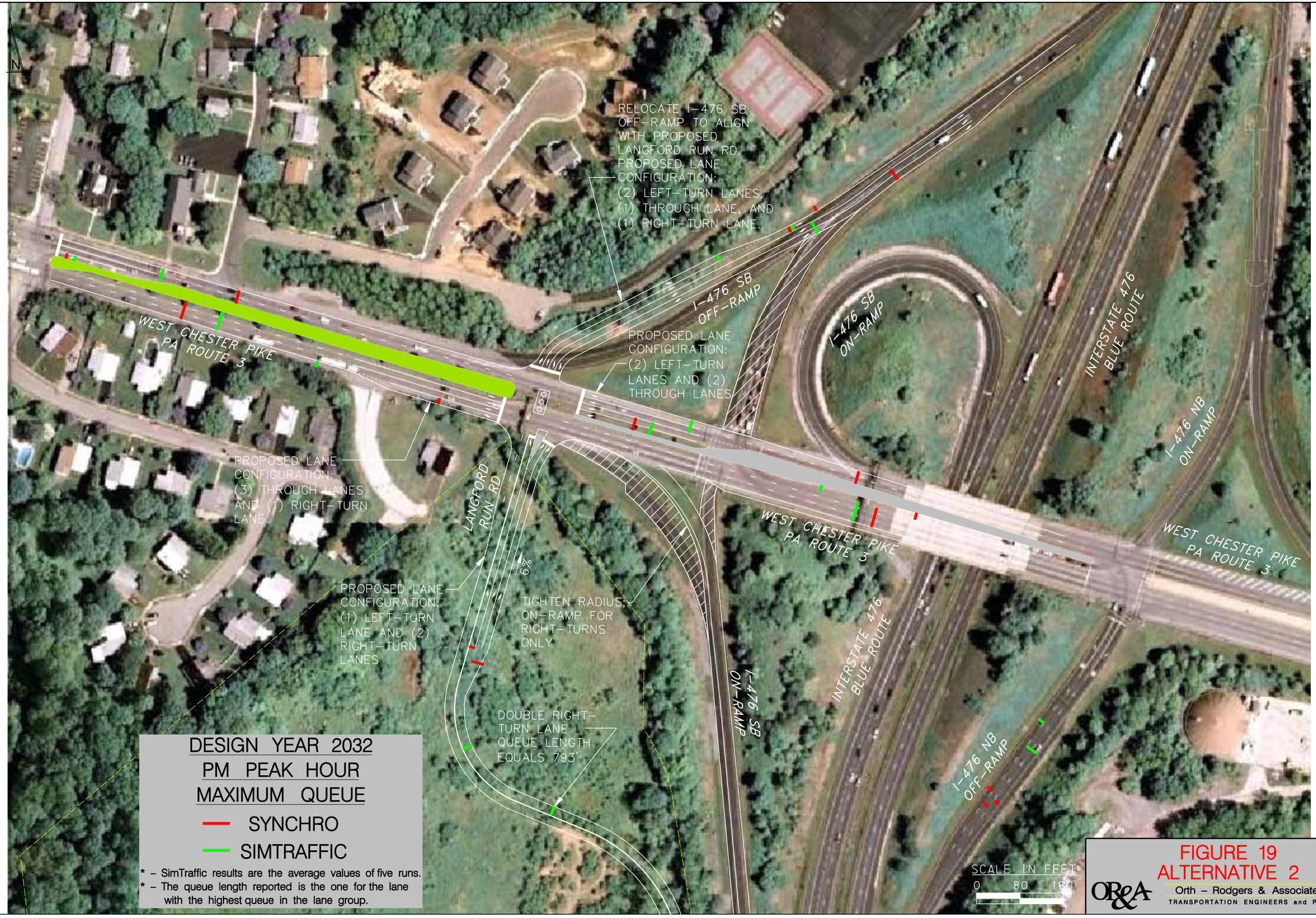


FIGURE 19
ALTERNATIVE 2

Orth – Rodgers & Associates, Inc.
TRANSPORTATION ENGINEERS and PLANNERS

N

RELOCATE I-476 SB OFF-RAMP TO ALIGN WITH PROPOSED LANGFORD RUN RD. PROPOSED LANE CONFIGURATION: (2) LEFT-TURN LANES, (2) THROUGH LANES, AND (1) RIGHT-TURN LANE.

I-476 SB OFF-RAMP

I-476 SB ON-RAMP

INTERSTATE 476 BLUE ROUTE

I-476 NB ON-RAMP

WEST CHESTER PIKE PA ROUTE 3

PROPOSED LANE CONFIGURATION: (2) LEFT-TURN LANES AND (2) THROUGH LANES

PROPOSED LANE CONFIGURATION: (3) THROUGH LANES AND (1) RIGHT-TURN LANE

LANGFORD RUN RD

PROPOSED LANE CONFIGURATION: (1) LEFT-TURN LANE AND (2) RIGHT-TURN LANES

TIGHTEN RADIUS: ON-RAMP FOR RIGHT-TURNS ONLY

DOUBLE RIGHT-TURN LANE QUEUE LENGTH EQUALS 966'

I-476 SB ON-RAMP

INTERSTATE 476 BLUE ROUTE

WEST CHESTER PIKE PA ROUTE 3

I-476 NB OFF-RAMP

DESIGN YEAR 2032
PM PEAK HOUR
MAXIMUM QUEUE

SYNCHRO

SIMTRAFFIC

* – SimTraffic results are the average values of five runs.
* – The queue length reported is the one for the lane with the highest queue in the lane group.

SCALE IN FEET
0 80 160

FIGURE 20
ALTERNATIVE 3

OR&A
Orth – Rodgers & Associates, Inc.
TRANSPORTATION ENGINEERS and PLANNERS

N

RELOCATE I-476 SB OFF-RAMP TO ALIGN WITH PROPOSED LANGFORD RUN RD. PROPOSED LANE CONFIGURATION: (2) LEFT-TURN LANES, (2) THROUGH LANES, AND (1) RIGHT-TURN LANE.

I-476 SB OFF-RAMP

I-476 SB ON-RAMP

INTERSTATE 476 BLUE ROUTE

I-476 NB ON-RAMP

WEST CHESTER PIKE PA ROUTE 3

PROPOSED LANE CONFIGURATION: (2) LEFT-TURN LANES AND (2) THROUGH LANES

PROPOSED LANE CONFIGURATION: (3) THROUGH LANES AND (1) RIGHT-TURN LANE

LANGFORD RUN RD

6%

PROPOSED LANE CONFIGURATION: (1) LEFT-TURN LANE AND (2) RIGHT-TURN LANES

TIGHTEN RADIUS; ON-RAMP FOR RIGHT-TURNS ONLY; CONTINUE RIGHT-TURN LANE

DOUBLE RIGHT-TURN LANE QUEUE LENGTH EQUALS 850'

I-476 SB ON-RAMP

INTERSTATE 476 BLUE ROUTE

I-476 NB OFF-RAMP

WEST CHESTER PIKE PA ROUTE 3

DESIGN YEAR 2032
PM PEAK HOUR
MAXIMUM QUEUE

— SYNCHRO

— SIMTRAFFIC

* – SimTraffic results are the average values of five runs.
* – The queue length reported is the one for the lane with the highest queue in the lane group.

SCALE IN FEET
0 80 160

FIGURE 21
ALTERNATIVE 4

OR&A
Orth – Rodgers & Associates, Inc.
TRANSPORTATION ENGINEERS and PLANNERS

N

RELOCATE I-476 SB OFF-RAMP TO ALIGN WITH PROPOSED LANGFORD RUN RD. PROPOSED LANE CONFIGURATION: (2) LEFT-TURN LANES, (2) THROUGH LANES, AND (1) RIGHT-TURN LANE ALONG WITH REVERSE JUGHANDLE

I-476 SB OFF-RAMP

WEST CHESTER PIKE PA ROUTE 3

I-476 SB ON-RAMP

PROPOSED LANE CONFIGURATION: (3) THROUGH LANES AND (1) RIGHT-TURN LANE

INTERSTATE 476 BLUE ROUTE

I-476 NB ON-RAMP

PROPOSED LANE CONFIGURATION: (3) THROUGH LANES AND (1) RIGHT-TURN LANE

LANGFORD RUN RD

5%

WEST CHESTER PIKE PA ROUTE 3

RELOCATE I-476 SB ON-RAMP; CONTINUE RIGHT-TURN LANE

I-476 SB ON-RAMP

PROPOSED LANE CONFIGURATION: (2) LEFT-TURN LANES AND (2) RIGHT-TURN LANES

WEST CHESTER PIKE PA ROUTE 3

INTERSTATE 476 BLUE ROUTE

I-476 NB OFF-RAMP

DESIGN YEAR 2032
PM PEAK HOUR
MAXIMUM QUEUE

SYNCHRO

SIMTRAFFIC

* – SimTraffic results are the average values of five runs.
* – The queue length reported is the one for the lane with the highest queue in the lane group.

SCALE IN FEET
0 80 160

FIGURE 22
ALTERNATIVE 5

OR&A
Orth – Rodgers & Associates, Inc.
TRANSPORTATION ENGINEERS and PLANNERS

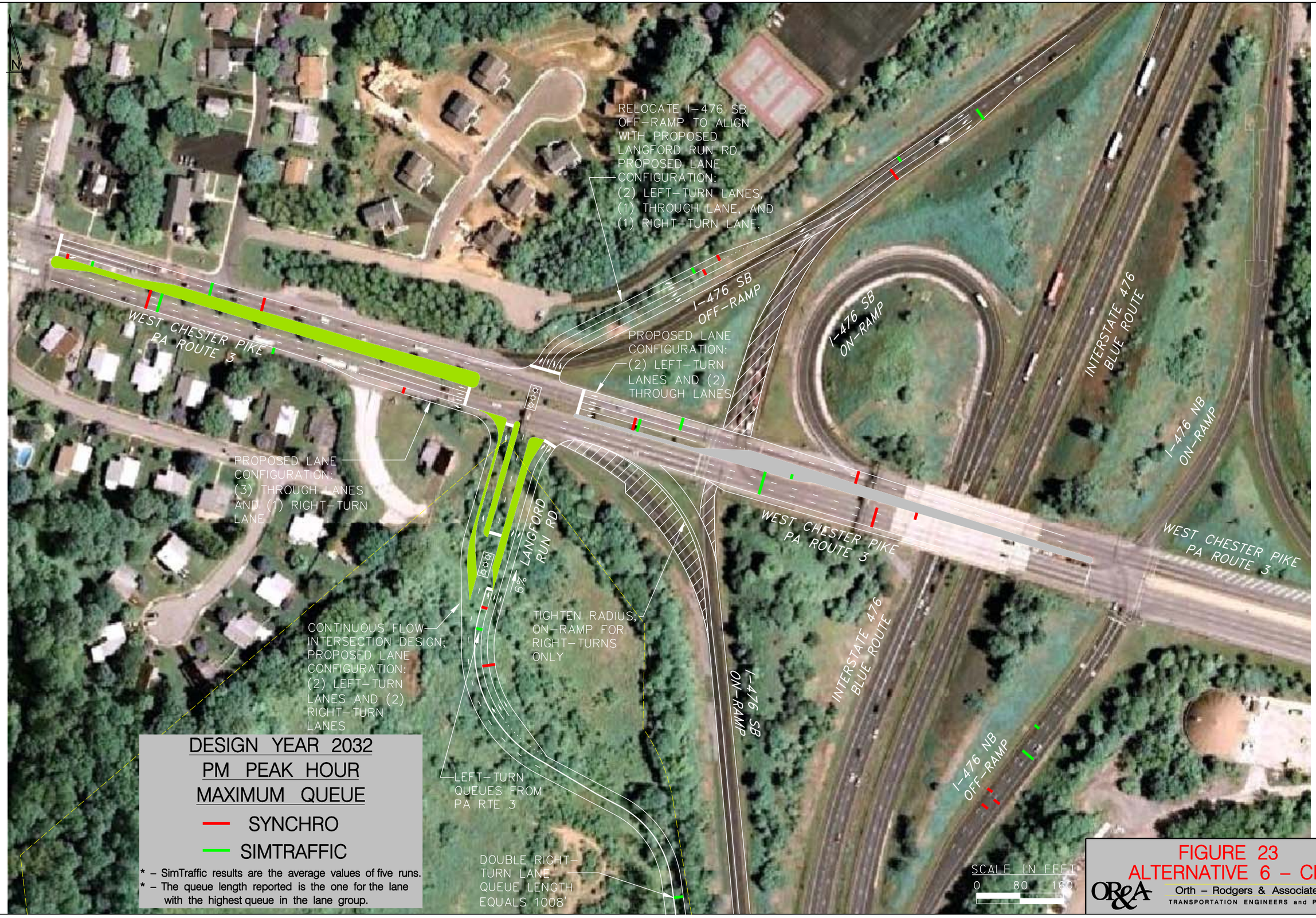


FIGURE 23
ALTERNATIVE 6 – CFI

Orth – Rodgers & Associates, Inc.
TRANSPORTATION ENGINEERS and PLANNERS

Table 1: PEAK HOUR TRIP GENERATION

Marple Associates Development

AM TRIP GENERATION

Use	ITE LUC	Trip Generation Rate	%in	%out	Size	Unit	AM Trips In	AM Trips Out	AM Trips Total
Drive-in Bank	912	Avg. rate = 12.35	0.56	0.44	4,000	sf GFA	28	22	50
Hotel	310	Ln(T) = 1.24 Ln(X) - 2.00	0.61	0.39	150	rooms	41	27	68
Health-fitness center	492	Avg. rate = 1.38	0.45	0.55	16,000	sf GFA	10	12	22
Day Care	565	Avg. rate = 12.26	0.53	0.47	4,000	sf GFA	26	23	49
General Office	710	Ln(T) = 0.80Ln(X) +1.55	0.88	0.12	40,000	sf GFA	79	11	90
Retail (Shopping Center)	820	Avg. rate = 1.00	0.61	0.39	260,000	sf GLA	159	101	260
Residential Condo-Townhouse	230	Ln(T) = 0.80Ln(X) +0.26	0.17	0.83	147	D.U.	12	58	70
Total AM Trip Generation							355	254	609
AM Passby - Drive-in Bank -0%							0	0	0
AM Passby - Shopping Center - 0%							0	0	0
Total Passby							0	0	0
Retail 'Internal' Trips									
AM Trips in-out of Langford Run Road (Total minus retail 'internal')							**355**	**254**	**609**
New AM Trips (Total minus Passby)							355	254	609

PM TRIP GENERATION

Use	ITE LUC	Trip Generation Rate	%in	%out	Size	Unit	PM Trips In	PM Trips Out	PM Trips Total
Drive-in Bank	912	Avg. rate = 25.82	0.50	0.50	4,000	sf GFA	52	52	103
Hotel	310	Avg. rate = 0.59	0.53	0.47	150	rooms	47	42	89
Health-fitness center	492	Avg. rate = 3.53	0.57	0.43	16,000	sf GFA	33	24	56
Day Care	565	Avg. rate + 12.46	0.47	0.53	4,000	sf GFA	23	26	50
General Office	710	T = 1.12(X) +78.81	0.17	0.83	40,000	sf GFA	21	103	124
Retail (Shopping Center)	820	Ln(T) = 0.67Ln(X) + 3.37	0.49	0.51	260,000	sf GLA	591	616	1207
Residential Condo-Townhouse	230	Ln(T) = 0.82 Ln(X) + 0.32	0.67	0.33	147	D.U.	55	27	82
Total PM Trip Generation							822	889	1711
PM Passby - Drive-in Bank - 47%							24	24	49
PM Passby - Shopping Center - 34%							201	209	410
Total Passby							225	234	459
Retail 'Internal' Trips							50	39	89
PM Trips in-out of Langford Run Road (Total minus 'retail internal')							**772**	**850**	**1622**
New PM Trips (Total minus Passby)							597	656	1253

Table 2. PM Peak Hour Level of Service Comparison of Alternatives

intersection (node)	approach	movement	Existing	2032 No Build	Proposed 2032 Build	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
West Chester Pike & New Ardmore (3)	EB	Left	E(65)	E(59)	E(69)	E(69)	E(69)	E(69)	E(69)	E(69)	E(69)
		Thru/Right	A(9)	D(54)	A(9)	A(9)	A(9)	A(9)	A(9)	A(9)	A(9)
	WB	Left	E(78)	F(676)	F(103)	F(96)	F(89)	F(98)	F(99)	F(96)	F(99)
		Thru/Right	C(22)	C(30)	B(16)	B(10)	A(8)	B(11)	B(10)	B(12)	B(12)
	NB	Left/Thru	E(67)	E(69)	F(109)	F(109)	F(109)	F(109)	F(109)	F(109)	F(109)
		Right	D(50)	D(51)	D(52)	D(52)	D(52)	D(52)	D(52)	D(52)	D(52)
	SB	LTR	D(55)	E(55)	E(63)	E(63)	E(63)	E(63)	E(63)	E(63)	E(63)
	Overall		**B(20)**	**E(63)**	**B(17)**	**B(14)**	**B(13)**	**B(14)**	**B(14)**	**B(15)**	**B(15)**
West Chester Pike & Langford (6)	EB	Thru			C(28)	F(82)	F(82)	F(82)	D(42)	D(48)	F(82)
		Right			A(7)	C(22)	C(22)	C(22)	F(120)	F(126)	A(0)
	WB	Left			D(45)	C(29)	C(29)	C(29)	C(26)		C(29)
		Thru			A(9)	B(15)	B(15)	B(15)	B(15)	C(30)	B(15)
	NB	Left			D(51)	F(169)	F(127)	E(62)	E(68)	D(44)	D(35)
		Right		f(54)	C(31)	F(149)	F(149)	F(149)	F(110)	F(110)	F(149)
	Overall				**C(23)**						
West Chester Pike & I-476 SB Ramps (10)	EB	Thru	D(37)	B(15)	C(24)						
	WB	Thru	C(21)	C(21)	D(49)						
	SB	Left	D(44)	D(52)	D(52)	E(75)	E(75)	E(75)	C(27)	F(83)	E(75)
		Thru/Right	B(18)	B(18)	D(35)	C(33)	F(130)	C(31)	D(36)	C(32)	C(33)
	Overall		**C(32)**	**C(28)**	**D(38)**	**E(66)**	**E(76)**	**E(60)**	**E(58)**	**E(61)**	**E(60)**
West Chester Pike & I-476 NB Ramps (15)	EB	Left	F(89)	E(78)	E(71)	D(42)	D(42)	D(42)	D(41)	D(51)	D(42)
		Thru	B(15)	B(13)	B(12)	A(8)	A(8)	A(8)	A(7)	B(15)	A(8)
	WB	Thru	D(36)	D(38)	D(36)	C(34)	C(34)	C(34)	C(34)	C(34)	C(34)
	NB	Left	C(32)	D(45)	E(61)	E(61)	E(61)	E(61)	E(61)	E(61)	E(61)
		LT(R)	C(32)	E(78)	E(76)	E(76)	E(76)	E(76)	E(76)	E(76)	E(76)
		Right	F(98)	E(76)	E(77)	E(77)	E(77)	E(77)	E(77)	E(77)	E(77)
	Overall		**C(35)**	**C(33)**	**C(33)**	**C(28)**	**C(28)**	**C(28)**	**C(28)**	**C(33)**	**C(29)**
West Chester Pike & S Lawrence Rd (18)	EB	Thru	F(123)	E(56)	D(45)	C(27)	C(27)	C(27)	C(28)	C(24)	C(27)
		Right	B(11)	A(7)	A(5)	A(4)	A(4)	A(4)	A(4)	A(4)	A(4)
	WB	Left	D(51)	E(74)	D(42)	F(84)	F(84)	F(84)	F(84)	F(83)	F(83)
		Thru	C(23)	B(13)	B(14)	B(11)	B(11)	B(11)	B(11)	B(13)	B(14)
	NB	Left	D(38)	F(112)	E(60)	E(60)	E(60)	E(60)	E(60)	E(60)	E(60)
		Right	C(25)	D(45)	D(49)	E(67)	E(67)	E(67)	E(67)	E(67)	E(67)
	Overall		**E(65)**	**D(44)**	**C(33)**	**C(31)**	**C(31)**	**C(31)**	**C(31)**	**C(30)**	**C(32)**
West Chester Pike & N Lawrence Rd (2)	EB	Left	E(60)	D(43)	D(45)	E(57)	E(57)	E(56)	E(57)	D(47)	D(45)
		Thru	A(9)	A(4)	A(4)	A(3)	A(3)	A(3)	A(3)	A(3)	A(3)
	WB	Thru/Right	D(49)	F(101)	F(86)	E(61)	E(61)	E(61)	E(61)	F(87)	F(92)
	SB	Left	D(53)	D(54)	D(54)	D(54)	D(54)	D(54)	D(54)	D(54)	D(54)
		Right	D(44)	D(54)	E(60)	E(74)	E(74)	E(74)	E(74)	E(60)	E(58)
	Overall		**D(37)**	**D(50)**	**D(46)**	**D(43)**	**D(43)**	**D(43)**	**D(43)**	**D(47)**	**D(48)**

NOTE: In Alternatives 1 - 6, the intersections of Langford Run Road and I-476 SB Ramps are combined in one 4-way intersection. EB and WB levels of service for the combined intersection in these Alternatives are shown at Langford Run Road.

Table 3. Existing PM Peak Hour Queue Length
Existing Roadway Conditions
Synchro vs. SimTraffic

Intersection (Node)	Approach	Movement	storage length	Synchro		SimTraffic	
				50th % Q length	95th % Q length	50th % Q length	95th % Q length
West Chester Pike & New Ardmore (3)	EB	L	**180**	89	177	*83*	*141*
		TTR		210	508	*109*	*230*
	WB	L	**145**	14	20	*14*	*39*
		TTR		767	841	*106*	*255*
	NB	LT		54	102	*61*	*112*
		R		0	11	*4*	*19*
	SB	LTR		44	53	*38*	*75*
West Chester Pike & Langford (6)	EB	TTT					
		R					
	WB	L					
		TT					
	NB	LL					
		R					
West Chester Pike & I-476 SB Ramps (10)	EB	TTT		353	500	*302*	*444*
	WB	TT		115	180	*143*	*256*
	SB	LL		578	742	*569*	*1409*
		T(R)	**180**	0	4	*1*	*7*
West Chester Pike & I-476 NB Ramps (15)	EB	L	**510**	268	399	*303*	*501*
		TTT	**650**	516	554	*458*	*874*
	WB	TT		413	371	*324*	*541*
	NB	L	**520**	81	137	*60*	*118*
		LT(R)	**520**	81	137	*72*	*123*
		R		430	646	*262*	*434*
West Chester Pike & S Lawrence Rd (18)	EB	TTT	**600**	923	1009	*478*	*655*
		R		295	361	*88*	*256*
	WB	LL	**460***	230	284	*234*	*343*
		TT		502	724	*369*	*506*
	NB	LL		104	129	*169*	*360*
		R	**200**	236	319	*183*	*283*
West Chester Pike & N Lawrence Rd (2)	EB	LL	**460***	462	372	*409*	*513*
		TT		138	48	*85*	*334*
	WB	TTTR		499	635	*399*	*595*
	SB	L	**325**	77	137	*158*	*476*
		R		568	734	*394*	*631*

**Average length of dual left turn lanes*

In Synchro, the 50th percentile queue is the maximum back of queue on a typical cycle;
the 95th precenitle queue is the maximum back of queue with 95th percentile traffic volumes.
In many cases, the 95th percentile queue will not be experienced due to upstream metering.
If the upstream intersection is at / near capacity, the 50th percentile queue represents the max. queue experienced.

SimTraffic results are the average values of five runs.

The queue length reported is the one for the lane with the highest queue in the lane group.

Table 4. Year 2032 PM Peak Hour Queue Length
Proposed Roadway Improvements
Synchro vs. SimTraffic

Intersection (Node)	Approach	Movement	storage length	Synchro		SimTraffic	
				50th % Q length	95th % Q length	50th % Q length	95th % Q length
West Chester Pike & New Ardmore (3)	EB	L	**180**	91	177	*95*	*154*
		TTR		233	477	*123*	*263*
	WB	L	**145**	15	23	*14*	*60*
		TTR	**550**	558	601	*224*	*379*
	NB	LT		55	130	*56*	*111*
		R		0	12	*4*	*21*
	SB	LTR		45	57	*35*	*85*
West Chester Pike & Langford (6)	EB	TTT	**550**	396	567	*215*	*341*
		R	**200**	113	171	*61*	*148*
	WB	L	**450**	333	329	*299*	*411*
		TT		315	285	*187*	*270*
	NB	LL		115	163	*107*	*272*
		R		341	400	*274*	*457*
West Chester Pike & I-476 SB Ramps (10)	EB	TTT	**510**	594	198	*182*	*319*
	WB	TT	**650**	707	815	*161*	*237*
	SB	LL	**900**	630	807	*662*	*866*
		T(R)	**900**	361	532	*310*	*445*
West Chester Pike & I-476 NB Ramps (15)	EB	L	**510**	386	404	*403*	*534**
		TTT	**650**	559	637	*208*	*467*
	WB	TT		369	471	*350*	*481*
	NB	L	**520**	241	390	*158*	*250*
		LT(R)	**520**	243	419	*219*	*310*
		R		233	403	*218*	*306*
West Chester Pike & S Lawrence Rd (18)	EB	TTT	**600**	906	982	*434*	*717*
		R		84	105	*81*	*149*
	WB	LL	**460****	274	255	*255*	*363*
		TT		539	471	*332*	*439*
	NB	LL		89	140	*301*	*604*
		R	**200**	333	510	*228*	*293*
West Chester Pike & N Lawrence Rd (2)	EB	LL	**460****	394	389	*447*	*542*
		TT		70	51	*109*	*373*
	WB	TTTR		665	750	*618*	*764*
	SB	L	**325**	81	143	*115*	*297*
		R		659	965	*597*	*857*

**If necessary, the eastbound left turn storage can be extended.*

In Synchro, the 50th percentile queue is the maximum back of queue on a typical cycle;
the 95th precenitle queue is the maximum back of queue with 95th percentile traffic volumes.
In many cases, the 95th percentile queue will not be experienced due to upstream metering.
If the upstream intersection is at / near capacity, the 50th percentile queue represents the max. queue experienced.

SimTraffic results are the average values of five runs.

The queue length reported is the one for the lane with the highest queue in the lane group.

Table 5. Year 2032 PM Peak Hour Queue Length
Alternative 1
Synchro vs. SimTraffic

Intersection (Node)	Approach	Movement	storage length	Synchro		SimTraffic	
				50th % Q length	95th % Q length	50th % Q length	95th % Q length
West Chester Pike & New Ardmore (3)	EB	L	**180**	97	177	*82*	*159*
		TTR		233	477	*149*	*286*
	WB	L	**145**	13	19	*10*	*34*
		TTR		330	377	*129*	*197*
	NB	LT		55	130	*50*	*102*
		R		0	12	*3*	*16*
	SB	LTR		45	57	*33*	*74*
West Chester Pike & Langford (6)	EB	TTT		515	614	*371*	*541*
		R	**200**	73	115	*187*	*336*
	WB	LL	**225**	85	106	*76*	*138*
		TT		451	528	*89*	*308*
	NB	L	**400**	290	469	*476*	*570*
		RR	**400**	303	428	*660*	*1008*
	SB	LL	**900**	596	731	*541*	*752*
		T	**900**	246	350	*361*	*766*
		R	**400**	269	396	*173*	*313*
West Chester Pike & I-476 NB Ramps (15)	EB	L	**510**	335	298	*312*	*517*
		TTT	**985**	408	313	*171*	*444*
	WB	TT		357	460	*361*	*535*
	NB	L	**520**	241	390	*158*	*230*
		LT(R)	**520**	243	419	*209*	*284*
		R		233	403	*208*	*284*
West Chester Pike & S Lawrence Rd (18)	EB	TTT	**600**	771	885	*349*	*644*
		R		39	50	*34*	*82*
	WB	LL	**460***	305	286	*391*	*572*
		TT		404	365	*320*	*623*
	NB	LL		89	140	*254*	*520*
		R	**200**	361	575	*227*	*288*
West Chester Pike & N Lawrence Rd (2)	EB	LL	**460***	420	484	*434*	*545*
		TT		77	102	*141*	*475*
	WB	TTTR		604	677	*463*	*626*
	SB	L	**325**	81	143	*134*	*327*
		R		774	1025	*668*	*944*

**Average length of dual left turn lanes*

In Synchro, the 50th percentile queue is the maximum back of queue on a typical cycle;
the 95th precenitle queue is the maximum back of queue with 95th percentile traffic volumes.
In many cases, the 95th percentile queue will not be experienced due to upstream metering.
If the upstream intersection is at / near capacity, the 50th percentile queue represents the max. queue experienced.

SimTraffic results are the average values of five runs.

The queue length reported is the one for the lane with the highest queue in the lane group.

Table 6. Year 2032 PM Peak Hour Queue length
Alternative 2
Synchro vs. SimTraffic

Intersection (Node)	Approach	Movement	storage length	Synchro		SimTraffic	
				50th % Q length	95th % Q length	50th % Q length	95th % Q length
West Chester Pike & New Ardmore (3)	EB	L	**180**	91	177	*83*	*161*
		TTR		233	477	*148*	*279*
	WB	L	**145**	13	18	*11*	*36*
		TTR		293	342	*160*	*229*
	NB	LT		55	130	*50*	*102*
		R		0	12	*3*	*16*
	SB	LTR		45	57	*33*	*74*
West Chester Pike & Langford (6)	EB	TTT		515	614	*379*	*545*
		R	**200**	73	115	*186*	*350*
	WB	LL	**225**	85	106	*77*	*138*
		TT		451	528	*86*	*207*
	NB	L	**400**	221	403	*364*	*590*
		RR	**400**	303	428	*409*	*793*
	SB	LL	**900**	596	731	*418*	*554*
		T	**900**	322	529	*317*	*529*
		R	**400**	390	596	*215*	*396*
West Chester Pike & I-476 NB Ramps (15)	EB	L	**510**	335	298	*323*	*523*
		TTT	**985**	408	313	*179*	*441*
	WB	TT		357	460	*359*	*522*
	NB	L	**520**	241	390	*156*	*228*
		LT(R)	**520**	243	419	*209*	*285*
		R		223	403	*208*	*283*
West Chester Pike & S Lawrence Rd (18)	EB	TTT	**600**	771	885	*414*	*721*
		R		39	50	*34*	*81*
	WB	LL	**460***	305	286	*363*	*552*
		TT		404	365	*329*	*612*
	NB	LL		89	140	*252*	*518*
		R	**200**	361	575	*226*	*288*
West Chester Pike & N Lawrence Rd (2)	EB	LL	**460***	420	484	*444*	*553*
		TT		77	102	*137*	*447*
	WB	TTTR		604	677	*455*	*594*
	SB	L	**325**	81	143	*139*	*342*
		R		774	1025	*643*	*947*

**Average length of dual left turn lanes*

In Synchro, the 50th percentile queue is the maximum back of queue on a typical cycle;
the 95th precenitle queue is the maximum back of queue with 95th percentile traffic volumes.
In many cases, the 95th percentile queue will not be experienced due to upstream metering.
If the upstream intersection is at / near capacity, the 50th percentile queue represents the max. queue experienced.

SimTraffic results are the average values of five runs.

The queue length reported is the one for the lane with the highest queue in the lane group.

Table 7. Year 2032 PM Peak Hour Queue Length
Alternative 3
Synchro vs. SimTraffic

Intersection (Node)	Approach	Movement	storage length	Synchro		SimTraffic	
				50th % Q length	95th % Q length	50th % Q length	95th % Q length
West Chester Pike & New Ardmore (3)	EB	L	**180**	91	177	*82*	*159*
		TTR		233	477	*146*	*274*
	WB	L	**145**	13	20	*11*	*36*
		TTR		336	391	*135*	*214*
	NB	LT		55	130	*50*	*102*
		R		0	12	*3*	*16*
	SB	LTR		45	57	*33*	*74*
West Chester Pike & Langford (6)	EB	TTT		515	614	*368*	*544*
		R	**200**	73	115	*173*	*340*
	WB	LL	**225**	85	106	*72*	*130*
		TT		451	528	*80*	*200*
	NB	L	**400**	219	398	*429*	*611*
		RR	**400**	303	428	*535*	*966*
	SB	LL	**900**	596	731	*537*	*752*
		TT	**900**	114	155	*262*	*726*
		R	**400**	269	396	*171*	*301*
West Chester Pike & I-476 NB Ramps (15)	EB	L	**510**	335	298	*323*	*525*
		TTT	**985**	408	313	*173*	*436*
	WB	TT		357	460	*359*	*529*
	NB	L	**520**	241	390	*155*	*228*
		LT(R)	**520**	243	419	*211*	*284*
		R		233	403	*208*	*282*
West Chester Pike & S Lawrence Rd (18)	EB	TTT	**600**	771	885	*385*	*678*
		R		39	50	*35*	*79*
	WB	LL	**460***	305	286	*382*	*556*
		TT		404	365	*317*	*609*
	NB	LL		89	140	*270*	*688*
		R	**200**	361	575	*229*	*284*
West Chester Pike & N Lawrence Rd (2)	EB	LL	**460***	420	484	*450*	*552*
		TT		77	102	*128*	*424*
	WB	TTTR		604	677	*475*	*657*
	SB	L	**325**	81	143	*151*	*372*
		R		774	1025	*661*	*947*

**Average length of dual left turn lanes*

In Synchro, the 50th percentile queue is the maximum back of queue on a typical cycle;
the 95th precenitle queue is the maximum back of queue with 95th percentile traffic volumes.
In many cases, the 95th percentile queue will not be experienced due to upstream metering.
If the upstream intersection is at / near capacity, the 50th percentile queue represents the max. queue experienced.

SimTraffic results are the average values of five runs.

The queue length reported is the one for the lane with the highest queue in the lane group.

Table 8. Year 2032 PM Peak Hour Queue Length
Alternative 4
Synchro vs. SimTraffic

Intersection (Node)	Approach	Movement	storage length	Synchro		SimTraffic	
				50th % Q length	95th % Q length	50th % Q length	95th % Q length
West Chester Pike & New Ardmore (3)	EB	L	**180**	91	177	*81*	*157*
		TTR		233	477	*150*	*281*
	WB	L	**145**	13	20	*11*	*35*
		TTR		336	390	*139*	*222*
	NB	LT		55	130	*50*	*103*
		R		0	12	*3*	*16*
	SB	LTR		45	57	*33*	*74*
West Chester Pike & Langford (6)	EB	TTT		358	425	*279*	*415*
		TR	**200**	524	753	*216*	*324*
	WB	LL	**225**	81	98	*65*	*127*
		TT		451	528	*74*	*179*
	NB	L	**400**	223	405	*329*	*550*
		RR	**400**	281	407	*410*	*850*
	SB	LL	**900**	608	743	*657*	*968*
		TT	**900**	115	157	*262*	*726*
		R	**400**	272	400	*171*	*301*
West Chester Pike & I-476 NB Ramps (15)	EB	L	**510**	325	297	*336*	*565*
		TTT	**985**	352	286	*232*	*590*
	WB	TT		357	460	*364*	*531*
	NB	L	**520**	241	390	*156*	*229*
		LT(R)	**520**	243	419	*209*	*284*
		R		233	403	*207*	*284*
West Chester Pike & S Lawrence Rd (18)	EB	TTT	**600**	765	881	*382*	*663*
		R		39	50	*33*	*77*
	WB	LL	**460***	305	286	*362*	*548*
		TT		404	365	*299*	*537*
	NB	LL		89	140	*287*	*616*
		R	**200**	361	575	*227*	*286*
West Chester Pike & N Lawrence Rd (2)	EB	LL	**460***	420	484	*441*	*539*
		TT		78	103	*106*	*355*
	WB	TTTR		604	677	*461*	*620*
	SB	L	**325**	81	143	*128*	*319*
		R		774	1025	*653*	*948*

**Average length of dual left turn lanes*

In Synchro, the 50th percentile queue is the maximum back of queue on a typical cycle;
the 95th precenitle queue is the maximum back of queue with 95th percentile traffic volumes.
In many cases, the 95th percentile queue will not be experienced due to upstream metering.
If the upstream intersection is at / near capacity, the 50th percentile queue represents the max. queue experienced.

SimTraffic results are the average values of five runs.

The queue length reported is the one for the lane with the highest queue in the lane group.

Table 9. Year 2032 PM Peak Hour Queue Length
Alternative 5
Synchro vs. SimTraffic

Intersection (Node)	Approach	Movement	storage length	Synchro		SimTraffic	
				50th % Q length	95th % Q length	50th % Q length	95th % Q length
West Chester Pike & New Ardmore (3)	EB	L	**180**	91	177	*83*	*163*
		TTR		233	477	*168*	*325*
	WB	L	**145**	14	20	*13*	*44*
		TTR		195	218	*94*	*159*
	NB	LT		55	130	*55*	*117*
		R		0	12	*3*	*18*
	SB	LTR		45	57	*38*	*80*
West Chester Pike & Langford (6)	EB	TTT	**1090**	357	395	*251*	*365*
		R	**200**	304	749	*319*	*438*
	WB	TTTT		345	354	*64*	*118*
	NB	LL	**400**	108	153	*95*	*149*
		RR	**400**	281	407	*226*	*333*
	SB	LL	**900**	607	742	*373*	*582*
		TT	**900**	231	294	*163*	*252*
		R	**300**	258	384	*80*	*149*
West Chester Pike & I-476 NB Ramps (15)	EB	L	**510**	360	339	*367*	*552*
		TTT	**750**	411	387	*395*	*805*
	WB	TT		357	460	*395*	*544*
	NB	L	**520**	241	390	*131*	*210*
		LT(R)	**520**	243	419	*235*	*334*
		R		233	403	*230*	*332*
West Chester Pike & S Lawrence Rd (18)	EB	TTT	**600**	765	881	*513*	*773*
		R		41	53	*38*	*87*
	WB	LL	**460***	305	286	*325*	*523*
		TT		391	352	*345*	*594*
	NB	LL		89	140	*297*	*597*
		R	**200**	361	576	*230*	*286*
West Chester Pike & N Lawrence Rd (2)	EB	LL	**460***	395	413	*444*	*561*
		TT		82	114	*165*	*513*
	WB	TTTR		665	743	*592*	*760*
	SB	L	**325**	81	143	*133*	*316*
		R		659	965	*603*	*940*

**Average length of dual left turn lanes*

In Synchro, the 50th percentile queue is the maximum back of queue on a typical cycle;
the 95th precenitle queue is the maximum back of queue with 95th percentile traffic volumes.
In many cases, the 95th percentile queue will not be experienced due to upstream metering.
If the upstream intersection is at / near capacity, the 50th percentile queue represents the max. queue experienced.

SimTraffic results are the average values of five runs.

The queue length reported is the one for the lane with the highest queue in the lane group.

Table 10. Year 2032 PM Peak Hour Queue Length
Alternative 6 - CFI
Synchro vs. SimTraffic

Intersection (Node)	Approach	Movement	storage length	Synchro		SimTraffic	
				50th % Q length	95th % Q length	50th % Q length	95th % Q length
West Chester Pike & New Ardmore (3)	EB	L	**180**	97	177	*86*	*163*
		TTR		233	477	*154*	*304*
	WB	L	**145**	13	20	*14*	*68*
		TTR		340	391	*198*	*291*
	NB	LT		55	130	*53*	*105*
		R		0	12	*3*	*19*
	SB	LTR		45	57	*37*	*84*
West Chester Pike & Langford (6)	EB	TTT		515	614	*403*	*592*
		R	**200**	0	0	*0*	*0*
	WB	LL	**225**	85	106	*65*	*115*
		TT		451	528	*74*	*190*
	NB	L	**300**	252	345	*315*	*388*
		RR	**400**	303	428	*660**	*1008**
	SB	LL	**900**	596	731	*628*	*922*
		T	**900**	246	350	*361**	*766**
		R	**400**	269	396	*194*	*344*
West Chester Pike & I-476 NB Ramps (15)	EB	L	**510**	335	298	*357*	*575*
		TTT	**985**	408	313	*262*	*624*
	WB	TT		357	460	*369*	*517*
	NB	L	**520**	241	390	*161*	*242*
		LT(R)	**520**	243	419	*213*	*298*
		R		233	403	*211*	*298*
West Chester Pike & S Lawrence Rd (18)	EB	TTT	**600**	771	885	*387*	*630*
		R		39	50	*39*	*91*
	WB	LL	**460****	305	286	*371*	*547*
		TT		404	365	*322*	*592*
	NB	LL		89	140	*257*	*565*
		R	**200**	361	575	*224*	*288*
West Chester Pike & N Lawrence Rd (2)	EB	LL	**460****	420	484	*430*	*545*
		TT		77	102	*142*	*482*
	WB	TTTR		604	677	*550*	*738*
	SB	L	**325**	81	143	*130*	*313*
		R		774	1025	*582*	*892*

**Results from Alternative 1 are used.*

***Average length of dual left turn lanes*

In Synchro, the 50th percentile queue is the maximum back of queue on a typical cycle;
the 95th precenitle queue is the maximum back of queue with 95th percentile traffic volumes.
In many cases, the 95th percentile queue will not be experienced due to upstream metering.
If the upstream intersection is at / near capacity, the 50th percentile queue represents the max. queue experienced.

SimTraffic results are the average values of five runs.

The queue length reported is the one for the lane with the highest queue in the lane group.

Table 11. Network Movements with Year 2032 PM Peak 95th% Queue Greater than Available Storage

Synchro Results

intersection (node)	approach	movement	Existing	Proposed	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
West Chester Pike & New Ardmore (3)	EB	Left								
		Thru/Right								
	WB	Left								
		Thru/Right								
	NB	Left/Thru								
		Right								
	SB	LTR								
West Chester Pike & Langford (6)	EB	Thru								
		Right								
	WB	Left								
		Thru								
	NB	Left								
		Right								
West Chester Pike & I-476 SB Ramps (10)	EB	Thru								
	WB	Thru								
	SB	Left								
		Thru								
		Right								
West Chester Pike & I-476 NB Ramps (15)	EB	Left								
		Thru								
	WB	Thru								
	NB	Left								
		LT(R)								
		Right								
West Chester Pike & S Lawrence Rd (18)	EB	Thru								
		Right								
	WB	Left								
		Thru								
	NB	Left								
		Right								
West Chester Pike & N Lawrence Rd (2)	EB	Left								
		Thru								
	WB	Thru/Right								
	SB	Left								
		Right								

movement w/ 95th% queue length longer than available storage

Table 12. Network Movements with Year 2032 PM Peak 95th% Queue Greater than Available Storage

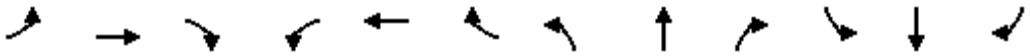
SimTraffic Results

intersection (node)	approach	movement	Existing	2032 Build	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
West Chester Pike & New Ardmore (3)	EB	Left								
		Thru/Right								
	WB	Left								
		Thru/Right								
	NB	Left/Thru								
		Right								
	SB	LTR								
West Chester Pike & Langford (6)	EB	Thru								
		Right								
	WB	Left								
		Thru								
	NB	Left								
		Right								
West Chester Pike & I-476 SB Ramps (10)	EB	Thru								
	WB	Thru								
	SB	Left								
		Thru								
		Right								
West Chester Pike & I-476 NB Ramps (15)	EB	Left								
		Thru								
	WB	Thru								
	NB	Left								
		LT(R)								
		Right								
West Chester Pike & S Lawrence Rd (18)	EB	Thru								
		Right								
	WB	Left								
		Thru								
	NB	Left								
		Right								
West Chester Pike & N Lawrence Rd (2)	EB	Left								
		Thru								
	WB	Thru/Right								
	SB	Left								
		Right								

movement w/ 95th% queue length longer than available storage

Appendix A

Synchro HCM Reports for Existing AM and PM Peak Hours



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	13	1406	17	26	1254	15	27	18	67	102	32	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	12	12	10	12	12	10	10	10	12	12	12
Grade (%)		-1%			1%			0%			0%	
Total Lost time (s)	6.0	6.0		6.0	6.0			6.0	6.0		6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	1.00		1.00	1.00			1.00	0.85		0.99	
Flt Protected	0.95	1.00		0.95	1.00			0.97	1.00		0.97	
Satd. Flow (prot)	1624	3515		1676	3516			1615	1463		1794	
Flt Permitted	0.95	1.00		0.95	1.00			0.78	1.00		0.76	
Satd. Flow (perm)	1624	3515		1676	3516			1295	1463		1416	
Peak-hour factor, PHF	0.94	0.94	0.94	0.89	0.89	0.89	0.93	0.93	0.93	0.88	0.88	0.88
Adj. Flow (vph)	14	1496	18	29	1409	17	29	19	72	116	36	15
RTOR Reduction (vph)	0	1	0	0	1	0	0	0	61	0	3	0
Lane Group Flow (vph)	14	1513	0	29	1425	0	0	48	11	0	164	0
Heavy Vehicles (%)	8%	3%	6%	0%	2%	0%	7%	6%	3%	1%	2%	0%
Turn Type	Prot			Prot			Perm		Perm	Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	1.4	62.1		4.2	64.9			15.7	15.7		15.7	
Effective Green, g (s)	1.4	62.1		4.2	64.9			15.7	15.7		15.7	
Actuated g/C Ratio	0.01	0.62		0.04	0.65			0.16	0.16		0.16	
Clearance Time (s)	6.0	6.0		6.0	6.0			6.0	6.0		6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	23	2183		70	2282			203	230		222	
v/s Ratio Prot	0.01	c0.43		c0.02	c0.41							
v/s Ratio Perm								0.04	0.01		c0.12	
v/c Ratio	0.61	0.69		0.41	0.62			0.24	0.05		0.74	
Uniform Delay, d1	49.0	12.6		46.7	10.4			36.9	35.8		40.2	
Progression Factor	1.00	1.00		0.96	0.96			1.00	1.00		1.00	
Incremental Delay, d2	38.0	1.8		3.7	1.2			0.6	0.1		12.0	
Delay (s)	87.1	14.4		48.4	11.1			37.5	35.9		52.2	
Level of Service	F	B		D	B			D	D		D	
Approach Delay (s)		15.1			11.9			36.5			52.2	
Approach LOS		B			B			D			D	

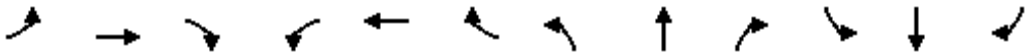
Intersection Summary			
HCM Average Control Delay	16.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	73.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑			↑↑	↱				↰↰	↑	
Volume (vph)	0	1300	0	0	1040	495	0	0	0	762	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	13	10	12
Grade (%)		-4%			4%			0%			0%	
Total Lost time (s)		6.0			6.0	6.0				6.0	6.0	
Lane Util. Factor		0.91			0.95	1.00				0.97	1.00	
Frt		1.00			1.00	0.85				1.00	1.00	
Flt Protected		1.00			1.00	1.00				0.95	1.00	
Satd. Flow (prot)		5137			3402	1552				3414	887	
Flt Permitted		1.00			1.00	1.00				0.95	1.00	
Satd. Flow (perm)		5137			3402	1552				3414	887	
Peak-hour factor, PHF	0.94	0.91	0.94	0.93	0.95	0.69	0.92	0.92	0.92	0.94	0.94	0.94
Adj. Flow (vph)	0	1429	0	0	1095	717	0	0	0	811	1	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1429	0	0	1095	717	0	0	0	811	1	0
Heavy Vehicles (%)	2%	3%	2%	2%	4%	2%	2%	2%	2%	6%	100%	1%
Turn Type						custom				Perm		
Protected Phases		2			6	4 6					4	
Permitted Phases										4		
Actuated Green, G (s)		57.6			57.6	100.0				30.4	30.4	
Effective Green, g (s)		57.6			57.6	100.0				30.4	30.4	
Actuated g/C Ratio		0.58			0.58	1.00				0.30	0.30	
Clearance Time (s)		6.0			6.0					6.0	6.0	
Vehicle Extension (s)		3.0			3.0					3.0	3.0	
Lane Grp Cap (vph)		2959			1960	1552				1038	270	
v/s Ratio Prot		0.28			c0.32	0.46					0.00	
v/s Ratio Perm										c0.24		
v/c Ratio		0.48			0.56	0.46				0.78	0.00	
Uniform Delay, d1		12.5			13.3	0.0				31.8	24.2	
Progression Factor		1.43			1.20	1.00				1.00	1.00	
Incremental Delay, d2		0.5			0.8	0.1				3.9	0.0	
Delay (s)		18.3			16.7	0.1				35.7	24.3	
Level of Service		B			B	A				D	C	
Approach Delay (s)		18.3			10.2			0.0			35.6	
Approach LOS		B			B			A			D	

Intersection Summary			
HCM Average Control Delay	18.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	60.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group



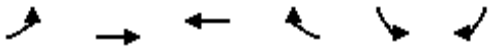
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	381	1681	0	0	1390	177	145	10	239	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	12	12	12	12	12	13	13	12	12	12	12
Grade (%)		-5%			5%			0%			0%	
Total Lost time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Lane Util. Factor	1.00	0.91			0.91		0.95	0.95	1.00			
Frt	1.00	1.00			0.98		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.96	1.00			
Satd. Flow (prot)	1893	5016			4874		1754	1770	1568			
Flt Permitted	0.95	1.00			1.00		0.95	0.96	1.00			
Satd. Flow (perm)	1893	5016			4874		1754	1770	1568			
Peak-hour factor, PHF	0.98	0.98	0.98	0.93	0.93	0.93	0.84	0.84	0.84	0.92	0.92	0.92
Adj. Flow (vph)	389	1715	0	0	1495	190	173	12	285	0	0	0
RTOR Reduction (vph)	0	0	0	0	15	0	0	0	19	0	0	0
Lane Group Flow (vph)	389	1715	0	0	1670	0	92	93	266	0	0	0
Heavy Vehicles (%)	1%	6%	2%	2%	2%	2%	1%	1%	3%	2%	2%	2%
Turn Type	Prot						Perm		Perm			
Protected Phases	5	2			6			8				
Permitted Phases							8		8			
Actuated Green, G (s)	23.8	66.6			36.8		21.4	21.4	21.4			
Effective Green, g (s)	23.8	66.6			36.8		21.4	21.4	21.4			
Actuated g/C Ratio	0.24	0.67			0.37		0.21	0.21	0.21			
Clearance Time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0			
Lane Grp Cap (vph)	451	3341			1794		375	379	336			
v/s Ratio Prot	c0.21	0.34			c0.34							
v/s Ratio Perm							0.05	0.05	c0.17			
v/c Ratio	0.86	0.51			0.93		0.25	0.25	0.79			
Uniform Delay, d1	36.5	8.5			30.4		32.6	32.6	37.2			
Progression Factor	1.42	0.88			1.02		1.00	1.00	1.00			
Incremental Delay, d2	14.1	0.5			5.5		0.3	0.3	12.0			
Delay (s)	65.8	8.0			36.6		32.9	32.9	49.2			
Level of Service	E	A			D		C	C	D			
Approach Delay (s)		18.7			36.6			42.8			0.0	
Approach LOS		B			D			D			A	

Intersection Summary			
HCM Average Control Delay	28.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	71.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1417	503	289	2408	558	417
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	-5%			1%	0%	
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.91	1.00	0.97	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	5212	1577	3318	3487	3433	1568
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	5212	1577	3318	3487	3433	1568
Peak-hour factor, PHF	0.98	0.89	0.90	0.90	0.95	0.95
Adj. Flow (vph)	1446	565	321	2676	587	439
RTOR Reduction (vph)	0	15	0	0	0	4
Lane Group Flow (vph)	1446	550	321	2676	587	435
Heavy Vehicles (%)	2%	5%	5%	3%	2%	3%
Turn Type		pt+ov	Prot			pt+ov
Protected Phases	2	2 8	1	6	8	8 1
Permitted Phases						
Actuated Green, G (s)	44.1	75.6	12.4	62.5	25.5	43.9
Effective Green, g (s)	44.1	75.6	12.4	62.5	25.5	43.9
Actuated g/C Ratio	0.44	0.76	0.12	0.62	0.26	0.44
Clearance Time (s)	6.0		6.0	6.0	6.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	2298	1192	411	2179	875	688
v/s Ratio Prot	0.28	0.35	0.10	c0.77	0.17	c0.28
v/s Ratio Perm						
v/c Ratio	0.63	0.46	0.78	1.23	0.67	0.63
Uniform Delay, d1	21.6	4.6	42.5	18.8	33.5	21.8
Progression Factor	1.25	2.53	1.22	0.73	1.00	1.00
Incremental Delay, d2	1.2	0.2	3.7	104.3	2.0	1.9
Delay (s)	28.3	11.8	55.3	117.9	35.5	23.7
Level of Service	C	B	E	F	D	C
Approach Delay (s)	23.6			111.2	30.5	
Approach LOS	C			F	C	

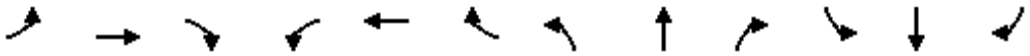
Intersection Summary			
HCM Average Control Delay	68.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	92.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	548	1286	1848	40	51	849
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	13	13
Grade (%)		5%	-5%		1%	
Total Lost time (s)	5.0	6.0	6.0		6.0	6.0
Lane Util. Factor	0.97	0.95	0.91		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3283	3451	5184		1718	1628
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3283	3451	5184		1718	1628
Peak-hour factor, PHF	0.94	0.98	0.98	0.98	0.93	0.93
Adj. Flow (vph)	583	1312	1886	41	55	913
RTOR Reduction (vph)	0	0	2	0	0	1
Lane Group Flow (vph)	583	1312	1925	0	55	912
Heavy Vehicles (%)	4%	2%	2%	13%	8%	2%
Turn Type	Prot					custom
Protected Phases	5	2	6		4	4 5
Permitted Phases						4
Actuated Green, G (s)	22.4	79.0	51.6		9.0	37.4
Effective Green, g (s)	22.4	79.0	51.6		9.0	37.4
Actuated g/C Ratio	0.22	0.79	0.52		0.09	0.37
Clearance Time (s)	5.0	6.0	6.0		6.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	735	2726	2675		155	609
v/s Ratio Prot	0.18	0.38	c0.37		0.03	c0.56
v/s Ratio Perm						
v/c Ratio	0.79	0.48	0.72		0.35	1.50
Uniform Delay, d1	36.6	3.6	18.6		42.8	31.3
Progression Factor	0.98	1.17	0.81		1.00	1.00
Incremental Delay, d2	4.6	0.5	1.5		1.4	232.7
Delay (s)	40.5	4.6	16.6		44.2	264.0
Level of Service	D	A	B		D	F
Approach Delay (s)		15.7	16.6		251.5	
Approach LOS		B	B		F	

Intersection Summary			
HCM Average Control Delay	63.7	HCM Level of Service	E
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	99.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	1559	35	16	1635	19	49	18	4	15	15	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	12	12	10	12	12	10	10	10	12	12	12
Grade (%)		-1%			1%			0%			0%	
Total Lost time (s)	6.0	6.0		6.0	6.0			6.0	6.0		6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	1.00		1.00	1.00			1.00	0.85		0.95	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.98	
Satd. Flow (prot)	1702	3511		1643	3516			1693	1492		1760	
Flt Permitted	0.95	1.00		0.95	1.00			0.73	1.00		0.87	
Satd. Flow (perm)	1702	3511		1643	3516			1283	1492		1550	
Peak-hour factor, PHF	0.95	0.95	0.95	0.89	0.89	0.89	0.93	0.93	0.93	0.59	0.59	0.59
Adj. Flow (vph)	119	1641	37	18	1837	21	53	19	4	25	25	29
RTOR Reduction (vph)	0	1	0	0	1	0	0	0	4	0	18	0
Lane Group Flow (vph)	119	1677	0	18	1857	0	0	72	0	0	61	0
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Turn Type	Prot			Prot			Perm		Perm	Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	12.0	88.5		3.3	79.8			10.2	10.2		10.2	
Effective Green, g (s)	12.0	88.5		3.3	79.8			10.2	10.2		10.2	
Actuated g/C Ratio	0.10	0.74		0.03	0.66			0.08	0.08		0.08	
Clearance Time (s)	6.0	6.0		6.0	6.0			6.0	6.0		6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	170	2589		45	2338			109	127		132	
v/s Ratio Prot	c0.07	c0.48		0.01	c0.53							
v/s Ratio Perm								c0.06	0.00		0.04	
v/c Ratio	0.70	0.65		0.40	0.79			0.66	0.00		0.46	
Uniform Delay, d1	52.3	7.9		57.4	14.3			53.2	50.2		52.3	
Progression Factor	1.00	1.00		1.29	1.39			1.00	1.00		1.00	
Incremental Delay, d2	12.2	1.3		4.5	2.3			14.0	0.0		2.5	
Delay (s)	64.5	9.2		78.2	22.2			67.2	50.3		54.8	
Level of Service	E	A		E	C			E	D		D	
Approach Delay (s)		12.8			22.7			66.3			54.8	
Approach LOS		B			C			E			D	

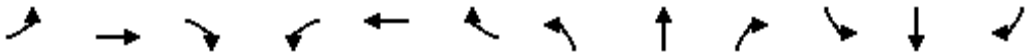
Intersection Summary			
HCM Average Control Delay	19.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	80.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑			↑↑	↱				↰↰	↑	
Volume (vph)	0	1393	0	0	1299	264	0	0	0	1458	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	13	10	12
Grade (%)		-4%			4%			0%			0%	
Total Lost time (s)		6.0			6.0	6.0				6.0	6.0	
Lane Util. Factor		0.91			0.95	1.00				0.97	1.00	
Frt		1.00			1.00	0.85				1.00	1.00	
Flt Protected		1.00			1.00	1.00				0.95	1.00	
Satd. Flow (prot)		5187			3468	1552				3583	1756	
Flt Permitted		1.00			1.00	1.00				0.95	1.00	
Satd. Flow (perm)		5187			3468	1552				3583	1756	
Peak-hour factor, PHF	0.94	0.94	0.94	0.93	0.93	0.93	0.92	0.92	0.92	0.94	0.94	0.94
Adj. Flow (vph)	0	1482	0	0	1397	284	0	0	0	1551	1	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1482	0	0	1397	284	0	0	0	1551	1	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	1%	1%	1%
Turn Type						custom				Perm		
Protected Phases		2			6	4 6					4	
Permitted Phases										4		
Actuated Green, G (s)		53.4			53.4	120.0				54.6	54.6	
Effective Green, g (s)		53.4			53.4	120.0				54.6	54.6	
Actuated g/C Ratio		0.44			0.44	1.00				0.46	0.46	
Clearance Time (s)		6.0			6.0					6.0	6.0	
Vehicle Extension (s)		3.0			3.0					3.0	3.0	
Lane Grp Cap (vph)		2308			1543	1552				1630	799	
v/s Ratio Prot		0.29			c0.40	0.18					0.00	
v/s Ratio Perm										c0.43		
v/c Ratio		0.64			0.91	0.18				0.95	0.00	
Uniform Delay, d1		25.9			31.0	0.0				31.4	17.8	
Progression Factor		1.39			0.45	1.00				1.00	1.00	
Incremental Delay, d2		1.1			6.8	0.0				12.6	0.0	
Delay (s)		37.1			20.9	0.0				44.1	17.8	
Level of Service		D			C	A				D	B	
Approach Delay (s)		37.1			17.4			0.0			44.0	
Approach LOS		D			B			A			D	

Intersection Summary			
HCM Average Control Delay	32.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	317	2534	0	0	1310	0	253	0	488	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	12	12	12	12	12	13	13	12	12	12	12
Grade (%)		-5%			5%			0%			0%	
Total Lost time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Lane Util. Factor	1.00	0.91			0.91		0.95	0.95	1.00			
Frt	1.00	1.00			1.00		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (prot)	1874	5212			4958		1754	1754	1599			
Flt Permitted	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (perm)	1874	5212			4958		1754	1754	1599			
Peak-hour factor, PHF	0.98	0.98	0.98	0.93	0.93	0.93	0.96	0.96	0.96	0.92	0.92	0.92
Adj. Flow (vph)	323	2586	0	0	1409	0	264	0	508	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	2	0	0	0
Lane Group Flow (vph)	323	2586	0	0	1409	0	132	132	506	0	0	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	1%	1%	1%	2%	2%	2%
Turn Type	Prot						Perm		Perm			
Protected Phases	5	2			6			8				
Permitted Phases							8		8			
Actuated Green, G (s)	23.4	72.0			42.6		36.0	36.0	36.0			
Effective Green, g (s)	23.4	72.0			42.6		36.0	36.0	36.0			
Actuated g/C Ratio	0.19	0.60			0.36		0.30	0.30	0.30			
Clearance Time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0			
Lane Grp Cap (vph)	365	3127			1760		526	526	480			
v/s Ratio Prot	0.17	c0.50			0.28							
v/s Ratio Perm							0.08	0.08	c0.32			
v/c Ratio	0.88	0.83			0.80		0.25	0.25	1.05			
Uniform Delay, d1	47.0	19.1			34.9		31.8	31.8	42.0			
Progression Factor	1.52	0.70			0.96		1.00	1.00	1.00			
Incremental Delay, d2	17.5	1.5			2.6		0.3	0.3	56.0			
Delay (s)	88.9	14.8			35.9		32.0	32.0	98.0			
Level of Service	F	B			D		C	C	F			
Approach Delay (s)		23.0			35.9			75.5			0.0	
Approach LOS		C			D			E			A	

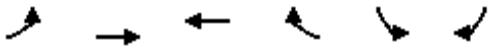
Intersection Summary			
HCM Average Control Delay	34.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	89.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2472	550	538	1700	283	423
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	-5%			1%	0%	
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.91	1.00	0.97	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	5212	1623	3416	3522	3433	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	8000	1623	3416	3522	3433	1583
Peak-hour factor, PHF	0.98	0.98	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2522	561	585	1848	308	460
RTOR Reduction (vph)	0	3	0	0	0	0
Lane Group Flow (vph)	2522	558	585	1848	308	460
Turn Type		pt+ov	Prot			custom
Protected Phases	2	2 8	1	6	8	8
Permitted Phases						1
Actuated Green, G (s)	48.0	83.4	24.6	78.6	29.4	54.0
Effective Green, g (s)	48.0	83.4	24.6	78.6	29.4	54.0
Actuated g/C Ratio	0.40	0.70	0.20	0.65	0.24	0.45
Clearance Time (s)	6.0		6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0		4.0	3.0	2.0	2.0
Lane Grp Cap (vph)	2085	1128	700	2307	841	792
v/s Ratio Prot	c0.48	0.34	0.17	c0.52	0.09	c0.14
v/s Ratio Perm						0.15
v/c Ratio	1.21	0.49	0.84	0.80	0.37	0.58
Uniform Delay, d1	36.0	8.5	45.8	15.0	37.6	24.6
Progression Factor	0.73	1.29	1.03	1.42	1.00	1.00
Incremental Delay, d2	97.0	0.1	3.6	1.2	0.1	0.7
Delay (s)	123.1	11.0	50.8	22.5	37.7	25.3
Level of Service	F	B	D	C	D	C
Approach Delay (s)	102.7			29.3	30.2	
Approach LOS	F			C	C	

Intersection Summary			
HCM Average Control Delay	65.4	HCM Level of Service	E
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	86.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	1097	1798	1442	86	101	796
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	13	13
Grade (%)		5%	-5%		1%	
Total Lost time (s)	5.0	6.0	6.0		6.0	6.0
Lane Util. Factor	0.97	0.95	0.91		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3347	3451	5168		1819	1628
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3347	3451	5168		1819	1628
Peak-hour factor, PHF	0.98	0.98	0.89	0.89	0.97	0.97
Adj. Flow (vph)	1119	1835	1620	97	104	821
RTOR Reduction (vph)	0	0	5	0	0	1
Lane Group Flow (vph)	1119	1835	1712	0	104	820
Turn Type	Prot					custom
Protected Phases	5	2	6		4	4
Permitted Phases						5
Actuated Green, G (s)	46.3	95.0	43.7		13.0	59.3
Effective Green, g (s)	46.3	95.0	43.7		13.0	59.3
Actuated g/C Ratio	0.39	0.79	0.36		0.11	0.49
Clearance Time (s)	5.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	1291	2732	1882		197	886
v/s Ratio Prot	0.33	0.53	c0.33		0.06	c0.10
v/s Ratio Perm						0.40
v/c Ratio	0.87	0.67	0.91		0.53	0.93
Uniform Delay, d1	34.0	5.6	36.3		50.6	28.3
Progression Factor	1.75	1.51	1.14		1.00	1.00
Incremental Delay, d2	0.6	0.1	7.6		2.5	15.2
Delay (s)	60.3	8.5	48.8		53.1	43.5
Level of Service	E	A	D		D	D
Approach Delay (s)		28.1	48.8		44.6	
Approach LOS		C	D		D	

Intersection Summary			
HCM Average Control Delay	37.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	89.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Appendix B

Synchro HCM Reports for Year 2032 "No Build" PM Peak Hour

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	113	1742	35	109	16	1716	19	49	18	4	15	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	12	12	12	10	12	12	10	10	10	12	12
Grade (%)		-1%				1%			0%			0%
Total Lost time (s)	6.0	6.0			6.0	6.0			6.0	6.0		6.0
Lane Util. Factor	1.00	0.95			1.00	0.95			1.00	1.00		1.00
Frt	1.00	1.00			1.00	1.00			1.00	0.85		0.95
Flt Protected	0.95	1.00			0.95	1.00			0.96	1.00		0.98
Satd. Flow (prot)	1702	3512			1643	3516			1693	1492		1760
Flt Permitted	0.95	1.00			0.14	1.00			0.73	1.00		0.87
Satd. Flow (perm)	1702	3512			236	3516			1281	1492		1550
Peak-hour factor, PHF	0.95	0.95	0.95	0.92	0.89	0.89	0.89	0.93	0.93	0.93	0.59	0.59
Adj. Flow (vph)	119	1834	37	118	18	1928	21	53	19	4	25	25
RTOR Reduction (vph)	0	1	0	0	0	1	0	0	0	4	0	18
Lane Group Flow (vph)	119	1870	0	0	136	1948	0	0	72	0	0	61
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	2%	1%	1%	1%	1%	1%
Turn Type	Prot			custom	Prot			Perm		Perm	Perm	
Protected Phases	5	2			1	6			8			4
Permitted Phases				1				8		8	4	
Actuated Green, G (s)	13.0	62.8			29.3	79.1			9.9	9.9		9.9
Effective Green, g (s)	13.0	62.8			29.3	79.1			9.9	9.9		9.9
Actuated g/C Ratio	0.11	0.52			0.24	0.66			0.08	0.08		0.08
Clearance Time (s)	6.0	6.0			6.0	6.0			6.0	6.0		6.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		3.0
Lane Grp Cap (vph)	184	1838			58	2318			106	123		128
v/s Ratio Prot	0.07	c0.53				0.55						
v/s Ratio Perm					c0.58				c0.06	0.00		0.04
v/c Ratio	0.65	1.02			2.34	0.84			0.68	0.00		0.47
Uniform Delay, d1	51.3	28.6			45.4	15.6			53.5	50.5		52.6
Progression Factor	1.00	1.00			0.70	1.71			1.00	1.00		1.00
Incremental Delay, d2	7.6	25.5			644.8	3.1			15.9	0.0		2.8
Delay (s)	58.9	54.1			676.4	29.7			69.4	50.5		55.3
Level of Service	E	D			F	C			E	D		E
Approach Delay (s)		54.3				71.9			68.4			55.3
Approach LOS		D				E			E			E

Intersection Summary			
HCM Average Control Delay	63.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.37		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	83.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

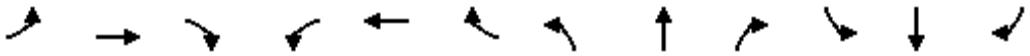
Movement	SBR
Lane Configurations	
Volume (vph)	17
Ideal Flow (vphpl)	1900
Lane Width	12
Grade (%)	
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.59
Adj. Flow (vph)	29
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Heavy Vehicles (%)	1%
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1655	215	0	1881	0	454
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1799	234	0	2045	0	493
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	Raised			Raised		
Median storage veh)	1			1		
Upstream signal (ft)	525			863		
pX, platoon unblocked			0.48		0.66	0.48
vC, conflicting volume			2033		2597	1016
vC1, stage 1 conf vol					1916	
vC2, stage 2 conf vol					682	
vCu, unblocked vol			999		0	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	6
cM capacity (veh/h)			333		612	524

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	1199	833	682	682	682	493
Volume Left	0	0	0	0	0	0
Volume Right	0	234	0	0	0	493
cSH	1700	1700	1700	1700	1700	524
Volume to Capacity	0.71	0.49	0.40	0.40	0.40	0.94
Queue Length 95th (ft)	0	0	0	0	0	295
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	54.1
Lane LOS						F
Approach Delay (s)	0.0		0.0			54.1
Approach LOS						F

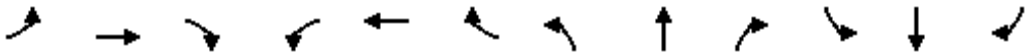
Intersection Summary			
Average Delay	5.8		
Intersection Capacity Utilization	87.4%	ICU Level of Service	E
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑			↑↑	↱				↰↰	↑	
Volume (vph)	0	1829	0	0	1363	277	0	0	0	1530	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	13	10	12
Grade (%)		-4%			4%			0%			0%	
Total Lost time (s)		6.0			6.0	6.0				6.0	6.0	
Lane Util. Factor		0.91			0.95	1.00				0.97	1.00	
Frt		1.00			1.00	0.85				1.00	1.00	
Flt Protected		1.00			1.00	1.00				0.95	1.00	
Satd. Flow (prot)		5187			3468	1552				3583	1756	
Flt Permitted		1.00			1.00	1.00				0.95	1.00	
Satd. Flow (perm)		5187			3468	1552				3583	1756	
Peak-hour factor, PHF	0.94	0.94	0.94	0.93	0.93	0.93	0.92	0.92	0.92	0.94	0.94	0.94
Adj. Flow (vph)	0	1946	0	0	1466	298	0	0	0	1628	1	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1946	0	0	1466	298	0	0	0	1628	1	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	1%	1%	1%
Turn Type						custom				Perm		
Protected Phases		2			6	4 6					4	
Permitted Phases										4		
Actuated Green, G (s)		53.0			53.0	120.0				55.0	55.0	
Effective Green, g (s)		53.0			53.0	120.0				55.0	55.0	
Actuated g/C Ratio		0.44			0.44	1.00				0.46	0.46	
Clearance Time (s)		6.0			6.0					6.0	6.0	
Vehicle Extension (s)		3.0			3.0					3.0	3.0	
Lane Grp Cap (vph)		2291			1532	1552				1642	805	
v/s Ratio Prot		0.38			c0.42	0.19					0.00	
v/s Ratio Perm										c0.45		
v/c Ratio		0.85			0.96	0.19				0.99	0.00	
Uniform Delay, d1		29.9			32.4	0.0				32.3	17.6	
Progression Factor		0.42			0.46	1.00				1.00	1.00	
Incremental Delay, d2		2.4			10.1	0.0				20.1	0.0	
Delay (s)		15.0			25.0	0.0				52.4	17.6	
Level of Service		B			C	A				D	B	
Approach Delay (s)		15.0			20.8			0.0			52.3	
Approach LOS		B			C			A			D	

Intersection Summary			
HCM Average Control Delay	28.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	456	2903	0	0	1375	0	266	0	593	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	12	12	12	12	12	13	13	12	12	12	12
Grade (%)		-5%			5%			0%			0%	
Total Lost time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Lane Util. Factor	1.00	0.91			0.91		0.95	0.91	0.95			
Frt	1.00	1.00			1.00		1.00	0.86	0.85			
Flt Protected	0.95	1.00			1.00		0.95	1.00	1.00			
Satd. Flow (prot)	1874	5212			4958		1754	1520	1519			
Flt Permitted	0.95	1.00			1.00		0.95	1.00	1.00			
Satd. Flow (perm)	1874	5212			4958		1754	1520	1519			
Peak-hour factor, PHF	0.98	0.98	0.98	0.93	0.93	0.93	0.96	0.96	0.96	0.92	0.92	0.92
Adj. Flow (vph)	465	2962	0	0	1478	0	277	0	618	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	2	2	0	0	0
Lane Group Flow (vph)	465	2962	0	0	1478	0	249	323	319	0	0	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	1%	1%	1%	2%	2%	2%
Turn Type	Prot						Perm		Perm			
Protected Phases	5	2			6			8				
Permitted Phases							8		8			
Actuated Green, G (s)	31.9	80.8			42.9		27.2	27.2	27.2			
Effective Green, g (s)	31.9	80.8			42.9		27.2	27.2	27.2			
Actuated g/C Ratio	0.27	0.67			0.36		0.23	0.23	0.23			
Clearance Time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0			
Lane Grp Cap (vph)	498	3509			1772		398	345	344			
v/s Ratio Prot	0.25	c0.57			0.30							
v/s Ratio Perm							0.14	0.21	0.21			
v/c Ratio	0.93	0.84			0.83		0.63	0.94	0.93			
Uniform Delay, d1	43.0	14.8			35.3		41.8	45.6	45.4			
Progression Factor	1.46	0.81			0.99		1.00	1.00	1.00			
Incremental Delay, d2	15.1	1.0			3.3		3.1	32.3	30.5			
Delay (s)	77.9	13.1			38.4		44.9	77.9	75.9			
Level of Service	E	B			D		D	E	E			
Approach Delay (s)		21.9			38.4			68.0			0.0	
Approach LOS		C			D			E			A	

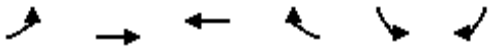
Intersection Summary			
HCM Average Control Delay	33.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	90.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2838	658	781	1784	297	444
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	-5%			1%	0%	
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.91	1.00	0.97	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	5212	1623	3416	3522	3433	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	8000	1623	3416	3522	3433	1583
Peak-hour factor, PHF	0.98	0.98	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2896	671	849	1939	323	483
RTOR Reduction (vph)	0	2	0	0	0	0
Lane Group Flow (vph)	2896	669	849	1939	323	483
Turn Type		pt+ov	Prot			custom
Protected Phases	2	2 8	1	6	8	8
Permitted Phases						1
Actuated Green, G (s)	63.0	80.0	28.0	97.0	11.0	39.0
Effective Green, g (s)	63.0	80.0	28.0	97.0	11.0	39.0
Actuated g/C Ratio	0.52	0.67	0.23	0.81	0.09	0.32
Clearance Time (s)	6.0		6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0		4.0	3.0	2.0	2.0
Lane Grp Cap (vph)	2736	1082	797	2847	315	594
v/s Ratio Prot	c0.56	0.41	c0.25	0.55	0.09	c0.07
v/s Ratio Perm						0.23
v/c Ratio	1.06	0.62	1.07	0.68	1.03	0.81
Uniform Delay, d1	28.5	11.3	46.0	4.9	54.5	37.2
Progression Factor	0.84	0.53	0.89	2.66	1.00	1.00
Incremental Delay, d2	31.9	0.4	32.4	0.1	57.4	7.9
Delay (s)	55.8	6.5	73.5	13.2	111.9	45.1
Level of Service	E	A	E	B	F	D
Approach Delay (s)	46.5			31.5	71.9	
Approach LOS	D			C	E	

Intersection Summary			
HCM Average Control Delay	43.5	HCM Level of Service	D
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	100.6%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

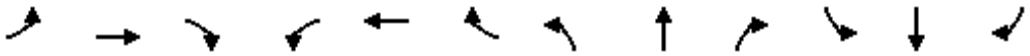


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	1201	2081	1684	90	106	880
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	13	13
Grade (%)		5%	-5%		1%	
Total Lost time (s)	5.0	6.0	6.0		6.0	6.0
Lane Util. Factor	0.97	0.95	0.91		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3347	3451	5173		1819	1628
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3347	3451	5173		1819	1628
Peak-hour factor, PHF	0.98	0.98	0.89	0.89	0.97	0.97
Adj. Flow (vph)	1226	2123	1892	101	109	907
RTOR Reduction (vph)	0	0	5	0	0	0
Lane Group Flow (vph)	1226	2123	1988	0	109	907
Turn Type	Prot					custom
Protected Phases	5	2	6		4	4
Permitted Phases						5
Actuated Green, G (s)	49.0	95.0	41.0		13.0	62.0
Effective Green, g (s)	49.0	95.0	41.0		13.0	62.0
Actuated g/C Ratio	0.41	0.79	0.34		0.11	0.52
Clearance Time (s)	5.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	1367	2732	1767		197	923
v/s Ratio Prot	0.37	0.62	c0.38		0.06	c0.11
v/s Ratio Perm						0.45
v/c Ratio	0.90	0.78	1.13		0.55	0.98
Uniform Delay, d1	33.1	6.8	39.5		50.7	28.5
Progression Factor	1.28	0.52	0.94		1.00	1.00
Incremental Delay, d2	0.8	0.2	63.7		3.3	25.3
Delay (s)	43.3	3.7	100.9		54.1	53.7
Level of Service	D	A	F		D	D
Approach Delay (s)		18.2	100.9		53.8	
Approach LOS		B	F		D	

Intersection Summary			
HCM Average Control Delay	49.8	HCM Level of Service	D
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	99.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Appendix C

Synchro HCM Reports for Year 2032 AM and PM Peak Hours with Proposed Improvements



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	13	1551	17	26	1365	15	27	18	67	102	32	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	12	12	10	12	12	10	10	10	12	12	12
Grade (%)		-1%			1%			0%			0%	
Total Lost time (s)	6.0	6.0		6.0	6.0			6.0	6.0		6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	1.00		1.00	1.00			1.00	0.85		0.99	
Flt Protected	0.95	1.00		0.95	1.00			0.97	1.00		0.97	
Satd. Flow (prot)	1624	3516		1676	3516			1615	1463		1792	
Flt Permitted	0.95	1.00		0.95	1.00			0.77	1.00		0.76	
Satd. Flow (perm)	1624	3516		1676	3516			1288	1463		1415	
Peak-hour factor, PHF	0.94	0.94	0.94	0.89	0.89	0.89	0.93	0.93	0.93	0.88	0.88	0.88
Adj. Flow (vph)	14	1650	18	29	1534	17	29	19	72	116	36	15
RTOR Reduction (vph)	0	1	0	0	1	0	0	0	61	0	3	0
Lane Group Flow (vph)	14	1667	0	29	1550	0	0	48	11	0	164	0
Heavy Vehicles (%)	8%	3%	6%	0%	2%	0%	7%	6%	3%	1%	2%	1%
Turn Type	Prot			Prot			Perm		Perm	Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	1.2	65.0		2.4	66.2			14.6	14.6		14.6	
Effective Green, g (s)	1.2	65.0		2.4	66.2			14.6	14.6		14.6	
Actuated g/C Ratio	0.01	0.65		0.02	0.66			0.15	0.15		0.15	
Clearance Time (s)	6.0	6.0		6.0	6.0			6.0	6.0		6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	19	2285		40	2328			188	214		207	
v/s Ratio Prot	0.01	c0.47		c0.02	0.44							
v/s Ratio Perm								0.04	0.01		c0.12	
v/c Ratio	0.74	0.73		0.72	0.67			0.26	0.05		0.79	
Uniform Delay, d1	49.2	11.7		48.5	10.2			37.9	36.7		41.2	
Progression Factor	1.00	1.00		1.12	0.54			1.00	1.00		1.00	
Incremental Delay, d2	88.4	2.1		44.4	1.4			0.7	0.1		18.3	
Delay (s)	137.6	13.7		98.9	6.9			38.6	36.8		59.5	
Level of Service	F	B		F	A			D	D		E	
Approach Delay (s)		14.8			8.5			37.5			59.5	
Approach LOS		B			A			D			E	

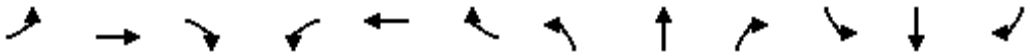
Intersection Summary			
HCM Average Control Delay	14.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	70.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1596	124	171	1259	141	184
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	-3%			3%	0%	
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.91	1.00	1.00	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	5162	1607	1743	3486	3433	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	5162	1607	1743	3486	3433	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1735	135	186	1368	153	200
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	1735	135	186	1368	153	200
Turn Type		pt+ov	Prot			custom
Protected Phases	2	2 8	1	6	8	8
Permitted Phases						1
Actuated Green, G (s)	52.7	72.7	15.3	74.0	14.0	29.3
Effective Green, g (s)	52.7	72.7	15.3	74.0	14.0	29.3
Actuated g/C Ratio	0.53	0.73	0.15	0.74	0.14	0.29
Clearance Time (s)	6.0		6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	2720	1168	267	2580	481	559
v/s Ratio Prot	c0.34	0.08	c0.11	0.39	0.04	c0.05
v/s Ratio Perm						0.08
v/c Ratio	0.64	0.12	0.70	0.53	0.32	0.36
Uniform Delay, d1	16.9	4.1	40.1	5.6	38.7	27.9
Progression Factor	0.55	0.35	1.08	0.63	1.00	1.00
Incremental Delay, d2	0.9	0.0	6.2	0.6	0.4	0.4
Delay (s)	10.2	1.5	49.7	4.1	39.1	28.3
Level of Service	B	A	D	A	D	C
Approach Delay (s)	9.5			9.6	33.0	
Approach LOS	A			A	C	

Intersection Summary			
HCM Average Control Delay	11.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	59.3%	ICU Level of Service	B
Analysis Period (min)	15		

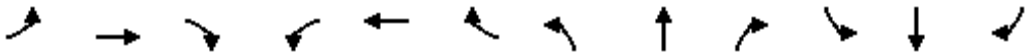
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1448	332	0	1097	508	0	0	0	800	1	334
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	13	10	12
Grade (%)		-4%			4%			0%			0%	
Total Lost time (s)		6.0			6.0	6.0				6.0	6.0	
Lane Util. Factor		0.91			0.95	1.00				0.97	1.00	
Frt		0.97			1.00	0.85				1.00	0.85	
Flt Protected		1.00			1.00	1.00				0.95	1.00	
Satd. Flow (prot)		5002			3402	1552				3414	1475	
Flt Permitted		1.00			1.00	1.00				0.95	1.00	
Satd. Flow (perm)		5002			3402	1552				3414	1475	
Peak-hour factor, PHF	0.94	0.91	0.91	0.93	0.95	0.69	0.92	0.92	0.92	0.94	0.94	0.94
Adj. Flow (vph)	0	1591	365	0	1155	736	0	0	0	851	1	355
RTOR Reduction (vph)	0	33	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1923	0	0	1155	736	0	0	0	851	356	0
Heavy Vehicles (%)	2%	3%	2%	2%	4%	2%	2%	2%	2%	6%	100%	2%
Turn Type						custom				Perm		
Protected Phases		2			6	4 6					4	
Permitted Phases										4		
Actuated Green, G (s)		56.1			56.1	100.0				31.9	31.9	
Effective Green, g (s)		56.1			56.1	100.0				31.9	31.9	
Actuated g/C Ratio		0.56			0.56	1.00				0.32	0.32	
Clearance Time (s)		6.0			6.0					6.0	6.0	
Vehicle Extension (s)		3.0			3.0					3.0	3.0	
Lane Grp Cap (vph)		2806			1909	1552				1089	471	
v/s Ratio Prot		c0.38			0.34	0.47					0.24	
v/s Ratio Perm										c0.25		
v/c Ratio		0.69			0.61	0.47				0.78	0.76	
Uniform Delay, d1		15.7			14.6	0.0				30.9	30.6	
Progression Factor		0.24			0.24	1.00				1.00	1.00	
Incremental Delay, d2		1.1			1.0	0.2				3.7	6.8	
Delay (s)		4.9			4.4	0.2				34.6	37.4	
Level of Service		A			A	A				C	D	
Approach Delay (s)		4.9			2.8			0.0			35.4	
Approach LOS		A			A			A			D	

Intersection Summary			
HCM Average Control Delay	11.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



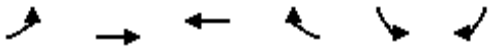
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	453	1795	0	0	1426	186	180	10	268	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	12	12	12	12	12	13	13	12	12	12	12
Grade (%)		-5%			5%			0%			0%	
Total Lost time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Lane Util. Factor	1.00	0.91			0.91		0.95	0.91	0.95			
Frt	1.00	1.00			0.98		1.00	0.88	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.99	1.00			
Satd. Flow (prot)	1893	5016			4872		1754	1522	1490			
Flt Permitted	0.95	1.00			1.00		0.95	0.99	1.00			
Satd. Flow (perm)	1893	5016			4872		1754	1522	1490			
Peak-hour factor, PHF	0.98	0.98	0.98	0.93	0.93	0.93	0.84	0.84	0.84	0.92	0.92	0.92
Adj. Flow (vph)	462	1832	0	0	1533	200	214	12	319	0	0	0
RTOR Reduction (vph)	0	0	0	0	16	0	0	34	34	0	0	0
Lane Group Flow (vph)	462	1832	0	0	1717	0	190	146	141	0	0	0
Heavy Vehicles (%)	1%	6%	2%	2%	2%	2%	1%	1%	3%	2%	2%	2%
Turn Type	Prot						Perm		Perm			
Protected Phases	5	2			6			8				
Permitted Phases							8		8			
Actuated Green, G (s)	27.2	74.6			41.4		13.4	13.4	13.4			
Effective Green, g (s)	27.2	74.6			41.4		13.4	13.4	13.4			
Actuated g/C Ratio	0.27	0.75			0.41		0.13	0.13	0.13			
Clearance Time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0			
Lane Grp Cap (vph)	515	3742			2017		235	204	200			
v/s Ratio Prot	c0.24	0.37			c0.35							
v/s Ratio Perm							c0.11	0.10	0.09			
v/c Ratio	0.90	0.49			0.85		0.81	0.72	0.71			
Uniform Delay, d1	35.1	5.1			26.5		42.1	41.5	41.4			
Progression Factor	0.76	1.22			0.76		1.00	1.00	1.00			
Incremental Delay, d2	13.8	0.3			0.5		18.2	11.4	10.8			
Delay (s)	40.3	6.5			20.5		60.2	52.8	52.2			
Level of Service	D	A			C		E	D	D			
Approach Delay (s)		13.3			20.5			55.2			0.0	
Approach LOS		B			C			E			A	

Intersection Summary			
HCM Average Control Delay	21.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	79.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1576	488	357	2598	482	438
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	-5%			1%	0%	
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.91	1.00	0.97	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	5212	1577	3318	3487	3433	1568
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	8000	1577	3318	3487	3433	1568
Peak-hour factor, PHF	0.98	0.89	0.90	0.90	0.95	0.95
Adj. Flow (vph)	1608	548	397	2887	507	461
RTOR Reduction (vph)	0	16	0	0	0	8
Lane Group Flow (vph)	1608	532	397	2887	507	453
Heavy Vehicles (%)	2%	5%	5%	3%	2%	3%
Turn Type		pt+ov	Prot			custom
Protected Phases	2	2 8	1	6	8	8
Permitted Phases						1
Actuated Green, G (s)	50.5	72.5	15.5	72.0	16.0	31.5
Effective Green, g (s)	50.5	72.5	15.5	72.0	16.0	31.5
Actuated g/C Ratio	0.50	0.72	0.16	0.72	0.16	0.32
Clearance Time (s)	6.0		6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0		4.0	3.0	2.0	2.0
Lane Grp Cap (vph)	2632	1143	514	2511	549	588
v/s Ratio Prot	0.31	0.34	0.12	c0.83	0.15	c0.12
v/s Ratio Perm						0.17
v/c Ratio	0.61	0.47	0.77	1.15	0.92	0.77
Uniform Delay, d1	17.7	5.7	40.6	14.0	41.4	31.0
Progression Factor	0.66	0.69	1.03	1.02	1.00	1.00
Incremental Delay, d2	0.9	0.1	1.8	68.6	21.0	5.7
Delay (s)	12.6	4.0	43.6	82.9	62.4	36.7
Level of Service	B	A	D	F	E	D
Approach Delay (s)	10.4			78.2	50.2	
Approach LOS	B			E	D	

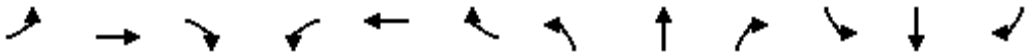
Intersection Summary			
HCM Average Control Delay	51.1	HCM Level of Service	D
HCM Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	95.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	597	1417	2034	42	54	921
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	13	13
Grade (%)		5%	-5%		1%	
Total Lost time (s)	5.0	6.0	6.0		6.0	6.0
Lane Util. Factor	0.97	0.95	0.91		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3283	3451	5185		1718	1628
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3283	3451	5185		1718	1628
Peak-hour factor, PHF	0.94	0.98	0.98	0.98	0.93	0.93
Adj. Flow (vph)	635	1446	2076	43	58	990
RTOR Reduction (vph)	0	0	2	0	0	1
Lane Group Flow (vph)	635	1446	2118	0	58	989
Heavy Vehicles (%)	4%	2%	2%	13%	8%	2%
Turn Type	Prot					pt+ov
Protected Phases	5	2	6		4	4 5
Permitted Phases						
Actuated Green, G (s)	24.0	79.0	50.0		9.0	39.0
Effective Green, g (s)	24.0	79.0	50.0		9.0	39.0
Actuated g/C Ratio	0.24	0.79	0.50		0.09	0.39
Clearance Time (s)	5.0	6.0	6.0		6.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	788	2726	2593		155	635
v/s Ratio Prot	0.19	0.42	c0.41		0.03	c0.61
v/s Ratio Perm						
v/c Ratio	0.81	0.53	0.82		0.37	1.56
Uniform Delay, d1	35.8	3.8	21.1		42.8	30.5
Progression Factor	1.44	0.44	0.81		1.00	1.00
Incremental Delay, d2	4.7	0.6	2.5		1.5	258.8
Delay (s)	56.2	2.2	19.5		44.4	289.3
Level of Service	E	A	B		D	F
Approach Delay (s)		18.7	19.5		275.8	
Approach LOS		B	B		F	

Intersection Summary			
HCM Average Control Delay	70.4	HCM Level of Service	E
HCM Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	107.3%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	1742	35	16	1842	19	49	18	4	15	15	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	12	12	10	12	12	10	10	10	12	12	12
Grade (%)		-1%			1%			0%			0%	
Total Lost time (s)	6.0	6.0		6.0	6.0			6.0	6.0		6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	1.00		1.00	1.00			1.00	0.85		0.95	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.98	
Satd. Flow (prot)	1702	3512		1643	3516			1693	1492		1760	
Flt Permitted	0.95	1.00		0.95	1.00			0.72	1.00		0.87	
Satd. Flow (perm)	1702	3512		1643	3516			1264	1492		1550	
Peak-hour factor, PHF	0.95	0.95	0.95	0.89	0.89	0.89	0.93	0.93	0.93	0.59	0.59	0.59
Adj. Flow (vph)	119	1834	37	18	2070	21	53	19	4	25	25	29
RTOR Reduction (vph)	0	1	0	0	1	0	0	0	4	0	18	0
Lane Group Flow (vph)	119	1870	0	18	2090	0	0	72	0	0	61	0
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Turn Type	Prot			Prot			Perm		Perm	Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	11.4	92.0		2.0	82.6			8.0	8.0		8.0	
Effective Green, g (s)	11.4	92.0		2.0	82.6			8.0	8.0		8.0	
Actuated g/C Ratio	0.10	0.77		0.02	0.69			0.07	0.07		0.07	
Clearance Time (s)	6.0	6.0		6.0	6.0			6.0	6.0		6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	162	2693		27	2420			84	99		103	
v/s Ratio Prot	c0.07	c0.53		0.01	c0.59							
v/s Ratio Perm								c0.06	0.00		0.04	
v/c Ratio	0.73	0.69		0.67	0.86			0.86	0.00		0.59	
Uniform Delay, d1	52.8	7.0		58.7	14.4			55.4	52.3		54.4	
Progression Factor	1.00	1.00		1.07	0.85			1.00	1.00		1.00	
Incremental Delay, d2	15.8	1.5		39.9	3.6			53.4	0.0		8.9	
Delay (s)	68.6	8.5		102.9	15.8			108.8	52.3		63.3	
Level of Service	E	A		F	B			F	D		E	
Approach Delay (s)		12.1			16.5			105.8			63.3	
Approach LOS		B			B			F			E	

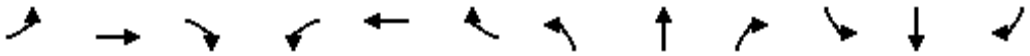
Intersection Summary			
HCM Average Control Delay	16.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	82.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1494	268	401	1620	279	529
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	-3%			3%	0%	
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.91	1.00	1.00	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	5162	1607	1743	3486	3433	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	5162	1607	1743	3486	3433	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1624	291	436	1761	303	575
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	1624	291	436	1761	303	575
Turn Type		pt+ov	Prot			custom
Protected Phases	2	2 8	1	6	8	8
Permitted Phases						1
Actuated Green, G (s)	48.6	71.6	36.4	91.0	17.0	53.4
Effective Green, g (s)	48.6	71.6	36.4	91.0	17.0	53.4
Actuated g/C Ratio	0.40	0.60	0.30	0.76	0.14	0.44
Clearance Time (s)	6.0		6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	2091	959	529	2644	486	784
v/s Ratio Prot	c0.31	0.18	c0.25	0.51	0.09	c0.10
v/s Ratio Perm						0.26
v/c Ratio	0.78	0.30	0.82	0.67	0.62	0.73
Uniform Delay, d1	31.0	11.9	38.8	7.1	48.5	27.4
Progression Factor	0.81	0.61	1.09	1.27	1.00	1.00
Incremental Delay, d2	2.3	0.1	2.9	0.4	2.5	3.6
Delay (s)	27.5	7.4	45.2	9.3	51.0	31.0
Level of Service	C	A	D	A	D	C
Approach Delay (s)	24.4			16.4	37.9	
Approach LOS	C			B	D	

Intersection Summary			
HCM Average Control Delay	23.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	74.0%	ICU Level of Service	D
Analysis Period (min)	15		

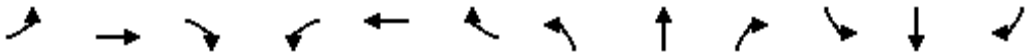
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1737	287	0	1501	272	0	0	0	1530	1	520
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	13	10	12
Grade (%)		-4%			4%			0%			0%	
Total Lost time (s)		6.0			6.0	6.0				6.0	6.0	
Lane Util. Factor		0.91			0.95	1.00				0.97	1.00	
Frt		0.98			1.00	0.85				1.00	0.85	
Flt Protected		1.00			1.00	1.00				0.95	1.00	
Satd. Flow (prot)		5077			3468	1552				3583	1493	
Flt Permitted		1.00			1.00	1.00				0.95	1.00	
Satd. Flow (perm)		5077			3468	1552				3583	1493	
Peak-hour factor, PHF	0.94	0.94	0.94	0.93	0.93	0.93	0.92	0.92	0.92	0.94	0.94	0.94
Adj. Flow (vph)	0	1848	305	0	1614	292	0	0	0	1628	1	553
RTOR Reduction (vph)	0	19	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	2134	0	0	1614	292	0	0	0	1628	554	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	1%	1%	1%
Turn Type						custom				Perm		
Protected Phases		2			6	4 6					4	
Permitted Phases										4		
Actuated Green, G (s)		53.0			53.0	120.0				55.0	55.0	
Effective Green, g (s)		53.0			53.0	120.0				55.0	55.0	
Actuated g/C Ratio		0.44			0.44	1.00				0.46	0.46	
Clearance Time (s)		6.0			6.0					6.0	6.0	
Vehicle Extension (s)		3.0			3.0					3.0	3.0	
Lane Grp Cap (vph)		2242			1532	1552				1642	684	
v/s Ratio Prot		0.42			c0.47	0.19					0.37	
v/s Ratio Perm										c0.45		
v/c Ratio		0.95			1.05	0.19				0.99	0.81	
Uniform Delay, d1		32.3			33.5	0.0				32.3	28.0	
Progression Factor		0.52			0.49	1.00				1.00	1.00	
Incremental Delay, d2		7.3			33.0	0.0				20.1	7.0	
Delay (s)		24.2			49.4	0.0				52.4	35.0	
Level of Service		C			D	A				D	D	
Approach Delay (s)		24.2			41.9			0.0			48.0	
Approach LOS		C			D			A			D	

Intersection Summary			
HCM Average Control Delay	37.9	HCM Level of Service	D
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	95.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	456	2811	0	0	1445	0	329	0	530	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	12	12	12	12	12	13	13	12	12	12	12
Grade (%)		-5%			5%			0%			0%	
Total Lost time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Lane Util. Factor	1.00	0.91			0.91		0.95	0.91	0.95			
Frt	1.00	1.00			1.00		1.00	0.87	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.99	1.00			
Satd. Flow (prot)	1874	5212			4958		1754	1526	1519			
Flt Permitted	0.95	1.00			1.00		0.95	0.99	1.00			
Satd. Flow (perm)	1874	5212			4958		1754	1526	1519			
Peak-hour factor, PHF	0.98	0.98	0.98	0.93	0.93	0.93	0.96	0.96	0.96	0.92	0.92	0.92
Adj. Flow (vph)	465	2868	0	0	1554	0	343	0	552	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	465	2868	0	0	1554	0	309	293	293	0	0	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	1%	1%	1%	2%	2%	2%
Turn Type	Prot						Perm		Perm			
Protected Phases	5	2			6			8				
Permitted Phases							8		8			
Actuated Green, G (s)	32.3	82.9			44.6		25.1	25.1	25.1			
Effective Green, g (s)	32.3	82.9			44.6		25.1	25.1	25.1			
Actuated g/C Ratio	0.27	0.69			0.37		0.21	0.21	0.21			
Clearance Time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0			
Lane Grp Cap (vph)	504	3601			1843		367	319	318			
v/s Ratio Prot	c0.25	0.55			c0.31							
v/s Ratio Perm							0.18	0.19	c0.19			
v/c Ratio	0.92	0.80			0.84		0.84	0.92	0.92			
Uniform Delay, d1	42.6	12.8			34.5		45.5	46.4	46.5			
Progression Factor	1.44	0.93			0.96		1.00	1.00	1.00			
Incremental Delay, d2	9.5	0.5			3.3		15.9	30.0	30.9			
Delay (s)	70.7	12.4			36.3		61.4	76.4	77.4			
Level of Service	E	B			D		E	E	E			
Approach Delay (s)		20.6			36.3			71.6			0.0	
Approach LOS		C			D			E			A	

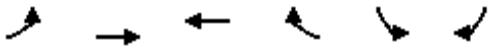
Intersection Summary			
HCM Average Control Delay	32.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	86.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2838	503	622	1942	209	444
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	-5%			1%	0%	
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.91	1.00	0.97	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	5212	1623	3416	3522	3433	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	8000	1623	3416	3522	3433	1583
Peak-hour factor, PHF	0.98	0.98	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2896	513	676	2111	227	483
RTOR Reduction (vph)	0	7	0	0	0	0
Lane Group Flow (vph)	2896	506	676	2111	227	483
Turn Type		pt+ov	Prot			custom
Protected Phases	2	2 8	1	6	8	8
Permitted Phases						1
Actuated Green, G (s)	64.5	81.5	26.5	97.0	11.0	37.5
Effective Green, g (s)	64.5	81.5	26.5	97.0	11.0	37.5
Actuated g/C Ratio	0.54	0.68	0.22	0.81	0.09	0.31
Clearance Time (s)	6.0		6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0		4.0	3.0	2.0	2.0
Lane Grp Cap (vph)	2801	1102	754	2847	315	574
v/s Ratio Prot	c0.56	0.31	0.20	0.60	0.07	c0.08
v/s Ratio Perm						0.23
v/c Ratio	1.03	0.46	0.90	0.74	0.72	0.84
Uniform Delay, d1	27.8	9.0	45.4	5.5	53.0	38.5
Progression Factor	0.80	0.55	0.89	2.58	1.00	1.00
Incremental Delay, d2	23.3	0.1	1.5	0.2	6.7	10.3
Delay (s)	45.3	5.0	42.1	14.4	59.7	48.8
Level of Service	D	A	D	B	E	D
Approach Delay (s)	39.3			21.1	52.3	
Approach LOS	D			C	D	

Intersection Summary			
HCM Average Control Delay	33.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	93.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

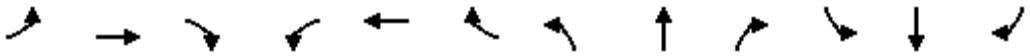


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	1201	2081	1684	90	106	880
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	13	13
Grade (%)		5%	-5%		1%	
Total Lost time (s)	5.0	6.0	6.0		6.0	6.0
Lane Util. Factor	0.97	0.95	0.91		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3347	3451	5173		1819	1628
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3347	3451	5173		1819	1628
Peak-hour factor, PHF	0.98	0.98	0.89	0.89	0.97	0.97
Adj. Flow (vph)	1226	2123	1892	101	109	907
RTOR Reduction (vph)	0	0	5	0	0	0
Lane Group Flow (vph)	1226	2123	1988	0	109	907
Turn Type	Prot					custom
Protected Phases	5	2	6		4	4
Permitted Phases						5
Actuated Green, G (s)	47.7	95.0	42.3		13.0	60.7
Effective Green, g (s)	47.7	95.0	42.3		13.0	60.7
Actuated g/C Ratio	0.40	0.79	0.35		0.11	0.51
Clearance Time (s)	5.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	1330	2732	1823		197	905
v/s Ratio Prot	0.37	0.62	c0.38		0.06	c0.11
v/s Ratio Perm						0.45
v/c Ratio	0.92	0.78	1.09		0.55	1.00
Uniform Delay, d1	34.4	6.8	38.8		50.7	29.6
Progression Factor	1.26	0.52	0.94		1.00	1.00
Incremental Delay, d2	1.2	0.2	49.6		3.3	30.5
Delay (s)	44.6	3.7	86.2		54.1	60.1
Level of Service	D	A	F		D	E
Approach Delay (s)		18.7	86.2		59.5	
Approach LOS		B	F		E	

Intersection Summary			
HCM Average Control Delay	46.4	HCM Level of Service	D
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	99.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Appendix D

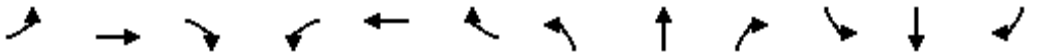
Synchro HCM Reports for Year 2032 PM Peak Hours for Alternative 1 with I-476 Ramp Relocation



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	1742	35	16	1842	19	49	18	4	15	15	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	12	12	10	12	12	10	10	10	12	12	12
Grade (%)		-1%			1%			0%			0%	
Total Lost time (s)	6.0	6.0		6.0	6.0			6.0	6.0		6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	1.00		1.00	1.00			1.00	0.85		0.95	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.98	
Satd. Flow (prot)	1702	3512		1643	3516			1693	1492		1760	
Flt Permitted	0.95	1.00		0.95	1.00			0.72	1.00		0.87	
Satd. Flow (perm)	1702	3512		1643	3516			1264	1492		1550	
Peak-hour factor, PHF	0.95	0.95	0.95	0.89	0.89	0.89	0.93	0.93	0.93	0.59	0.59	0.59
Adj. Flow (vph)	119	1834	37	18	2070	21	53	19	4	25	25	29
RTOR Reduction (vph)	0	1	0	0	1	0	0	0	4	0	18	0
Lane Group Flow (vph)	119	1870	0	18	2090	0	0	72	0	0	61	0
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Turn Type	Prot			Prot			Perm		Perm	Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	11.4	92.0		2.0	82.6			8.0	8.0		8.0	
Effective Green, g (s)	11.4	92.0		2.0	82.6			8.0	8.0		8.0	
Actuated g/C Ratio	0.10	0.77		0.02	0.69			0.07	0.07		0.07	
Clearance Time (s)	6.0	6.0		6.0	6.0			6.0	6.0		6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	162	2693		27	2420			84	99		103	
v/s Ratio Prot	c0.07	c0.53		0.01	c0.59							
v/s Ratio Perm								c0.06	0.00		0.04	
v/c Ratio	0.73	0.69		0.67	0.86			0.86	0.00		0.59	
Uniform Delay, d1	52.8	7.0		58.7	14.4			55.4	52.3		54.4	
Progression Factor	1.00	1.00		1.05	0.49			1.00	1.00		1.00	
Incremental Delay, d2	15.8	1.5		34.1	3.0			53.4	0.0		8.9	
Delay (s)	68.6	8.5		95.8	10.0			108.8	52.3		63.3	
Level of Service	E	A		F	B			F	D		E	
Approach Delay (s)		12.1			10.7			105.8			63.3	
Approach LOS		B			B			F			E	

Intersection Summary			
HCM Average Control Delay	14.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	82.1%	ICU Level of Service	E
Analysis Period (min)	15		

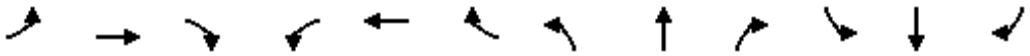
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1494	268	292	1209	0	279	0	529	1266	374	411
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-3%			3%			0%			0%	
Total Lost time (s)		6.0	6.0	6.0	6.0		6.0		6.0	6.0	6.0	6.0
Lane Util. Factor		0.91	1.00	0.97	0.95		1.00		0.88	0.97	1.00	1.00
Frt		1.00	0.85	1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		5162	1607	3382	3486		1770		2787	3433	1863	1583
Flt Permitted		1.00	1.00	0.95	1.00		0.35		1.00	0.95	1.00	1.00
Satd. Flow (perm)		5162	1607	3382	3486		644		2787	3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1624	291	317	1314	0	303	0	575	1376	407	447
RTOR Reduction (vph)	0	0	132	0	0	0	0	0	0	0	0	22
Lane Group Flow (vph)	0	1624	159	317	1314	0	303	0	575	1376	407	425
Turn Type			Prot	Prot			D.Pm		Over	Perm		Perm
Protected Phases		2	2	1	6				1		4	
Permitted Phases							4			4		4
Actuated Green, G (s)		35.0	35.0	21.0	62.0		46.0		21.0	46.0	46.0	46.0
Effective Green, g (s)		35.0	35.0	21.0	62.0		46.0		21.0	46.0	46.0	46.0
Actuated g/C Ratio		0.29	0.29	0.18	0.52		0.38		0.18	0.38	0.38	0.38
Clearance Time (s)		6.0	6.0	6.0	6.0		6.0		6.0	6.0	6.0	6.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0		3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		1506	469	592	1801		247		488	1316	714	607
v/s Ratio Prot		c0.31	0.10	0.09	0.38				c0.21		0.22	
v/s Ratio Perm							c0.47			0.40		0.27
v/c Ratio		1.08	0.34	0.54	0.73		1.23		1.18	1.05	0.57	0.70
Uniform Delay, d1		42.5	33.4	45.1	22.5		37.0		49.5	37.0	29.2	31.2
Progression Factor		0.86	0.62	0.63	0.61		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		45.2	1.5	0.5	1.4		132.4		99.8	37.6	1.1	3.7
Delay (s)		81.9	22.3	28.7	15.2		169.4		149.3	74.6	30.3	34.9
Level of Service		F	C	C	B		F		F	E	C	C
Approach Delay (s)		72.9			17.8			156.3			58.6	
Approach LOS		E			B			F			E	

Intersection Summary			
HCM Average Control Delay	65.6	HCM Level of Service	E
HCM Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	98.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	456	2547	0	0	1445	0	329	0	530	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	12	12	12	12	12	13	13	12	12	12	12
Grade (%)		-5%			5%			0%			0%	
Total Lost time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Lane Util. Factor	1.00	0.91			0.91		0.95	0.91	0.95			
Frt	1.00	1.00			1.00		1.00	0.87	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.99	1.00			
Satd. Flow (prot)	1874	5212			4958		1754	1526	1519			
Flt Permitted	0.95	1.00			1.00		0.95	0.99	1.00			
Satd. Flow (perm)	1874	5212			4958		1754	1526	1519			
Peak-hour factor, PHF	0.98	0.98	0.98	0.93	0.93	0.93	0.96	0.96	0.96	0.92	0.92	0.92
Adj. Flow (vph)	465	2599	0	0	1554	0	343	0	552	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	465	2599	0	0	1554	0	309	293	293	0	0	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	1%	1%	1%	2%	2%	2%
Turn Type	Prot						Perm		Perm			
Protected Phases	5	2			6			8				
Permitted Phases							8		8			
Actuated Green, G (s)	32.3	82.9			44.6		25.1	25.1	25.1			
Effective Green, g (s)	32.3	82.9			44.6		25.1	25.1	25.1			
Actuated g/C Ratio	0.27	0.69			0.37		0.21	0.21	0.21			
Clearance Time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0			
Lane Grp Cap (vph)	504	3601			1843		367	319	318			
v/s Ratio Prot	c0.25	0.50			c0.31							
v/s Ratio Perm							0.18	0.19	c0.19			
v/c Ratio	0.92	0.72			0.84		0.84	0.92	0.92			
Uniform Delay, d1	42.6	11.4			34.5		45.5	46.4	46.5			
Progression Factor	0.91	0.66			0.88		1.00	1.00	1.00			
Incremental Delay, d2	3.1	0.1			3.3		15.9	30.0	30.9			
Delay (s)	41.9	7.7			33.5		61.4	76.4	77.4			
Level of Service	D	A			C		E	E	E			
Approach Delay (s)		12.9			33.5			71.6			0.0	
Approach LOS		B			C			E			A	

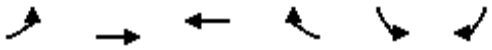
Intersection Summary			
HCM Average Control Delay	28.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	82.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2838	239	622	1942	209	444
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	-5%			1%	0%	
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.91	1.00	0.97	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	5212	1623	3416	3522	3433	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	8000	1623	3416	3522	3433	1583
Peak-hour factor, PHF	0.98	0.98	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2896	244	676	2111	227	483
RTOR Reduction (vph)	0	2	0	0	0	1
Lane Group Flow (vph)	2896	242	676	2111	227	482
Turn Type		pt+ov	Prot			custom
Protected Phases	2	2 8	1	6	8	8
Permitted Phases						1
Actuated Green, G (s)	69.0	86.0	22.0	97.0	11.0	33.0
Effective Green, g (s)	69.0	86.0	22.0	97.0	11.0	33.0
Actuated g/C Ratio	0.57	0.72	0.18	0.81	0.09	0.28
Clearance Time (s)	6.0		6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0		4.0	3.0	2.0	2.0
Lane Grp Cap (vph)	2997	1163	626	2847	315	514
v/s Ratio Prot	c0.56	0.15	c0.20	0.60	0.07	c0.09
v/s Ratio Perm						0.22
v/c Ratio	0.97	0.21	1.08	0.74	0.72	0.94
Uniform Delay, d1	24.4	5.7	49.0	5.5	53.0	42.5
Progression Factor	0.79	0.62	0.91	1.94	1.00	1.00
Incremental Delay, d2	7.9	0.0	39.2	0.2	6.7	24.7
Delay (s)	27.2	3.5	83.9	10.8	59.7	67.2
Level of Service	C	A	F	B	E	E
Approach Delay (s)	25.4			28.6	64.8	
Approach LOS	C			C	E	

Intersection Summary			
HCM Average Control Delay	30.9	HCM Level of Service	C
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	93.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

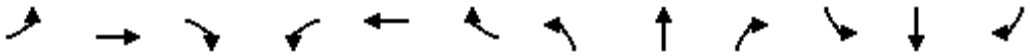


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	1201	2081	1684	90	106	880
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	13	13
Grade (%)		5%	-5%		1%	
Total Lost time (s)	5.0	6.0	6.0		6.0	6.0
Lane Util. Factor	0.97	0.95	0.91		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3347	3451	5173		1819	1628
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3347	3451	5173		1819	1628
Peak-hour factor, PHF	0.98	0.98	0.89	0.89	0.97	0.97
Adj. Flow (vph)	1226	2123	1892	101	109	907
RTOR Reduction (vph)	0	0	5	0	0	1
Lane Group Flow (vph)	1226	2123	1988	0	109	906
Turn Type	Prot					custom
Protected Phases	5	2	6		4	4
Permitted Phases						5
Actuated Green, G (s)	44.9	95.0	45.1		13.0	57.9
Effective Green, g (s)	44.9	95.0	45.1		13.0	57.9
Actuated g/C Ratio	0.37	0.79	0.38		0.11	0.48
Clearance Time (s)	5.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	1252	2732	1944		197	867
v/s Ratio Prot	0.37	0.62	c0.38		0.06	c0.11
v/s Ratio Perm						0.44
v/c Ratio	0.98	0.78	1.02		0.55	1.05
Uniform Delay, d1	37.1	6.8	37.4		50.7	31.0
Progression Factor	1.27	0.35	0.95		1.00	1.00
Incremental Delay, d2	9.6	0.7	25.3		3.3	43.1
Delay (s)	56.5	3.1	60.8		54.1	74.2
Level of Service	E	A	E		D	E
Approach Delay (s)		22.6	60.8		72.0	
Approach LOS		C	E		E	

Intersection Summary			
HCM Average Control Delay	42.5	HCM Level of Service	D
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	99.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Appendix E

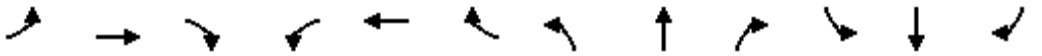
Synchro HCM Reports for Year 2032 PM Peak Hours for Alternative 2 with I-476 Ramp Relocation



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	1742	35	16	1842	19	49	18	4	15	15	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	12	12	10	12	12	10	10	10	12	12	12
Grade (%)		-1%			1%			0%			0%	
Total Lost time (s)	6.0	6.0		6.0	6.0			6.0	6.0		6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	1.00		1.00	1.00			1.00	0.85		0.95	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.98	
Satd. Flow (prot)	1702	3512		1643	3516			1693	1492		1760	
Flt Permitted	0.95	1.00		0.95	1.00			0.72	1.00		0.87	
Satd. Flow (perm)	1702	3512		1643	3516			1264	1492		1550	
Peak-hour factor, PHF	0.95	0.95	0.95	0.89	0.89	0.89	0.93	0.93	0.93	0.59	0.59	0.59
Adj. Flow (vph)	119	1834	37	18	2070	21	53	19	4	25	25	29
RTOR Reduction (vph)	0	1	0	0	1	0	0	0	4	0	18	0
Lane Group Flow (vph)	119	1870	0	18	2090	0	0	72	0	0	61	0
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Turn Type	Prot			Prot			Perm		Perm	Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	11.4	92.0		2.0	82.6			8.0	8.0		8.0	
Effective Green, g (s)	11.4	92.0		2.0	82.6			8.0	8.0		8.0	
Actuated g/C Ratio	0.10	0.77		0.02	0.69			0.07	0.07		0.07	
Clearance Time (s)	6.0	6.0		6.0	6.0			6.0	6.0		6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	162	2693		27	2420			84	99		103	
v/s Ratio Prot	c0.07	c0.53		0.01	c0.59							
v/s Ratio Perm								c0.06	0.00		0.04	
v/c Ratio	0.73	0.69		0.67	0.86			0.86	0.00		0.59	
Uniform Delay, d1	52.8	7.0		58.7	14.4			55.4	52.3		54.4	
Progression Factor	1.00	1.00		1.02	0.39			1.00	1.00		1.00	
Incremental Delay, d2	15.8	1.5		29.2	2.5			53.4	0.0		8.9	
Delay (s)	68.6	8.5		89.3	8.1			108.8	52.3		63.3	
Level of Service	E	A		F	A			F	D		E	
Approach Delay (s)		12.1			8.8			105.8			63.3	
Approach LOS		B			A			F			E	

Intersection Summary			
HCM Average Control Delay	13.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	82.1%	ICU Level of Service	E
Analysis Period (min)	15		

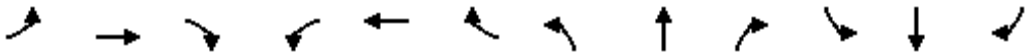
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1494	268	292	1209	0	279	0	529	1266	374	411
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-3%			3%			0%			0%	
Total Lost time (s)		6.0	6.0	6.0	6.0		6.0		6.0	6.0	6.0	6.0
Lane Util. Factor		0.91	1.00	0.97	0.95		1.00		0.88	0.97	1.00	1.00
Frt		1.00	0.85	1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		5162	1607	3382	3486		1770		2787	3433	1863	1583
Flt Permitted		1.00	1.00	0.95	1.00		0.15		1.00	0.95	1.00	1.00
Satd. Flow (perm)		5162	1607	3382	3486		287		2787	3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1624	291	317	1314	0	303	0	575	1376	407	447
RTOR Reduction (vph)	0	0	132	0	0	0	0	0	0	0	0	34
Lane Group Flow (vph)	0	1624	159	317	1314	0	303	0	575	1376	407	413
Turn Type			Prot	Prot			D.P+P		Over	pm+pt		Perm
Protected Phases		2	2	1	6		3		1	7	4	
Permitted Phases							4			4		4
Actuated Green, G (s)		35.0	35.0	21.0	62.0		40.0		21.0	46.0	26.0	26.0
Effective Green, g (s)		35.0	35.0	21.0	62.0		40.0		21.0	46.0	26.0	26.0
Actuated g/C Ratio		0.29	0.29	0.18	0.52		0.33		0.18	0.38	0.22	0.22
Clearance Time (s)		6.0	6.0	6.0	6.0		6.0		6.0	6.0	6.0	6.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0		3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		1506	469	592	1801		269		488	1316	404	343
v/s Ratio Prot		c0.31	0.10	0.09	0.38		0.13		c0.21	c0.40	0.22	
v/s Ratio Perm							0.24					c0.26
v/c Ratio		1.08	0.34	0.54	0.73		1.13		1.18	1.05	1.01	1.20
Uniform Delay, d1		42.5	33.4	45.1	22.5		34.1		49.5	37.0	47.0	47.0
Progression Factor		0.86	0.62	0.63	0.61		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		45.2	1.5	0.5	1.4		93.2		99.8	37.6	46.6	115.8
Delay (s)		81.9	22.3	28.7	15.2		127.4		149.3	74.6	93.6	162.8
Level of Service		F	C	C	B		F		F	E	F	F
Approach Delay (s)		72.9			17.8			141.8			95.8	
Approach LOS		E			B			F			F	

Intersection Summary			
HCM Average Control Delay	76.1	HCM Level of Service	E
HCM Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	98.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	456	2547	0	0	1445	0	329	0	530	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	12	12	12	12	12	13	13	12	12	12	12
Grade (%)		-5%			5%			0%			0%	
Total Lost time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Lane Util. Factor	1.00	0.91			0.91		0.95	0.91	0.95			
Frt	1.00	1.00			1.00		1.00	0.87	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.99	1.00			
Satd. Flow (prot)	1874	5212			4958		1754	1526	1519			
Flt Permitted	0.95	1.00			1.00		0.95	0.99	1.00			
Satd. Flow (perm)	1874	5212			4958		1754	1526	1519			
Peak-hour factor, PHF	0.98	0.98	0.98	0.93	0.93	0.93	0.96	0.96	0.96	0.92	0.92	0.92
Adj. Flow (vph)	465	2599	0	0	1554	0	343	0	552	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	465	2599	0	0	1554	0	309	293	293	0	0	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	1%	1%	1%	2%	2%	2%
Turn Type	Prot						Perm		Perm			
Protected Phases	5	2			6			8				
Permitted Phases							8		8			
Actuated Green, G (s)	32.3	82.9			44.6		25.1	25.1	25.1			
Effective Green, g (s)	32.3	82.9			44.6		25.1	25.1	25.1			
Actuated g/C Ratio	0.27	0.69			0.37		0.21	0.21	0.21			
Clearance Time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0			
Lane Grp Cap (vph)	504	3601			1843		367	319	318			
v/s Ratio Prot	c0.25	0.50			c0.31							
v/s Ratio Perm							0.18	0.19	c0.19			
v/c Ratio	0.92	0.72			0.84		0.84	0.92	0.92			
Uniform Delay, d1	42.6	11.4			34.5		45.5	46.4	46.5			
Progression Factor	0.91	0.66			0.88		1.00	1.00	1.00			
Incremental Delay, d2	3.1	0.1			3.3		15.9	30.0	30.9			
Delay (s)	41.9	7.7			33.5		61.4	76.4	77.4			
Level of Service	D	A			C		E	E	E			
Approach Delay (s)		12.9			33.5			71.6			0.0	
Approach LOS		B			C			E			A	

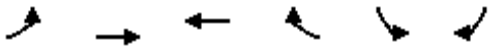
Intersection Summary			
HCM Average Control Delay	28.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	82.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2838	239	622	1942	209	444
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	-5%			1%	0%	
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.91	1.00	0.97	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	5212	1623	3416	3522	3433	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	8000	1623	3416	3522	3433	1583
Peak-hour factor, PHF	0.98	0.98	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2896	244	676	2111	227	483
RTOR Reduction (vph)	0	2	0	0	0	1
Lane Group Flow (vph)	2896	242	676	2111	227	482
Turn Type		pt+ov	Prot			custom
Protected Phases	2	2 8	1	6	8	8
Permitted Phases						1
Actuated Green, G (s)	69.0	86.0	22.0	97.0	11.0	33.0
Effective Green, g (s)	69.0	86.0	22.0	97.0	11.0	33.0
Actuated g/C Ratio	0.57	0.72	0.18	0.81	0.09	0.28
Clearance Time (s)	6.0		6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0		4.0	3.0	2.0	2.0
Lane Grp Cap (vph)	2997	1163	626	2847	315	514
v/s Ratio Prot	c0.56	0.15	c0.20	0.60	0.07	c0.09
v/s Ratio Perm						0.22
v/c Ratio	0.97	0.21	1.08	0.74	0.72	0.94
Uniform Delay, d1	24.4	5.7	49.0	5.5	53.0	42.5
Progression Factor	0.79	0.62	0.91	1.94	1.00	1.00
Incremental Delay, d2	7.9	0.0	39.2	0.2	6.7	24.7
Delay (s)	27.2	3.5	83.9	10.8	59.7	67.2
Level of Service	C	A	F	B	E	E
Approach Delay (s)	25.4			28.6	64.8	
Approach LOS	C			C	E	

Intersection Summary			
HCM Average Control Delay	30.9	HCM Level of Service	C
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	93.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

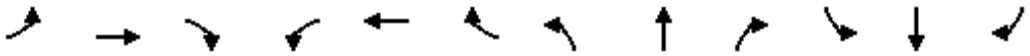


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	1201	2081	1684	90	106	880
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	13	13
Grade (%)		5%	-5%		1%	
Total Lost time (s)	5.0	6.0	6.0		6.0	6.0
Lane Util. Factor	0.97	0.95	0.91		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3347	3451	5173		1819	1628
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3347	3451	5173		1819	1628
Peak-hour factor, PHF	0.98	0.98	0.89	0.89	0.97	0.97
Adj. Flow (vph)	1226	2123	1892	101	109	907
RTOR Reduction (vph)	0	0	5	0	0	1
Lane Group Flow (vph)	1226	2123	1988	0	109	906
Turn Type	Prot					custom
Protected Phases	5	2	6		4	4
Permitted Phases						5
Actuated Green, G (s)	44.9	95.0	45.1		13.0	57.9
Effective Green, g (s)	44.9	95.0	45.1		13.0	57.9
Actuated g/C Ratio	0.37	0.79	0.38		0.11	0.48
Clearance Time (s)	5.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	1252	2732	1944		197	867
v/s Ratio Prot	0.37	0.62	c0.38		0.06	c0.11
v/s Ratio Perm						0.44
v/c Ratio	0.98	0.78	1.02		0.55	1.05
Uniform Delay, d1	37.1	6.8	37.4		50.7	31.0
Progression Factor	1.27	0.35	0.95		1.00	1.00
Incremental Delay, d2	9.6	0.7	25.3		3.3	43.1
Delay (s)	56.5	3.1	60.8		54.1	74.2
Level of Service	E	A	E		D	E
Approach Delay (s)		22.6	60.8		72.0	
Approach LOS		C	E		E	

Intersection Summary			
HCM Average Control Delay	42.5	HCM Level of Service	D
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	99.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Appendix F

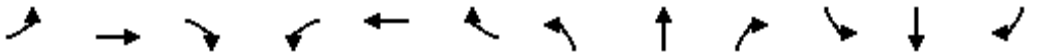
Synchro HCM Reports for Year 2032 PM Peak Hours for Alternative 3 with I-476 Ramp Relocation



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	1742	35	16	1842	19	49	18	4	15	15	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	12	12	10	12	12	10	10	10	12	12	12
Grade (%)		-1%			1%			0%			0%	
Total Lost time (s)	6.0	6.0		6.0	6.0			6.0	6.0		6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	1.00		1.00	1.00			1.00	0.85		0.95	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.98	
Satd. Flow (prot)	1702	3512		1643	3516			1693	1492		1760	
Flt Permitted	0.95	1.00		0.95	1.00			0.72	1.00		0.87	
Satd. Flow (perm)	1702	3512		1643	3516			1264	1492		1550	
Peak-hour factor, PHF	0.95	0.95	0.95	0.89	0.89	0.89	0.93	0.93	0.93	0.59	0.59	0.59
Adj. Flow (vph)	119	1834	37	18	2070	21	53	19	4	25	25	29
RTOR Reduction (vph)	0	1	0	0	1	0	0	0	4	0	18	0
Lane Group Flow (vph)	119	1870	0	18	2090	0	0	72	0	0	61	0
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Turn Type	Prot			Prot			Perm		Perm	Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	11.4	92.0		2.0	82.6			8.0	8.0		8.0	
Effective Green, g (s)	11.4	92.0		2.0	82.6			8.0	8.0		8.0	
Actuated g/C Ratio	0.10	0.77		0.02	0.69			0.07	0.07		0.07	
Clearance Time (s)	6.0	6.0		6.0	6.0			6.0	6.0		6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	162	2693		27	2420			84	99		103	
v/s Ratio Prot	c0.07	c0.53		0.01	c0.59							
v/s Ratio Perm								c0.06	0.00		0.04	
v/c Ratio	0.73	0.69		0.67	0.86			0.86	0.00		0.59	
Uniform Delay, d1	52.8	7.0		58.7	14.4			55.4	52.3		54.4	
Progression Factor	1.00	1.00		1.06	0.51			1.00	1.00		1.00	
Incremental Delay, d2	15.8	1.5		36.3	3.2			53.4	0.0		8.9	
Delay (s)	68.6	8.5		98.2	10.5			108.8	52.3		63.3	
Level of Service	E	A		F	B			F	D		E	
Approach Delay (s)		12.1			11.2			105.8			63.3	
Approach LOS		B			B			F			E	

Intersection Summary			
HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	82.1%	ICU Level of Service	E
Analysis Period (min)	15		

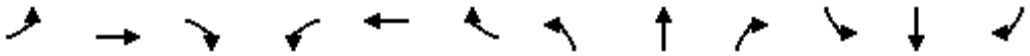
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1494	268	292	1209	0	279	0	529	1266	374	411
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-3%			3%			0%			0%	
Total Lost time (s)		6.0	6.0	6.0	6.0		6.0		6.0	6.0	6.0	6.0
Lane Util. Factor		0.91	1.00	0.97	0.95		1.00		0.88	0.97	0.95	1.00
Frt		1.00	0.85	1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		5162	1607	3382	3486		1770		2787	3433	3539	1583
Flt Permitted		1.00	1.00	0.95	1.00		0.47		1.00	0.95	1.00	1.00
Satd. Flow (perm)		5162	1607	3382	3486		872		2787	3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1624	291	317	1314	0	303	0	575	1376	407	447
RTOR Reduction (vph)	0	0	132	0	0	0	0	0	0	0	0	22
Lane Group Flow (vph)	0	1624	159	317	1314	0	303	0	575	1376	407	425
Turn Type			Prot	Prot			D.Pm		Over	Perm		Perm
Protected Phases		2	2	1	6				1		4	
Permitted Phases							4			4		4
Actuated Green, G (s)		35.0	35.0	21.0	62.0		46.0		21.0	46.0	46.0	46.0
Effective Green, g (s)		35.0	35.0	21.0	62.0		46.0		21.0	46.0	46.0	46.0
Actuated g/C Ratio		0.29	0.29	0.18	0.52		0.38		0.18	0.38	0.38	0.38
Clearance Time (s)		6.0	6.0	6.0	6.0		6.0		6.0	6.0	6.0	6.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0		3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		1506	469	592	1801		334		488	1316	1357	607
v/s Ratio Prot		c0.31	0.10	0.09	0.38				c0.21		0.11	
v/s Ratio Perm							0.35			c0.40		0.27
v/c Ratio		1.08	0.34	0.54	0.73		0.91		1.18	1.05	0.30	0.70
Uniform Delay, d1		42.5	33.4	45.1	22.5		35.0		49.5	37.0	25.8	31.2
Progression Factor		0.86	0.62	0.63	0.61		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		45.2	1.5	0.5	1.4		26.9		99.8	37.6	0.1	3.7
Delay (s)		81.9	22.3	28.7	15.2		61.9		149.3	74.6	25.9	34.9
Level of Service		F	C	C	B		E		F	E	C	C
Approach Delay (s)		72.9			17.8			119.1			57.8	
Approach LOS		E			B			F			E	

Intersection Summary			
HCM Average Control Delay	60.4	HCM Level of Service	E
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	98.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	456	2547	0	0	1445	0	329	0	530	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	12	12	12	12	12	13	13	12	12	12	12
Grade (%)		-5%			5%			0%			0%	
Total Lost time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Lane Util. Factor	1.00	0.91			0.91		0.95	0.91	0.95			
Frt	1.00	1.00			1.00		1.00	0.87	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.99	1.00			
Satd. Flow (prot)	1874	5212			4958		1754	1526	1519			
Flt Permitted	0.95	1.00			1.00		0.95	0.99	1.00			
Satd. Flow (perm)	1874	5212			4958		1754	1526	1519			
Peak-hour factor, PHF	0.98	0.98	0.98	0.93	0.93	0.93	0.96	0.96	0.96	0.92	0.92	0.92
Adj. Flow (vph)	465	2599	0	0	1554	0	343	0	552	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	465	2599	0	0	1554	0	309	293	293	0	0	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	1%	1%	1%	2%	2%	2%
Turn Type	Prot						Perm		Perm			
Protected Phases	5	2			6			8				
Permitted Phases							8		8			
Actuated Green, G (s)	32.3	82.9			44.6		25.1	25.1	25.1			
Effective Green, g (s)	32.3	82.9			44.6		25.1	25.1	25.1			
Actuated g/C Ratio	0.27	0.69			0.37		0.21	0.21	0.21			
Clearance Time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0			
Lane Grp Cap (vph)	504	3601			1843		367	319	318			
v/s Ratio Prot	c0.25	0.50			c0.31							
v/s Ratio Perm							0.18	0.19	c0.19			
v/c Ratio	0.92	0.72			0.84		0.84	0.92	0.92			
Uniform Delay, d1	42.6	11.4			34.5		45.5	46.4	46.5			
Progression Factor	0.91	0.66			0.88		1.00	1.00	1.00			
Incremental Delay, d2	3.1	0.1			3.3		15.9	30.0	30.9			
Delay (s)	41.9	7.7			33.5		61.4	76.4	77.4			
Level of Service	D	A			C		E	E	E			
Approach Delay (s)		12.9			33.5			71.6			0.0	
Approach LOS		B			C			E			A	

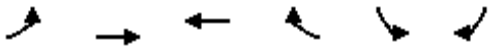
Intersection Summary			
HCM Average Control Delay	28.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	82.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2838	239	622	1942	209	444
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	-5%			1%	0%	
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.91	1.00	0.97	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	5212	1623	3416	3522	3433	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	8000	1623	3416	3522	3433	1583
Peak-hour factor, PHF	0.98	0.98	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2896	244	676	2111	227	483
RTOR Reduction (vph)	0	2	0	0	0	1
Lane Group Flow (vph)	2896	242	676	2111	227	482
Turn Type		pt+ov	Prot			custom
Protected Phases	2	2 8	1	6	8	8
Permitted Phases						1
Actuated Green, G (s)	69.0	86.0	22.0	97.0	11.0	33.0
Effective Green, g (s)	69.0	86.0	22.0	97.0	11.0	33.0
Actuated g/C Ratio	0.57	0.72	0.18	0.81	0.09	0.28
Clearance Time (s)	6.0		6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0		4.0	3.0	2.0	2.0
Lane Grp Cap (vph)	2997	1163	626	2847	315	514
v/s Ratio Prot	c0.56	0.15	c0.20	0.60	0.07	c0.09
v/s Ratio Perm						0.22
v/c Ratio	0.97	0.21	1.08	0.74	0.72	0.94
Uniform Delay, d1	24.4	5.7	49.0	5.5	53.0	42.5
Progression Factor	0.79	0.62	0.91	1.94	1.00	1.00
Incremental Delay, d2	7.9	0.0	39.2	0.2	6.7	24.7
Delay (s)	27.2	3.5	83.9	10.8	59.7	67.2
Level of Service	C	A	F	B	E	E
Approach Delay (s)	25.4			28.6	64.8	
Approach LOS	C			C	E	

Intersection Summary			
HCM Average Control Delay	30.9	HCM Level of Service	C
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	93.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

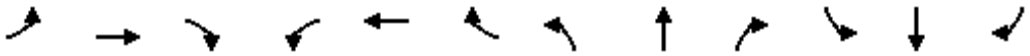


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	1201	2081	1684	90	106	880
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	13	13
Grade (%)		5%	-5%		1%	
Total Lost time (s)	5.0	6.0	6.0		6.0	6.0
Lane Util. Factor	0.97	0.95	0.91		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3347	3451	5173		1819	1628
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3347	3451	5173		1819	1628
Peak-hour factor, PHF	0.98	0.98	0.89	0.89	0.97	0.97
Adj. Flow (vph)	1226	2123	1892	101	109	907
RTOR Reduction (vph)	0	0	5	0	0	1
Lane Group Flow (vph)	1226	2123	1988	0	109	906
Turn Type	Prot					custom
Protected Phases	5	2	6		4	4
Permitted Phases						5
Actuated Green, G (s)	44.9	95.0	45.1		13.0	57.9
Effective Green, g (s)	44.9	95.0	45.1		13.0	57.9
Actuated g/C Ratio	0.37	0.79	0.38		0.11	0.48
Clearance Time (s)	5.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	1252	2732	1944		197	867
v/s Ratio Prot	0.37	0.62	c0.38		0.06	c0.11
v/s Ratio Perm						0.44
v/c Ratio	0.98	0.78	1.02		0.55	1.05
Uniform Delay, d1	37.1	6.8	37.4		50.7	31.0
Progression Factor	1.27	0.35	0.95		1.00	1.00
Incremental Delay, d2	9.6	0.7	25.3		3.3	43.1
Delay (s)	56.5	3.1	60.8		54.1	74.2
Level of Service	E	A	E		D	E
Approach Delay (s)		22.6	60.8		72.0	
Approach LOS		C	E		E	

Intersection Summary			
HCM Average Control Delay	42.5	HCM Level of Service	D
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	99.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Appendix G

Synchro HCM Reports for Year 2032 PM Peak Hours for Alternative 4 with I-476 Ramp Relocation



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	1742	35	16	1842	19	49	18	4	15	15	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	12	12	10	12	12	10	10	10	12	12	12
Grade (%)		-1%			1%			0%			0%	
Total Lost time (s)	6.0	6.0		6.0	6.0			6.0	6.0		6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	1.00		1.00	1.00			1.00	0.85		0.95	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.98	
Satd. Flow (prot)	1702	3512		1643	3516			1693	1492		1760	
Flt Permitted	0.95	1.00		0.95	1.00			0.72	1.00		0.87	
Satd. Flow (perm)	1702	3512		1643	3516			1264	1492		1550	
Peak-hour factor, PHF	0.95	0.95	0.95	0.89	0.89	0.89	0.93	0.93	0.93	0.59	0.59	0.59
Adj. Flow (vph)	119	1834	37	18	2070	21	53	19	4	25	25	29
RTOR Reduction (vph)	0	1	0	0	1	0	0	0	4	0	18	0
Lane Group Flow (vph)	119	1870	0	18	2090	0	0	72	0	0	61	0
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Turn Type	Prot			Prot			Perm		Perm	Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	11.4	92.0		2.0	82.6			8.0	8.0		8.0	
Effective Green, g (s)	11.4	92.0		2.0	82.6			8.0	8.0		8.0	
Actuated g/C Ratio	0.10	0.77		0.02	0.69			0.07	0.07		0.07	
Clearance Time (s)	6.0	6.0		6.0	6.0			6.0	6.0		6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	162	2693		27	2420			84	99		103	
v/s Ratio Prot	c0.07	c0.53		0.01	c0.59							
v/s Ratio Perm								c0.06	0.00		0.04	
v/c Ratio	0.73	0.69		0.67	0.86			0.86	0.00		0.59	
Uniform Delay, d1	52.8	7.0		58.7	14.4			55.4	52.3		54.4	
Progression Factor	1.00	1.00		1.06	0.49			1.00	1.00		1.00	
Incremental Delay, d2	15.8	1.5		36.4	3.2			53.4	0.0		8.9	
Delay (s)	68.6	8.5		98.8	10.2			108.8	52.3		63.3	
Level of Service	E	A		F	B			F	D		E	
Approach Delay (s)		12.1			11.0			105.8			63.3	
Approach LOS		B			B			F			E	

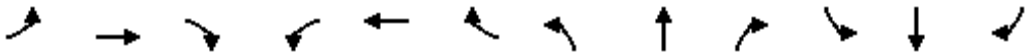
Intersection Summary			
HCM Average Control Delay	14.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	82.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1494	268	292	1209	0	279	0	529	1266	374	411
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-3%			3%			0%			0%	
Total Lost time (s)		6.0		6.0	6.0		6.0		6.0	6.0	6.0	6.0
Lane Util. Factor		0.86		0.97	0.95		1.00		0.88	0.97	0.95	1.00
Frt		0.98		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		6356		3382	3486		1770		2787	3433	3539	1583
Flt Permitted		1.00		0.95	1.00		0.47		1.00	0.95	1.00	1.00
Satd. Flow (perm)		6356		3382	3486		868		2787	3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1624	291	317	1314	0	303	0	575	1376	407	447
RTOR Reduction (vph)	0	27	0	0	0	0	0	0	0	0	0	23
Lane Group Flow (vph)	0	1888	0	317	1314	0	303	0	575	1376	407	424
Turn Type				Prot			D.Pm		Over	Perm		Perm
Protected Phases		2		1	6				1		4	
Permitted Phases							4			4		4
Actuated Green, G (s)		34.0		23.0	63.0		45.0		23.0	45.0	45.0	45.0
Effective Green, g (s)		34.0		23.0	63.0		45.0		23.0	45.0	45.0	45.0
Actuated g/C Ratio		0.28		0.19	0.52		0.38		0.19	0.38	0.38	0.38
Clearance Time (s)		6.0		6.0	6.0		6.0		6.0	6.0	6.0	6.0
Vehicle Extension (s)		3.0		3.0	3.0		3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		1801		648	1830		326		534	1287	1327	594
v/s Ratio Prot		c0.30		0.09	0.38				c0.21		0.11	
v/s Ratio Perm							0.35			c0.40		0.27
v/c Ratio		1.05		0.49	0.72		0.93		1.08	1.07	0.31	0.71
Uniform Delay, d1		43.0		43.3	21.7		36.0		48.5	37.5	26.5	32.0
Progression Factor		0.86		0.58	0.63		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		32.8		0.3	1.3		31.7		61.2	45.8	0.1	4.1
Delay (s)		69.9		25.5	15.1		67.7		109.7	83.3	26.6	36.1
Level of Service		E		C	B		E		F	F	C	D
Approach Delay (s)		69.9			17.1			95.2			63.5	
Approach LOS		E			B			F			E	

Intersection Summary			
HCM Average Control Delay	58.2	HCM Level of Service	E
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	95.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	456	2547	0	0	1445	0	329	0	530	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	12	12	12	12	12	13	13	12	12	12	12
Grade (%)		-5%			5%			0%			0%	
Total Lost time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Lane Util. Factor	1.00	0.91			0.91		0.95	0.91	0.95			
Frt	1.00	1.00			1.00		1.00	0.87	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.99	1.00			
Satd. Flow (prot)	1874	5212			4958		1754	1526	1519			
Flt Permitted	0.95	1.00			1.00		0.95	0.99	1.00			
Satd. Flow (perm)	1874	5212			4958		1754	1526	1519			
Peak-hour factor, PHF	0.98	0.98	0.98	0.93	0.93	0.93	0.96	0.96	0.96	0.92	0.92	0.92
Adj. Flow (vph)	465	2599	0	0	1554	0	343	0	552	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	465	2599	0	0	1554	0	309	293	293	0	0	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	1%	1%	1%	2%	2%	2%
Turn Type	Prot						Perm		Perm			
Protected Phases	5	2			6			8				
Permitted Phases							8		8			
Actuated Green, G (s)	32.3	82.9			44.6		25.1	25.1	25.1			
Effective Green, g (s)	32.3	82.9			44.6		25.1	25.1	25.1			
Actuated g/C Ratio	0.27	0.69			0.37		0.21	0.21	0.21			
Clearance Time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0			
Lane Grp Cap (vph)	504	3601			1843		367	319	318			
v/s Ratio Prot	c0.25	0.50			c0.31							
v/s Ratio Perm							0.18	0.19	c0.19			
v/c Ratio	0.92	0.72			0.84		0.84	0.92	0.92			
Uniform Delay, d1	42.6	11.4			34.5		45.5	46.4	46.5			
Progression Factor	0.90	0.60			0.88		1.00	1.00	1.00			
Incremental Delay, d2	3.1	0.1			3.3		15.9	30.0	30.9			
Delay (s)	41.4	7.0			33.5		61.4	76.4	77.4			
Level of Service	D	A			C		E	E	E			
Approach Delay (s)		12.2			33.5			71.6			0.0	
Approach LOS		B			C			E			A	

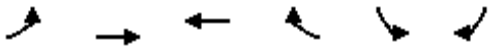
Intersection Summary			
HCM Average Control Delay	27.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	82.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2838	239	622	1942	209	444
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	-5%			1%	0%	
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.91	1.00	0.97	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	5212	1623	3416	3522	3433	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	8000	1623	3416	3522	3433	1583
Peak-hour factor, PHF	0.98	0.98	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2896	244	676	2111	227	483
RTOR Reduction (vph)	0	2	0	0	0	1
Lane Group Flow (vph)	2896	242	676	2111	227	482
Turn Type		pt+ov	Prot			custom
Protected Phases	2	2 8	1	6	8	8
Permitted Phases						1
Actuated Green, G (s)	69.0	86.0	22.0	97.0	11.0	33.0
Effective Green, g (s)	69.0	86.0	22.0	97.0	11.0	33.0
Actuated g/C Ratio	0.57	0.72	0.18	0.81	0.09	0.28
Clearance Time (s)	6.0		6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0		4.0	3.0	2.0	2.0
Lane Grp Cap (vph)	2997	1163	626	2847	315	514
v/s Ratio Prot	c0.56	0.15	c0.20	0.60	0.07	c0.09
v/s Ratio Perm						0.22
v/c Ratio	0.97	0.21	1.08	0.74	0.72	0.94
Uniform Delay, d1	24.4	5.7	49.0	5.5	53.0	42.5
Progression Factor	0.81	0.63	0.91	1.94	1.00	1.00
Incremental Delay, d2	7.9	0.0	39.2	0.2	6.7	24.7
Delay (s)	27.7	3.6	83.9	10.8	59.7	67.2
Level of Service	C	A	F	B	E	E
Approach Delay (s)	25.8			28.6	64.8	
Approach LOS	C			C	E	

Intersection Summary			
HCM Average Control Delay	31.1	HCM Level of Service	C
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	93.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

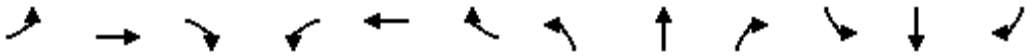


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	1201	2081	1684	90	106	880
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	13	13
Grade (%)		5%	-5%		1%	
Total Lost time (s)	5.0	6.0	6.0		6.0	6.0
Lane Util. Factor	0.97	0.95	0.91		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3347	3451	5173		1819	1628
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3347	3451	5173		1819	1628
Peak-hour factor, PHF	0.98	0.98	0.89	0.89	0.97	0.97
Adj. Flow (vph)	1226	2123	1892	101	109	907
RTOR Reduction (vph)	0	0	5	0	0	1
Lane Group Flow (vph)	1226	2123	1988	0	109	906
Turn Type	Prot					custom
Protected Phases	5	2	6		4	4
Permitted Phases						5
Actuated Green, G (s)	44.9	95.0	45.1		13.0	57.9
Effective Green, g (s)	44.9	95.0	45.1		13.0	57.9
Actuated g/C Ratio	0.37	0.79	0.38		0.11	0.48
Clearance Time (s)	5.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	1252	2732	1944		197	867
v/s Ratio Prot	0.37	0.62	c0.38		0.06	c0.11
v/s Ratio Perm						0.44
v/c Ratio	0.98	0.78	1.02		0.55	1.05
Uniform Delay, d1	37.1	6.8	37.4		50.7	31.0
Progression Factor	1.27	0.35	0.95		1.00	1.00
Incremental Delay, d2	9.6	0.7	25.3		3.3	43.1
Delay (s)	56.5	3.1	60.8		54.1	74.2
Level of Service	E	A	E		D	E
Approach Delay (s)		22.6	60.8		72.0	
Approach LOS		C	E		E	

Intersection Summary			
HCM Average Control Delay	42.5	HCM Level of Service	D
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	99.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Appendix H

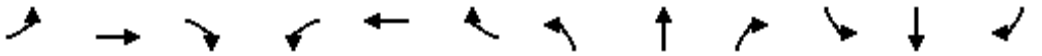
Synchro HCM Reports for Year 2032 PM Peak Hours for Alternative 5 with I-476 Ramp Relocation and Reverse Jughandle



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	1742	35	16	1842	19	49	18	4	15	15	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	12	12	10	12	12	10	10	10	12	12	12
Grade (%)		-1%			1%			0%			0%	
Total Lost time (s)	6.0	6.0		6.0	6.0			6.0	6.0		6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	1.00		1.00	1.00			1.00	0.85		0.95	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.98	
Satd. Flow (prot)	1702	3512		1643	3516			1693	1492		1760	
Flt Permitted	0.95	1.00		0.95	1.00			0.72	1.00		0.87	
Satd. Flow (perm)	1702	3512		1643	3516			1264	1492		1550	
Peak-hour factor, PHF	0.95	0.95	0.95	0.89	0.89	0.89	0.93	0.93	0.93	0.59	0.59	0.59
Adj. Flow (vph)	119	1834	37	18	2070	21	53	19	4	25	25	29
RTOR Reduction (vph)	0	1	0	0	1	0	0	0	4	0	18	0
Lane Group Flow (vph)	119	1870	0	18	2090	0	0	72	0	0	61	0
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Turn Type	Prot			Prot			Perm		Perm	Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	11.4	92.0		2.0	82.6			8.0	8.0		8.0	
Effective Green, g (s)	11.4	92.0		2.0	82.6			8.0	8.0		8.0	
Actuated g/C Ratio	0.10	0.77		0.02	0.69			0.07	0.07		0.07	
Clearance Time (s)	6.0	6.0		6.0	6.0			6.0	6.0		6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	162	2693		27	2420			84	99		103	
v/s Ratio Prot	c0.07	c0.53		0.01	c0.59							
v/s Ratio Perm								c0.06	0.00		0.04	
v/c Ratio	0.73	0.69		0.67	0.86			0.86	0.00		0.59	
Uniform Delay, d1	52.8	7.0		58.7	14.4			55.4	52.3		54.4	
Progression Factor	1.00	1.00		1.06	0.63			1.00	1.00		1.00	
Incremental Delay, d2	15.8	1.5		33.9	2.9			53.4	0.0		8.9	
Delay (s)	68.6	8.5		96.0	12.0			108.8	52.3		63.3	
Level of Service	E	A		F	B			F	D		E	
Approach Delay (s)		12.1			12.7			105.8			63.3	
Approach LOS		B			B			F			E	

Intersection Summary			
HCM Average Control Delay	15.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	82.1%	ICU Level of Service	E
Analysis Period (min)	15		

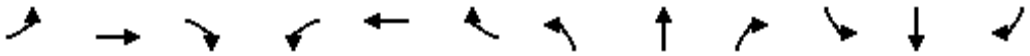
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1494	268	0	1501	0	279	0	529	1266	666	411
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-3%			3%			0%			0%	
Total Lost time (s)		6.0			6.0		6.0		6.0	6.0	6.0	6.0
Lane Util. Factor		0.86			0.86		0.97		0.88	0.97	0.95	1.00
Frt		0.98			1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00			1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		6356			6312		3433		2787	3433	3539	1583
Flt Permitted		1.00			1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		6356			6312		3433		2787	3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1624	291	0	1632	0	303	0	575	1376	724	447
RTOR Reduction (vph)	0	27	0	0	0	0	0	0	0	0	0	34
Lane Group Flow (vph)	0	1888	0	0	1632	0	303	0	575	1376	724	413
Turn Type							Prot		custom	Split		Perm
Protected Phases		2			6		3		3	7	7	
Permitted Phases												7
Actuated Green, G (s)		34.0			34.0		23.0		23.0	45.0	45.0	45.0
Effective Green, g (s)		34.0			34.0		23.0		23.0	45.0	45.0	45.0
Actuated g/C Ratio		0.28			0.28		0.19		0.19	0.38	0.38	0.38
Clearance Time (s)		6.0			6.0		6.0		6.0	6.0	6.0	6.0
Vehicle Extension (s)		3.0			3.0		3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		1801			1788		658		534	1287	1327	594
v/s Ratio Prot		c0.30			0.26		0.09		c0.21	c0.40	0.20	
v/s Ratio Perm												0.26
v/c Ratio		1.05			0.91		0.46		1.08	1.07	0.55	0.69
Uniform Delay, d1		43.0			41.6		43.0		48.5	37.5	29.5	31.7
Progression Factor		0.99			0.61		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		32.8			5.1		0.5		61.2	45.8	0.5	3.5
Delay (s)		75.5			30.4		43.5		109.7	83.3	30.0	35.2
Level of Service		E			C		D		F	F	C	D
Approach Delay (s)		75.5			30.4			86.9			59.7	
Approach LOS		E			C			F			E	

Intersection Summary			
HCM Average Control Delay	60.6	HCM Level of Service	E
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	95.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	456	2547	0	0	1445	0	329	0	530	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	12	12	12	12	12	13	13	12	12	12	12
Grade (%)		-5%			5%			0%			0%	
Total Lost time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Lane Util. Factor	1.00	0.91			0.91		0.95	0.91	0.95			
Frt	1.00	1.00			1.00		1.00	0.87	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.99	1.00			
Satd. Flow (prot)	1874	5212			4958		1754	1526	1519			
Flt Permitted	0.95	1.00			1.00		0.95	0.99	1.00			
Satd. Flow (perm)	1874	5212			4958		1754	1526	1519			
Peak-hour factor, PHF	0.98	0.98	0.98	0.93	0.93	0.93	0.96	0.96	0.96	0.92	0.92	0.92
Adj. Flow (vph)	465	2599	0	0	1554	0	343	0	552	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	465	2599	0	0	1554	0	309	293	293	0	0	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	1%	1%	1%	2%	2%	2%
Turn Type	Prot						Perm		Perm			
Protected Phases	5	2			6			8				
Permitted Phases							8		8			
Actuated Green, G (s)	32.3	82.9			44.6		25.1	25.1	25.1			
Effective Green, g (s)	32.3	82.9			44.6		25.1	25.1	25.1			
Actuated g/C Ratio	0.27	0.69			0.37		0.21	0.21	0.21			
Clearance Time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0			
Lane Grp Cap (vph)	504	3601			1843		367	319	318			
v/s Ratio Prot	c0.25	0.50			c0.31							
v/s Ratio Perm							0.18	0.19	c0.19			
v/c Ratio	0.92	0.72			0.84		0.84	0.92	0.92			
Uniform Delay, d1	42.6	11.4			34.5		45.5	46.4	46.5			
Progression Factor	1.12	1.30			0.89		1.00	1.00	1.00			
Incremental Delay, d2	3.1	0.1			3.3		15.9	30.0	30.9			
Delay (s)	50.7	15.0			34.0		61.4	76.4	77.4			
Level of Service	D	B			C		E	E	E			
Approach Delay (s)		20.5			34.0			71.6			0.0	
Approach LOS		C			C			E			A	

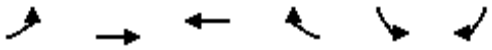
Intersection Summary			
HCM Average Control Delay	32.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	82.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2838	239	622	1942	209	444
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	-5%			1%	0%	
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.91	1.00	0.97	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	5212	1623	3416	3522	3433	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	8000	1623	3416	3522	3433	1583
Peak-hour factor, PHF	0.98	0.98	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2896	244	676	2111	227	483
RTOR Reduction (vph)	0	2	0	0	0	1
Lane Group Flow (vph)	2896	242	676	2111	227	482
Turn Type		pt+ov	Prot			custom
Protected Phases	2	2 8	1	6	8	8
Permitted Phases						1
Actuated Green, G (s)	69.0	86.0	22.0	97.0	11.0	33.0
Effective Green, g (s)	69.0	86.0	22.0	97.0	11.0	33.0
Actuated g/C Ratio	0.57	0.72	0.18	0.81	0.09	0.28
Clearance Time (s)	6.0		6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0		4.0	3.0	2.0	2.0
Lane Grp Cap (vph)	2997	1163	626	2847	315	514
v/s Ratio Prot	c0.56	0.15	c0.20	0.60	0.07	c0.09
v/s Ratio Perm						0.22
v/c Ratio	0.97	0.21	1.08	0.74	0.72	0.94
Uniform Delay, d1	24.4	5.7	49.0	5.5	53.0	42.5
Progression Factor	0.68	0.71	0.90	2.31	1.00	1.00
Incremental Delay, d2	7.9	0.0	39.2	0.2	6.7	24.7
Delay (s)	24.4	4.1	83.3	12.8	59.7	67.2
Level of Service	C	A	F	B	E	E
Approach Delay (s)	22.8			29.9	64.8	
Approach LOS	C			C	E	

Intersection Summary			
HCM Average Control Delay	30.3	HCM Level of Service	C
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	93.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

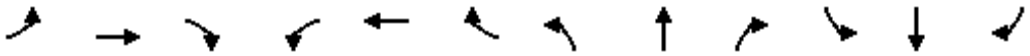


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	1201	2081	1684	90	106	880
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	13	13
Grade (%)		5%	-5%		1%	
Total Lost time (s)	5.0	6.0	6.0		6.0	6.0
Lane Util. Factor	0.97	0.95	0.91		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3347	3451	5173		1819	1628
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3347	3451	5173		1819	1628
Peak-hour factor, PHF	0.98	0.98	0.89	0.89	0.97	0.97
Adj. Flow (vph)	1226	2123	1892	101	109	907
RTOR Reduction (vph)	0	0	5	0	0	0
Lane Group Flow (vph)	1226	2123	1988	0	109	907
Turn Type	Prot					custom
Protected Phases	5	2	6		4	4
Permitted Phases						5
Actuated Green, G (s)	47.7	95.0	42.3		13.0	60.7
Effective Green, g (s)	47.7	95.0	42.3		13.0	60.7
Actuated g/C Ratio	0.40	0.79	0.35		0.11	0.51
Clearance Time (s)	5.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	1330	2732	1823		197	905
v/s Ratio Prot	0.37	0.62	c0.38		0.06	c0.11
v/s Ratio Perm						0.45
v/c Ratio	0.92	0.78	1.09		0.55	1.00
Uniform Delay, d1	34.4	6.8	38.8		50.7	29.6
Progression Factor	1.26	0.38	0.95		1.00	1.00
Incremental Delay, d2	3.8	0.7	49.6		3.3	30.5
Delay (s)	47.0	3.3	86.5		54.1	60.1
Level of Service	D	A	F		D	E
Approach Delay (s)		19.3	86.5		59.5	
Approach LOS		B	F		E	

Intersection Summary			
HCM Average Control Delay	46.8	HCM Level of Service	D
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	99.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Appendix I

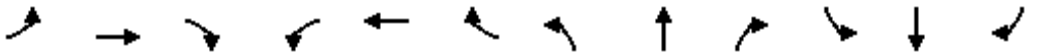
Synchro HCM Reports for Year 2032 PM Peak Hours for Alternative 6 with I-476 Ramp Relocation and Modified Continuous Flow Intersection



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	1742	35	16	1842	19	49	18	4	15	15	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	12	12	10	12	12	10	10	10	12	12	12
Grade (%)		-1%			1%			0%			0%	
Total Lost time (s)	6.0	6.0		6.0	6.0			6.0	6.0		6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	1.00		1.00	1.00			1.00	0.85		0.95	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.98	
Satd. Flow (prot)	1702	3512		1643	3516			1693	1492		1760	
Flt Permitted	0.95	1.00		0.95	1.00			0.72	1.00		0.87	
Satd. Flow (perm)	1702	3512		1643	3516			1264	1492		1550	
Peak-hour factor, PHF	0.95	0.95	0.95	0.89	0.89	0.89	0.93	0.93	0.93	0.59	0.59	0.59
Adj. Flow (vph)	119	1834	37	18	2070	21	53	19	4	25	25	29
RTOR Reduction (vph)	0	1	0	0	1	0	0	0	4	0	18	0
Lane Group Flow (vph)	119	1870	0	18	2090	0	0	72	0	0	61	0
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Turn Type	Prot			Prot			Perm		Perm	Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	11.4	92.0		2.0	82.6			8.0	8.0		8.0	
Effective Green, g (s)	11.4	92.0		2.0	82.6			8.0	8.0		8.0	
Actuated g/C Ratio	0.10	0.77		0.02	0.69			0.07	0.07		0.07	
Clearance Time (s)	6.0	6.0		6.0	6.0			6.0	6.0		6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	162	2693		27	2420			84	99		103	
v/s Ratio Prot	c0.07	c0.53		0.01	c0.59							
v/s Ratio Perm								c0.06	0.00		0.04	
v/c Ratio	0.73	0.69		0.67	0.86			0.86	0.00		0.59	
Uniform Delay, d1	52.8	7.0		58.7	14.4			55.4	52.3		54.4	
Progression Factor	1.00	1.00		1.04	0.57			1.00	1.00		1.00	
Incremental Delay, d2	15.8	1.5		38.4	3.4			53.4	0.0		8.9	
Delay (s)	68.6	8.5		99.4	11.6			108.8	52.3		63.3	
Level of Service	E	A		F	B			F	D		E	
Approach Delay (s)		12.1			12.3			105.8			63.3	
Approach LOS		B			B			F			E	

Intersection Summary			
HCM Average Control Delay	14.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	82.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1494	268	292	1209	0	279	0	529	1266	0	411
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-3%			3%			0%			0%	
Total Lost time (s)		6.0	4.0	6.0	6.0		6.0		6.0	6.0		6.0
Lane Util. Factor		0.91	1.00	0.97	0.95		1.00		0.88	0.97		1.00
Frt		1.00	0.85	1.00	1.00		1.00		0.85	1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95		1.00	0.95		1.00
Satd. Flow (prot)		5162	1607	3382	3486		1770		2787	3433		1583
Flt Permitted		1.00	1.00	0.95	1.00		0.76		1.00	0.95		1.00
Satd. Flow (perm)		5162	1607	3382	3486		1410		2787	3433		1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1624	291	317	1314	0	303	0	575	1376	0	447
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	22
Lane Group Flow (vph)	0	1624	291	317	1314	0	303	0	575	1376	0	425
Turn Type			Free	Prot			D.Pm		Over	Perm		Perm
Protected Phases		2		1	6				1		4	
Permitted Phases			Free				4			4		4
Actuated Green, G (s)		35.0	120.0	21.0	62.0		46.0		21.0	46.0		46.0
Effective Green, g (s)		35.0	120.0	21.0	62.0		46.0		21.0	46.0		46.0
Actuated g/C Ratio		0.29	1.00	0.18	0.52		0.38		0.18	0.38		0.38
Clearance Time (s)		6.0		6.0	6.0		6.0		6.0	6.0		6.0
Vehicle Extension (s)		3.0		3.0	3.0		3.0		3.0	3.0		3.0
Lane Grp Cap (vph)		1506	1607	592	1801		541		488	1316		607
v/s Ratio Prot		c0.31		0.09	0.38				c0.21			
v/s Ratio Perm			0.18				0.21			c0.40		0.27
v/c Ratio		1.08	0.18	0.54	0.73		0.56		1.18	1.05		0.70
Uniform Delay, d1		42.5	0.0	45.1	22.5		29.1		49.5	37.0		31.2
Progression Factor		0.86	1.00	0.63	0.61		1.18		1.00	1.00		1.00
Incremental Delay, d2		45.2	0.2	0.5	1.4		1.1		99.6	37.6		3.7
Delay (s)		81.9	0.2	28.7	15.2		35.4		149.1	74.6		34.9
Level of Service		F	A	C	B		D		F	E		C
Approach Delay (s)		69.5			17.8			109.9			64.9	
Approach LOS		E			B			F			E	

Intersection Summary			
HCM Average Control Delay	60.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	98.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	456	2547	0	0	1445	0	329	0	530	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	12	12	12	12	12	13	13	12	12	12	12
Grade (%)		-5%			5%			0%			0%	
Total Lost time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Lane Util. Factor	1.00	0.91			0.91		0.95	0.91	0.95			
Frt	1.00	1.00			1.00		1.00	0.87	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.99	1.00			
Satd. Flow (prot)	1874	5212			4958		1754	1526	1519			
Flt Permitted	0.95	1.00			1.00		0.95	0.99	1.00			
Satd. Flow (perm)	1874	5212			4958		1754	1526	1519			
Peak-hour factor, PHF	0.98	0.98	0.98	0.93	0.93	0.93	0.96	0.96	0.96	0.92	0.92	0.92
Adj. Flow (vph)	465	2599	0	0	1554	0	343	0	552	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	465	2599	0	0	1554	0	309	293	293	0	0	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	1%	1%	1%	2%	2%	2%
Turn Type	Prot						Perm		Perm			
Protected Phases	5	2			6			8				
Permitted Phases							8		8			
Actuated Green, G (s)	32.3	82.9			44.6		25.1	25.1	25.1			
Effective Green, g (s)	32.3	82.9			44.6		25.1	25.1	25.1			
Actuated g/C Ratio	0.27	0.69			0.37		0.21	0.21	0.21			
Clearance Time (s)	6.0	6.0			6.0		6.0	6.0	6.0			
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0			
Lane Grp Cap (vph)	504	3601			1843		367	319	318			
v/s Ratio Prot	c0.25	0.50			c0.31							
v/s Ratio Perm							0.18	0.19	c0.19			
v/c Ratio	0.92	0.72			0.84		0.84	0.92	0.92			
Uniform Delay, d1	42.6	11.4			34.5		45.5	46.4	46.5			
Progression Factor	0.91	0.66			0.90		1.00	1.00	1.00			
Incremental Delay, d2	3.1	0.1			3.3		15.9	30.0	30.9			
Delay (s)	41.9	7.7			34.4		61.4	76.4	77.4			
Level of Service	D	A			C		E	E	E			
Approach Delay (s)		12.9			34.4			71.6			0.0	
Approach LOS		B			C			E			A	

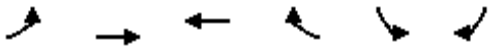
Intersection Summary			
HCM Average Control Delay	28.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	82.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2838	239	622	1942	209	444
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	-5%			1%	0%	
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.91	1.00	0.97	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	5212	1623	3416	3522	3433	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	8000	1623	3416	3522	3433	1583
Peak-hour factor, PHF	0.98	0.98	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2896	244	676	2111	227	483
RTOR Reduction (vph)	0	2	0	0	0	1
Lane Group Flow (vph)	2896	242	676	2111	227	482
Turn Type		pt+ov	Prot			custom
Protected Phases	2	2 8	1	6	8	8
Permitted Phases						1
Actuated Green, G (s)	69.0	86.0	22.0	97.0	11.0	33.0
Effective Green, g (s)	69.0	86.0	22.0	97.0	11.0	33.0
Actuated g/C Ratio	0.57	0.72	0.18	0.81	0.09	0.28
Clearance Time (s)	6.0		6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0		4.0	3.0	2.0	2.0
Lane Grp Cap (vph)	2997	1163	626	2847	315	514
v/s Ratio Prot	c0.56	0.15	c0.20	0.60	0.07	c0.09
v/s Ratio Perm						0.22
v/c Ratio	0.97	0.21	1.08	0.74	0.72	0.94
Uniform Delay, d1	24.4	5.7	49.0	5.5	53.0	42.5
Progression Factor	0.79	0.62	0.89	2.42	1.00	1.00
Incremental Delay, d2	7.9	0.0	39.2	0.2	6.7	24.7
Delay (s)	27.2	3.5	82.7	13.5	59.7	67.2
Level of Service	C	A	F	B	E	E
Approach Delay (s)	25.4			30.3	64.8	
Approach LOS	C			C	E	

Intersection Summary			
HCM Average Control Delay	31.7	HCM Level of Service	C
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	93.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	1201	2081	1684	90	106	880
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	13	13
Grade (%)		5%	-5%		1%	
Total Lost time (s)	5.0	6.0	6.0		6.0	6.0
Lane Util. Factor	0.97	0.95	0.91		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3347	3451	5173		1819	1628
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3347	3451	5173		1819	1628
Peak-hour factor, PHF	0.98	0.98	0.89	0.89	0.97	0.97
Adj. Flow (vph)	1226	2123	1892	101	109	907
RTOR Reduction (vph)	0	0	5	0	0	0
Lane Group Flow (vph)	1226	2123	1988	0	109	907
Turn Type	Prot					custom
Protected Phases	5	2	6		4	4
Permitted Phases						5
Actuated Green, G (s)	48.2	95.0	41.8		13.0	61.2
Effective Green, g (s)	48.2	95.0	41.8		13.0	61.2
Actuated g/C Ratio	0.40	0.79	0.35		0.11	0.51
Clearance Time (s)	5.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	1344	2732	1802		197	912
v/s Ratio Prot	0.37	0.62	c0.38		0.06	c0.11
v/s Ratio Perm						0.45
v/c Ratio	0.91	0.78	1.10		0.55	0.99
Uniform Delay, d1	33.9	6.8	39.1		50.7	29.2
Progression Factor	1.24	0.35	0.95		1.00	1.00
Incremental Delay, d2	3.3	0.7	54.7		3.3	28.3
Delay (s)	45.2	3.1	91.8		54.1	57.5
Level of Service	D	A	F		D	E
Approach Delay (s)		18.5	91.8		57.1	
Approach LOS		B	F		E	

Intersection Summary			
HCM Average Control Delay	47.7	HCM Level of Service	D
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	99.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Appendix J

SimTraffic Queue Report for Existing PM Peak Hour

Intersection: 2: West Chester Pike & N Lawrence Rd

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	L	L	T	T	T	T	TR	L	R
Maximum Queue (ft)	360	671	562	103	588	635	643	677	672
Average Queue (ft)	347	471	85	59	376	387	399	158	394
95th Queue (ft)	376	649	334	96	566	585	595	476	631
Link Distance (ft)		663	663	663	630	630	630	760	760
Upstream Blk Time (%)		1	1		1	1	2	0	0
Queuing Penalty (veh)		5	6		5	7	9	0	0
Storage Bay Dist (ft)	290								
Storage Blk Time (%)	30	35							
Queuing Penalty (veh)	165	190							

Intersection: 3: West Chester Pike & N New Ardmore Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB
Directions Served	L	T	TR	L	T	TR	LT	R	LTR
Maximum Queue (ft)	160	278	245	52	273	344	127	29	82
Average Queue (ft)	83	109	99	14	72	106	61	4	38
95th Queue (ft)	141	230	211	39	184	255	112	19	75
Link Distance (ft)		722	722		288	288	415	415	310
Upstream Blk Time (%)					0	0			
Queuing Penalty (veh)					0	4			
Storage Bay Dist (ft)	180			145					
Storage Blk Time (%)		2			1				
Queuing Penalty (veh)		2			0				

Intersection: 6: West Chester Pike &

Movement	EB	EB	B9	B9	WB
Directions Served	T	TR	T	T	T
Maximum Queue (ft)	46	46	30	36	0
Average Queue (ft)	2	2	1	1	0
95th Queue (ft)	32	32	21	26	0
Link Distance (ft)	158	158	109	109	419
Upstream Blk Time (%)	0	0	0	0	
Queuing Penalty (veh)	1	1	0	0	
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 10: West Chester Pike & I-476 SB Off-Ramp

Movement	EB	EB	EB	WB	WB	SB	SB	SB
Directions Served	T	T	T	T	T	L	L	T
Maximum Queue (ft)	364	502	497	407	387	455	660	11
Average Queue (ft)	273	288	302	132	143	426	569	1
95th Queue (ft)	371	439	444	245	256	504	762	7
Link Distance (ft)		419	419	663	663		471	
Upstream Blk Time (%)		1	2			0	19	
Queuing Penalty (veh)		9	11			0	281	
Storage Bay Dist (ft)	340					415		200
Storage Blk Time (%)	3	3				18	45	
Queuing Penalty (veh)	13	12				133	332	

Intersection: 12: I-476 SB Off-Ramp &

Movement	SW	SW
Directions Served	T	R
Maximum Queue (ft)	773	450
Average Queue (ft)	377	107
95th Queue (ft)	938	413
Link Distance (ft)	748	
Upstream Blk Time (%)	9	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		350
Storage Blk Time (%)	11	1
Queuing Penalty (veh)	43	13

Intersection: 15: West Chester Pike & I-476 NB

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	T	T	T	L	LT	R
Maximum Queue (ft)	533	736	746	751	540	535	130	138	136	484
Average Queue (ft)	303	456	455	458	324	321	92	60	72	262
95th Queue (ft)	501	874	870	865	541	526	155	118	123	434
Link Distance (ft)		663	663	663	451	451				1115
Upstream Blk Time (%)		9	7	7	3	2				
Queuing Penalty (veh)		87	71	63	17	14				
Storage Bay Dist (ft)	510						90	520	520	
Storage Blk Time (%)	2	11				41	9			0
Queuing Penalty (veh)	17	36				180	39			1

Intersection: 18: West Chester Pike & S Lawrence Rd

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	T	T	T	R	L	L	T	T	L	L	R
Maximum Queue (ft)	174	161	167	158	337	410	536	522	177	473	250
Average Queue (ft)	158	146	153	88	227	241	318	369	60	169	183
95th Queue (ft)	169	180	175	184	320	365	481	506	127	360	283
Link Distance (ft)	63	63	63	63		663	663	663	688	688	
Upstream Blk Time (%)	50	41	46	7		0	0				
Queuing Penalty (veh)	381	313	347	57		0	0				
Storage Bay Dist (ft)					290						200
Storage Blk Time (%)					3	4				1	10
Queuing Penalty (veh)					7	11				3	14

Intersection: 20: West Chester Pike &

Movement	EB	EB	EB	EB	WB	WB
Directions Served	T	T	T	T	T	TR
Maximum Queue (ft)	489	497	517	374	88	93
Average Queue (ft)	415	416	389	40	6	7
95th Queue (ft)	577	574	592	193	45	48
Link Distance (ft)	451	451	451	451	63	63
Upstream Blk Time (%)	14	11	6	0	1	1
Queuing Penalty (veh)	110	86	48	1	6	5
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 24: West Chester Pike & Mather Avenue

Movement	EB	EB	WB	WB	B9	B9	SB
Directions Served	T	T	T	TR	T	T	R
Maximum Queue (ft)	31	23	6	91	39	47	52
Average Queue (ft)	1	1	0	4	1	2	12
95th Queue (ft)	22	16	5	47	21	28	38
Link Distance (ft)	288	288	109	109	158	158	143
Upstream Blk Time (%)				0			
Queuing Penalty (veh)				1			
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 26: West Chester Pike &

Movement	EB	EB	WB	WB	WB	WB	NB	NB	SB
Directions Served	T	TR	L	T	T	TR	LT	R	LR
Maximum Queue (ft)	556	566	146	215	222	185	250	110	30
Average Queue (ft)	382	391	49	60	69	66	109	61	4
95th Queue (ft)	519	527	110	177	182	156	206	116	21
Link Distance (ft)	630	630		1248	1248		599		180
Upstream Blk Time (%)	0	0							
Queuing Penalty (veh)	0	1							
Storage Bay Dist (ft)			170			300		70	
Storage Blk Time (%)			0	1	0	0	29	4	
Queuing Penalty (veh)			1	0	2	1	36	6	

Network Summary

Network wide Queuing Penalty: 3206

Appendix K

SimTraffic Queuing Report for Year 2032 PM Peak Hour with Proposed Improvements

Intersection: 2: West Chester Pike & N Lawrence Rd

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	L	L	T	T	T	T	TR	L	R
Maximum Queue (ft)	360	689	675	534	678	680	679	394	778
Average Queue (ft)	354	540	109	85	614	618	618	115	597
95th Queue (ft)	373	711	373	241	764	765	749	297	857
Link Distance (ft)		664	664	664	629	629	629		761
Upstream Blk Time (%)		2	0	0	33	33	35		7
Queuing Penalty (veh)		23	4	2	196	192	204		0
Storage Bay Dist (ft)	290							325	
Storage Blk Time (%)	34	37							23
Queuing Penalty (veh)	204	223							24

Intersection: 3: West Chester Pike & N New Ardmore Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB
Directions Served	L	T	TR	L	T	TR	LT	R	LTR
Maximum Queue (ft)	168	360	390	115	347	353	134	30	111
Average Queue (ft)	95	113	123	14	199	224	56	4	35
95th Queue (ft)	154	259	263	60	353	379	111	21	85
Link Distance (ft)		722	722		271	271	415	415	310
Upstream Blk Time (%)					2	3			
Queuing Penalty (veh)					20	27			
Storage Bay Dist (ft)	180			145					
Storage Blk Time (%)	0	2			6				
Queuing Penalty (veh)	1	2			1				

Intersection: 6: West Chester Pike & Langford

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	T	T	T	R	L	T	T	L	L	R
Maximum Queue (ft)	325	340	346	206	439	320	282	152	435	462
Average Queue (ft)	203	209	215	61	299	180	187	88	107	274
95th Queue (ft)	321	325	341	148	411	270	263	138	272	457
Link Distance (ft)	280	280	280	280		598	598		676	
Upstream Blk Time (%)	2	1	2	0					0	
Queuing Penalty (veh)	7	6	10	0					0	
Storage Bay Dist (ft)					450			200		400
Storage Blk Time (%)					0				0	1
Queuing Penalty (veh)					4				0	3

Intersection: 10: West Chester Pike & I-476 SB Off-Ramp

Movement	EB	EB	EB	WB	WB	SB	SB	SB
Directions Served	T	T	TR	T	T	L	L	TR
Maximum Queue (ft)	421	370	346	269	273	636	640	505
Average Queue (ft)	182	153	126	161	154	553	557	310
95th Queue (ft)	319	265	236	237	233	701	706	445
Link Distance (ft)	598	598	598	676	676	574	574	574
Upstream Blk Time (%)						13	14	0
Queuing Penalty (veh)						86	95	0
Storage Bay Dist (ft)								
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 12: I-476 SB Off-Ramp &

Movement	SW	SW	SW	B13
Directions Served	T	T	T	T
Maximum Queue (ft)	207	193	177	71
Average Queue (ft)	88	85	25	8
95th Queue (ft)	292	279	154	90
Link Distance (ft)	361	361	361	339
Upstream Blk Time (%)	1	1	0	1
Queuing Penalty (veh)	0	0	0	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 15: West Chester Pike & I-476 NB

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	T	T	T	L	LR	R
Maximum Queue (ft)	532	642	624	516	518	521	130	259	321	314
Average Queue (ft)	403	198	195	208	343	350	86	158	219	218
95th Queue (ft)	534	467	429	413	477	481	159	250	310	306
Link Distance (ft)		676	676	676	451	451				1115
Upstream Blk Time (%)		1	0	0	1	2				
Queuing Penalty (veh)		8	1	1	8	13				
Storage Bay Dist (ft)	510						90	520	520	
Storage Blk Time (%)	6	0				37	9			
Queuing Penalty (veh)	52	0				176	44			

Intersection: 18: West Chester Pike & S Lawrence Rd

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	T	T	T	R	L	L	T	T	L	L	R
Maximum Queue (ft)	176	172	178	158	341	403	377	469	318	607	250
Average Queue (ft)	158	153	155	81	250	259	246	332	71	301	228
95th Queue (ft)	166	175	174	149	349	377	387	439	258	604	293
Link Distance (ft)	63	63	63	63		664	664	664	688	688	
Upstream Blk Time (%)	39	31	35	9					0	0	
Queuing Penalty (veh)	326	255	292	76					0	0	
Storage Bay Dist (ft)					290						200
Storage Blk Time (%)					3	3				6	26
Queuing Penalty (veh)					9	10				26	27

Intersection: 20: West Chester Pike &

Movement	EB	EB	EB	EB	WB	WB
Directions Served	T	T	T	T	T	TR
Maximum Queue (ft)	554	557	524	416	27	74
Average Queue (ft)	371	348	307	21	1	5
95th Queue (ft)	654	639	574	167	13	47
Link Distance (ft)	451	451	451	451	63	63
Upstream Blk Time (%)	7	5	2		0	0
Queuing Penalty (veh)	59	42	20		1	4
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 24: West Chester Pike & Mather Avenue

Movement	EB	EB	EB	WB	WB	SB
Directions Served	T	T	T	T	TR	R
Maximum Queue (ft)	27	12	91	133	160	42
Average Queue (ft)	1	0	4	12	20	12
95th Queue (ft)	15	5	39	67	91	38
Link Distance (ft)		271	271	280	280	147
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	50					
Storage Blk Time (%)	0					
Queuing Penalty (veh)	1					

Intersection: 26: West Chester Pike &

Movement	EB	EB	WB	WB	WB	WB	NB	NB	SB
Directions Served	T	TR	L	T	T	TR	LT	R	LR
Maximum Queue (ft)	340	346	220	1276	1281	350	446	110	34
Average Queue (ft)	146	158	101	693	686	270	182	70	3
95th Queue (ft)	271	284	219	1494	1471	470	375	128	17
Link Distance (ft)	629	629		1248	1248		599		180
Upstream Blk Time (%)				17	15		1		
Queuing Penalty (veh)				0	0		0		
Storage Bay Dist (ft)			170			300		70	
Storage Blk Time (%)			3	41	33	21	46	9	
Queuing Penalty (veh)			18	27	183	116	58	14	

Network Summary

Network wide Queuing Penalty: 3202

Appendix L

SimTraffic Queuing Report for Year 2032 PM Peak Hour with Alternative 1

Intersection: 2: West Chester Pike & N Lawrence Rd

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	L	L	T	T	T	T	TR	L	R
Maximum Queue (ft)	360	684	687	249	591	609	604	394	793
Average Queue (ft)	352	515	141	83	431	448	463	134	668
95th Queue (ft)	379	710	475	202	608	620	626	327	944
Link Distance (ft)		664	664	664	629	629	629		761
Upstream Blk Time (%)		3	2	0	1	0	1		26
Queuing Penalty (veh)		32	17	0	3	2	4		0
Storage Bay Dist (ft)	290							325	
Storage Blk Time (%)	37	40							39
Queuing Penalty (veh)	224	239							41

Intersection: 3: West Chester Pike & N New Ardmore Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB
Directions Served	L	T	TR	L	T	TR	LT	R	LTR
Maximum Queue (ft)	185	327	337	52	202	225	119	30	99
Average Queue (ft)	82	131	149	10	104	129	50	3	33
95th Queue (ft)	159	261	286	34	172	197	102	16	74
Link Distance (ft)		722	722		271	271	415	415	310
Upstream Blk Time (%)					0	0			
Queuing Penalty (veh)					0	0			
Storage Bay Dist (ft)	180			145					
Storage Blk Time (%)	0	2			1				
Queuing Penalty (veh)	4	2			0				

Intersection: 6: West Chester Pike & I-476 SB Off Ramp

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	T	T	T	R	L	L	T	T	L	R	R	L
Maximum Queue (ft)	453	517	544	275	147	177	254	295	500	775	499	692
Average Queue (ft)	330	362	371	187	67	76	70	89	476	660	212	523
95th Queue (ft)	462	507	541	336	124	138	172	213	570	1008	429	734
Link Distance (ft)	627	627	627				242	242		743		
Upstream Blk Time (%)			0			0	0	1		47		
Queuing Penalty (veh)			0			0	1	5		0		
Storage Bay Dist (ft)				200	200	200			400		400	900
Storage Blk Time (%)			26	1	0	0	0		70	1	0	
Queuing Penalty (veh)			70	4	0	0	1		368	3	2	

Intersection: 6: West Chester Pike & I-476 SB Off Ramp

Movement	SB	SB	SB
Directions Served	L	T	R
Maximum Queue (ft)	730	710	346
Average Queue (ft)	541	361	173
95th Queue (ft)	752	766	313
Link Distance (ft)		1449	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	900		300
Storage Blk Time (%)		2	1
Queuing Penalty (veh)		39	11

Intersection: 10: West Chester Pike & I-476 SB Off-Ramp

Movement	EB	WB	WB
Directions Served	T	T	T
Maximum Queue (ft)	5	102	153
Average Queue (ft)	0	3	7
95th Queue (ft)	4	42	66
Link Distance (ft)	242	679	679
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 15: West Chester Pike & I-476 NB

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	T	T	T	L	LR	R
Maximum Queue (ft)	515	504	462	359	528	520	130	241	304	303
Average Queue (ft)	312	171	166	147	357	361	119	158	209	208
95th Queue (ft)	517	444	398	293	535	534	149	230	284	284
Link Distance (ft)		679	679	679	451	451				1115
Upstream Blk Time (%)		0	0		2	2				
Queuing Penalty (veh)		2	0		16	15				
Storage Bay Dist (ft)	510						90	520	520	
Storage Blk Time (%)	2	0				35	27			
Queuing Penalty (veh)	14	0				170	130			

Intersection: 18: West Chester Pike & S Lawrence Rd

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	T	T	T	R	L	L	T	T	L	L	R
Maximum Queue (ft)	176	167	168	95	360	675	707	501	356	607	250
Average Queue (ft)	156	150	156	34	322	460	320	291	83	254	227
95th Queue (ft)	172	189	168	82	414	730	623	436	237	520	288
Link Distance (ft)	63	63	63	63		664	664	664	688	688	
Upstream Blk Time (%)	36	30	33	2		6	2	0	0	0	
Queuing Penalty (veh)	276	228	257	18		55	13	0	0	0	
Storage Bay Dist (ft)					290						200
Storage Blk Time (%)					34	38				2	22
Queuing Penalty (veh)					106	118				7	23

Intersection: 20: West Chester Pike &

Movement	EB	EB	EB	WB	WB
Directions Served	T	T	T	T	TR
Maximum Queue (ft)	551	545	538	101	105
Average Queue (ft)	286	272	240	10	11
95th Queue (ft)	581	570	525	68	73
Link Distance (ft)	451	451	451	63	63
Upstream Blk Time (%)	4	3	2	1	1
Queuing Penalty (veh)	34	26	17	8	9
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 24: West Chester Pike & Mather Avenue

Movement	SB
Directions Served	R
Maximum Queue (ft)	61
Average Queue (ft)	15
95th Queue (ft)	44
Link Distance (ft)	147
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 26: West Chester Pike &

Movement	EB	EB	WB	WB	WB	WB	NB	NB	SB
Directions Served	T	TR	L	T	T	TR	LT	R	LR
Maximum Queue (ft)	295	309	173	174	207	193	343	110	30
Average Queue (ft)	142	156	79	60	70	68	170	76	4
95th Queue (ft)	271	286	164	140	149	137	330	133	20
Link Distance (ft)	629	629		1248	1248		599		180
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)			170			300		70	
Storage Blk Time (%)			3	0	0		45	12	
Queuing Penalty (veh)			17	0	0		58	17	

Network Summary

Network wide Queuing Penalty: 2709

Appendix M

SimTraffic Queuing Report for Year 2032 PM Peak Hour with Alternative 2

Intersection: 2: West Chester Pike & N Lawrence Rd

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	L	L	T	T	T	T	TR	L	R
Maximum Queue (ft)	360	685	690	251	587	585	619	394	787
Average Queue (ft)	353	535	137	86	419	440	455	139	643
95th Queue (ft)	379	727	447	183	562	580	594	342	947
Link Distance (ft)		664	664	664	629	629	629		761
Upstream Blk Time (%)		3	1	0	0		0		24
Queuing Penalty (veh)		31	12	0	1		1		0
Storage Bay Dist (ft)	290							325	
Storage Blk Time (%)	38	40							36
Queuing Penalty (veh)	225	242							38

Intersection: 3: West Chester Pike & N New Ardmore Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB
Directions Served	L	T	TR	L	T	TR	LT	R	LTR
Maximum Queue (ft)	181	311	312	57	231	243	119	30	99
Average Queue (ft)	83	131	148	11	130	160	50	3	33
95th Queue (ft)	161	257	279	36	209	229	102	16	74
Link Distance (ft)		722	722		271	271	415	415	310
Upstream Blk Time (%)					0	0			
Queuing Penalty (veh)					0	0			
Storage Bay Dist (ft)	180			145					
Storage Blk Time (%)	0	2			2				
Queuing Penalty (veh)	4	2			0				

Intersection: 6: West Chester Pike & I-476 SB Off Ramp

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	T	T	T	R	L	L	T	T	L	R	R	L
Maximum Queue (ft)	472	521	564	275	142	179	262	295	499	766	474	578
Average Queue (ft)	336	366	379	186	67	77	85	86	364	409	268	403
95th Queue (ft)	470	511	545	350	116	138	189	207	590	793	475	534
Link Distance (ft)	627	627	627				242	242		743		
Upstream Blk Time (%)		0	0			0	0	1		7		
Queuing Penalty (veh)		0	0			0	2	4		0		
Storage Bay Dist (ft)				200	200	200			400		400	900
Storage Blk Time (%)			27	1			0		25	7	6	
Queuing Penalty (veh)			73	3			1		130	39	34	

Intersection: 6: West Chester Pike & I-476 SB Off Ramp

Movement	SB	SB	SB
Directions Served	L	T	R
Maximum Queue (ft)	617	613	399
Average Queue (ft)	418	317	215
95th Queue (ft)	554	529	396
Link Distance (ft)		1449	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	900		300
Storage Blk Time (%)		9	1
Queuing Penalty (veh)		145	18

Intersection: 10: West Chester Pike & I-476 SB Off-Ramp

Movement	EB	EB	WB	WB
Directions Served	T	T	T	T
Maximum Queue (ft)	20	20	71	125
Average Queue (ft)	2	1	3	6
95th Queue (ft)	19	14	33	60
Link Distance (ft)	242	242	679	679
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 15: West Chester Pike & I-476 NB

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	T	T	T	L	LR	R
Maximum Queue (ft)	514	528	505	437	532	520	130	240	304	306
Average Queue (ft)	323	179	188	169	359	361	121	156	209	208
95th Queue (ft)	523	441	425	338	522	528	148	228	285	283
Link Distance (ft)		679	679	679	451	451				1115
Upstream Blk Time (%)		1	0	0	1	2				
Queuing Penalty (veh)		5	1	1	9	12				
Storage Bay Dist (ft)	510						90	520	520	
Storage Blk Time (%)	2	0				36	27			
Queuing Penalty (veh)	15	0				172	128			

Intersection: 18: West Chester Pike & S Lawrence Rd

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	T	T	T	R	L	L	T	T	L	L	R
Maximum Queue (ft)	178	177	175	109	360	615	583	533	362	612	250
Average Queue (ft)	156	152	157	34	308	418	329	297	77	252	226
95th Queue (ft)	175	184	167	81	406	698	612	446	205	518	288
Link Distance (ft)	63	63	63	63		664	664	664	688	688	
Upstream Blk Time (%)	39	31	34	2		4	2			0	
Queuing Penalty (veh)	302	242	261	16		37	19			0	
Storage Bay Dist (ft)					290						200
Storage Blk Time (%)					28	31				1	23
Queuing Penalty (veh)					86	96				7	23

Intersection: 20: West Chester Pike &

Movement	EB	EB	EB	EB	WB	WB
Directions Served	T	T	T	T	T	TR
Maximum Queue (ft)	549	550	545	108	63	75
Average Queue (ft)	351	335	281	4	4	4
95th Queue (ft)	658	632	576	76	34	39
Link Distance (ft)	451	451	451	451	63	63
Upstream Blk Time (%)	7	5	3		0	0
Queuing Penalty (veh)	51	36	22		2	2
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 24: West Chester Pike & Mather Avenue

Movement	SB
Directions Served	R
Maximum Queue (ft)	52
Average Queue (ft)	15
95th Queue (ft)	41
Link Distance (ft)	147
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 26: West Chester Pike &

Movement	EB	EB	WB	WB	WB	WB	NB	NB	SB
Directions Served	T	TR	L	T	T	TR	LT	R	LR
Maximum Queue (ft)	306	347	173	191	194	194	341	110	30
Average Queue (ft)	150	170	78	60	69	66	171	75	4
95th Queue (ft)	272	299	161	141	147	136	328	132	20
Link Distance (ft)	629	629		1248	1248		599		180
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)			170			300		70	
Storage Blk Time (%)			3	0	0		45	11	
Queuing Penalty (veh)			15	0	0		58	17	

Network Summary

Network wide Queuing Penalty: 2638

Appendix N

SimTraffic Queuing Report for Year 2032 PM Peak Hour with Alternative 3

Intersection: 2: West Chester Pike & N Lawrence Rd

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	L	L	T	T	T	T	TR	L	R
Maximum Queue (ft)	360	686	694	351	619	661	666	394	791
Average Queue (ft)	354	545	128	86	440	458	475	151	661
95th Queue (ft)	375	728	424	211	623	641	657	372	947
Link Distance (ft)		664	664	664	629	629	629		761
Upstream Blk Time (%)		3	1	0	0	1	1		27
Queuing Penalty (veh)		32	16	1	2	5	9		0
Storage Bay Dist (ft)	290							325	
Storage Blk Time (%)	39	42							38
Queuing Penalty (veh)	236	249							41

Intersection: 3: West Chester Pike & N New Ardmore Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB
Directions Served	L	T	TR	L	T	TR	LT	R	LTR
Maximum Queue (ft)	181	285	305	56	205	238	119	30	99
Average Queue (ft)	82	130	146	11	106	135	50	3	33
95th Queue (ft)	159	247	274	36	178	214	102	16	74
Link Distance (ft)		722	722		271	271	415	415	310
Upstream Blk Time (%)						0			
Queuing Penalty (veh)						0			
Storage Bay Dist (ft)	180			145					
Storage Blk Time (%)	0	1			1				
Queuing Penalty (veh)	4	2			0				

Intersection: 6: West Chester Pike & I-476 SB Off Ramp

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	T	T	T	R	L	L	T	T	L	R	R	L
Maximum Queue (ft)	472	528	607	275	129	184	236	255	500	766	492	698
Average Queue (ft)	320	355	368	173	62	72	67	80	429	535	258	525
95th Queue (ft)	450	498	544	340	113	130	174	200	611	966	476	740
Link Distance (ft)	615	615	615				242	242		743		
Upstream Blk Time (%)			0			0	0	1		24		
Queuing Penalty (veh)			1			0	2	4		0		
Storage Bay Dist (ft)				200	200	200			400		400	900
Storage Blk Time (%)			25	0			0		51	4	3	
Queuing Penalty (veh)			67	2			1		267	22	15	

Intersection: 6: West Chester Pike & I-476 SB Off Ramp

Movement	SB	SB	SB	SB
Directions Served	L	T	T	R
Maximum Queue (ft)	710	760	313	349
Average Queue (ft)	537	262	113	171
95th Queue (ft)	752	726	225	301
Link Distance (ft)		1449		
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	900		300	300
Storage Blk Time (%)				1
Queuing Penalty (veh)				16

Intersection: 10: West Chester Pike & I-476 SB Off-Ramp

Movement	EB	EB	WB	WB
Directions Served	T	T	T	T
Maximum Queue (ft)	35	9	79	96
Average Queue (ft)	2	0	3	6
95th Queue (ft)	27	6	43	53
Link Distance (ft)	242	242	679	679
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 15: West Chester Pike & I-476 NB

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	T	T	T	L	LR	R
Maximum Queue (ft)	512	512	496	362	545	516	130	245	304	302
Average Queue (ft)	323	177	173	166	355	359	123	155	211	208
95th Queue (ft)	525	436	389	309	527	529	145	228	284	282
Link Distance (ft)		679	679	679	451	451				1115
Upstream Blk Time (%)		0	0		2	1				
Queuing Penalty (veh)		3	0		12	11				
Storage Bay Dist (ft)	510						90	520	520	
Storage Blk Time (%)	2	0				36	28			
Queuing Penalty (veh)	15	0				172	133			

Intersection: 18: West Chester Pike & S Lawrence Rd

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	T	T	T	R	L	L	T	T	L	L	R
Maximum Queue (ft)	180	163	167	93	360	664	639	545	395	625	250
Average Queue (ft)	156	150	157	35	322	441	317	294	96	270	229
95th Queue (ft)	176	182	165	79	404	707	608	441	297	569	284
Link Distance (ft)	63	63	63	63		664	664	664	688	688	
Upstream Blk Time (%)	37	29	34	2		5	1	0		2	
Queuing Penalty (veh)	285	226	260	17		45	13	0		0	
Storage Bay Dist (ft)					290						200
Storage Blk Time (%)					32	35				2	25
Queuing Penalty (veh)					98	110				10	26

Intersection: 20: West Chester Pike &

Movement	EB	EB	EB	EB	WB	WB
Directions Served	T	T	T	T	T	TR
Maximum Queue (ft)	546	539	533	217	107	113
Average Queue (ft)	322	312	264	13	6	9
95th Queue (ft)	615	608	548	145	48	66
Link Distance (ft)	451	451	451	451	63	63
Upstream Blk Time (%)	5	4	3		0	0
Queuing Penalty (veh)	40	33	20		3	5
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 24: West Chester Pike & Mather Avenue

Movement	EB	SB
Directions Served	T	R
Maximum Queue (ft)	14	52
Average Queue (ft)	0	15
95th Queue (ft)	10	42
Link Distance (ft)	271	147
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 26: West Chester Pike &

Movement	EB	EB	WB	WB	WB	WB	NB	NB	SB
Directions Served	T	TR	L	T	T	TR	LT	R	LR
Maximum Queue (ft)	323	334	173	179	203	198	344	110	30
Average Queue (ft)	149	166	77	60	71	70	171	76	4
95th Queue (ft)	276	298	160	139	151	146	330	133	20
Link Distance (ft)	629	629		1248	1248		599		180
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)			170			300		70	
Storage Blk Time (%)			3	0	0	0	45	12	
Queuing Penalty (veh)			15	0	0	0	58	18	

Network Summary

Network wide Queuing Penalty: 2621

Appendix O

SimTraffic Queuing Report for Year 2032 PM Peak Hour with Alternative 4

Intersection: 2: West Chester Pike & N Lawrence Rd

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	L	L	T	T	T	T	TR	L	R
Maximum Queue (ft)	360	680	685	433	573	609	614	394	788
Average Queue (ft)	355	527	106	88	420	441	461	128	653
95th Queue (ft)	373	704	355	222	573	601	620	319	948
Link Distance (ft)		664	664	664	629	629	629		761
Upstream Blk Time (%)		2	0	0	0	0	1		26
Queuing Penalty (veh)		25	4	0	0	1	4		0
Storage Bay Dist (ft)	290							325	
Storage Blk Time (%)	38	41							37
Queuing Penalty (veh)	226	245							39

Intersection: 3: West Chester Pike & N New Ardmore Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB
Directions Served	L	T	TR	L	T	TR	LT	R	LTR
Maximum Queue (ft)	181	285	319	52	238	276	123	30	99
Average Queue (ft)	81	134	150	11	107	139	50	3	33
95th Queue (ft)	157	255	281	35	183	222	103	16	74
Link Distance (ft)		722	722		271	271	415	415	310
Upstream Blk Time (%)						0			
Queuing Penalty (veh)						1			
Storage Bay Dist (ft)	180			145					
Storage Blk Time (%)	0	1			1				
Queuing Penalty (veh)	4	2			0				

Intersection: 6: West Chester Pike & I-476 SB Off Ramp

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	T	T	T	TR	L	L	T	T	L	R	R	L
Maximum Queue (ft)	360	406	474	275	139	161	208	257	439	586	409	791
Average Queue (ft)	248	270	279	216	55	65	60	74	329	410	219	641
95th Queue (ft)	341	372	415	324	113	127	147	179	550	850	379	943
Link Distance (ft)	615	615	615				241	241		738		
Upstream Blk Time (%)						0	0	1		16		
Queuing Penalty (veh)						0	1	4		0		
Storage Bay Dist (ft)				200	200	200			400		400	900
Storage Blk Time (%)			15	6			0		30	1	1	1
Queuing Penalty (veh)			94	22			1		157	4	4	6

Intersection: 6: West Chester Pike & I-476 SB Off Ramp

Movement	SB	SB	SB	SB	B14
Directions Served	L	T	T	R	T
Maximum Queue (ft)	826	928	371	365	69
Average Queue (ft)	657	526	154	206	7
95th Queue (ft)	968	1183	353	345	86
Link Distance (ft)		1449			329
Upstream Blk Time (%)		1			1
Queuing Penalty (veh)		0			0
Storage Bay Dist (ft)	900		300	300	
Storage Blk Time (%)	1			2	
Queuing Penalty (veh)	6			35	

Intersection: 10: West Chester Pike & I-476 SB Off-Ramp

Movement	EB	EB	EB	WB	WB
Directions Served	T	T	T	T	T
Maximum Queue (ft)	132	98	89	47	100
Average Queue (ft)	9	6	5	2	6
95th Queue (ft)	76	60	57	30	55
Link Distance (ft)	241	241	241	679	679
Upstream Blk Time (%)	0	0	0		
Queuing Penalty (veh)	1	0	0		
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 15: West Chester Pike & I-476 NB

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	T	T	T	L	LR	R
Maximum Queue (ft)	505	534	507	438	528	514	130	240	304	309
Average Queue (ft)	336	232	209	179	362	364	121	156	209	207
95th Queue (ft)	565	590	502	378	531	525	146	229	284	284
Link Distance (ft)		679	679	679	451	451				1115
Upstream Blk Time (%)		2	0	0	2	2				
Queuing Penalty (veh)		16	2	0	14	14				
Storage Bay Dist (ft)	510						90	520	520	
Storage Blk Time (%)	4	0				36	27			
Queuing Penalty (veh)	35	1				173	128			

Intersection: 18: West Chester Pike & S Lawrence Rd

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	T	T	T	R	L	L	T	T	L	L	R
Maximum Queue (ft)	162	166	167	95	360	628	580	519	393	637	250
Average Queue (ft)	157	151	156	33	312	411	298	299	101	287	227
95th Queue (ft)	163	184	165	77	408	687	537	431	316	616	286
Link Distance (ft)	63	63	63	63		664	664	664	688	688	
Upstream Blk Time (%)	36	30	33	2		5	1		0	3	
Queuing Penalty (veh)	278	228	257	16		46	10		0	0	
Storage Bay Dist (ft)					290						200
Storage Blk Time (%)					28	31				2	25
Queuing Penalty (veh)					87	96				8	26

Intersection: 20: West Chester Pike &

Movement	EB	EB	EB	EB	WB	WB
Directions Served	T	T	T	T	T	TR
Maximum Queue (ft)	550	544	526	109	117	133
Average Queue (ft)	319	303	262	4	8	10
95th Queue (ft)	600	591	543	77	62	71
Link Distance (ft)	451	451	451	451	63	63
Upstream Blk Time (%)	5	4	2		0	1
Queuing Penalty (veh)	35	30	17		5	7
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 24: West Chester Pike & Mather Avenue

Movement	SB
Directions Served	R
Maximum Queue (ft)	56
Average Queue (ft)	15
95th Queue (ft)	42
Link Distance (ft)	147
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 26: West Chester Pike &

Movement	EB	EB	WB	WB	WB	WB	NB	NB	SB
Directions Served	T	TR	L	T	T	TR	LT	R	LR
Maximum Queue (ft)	292	304	173	180	192	198	343	110	30
Average Queue (ft)	142	159	77	60	68	70	169	75	4
95th Queue (ft)	266	283	160	138	146	141	328	130	20
Link Distance (ft)	629	629		1248	1248		599		180
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)			170			300		70	
Storage Blk Time (%)			3	0	0		45	10	
Queuing Penalty (veh)			15	0	0		58	15	

Network Summary

Network wide Queuing Penalty: 2507

Appendix P

SimTraffic Queuing Report for Year 2032 PM Peak Hour with Alternative 5

Intersection: 2: West Chester Pike & N Lawrence Rd

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	L	L	T	T	T	T	TR	L	R
Maximum Queue (ft)	360	699	715	450	662	689	684	394	800
Average Queue (ft)	353	535	165	108	571	587	592	133	603
95th Queue (ft)	383	739	513	266	756	760	749	316	940
Link Distance (ft)		664	664	664	629	629	629		761
Upstream Blk Time (%)		3	1	0	23	24	25		22
Queuing Penalty (veh)		28	16	0	135	139	150		0
Storage Bay Dist (ft)	290							325	
Storage Blk Time (%)	35	38							31
Queuing Penalty (veh)	208	226							33

Intersection: 3: West Chester Pike & N New Ardmore Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB
Directions Served	L	T	TR	L	T	TR	LT	R	LTR
Maximum Queue (ft)	189	417	389	60	176	177	142	30	106
Average Queue (ft)	83	151	168	13	83	94	55	3	38
95th Queue (ft)	163	314	325	44	154	159	117	18	80
Link Distance (ft)		722	722		272	272	424	424	318
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	180			145					
Storage Blk Time (%)	2	2			1				
Queuing Penalty (veh)	14	2			0				

Intersection: 6: West Chester Pike & I-476 SB Off Ramp

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB
Directions Served	T	T	T	TR	T	T	T	T	L	L	R	R
Maximum Queue (ft)	343	356	325	382	128	132	125	99	174	174	334	348
Average Queue (ft)	243	251	239	319	113	111	64	37	90	95	214	226
95th Queue (ft)	355	365	334	438	146	147	118	83	147	149	319	333
Link Distance (ft)	312	312	312	312	68	68	68	68		748		
Upstream Blk Time (%)	8	7	3	31	39	38	13	4				
Queuing Penalty (veh)	34	29	12	134	145	143	48	17				
Storage Bay Dist (ft)									200		400	400
Storage Blk Time (%)									0	0		0
Queuing Penalty (veh)									0	0		0

Intersection: 6: West Chester Pike & I-476 SB Off Ramp

Movement	SB	SB	SB	SB	SB
Directions Served	L	L	T	T	R
Maximum Queue (ft)	364	365	316	276	208
Average Queue (ft)	339	345	164	163	80
95th Queue (ft)	389	378	275	252	149
Link Distance (ft)	282	282	282	282	282
Upstream Blk Time (%)	23	25	0	0	
Queuing Penalty (veh)	106	119	1	1	
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 7: West Chester Pike &

Movement	EB	EB	EB	WB	WB	WB
Directions Served	T	T	T	T	T	T
Maximum Queue (ft)	340	417	462	153	182	48
Average Queue (ft)	47	133	178	5	6	2
95th Queue (ft)	253	424	498	65	78	34
Link Distance (ft)	430	430	430	312	312	312
Upstream Blk Time (%)	1	1	7	0	0	
Queuing Penalty (veh)	6	8	40	0	0	
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 10: West Chester Pike & I-476 SB Off-Ramp

Movement	EB	EB	EB	WB	WB	WB
Directions Served	T	T	T	T	T	TR
Maximum Queue (ft)	109	111	99	315	359	391
Average Queue (ft)	24	21	11	70	74	37
95th Queue (ft)	125	110	72	212	234	192
Link Distance (ft)	68	68	68	680	680	680
Upstream Blk Time (%)	2	1	0			0
Queuing Penalty (veh)	18	10	3			1
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 15: West Chester Pike & I-476 NB

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	T	T	T	L	LR	R
Maximum Queue (ft)	522	648	648	612	508	532	130	236	346	336
Average Queue (ft)	367	395	395	387	361	395	127	131	235	230
95th Queue (ft)	552	696	685	652	529	544	141	210	334	322
Link Distance (ft)		680	680	680	451	451				1115
Upstream Blk Time (%)		3	2	1	2	4				
Queuing Penalty (veh)		29	21	13	16	32				
Storage Bay Dist (ft)	510						90	520	520	
Storage Blk Time (%)	1	5				39	37			
Queuing Penalty (veh)	12	24				188	176			

Intersection: 18: West Chester Pike & S Lawrence Rd

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	T	T	T	R	L	L	T	T	L	L	R
Maximum Queue (ft)	174	166	172	112	360	593	571	510	349	584	250
Average Queue (ft)	157	149	157	38	284	366	312	345	92	297	230
95th Queue (ft)	168	189	172	87	396	650	594	498	302	597	286
Link Distance (ft)	63	63	63	63		664	664	664	688	688	
Upstream Blk Time (%)	42	32	36	2		3	2	0	0	1	
Queuing Penalty (veh)	320	249	274	19		27	13	3	0	0	
Storage Bay Dist (ft)					290						200
Storage Blk Time (%)					19	23				5	25
Queuing Penalty (veh)					60	72				22	26

Intersection: 20: West Chester Pike &

Movement	EB	EB	EB	EB	WB	WB
Directions Served	T	T	T	T	T	TR
Maximum Queue (ft)	560	558	538	420	42	110
Average Queue (ft)	450	445	396	25	13	25
95th Queue (ft)	710	703	684	207	79	116
Link Distance (ft)	451	451	451	451	63	63
Upstream Blk Time (%)	14	11	8	0	1	3
Queuing Penalty (veh)	109	88	58	2	14	27
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 24: West Chester Pike & Mather Avenue

Movement	EB	EB	EB	SB
Directions Served	T	T	T	R
Maximum Queue (ft)	24	184	192	40
Average Queue (ft)	4	28	35	10
95th Queue (ft)	38	165	191	31
Link Distance (ft)		272	272	147
Upstream Blk Time (%)		0	1	
Queuing Penalty (veh)		4	13	
Storage Bay Dist (ft)	50			
Storage Blk Time (%)	1	1		
Queuing Penalty (veh)	4	4		

Intersection: 26: West Chester Pike &

Movement	EB	EB	WB	WB	WB	WB	NB	NB	SB
Directions Served	T	TR	L	T	T	TR	LT	R	LR
Maximum Queue (ft)	396	415	206	883	872	325	381	110	30
Average Queue (ft)	160	173	90	425	433	206	158	79	5
95th Queue (ft)	302	321	205	1207	1195	419	290	130	22
Link Distance (ft)	629	629		1248	1248		599		180
Upstream Blk Time (%)	0	0		10	9				
Queuing Penalty (veh)	0	0		0	0				
Storage Bay Dist (ft)			170			300		70	
Storage Blk Time (%)			3	25	17	14	46	12	
Queuing Penalty (veh)			16	17	96	74	58	18	

Intersection: 29: I-476 SB Off Ramp &

Movement	SE	SW	SW	SW
Directions Served	R	T	T	T
Maximum Queue (ft)	340	237	257	170
Average Queue (ft)	176	83	91	14
95th Queue (ft)	300	210	227	123
Link Distance (ft)	599	1040		
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			500	500
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 4026

Appendix Q

SimTraffic Queuing Report for Year 2032 PM Peak Hour with Alternative 6

Intersection: 2: West Chester Pike & N Lawrence Rd

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	L	L	T	T	T	T	TR	L	R
Maximum Queue (ft)	349	685	693	541	651	691	687	394	789
Average Queue (ft)	342	517	142	88	512	535	550	130	582
95th Queue (ft)	375	714	482	247	716	737	738	313	892
Link Distance (ft)		664	664	664	629	629	629		761
Upstream Blk Time (%)		3	2	0	7	9	11		14
Queuing Penalty (veh)		37	21	0	42	55	66		0
Storage Bay Dist (ft)	280							325	
Storage Blk Time (%)	35	38						0	28
Queuing Penalty (veh)	211	226						0	29

Intersection: 3: West Chester Pike & N New Ardmore Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB
Directions Served	L	T	TR	L	T	TR	LT	R	LTR
Maximum Queue (ft)	180	376	369	154	276	321	127	34	109
Average Queue (ft)	86	140	154	14	166	198	53	3	37
95th Queue (ft)	163	297	304	68	264	291	105	19	84
Link Distance (ft)		722	722		271	271	415	415	310
Upstream Blk Time (%)					0	1			
Queuing Penalty (veh)					1	8			
Storage Bay Dist (ft)	180			145					
Storage Blk Time (%)	2	1			5				
Queuing Penalty (veh)	17	2			1				

Intersection: 6: West Chester Pike & I-476 SB Off Ramp

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	T	T	T	R	L	L	T	T	L	R	R	L
Maximum Queue (ft)	563	608	665	275	116	150	244	285	284	345	325	869
Average Queue (ft)	349	383	403	141	57	65	58	74	218	315	296	620
95th Queue (ft)	506	549	592	366	102	115	153	190	305	388	362	916
Link Distance (ft)	627	627	627				243	243	272	272	272	
Upstream Blk Time (%)	0	0	1				0	1	6	52	44	
Queuing Penalty (veh)	1	2	5				1	4	15	141	118	
Storage Bay Dist (ft)				200	200	200						900
Storage Blk Time (%)			30				0					1
Queuing Penalty (veh)			79				1					3

Intersection: 6: West Chester Pike & I-476 SB Off Ramp

Movement	SB	SB	SB
Directions Served	L	T	R
Maximum Queue (ft)	886	944	391
Average Queue (ft)	628	383	194
95th Queue (ft)	922	1032	344
Link Distance (ft)		1477	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	900		300
Storage Blk Time (%)	1		3
Queuing Penalty (veh)	4		42

Intersection: 7: Langford Run Road &

Movement	WB	WB	B29	B29	NB	SB	SB
Directions Served	R	R	T	T	T	T	T
Maximum Queue (ft)	256	248	37	38	343	141	148
Average Queue (ft)	113	107	10	8	184	79	85
95th Queue (ft)	297	296	62	56	301	137	138
Link Distance (ft)	242	242	547	547	350	272	272
Upstream Blk Time (%)	7	6			0		
Queuing Penalty (veh)	0	0			0		
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 10: West Chester Pike & I-476 SB Off-Ramp

Movement	EB	EB	EB	WB	WB
Directions Served	T	T	TR	T	T
Maximum Queue (ft)	123	103	65	32	60
Average Queue (ft)	23	14	6	1	3
95th Queue (ft)	155	104	65	21	32
Link Distance (ft)	243	243	243	679	679
Upstream Blk Time (%)	1	0	0		
Queuing Penalty (veh)	9	3	1		
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 15: West Chester Pike & I-476 NB

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	T	T	T	L	LR	R
Maximum Queue (ft)	528	640	598	503	532	536	130	261	331	342
Average Queue (ft)	357	262	245	196	359	369	120	161	213	211
95th Queue (ft)	575	624	564	387	502	517	144	242	298	298
Link Distance (ft)		679	679	679	451	451				1115
Upstream Blk Time (%)		3	0	0	1	2				
Queuing Penalty (veh)		32	4	0	8	13				
Storage Bay Dist (ft)	510						90	520	520	
Storage Blk Time (%)	7	0				36	29			
Queuing Penalty (veh)	57	1				173	138			

Intersection: 18: West Chester Pike & S Lawrence Rd

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	T	T	T	R	L	L	T	T	L	L	R
Maximum Queue (ft)	175	175	172	120	360	660	646	469	444	680	250
Average Queue (ft)	157	152	157	39	319	422	322	303	87	257	224
95th Queue (ft)	170	183	168	91	410	683	592	426	254	565	288
Link Distance (ft)	63	63	63	63		664	664	664	688	688	
Upstream Blk Time (%)	38	31	34	3		3	1			0	
Queuing Penalty (veh)	295	236	263	20		24	11			0	
Storage Bay Dist (ft)					290						200
Storage Blk Time (%)					29	32				2	22
Queuing Penalty (veh)					89	100				9	23

Intersection: 20: West Chester Pike &

Movement	EB	EB	EB	EB	WB	WB
Directions Served	T	T	T	T	T	TR
Maximum Queue (ft)	482	484	488	4	135	121
Average Queue (ft)	324	312	278	0	7	7
95th Queue (ft)	567	557	529	3	62	59
Link Distance (ft)	451	451	451	451	63	63
Upstream Blk Time (%)	5	4	2		0	0
Queuing Penalty (veh)	41	31	18		4	4
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 24: West Chester Pike & Mather Avenue

Movement	EB	EB	WB	SB
Directions Served	T	T	TR	R
Maximum Queue (ft)	21	48	4	47
Average Queue (ft)	1	2	0	15
95th Queue (ft)	13	23	3	42
Link Distance (ft)	271	271	627	147
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 26: West Chester Pike &

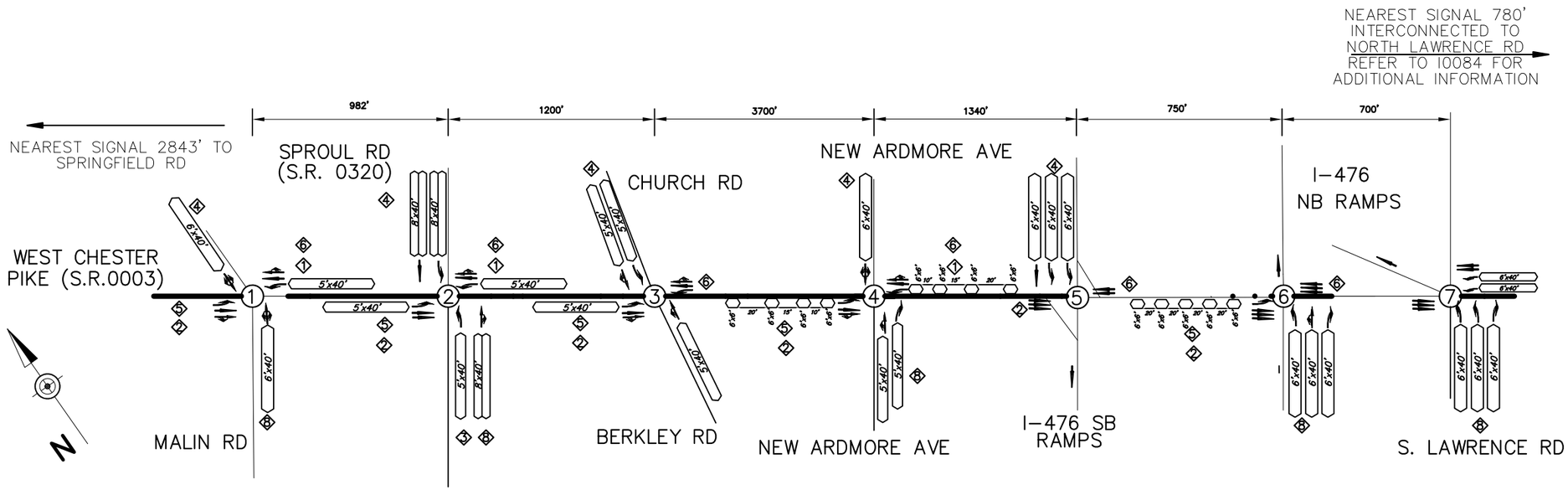
Movement	EB	EB	WB	WB	WB	WB	NB	NB	SB
Directions Served	T	TR	L	T	T	TR	LT	R	LR
Maximum Queue (ft)	272	283	197	304	310	245	346	110	30
Average Queue (ft)	140	156	85	97	110	101	148	78	2
95th Queue (ft)	248	267	187	274	282	237	275	132	15
Link Distance (ft)	629	629		1248	1248		599		180
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)			170			300		70	
Storage Blk Time (%)			6	4	1	1	41	11	
Queuing Penalty (veh)			33	2	8	6	52	16	

Network Summary

Network wide Queuing Penalty: 2856

Appendix R

Existing Traffic Signal Permit Condition Diagrams and System Plan



GENERAL NOTES

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

REFER TO TRAFFIC SIGNAL PERMIT DRAWING FOR INDIVIDUAL INTERSECTION OPERATION, GEOMETRY, PHASING AND CRITICAL TIMES.

FOR CONSTRUCTION AND INSPECTION THE SYSTEM PERMIT SHOULD ALWAYS BE ACCOMPANIED WITH TRAFFIC SIGNAL PERMIT DRAWING.

TEST THE SYSTEM AT LOCAL INTERSECTION LEVEL, SUBSYSTEM LEVEL MASTER CONTROLLER LEVEL AND PERSONAL COMPUTER REMOTE DIAL UP LEVEL.

GATHER THE SYSTEM FAILURE CRITICAL ALARMS REPORT AND ARCHIVE THEM WHERE APPLICABLE.

SET UP PENNDOT DISTRICT 6-0 COMPUTER WITH THE SYSTEM DATABASE AND GRAPHICS. MODIFY THE DATABASE AND GRAPHICS FOR SYSTEMS REVISIONS.

ASSIGN LOOP DETECTORS AND PROGRAM THE CONTROLLERS TO GATHER TRAFFIC VOLUMES IN 15 MINUTE INTERVAL, WHERE APPLICABLE.

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

OBTAIN POLE ATTACHMENT PERMIT FOR AERIAL FIBER OPTIC INSTALLATION.

MAINTAIN MASTER CONTROLLER COMMUNICATION SUCH AS PHONE DROPS.

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

THIS DRAWING CANNOT BE USED AS A CONSTRUCTION DRAWING UNLESS THE PERMITTEE COMPLIES WITH THE PROVISIONS OF ACT 187, PREVENTION OF DAMAGE TO UNDERGROUND UTILITIES EFFECTIVE DATE DECEMBER 19, 1996.

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

PERMITTEE SHALL OBTAIN A HIGHWAY OCCUPANCY PERMIT FOR ANY CHANGES IN INTERSECTION GEOMETRY REGARDING EXCAVATION.

CONDUIT INSTALLED IN BITUMINOUS ROADWAY LESS THAN 5 YEARS OLD, OR CONCRETE ROADWAY REGARDLESS OF AGE, MUST BE BORED OR JACKED UNDER THE ROADWAY. INSTALL IN ACCORDANCE WITH TRAFFIC SIGNAL STANDARDS TC-7800 SERIES.

Program 1=					Phase					Cycle	Offsets	Offsets	
FILE #	Intersections	1	2	3	4	5	6	7	8		Bal	DR2(WB)	DR1(EB)
0433	1 Malin Rd	13(LEAD)	61		26		74		26	100	91(38)		
0432	2 Sproul Rd	13(LEAD)	37	13(LEAD)	27	23(LEAD)	37		40	100	83(47)		
0480	3 Church Rd/Berkley Rd	13(LEAD)	61		26	13(LEAD)	61		26	100	0		
0002	4 New Ardmore Ave	13(LEAD)	62		25	13(LEAD)	62		25	100	70		
2418	5 I-476 Southbound Ramps		53		47		53			100	34		
2419	6 I-476 Northbound Ramps		67			29(LEAD)	38		33	100	23		
0827	7 South Lawrence Rd	21(LEAD)	46				67		33	100	45		

Program 2 =					Phase					Cycle	Offset # 1	Offset # 2	Offset # 3
FILE #	Intersections	1	2	3	4	5	6	7	8		Bal	DR2(WB)	DR1(EB)
0433	1 Malin Rd	13(LEAD)	50		37		63		37	100	12		
0432	2 Sproul Rd	13(LEAD)	46	13(LEAD)	27	14(LEAD)	46		40	100	12		
0480	3 Church Rd/Berkley Rd	13(LEAD)	41		46	13(LEAD)	41		46	100	69		
0002	4 New Ardmore Ave	13(LEAD)	68		21	13(LEAD)	66		21	100	99		
2418	5 I-476 Southbound Ramps		58		42		58			100	56		
2419	6 I-476 Northbound Ramps		69			30(LEAD)	39		31	100	28		
0827	7 South Lawrence Rd	27(LEAD)	42				69		31	100	58		

Program 3 =					Phase					Cycle	Offset # 1	Offset # 2	Offset # 3
FILE #	Intersections	1	2	3	4	5	6	7	8		Bal	DR2(WB)	DR1(EB)
0433	1 Malin Rd	13(LEAD)	76		31		89		31	120	56		
0432	2 Sproul Rd	13(LEAD)	42	13(LEAD)	41	24(LEAD)	41		54	120	79		
0480	3 Church Rd/Berkley Rd	13(LEAD)	75		32	13(LEAD)	75		32	120	115		
0002	4 New Ardmore Ave	18(LEAD)	81		21	18(LEAD)	81		21	120	56		
2418	5 I-476 Southbound Ramps		59		61		59			120	15		
2419	6 I-476 Northbound Ramps		78			31(LEAD)	47		42	120	106		
0827	7 South Lawrence Rd	27(LEAD)	49				76		44	120	118		

Notes:
- ALL SPLIT TIMES INCLUDE YELLOW AND RED TIMES FOR A GIVEN PHASE.
- REFER TO SIGNAL PERMIT PLAN FOR MAX 1, MAX 2 AND CLEARANCE AND PED TIMES.

WEEKLY PROGRAM CHART						
EVENT	DAY*	TIME	CYCLE	OFFSET	PROGRAM	REMARKS
1	1-5	0000	---		---	FREE
2	1-5	0600	100		1	AM PEAK
3	1-5	0900	100		2	MD PEAK
4	1-5	1500	120		3	PM PEAK
5	1-5	1900	---		---	FREE
6	6,7	0000	---		---	FREE
6	6,7	0900	100		2	MD PEAK
6	6,7	1900	---		---	FREE

▲ DAY 1 = MONDAY
* MAX 1 / FREE WHERE NOTED IN CYCLE/SPLIT/OFFSET MATRIX.

SYSTEM NOTES

1. THE SIGNALS ALONG WEST CHESTER PIKE (S.R. 0003) SHOWN ON THIS PLAN ARE TO BE INTERCONNECTED AND COORDINATED.
2. PROGRAM TO BE SELECTED BY CLOSED LOOP SYSTEM (TIME OF DAY) OR TBC BACKUP.
3. OFFSETS ARE REFERENCED TO TS2 FIRST GREEN (PHASE 2+6), ON WEST CHESTER PIKE.
4. SYSTEM LIMITS:
   WEST CHESTER PIKE – FROM MALIN RD TO SOUTH LAWRENCE RD
   MASTER CONTROLLER:
   ON STREET MASTER AT: SPROUL RD
5. PRIMARY COORDINATION: CLOSED LOOP SYSTEM – FIBER OPTIC COMMUNICATION CABLE.
   SECONDARY COORDINATION: TBC (DEFAULT TO BACKUP TBC).
6. SYSTEM IS DESIGNED FOR THE SYSTEM SOFTWARE: ARIES.
7. CYCLES, SPLITS & OFFSETS ARE IN SECONDS.

LEGEND

- ④ INTERSECTION ADDRESS
- S## SYSTEM LOOP / IDENTIFYING NUMBER
- LOOP SENSOR
- ④ PHASE NUMBER

NOT TO SCALE

PENNSYLVANIA DEPARTMENT OF TRANSPORTATION
ENGINEERING DISTRICT 6-0

COUNTY: DELAWARE
MUNICIPALITY: MARPLE TOWNSHIP
INTERSECTION: WEST CHESTER PIKE (S.R. 0003) CORRIDOR
BETWEEN MALIN RD AND S. LAWRENCE RD

REVIEWED:

DATE

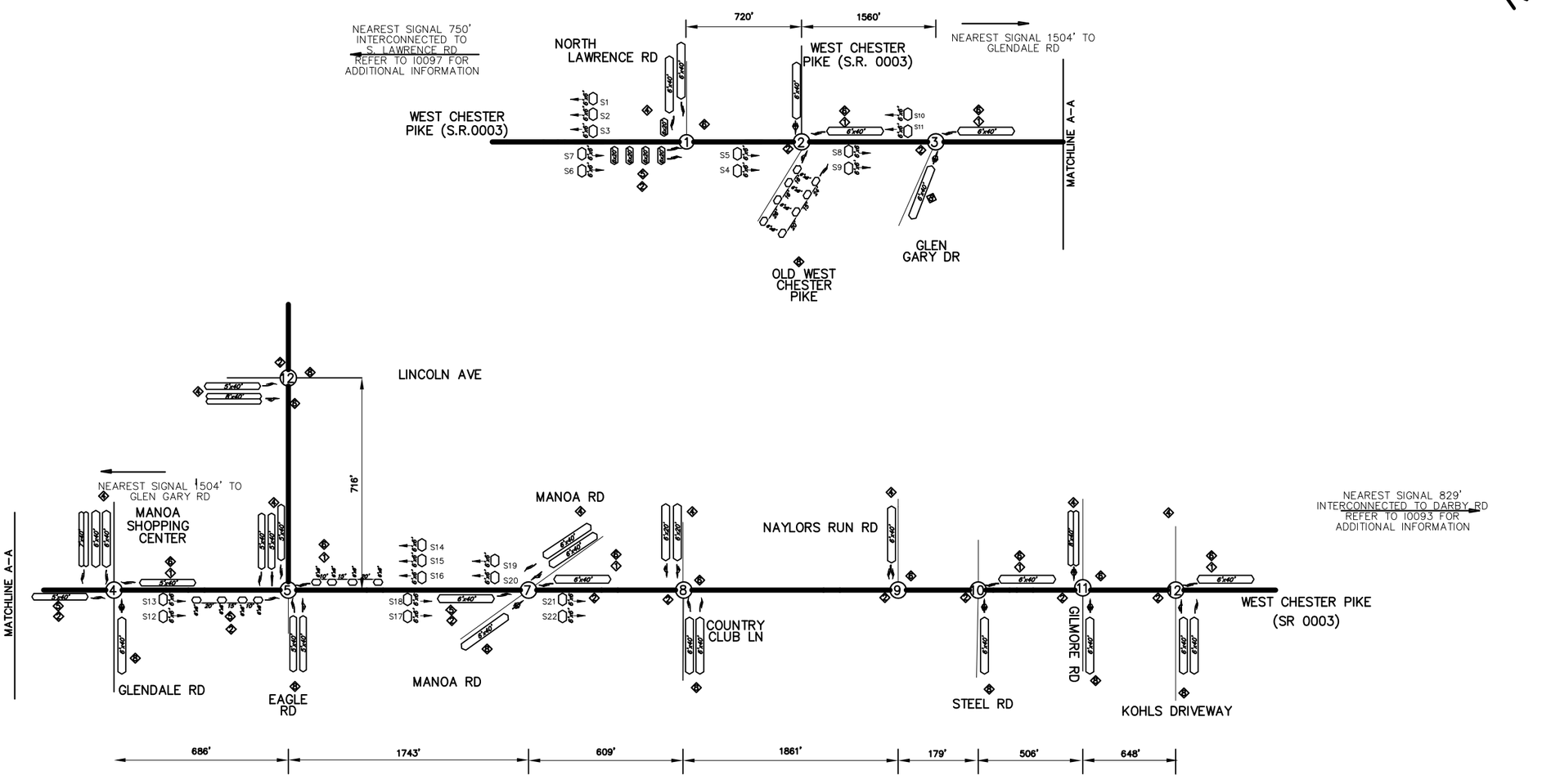
MUNICIPAL OFFICIAL DATE

RECOMMENDED:

DISTRICT TRAFFIC ENGINEER DATE

NO	REVISION	DES/ REVW	DATE	REVW	DATE	RECOM	DATE
1	TIMING AND OFFSETS	SM	3/16/06				
2							
3							
4							
5							
6							
7							
8							

SHEET 2 OF 2 INTERCONNECT PERMIT # 10097



GENERAL NOTES

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

REFER TO TRAFFIC SIGNAL PERMIT DRAWING FOR INDIVIDUAL INTERSECTION OPERATION, GEOMETRY, PHASING AND CRITICAL TIMES.

FOR CONSTRUCTION AND INSPECTION THE SYSTEM PERMIT SHOULD ALWAYS BE ACCOMPANIED WITH TRAFFIC SIGNAL PERMIT DRAWING.

TEST THE SYSTEM AT LOCAL INTERSECTION LEVEL, SUBSYSTEM LEVEL MASTER CONTROLLER LEVEL AND PERSONAL COMPUTER REMOTE DIAL UP LEVEL.

GATHER THE SYSTEM FAILURE CRITICAL ALARMS REPORT AND ARCHIVE THEM WHERE APPLICABLE.

SET UP PENNDOT DISTRICT 6-0 COMPUTER WITH THE SYSTEM DATABASE AND GRAPHICS. MODIFY THE DATABASE AND GRAPHICS FOR SYSTEMS REVISIONS.

ASSIGN LOOP DETECTORS AND PROGRAM THE CONTROLLERS TO GATHER TRAFFIC VOLUMES IN 15 MINUTE INTERVAL, WHERE APPLICABLE.

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

OBTAIN POLE ATTACHMENT PERMIT FOR AERIAL FIBER OPTIC INSTALLATION.

MAINTAIN MASTER CONTROLLER COMMUNICATION SUCH AS PHONE DROPS.

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

THIS DRAWING CANNOT BE USED AS A CONSTRUCTION DRAWING UNLESS THE PERMITTEE COMPLIES WITH THE PROVISIONS OF ACT 187, PREVENTION OF DAMAGE TO UNDERGROUND UTILITIES EFFECTIVE DATE DECEMBER 19, 1996.

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

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LEGEND

- ④ INTERSECTION ADDRESS
- S## SYSTEM LOOP / IDENTIFYING NUMBER
- LOOP SENSOR
- ④ PHASE NUMBER

NOT TO SCALE

PENNSYLVANIA DEPARTMENT OF TRANSPORTATION
ENGINEERING DISTRICT 6-0

COUNTY: DELAWARE
MUNICIPALITY: HAVERFORD TOWNSHIP
INTERSECTION: WEST CHESTER PIKE (S.R. 0003) CORRIDOR BETWEEN MALIN RD AND DARBY RD (SR 2005)

REVIEWED:

DATE

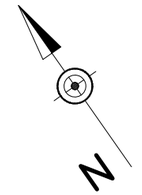
MUNICIPAL OFFICIAL DATE

RECOMMENDED:

DISTRICT TRAFFIC ENGINEER DATE

NO	REVISION	DES/ REVW	DATE	REVW	DATE	RECOM	DATE
1							
2							
3							
4							
5							
6							
7							
8							

SHEET 1 OF 2 INTERCONNECT PERMIT # 10084



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WEEKLY PROGRAM CHART						
EVENT	DAY*	TIME	CYCLE	OFFSET	PROGRAM	REMARKS
1	1-5	0000	---		---	FREE
2	1-5	0600	100		1	AM PEAK
3	1-5	0900	100/90		2	MD PEAK
4	1-5	1500	120		3	PM PEAK
5	1-5	1900	---		---	FREE
6	6,7	0000	---		---	FREE
6	6,7	0900	100/90		2	MD PEAK
6	6,7	1900	---		---	FREE

▲ DAY 1 = MONDAY
* MAX 1 / FREE WHERE NOTED IN CYCLE/SPLIT/OFFSET MATRIX.

		Program 1 =				Phase					Cycle	Offset # 1	Offset # 2	Offset # 3
FILE #		Intersections	1	2	3	4	5	6	7	8		Bal	DR2(WB)	DR1(EB)
0384	1	North Lawrence Rd		85		15(LEAD)	42(LEAD)	43			100	19		
0639	2	Old West Chester Pike	21(LEAD)	57		22		78		22	100	29		
0420	3	Glen Gary Drive	22(LEAD)	56				78		22	100	32		
0818	4	Glendale Rd/Manoa Shopping Center	12(LEAD)	38		22(SPLIT)	12(LEAD)	38		28(SPLIT)	100	0		
1743	5	Eagle Rd and Lincoln Avenue										Free		
0809	6	Eagle Rd	13(LEAD)	39	26(LEAD)	22	13(LEAD)	39	12(LEAD)	36	100	0		
0808	7	Manoa Rd	13(LEAD)	55		32	21(LEAD)	47		32	100	39		
0820	8	Country Club Ln		61				61		39	100	53		
2833	9	Naylors Run Rd		63		37		63			100	23		
0823	10	Steel Rd	18(LEAD)	54				72		28	100	15		
0824	11	Gilmore Rd		63		37		63		37	100	25		
2234	12	Kohl's Driveway	20(LEAD)	50		30		70		30	100	5		

		Program 2 =				Phase					Cycle	Offset # 1	Offset # 2	Offset # 3
FILE #		Intersections	1	2	3	4	5	6	7	8		Bal	DR2(WB)	DR1(EB)
0384	1	North Lawrence Rd		88		12	45(LEAD)	43			100	71		
0639	2	Old West Chester Pike	21(LEAD)	57		22		78		22	100	66		
0420	3	Glen Gary Drive	22(LEAD)	56				78		22	100	66		
0818	4	Glendale Rd/Manoa Shopping Center	12(LEAD)	38		22(SPLIT)	12(LEAD)	38		28(SPLIT)	100	39		
1743	5	Eagle Rd and Lincoln Avenue										Free		
0809	6	Eagle Rd	12(LEAD)	40	26(LEAD)	22	13(LEAD)	39	12(LEAD)	36	100	0		
0808	7	Manoa Rd	12(LEAD)	50		28	19(LEAD)	43		28	90	42		
0820	8	Country Club Ln		54		36		54			90	67		
2833	9	Naylors Run Rd		56		34		56			90	22		
0823	10	Steel Rd	16(LEAD)	48				64		26	90	0		
0824	11	Gilmore Rd		56		34		56		34	90	19		
2234	12	Kohl's Driveway	18(LEAD)	44		28		62		28	90	36		

		Program 3 =				Phase					Cycle	Offset # 1	Offset # 2	Offset # 3
FILE #		Intersections	1	2	3	4	5	6	7	8		Bal	DR2(WB)	DR1(EB)
0384	1	North Lawrence Rd		101		19	58(LEAD)	43			120	108		
0639	2	Old West Chester Pike	21(LEAD)	77		22		98		22	120	111		
0420	3	Glen Gary Drive	22(LEAD)	76				98		22	120	35		
0818	4	Glendale Rd/Manoa Shopping Center	16(LEAD)	54		22(SPLIT)	16(LEAD)	54		28(SPLIT)	120	111		
1743	5	Eagle Rd and Lincoln Avenue										Free		
0809	6	Eagle Rd	12(LEAD)	53	21(LEAD)	34	14(LEAD)	51	24(LEAD)	31	120	0		
0808	7	Manoa Rd	12(LEAD)	57		51	18(LEAD)	51		51	120	59		
0820	8	Country Club Ln		82				82		38	120	51		
2833	9	Naylors Run Rd		80		40		80			120	3		
0823	10	Steel Rd	18(LEAD)	74				92		28	120	111		
0824	11	Gilmore Rd		91		29		91		29	120	112		
2234	12	Kohl's Driveway	20(LEAD)	70		30		90		30	120	111		

Notes:
- ALL SPLIT TIMES INCLUDE YELLOW AND RED TIMES FOR A GIVEN PHASE.
- REFER TO SIGNAL PERMIT PLAN FOR MAX 1, MAX 2 AND CLEARANCE AND PED TIMES.

SYSTEM NOTES

1. THE SIGNALS ALONG WEST CHESTER PIKE (S.R. 0003) SHOWN ON THIS PLAN ARE TO BE INTERCONNECTED AND COORDINATED.
2. PROGRAM TO BE SELECTED BY CLOSED LOOP SYSTEM (TIME OF DAY) OR TBC BACKUP.
3. OFFSETS ARE REFERENCED TO TS2 FIRST GREEN (PHASE 2+6), ON WEST CHESTER PIKE.
4. SYSTEM LIMITS:
   WEST CHESTER PIKE – FROM N. LAWRENCE RD TO KOHL'S DRIVEWAY
   MASTER CONTROLLER:
   ON STREET MASTER AT: EAGLE RD
5. PRIMARY COORDINATION: CLOSED LOOP SYSTEM – FIBER OPTIC COMMUNICATION CABLE.
   SECONDARY COORDINATION: TBC (DEFAULT TO BACKUP TBC).
6. SYSTEM IS DESIGNED FOR THE SYSTEM SOFTWARE: ARIES.
7. CYCLES, SPLITS & OFFSETS ARE IN SECONDS.

LEGEND

- (4) INTERSECTION ADDRESS
- S## SYSTEM LOOP/ IDENTIFYING NUMBER
- LOOP SENSOR
- PHASE NUMBER

NOT TO SCALE

PENNSYLVANIA DEPARTMENT OF TRANSPORTATION
ENGINEERING DISTRICT 6-0

COUNTY: DELAWARE
MUNICIPALITY: HAVERFORD TOWNSHIP
INTERSECTION: WEST CHESTER PIKE (S.R. 0003) CORRIDOR
BETWEEN MALIN RD AND DARBY RD (SR 2005)

REVIEWED:

DATE

MUNICIPAL OFFICIAL DATE

RECOMMENDED:

DISTRICT TRAFFIC ENGINEER DATE

NO	REVISION	DES/ REVW	DATE	REVW	DATE	RECOM	DATE
1							
2							
3							
4							
5							
6							
7							
8							

SHEET 2 OF 2 INTERCONNECT PERMIT # 10084

EMERGENCY PRE–EMPTION NOTES:

CONTROLLER TO BE EQUIPPED WITH EMERGENCY PRE–EMPTION FOR THE NORTHBOUND AND SOUTHBOUND APPROACHES OF NEW ARDMORE AVENUE AND THE EASTBOUND AND WESTBOUND APPROACHES OF WEST CHESTER PIKE 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 APPROACH.

THE SIGNALS, WHEN ACTIVATED BY EMERGENCY VEHICLE, SHALL TERMINATE ALL GREEN INDICATIONS, EXCEPT THE GREEN INDICATIONS FOR THE PHASE GOVERNED BY THE APPROACHING EMERGENCY VEHICLE, FOLLOWED BY SELECTIVE CLEARANCES DEPENDENT UPON THE PHASE IN WHICH THE PRE–EMPTION OCCURS. THE "GREEN" INDICATIONS FOR THE PRE–EMPTED PHASE SHALL REMAIN "GREEN" FOR THE DURATION OF SIGNAL PRE–EMPTION AND "RED" INDICATIONS DISPLAYED FOR ALL OTHER PHASES.

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

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

IF SIGNALS HAVE BEEN ACTUATED BY PEDESTRIAN PUSHBUTTON, AND THE SIGNAL IS PRE–EMPTED DURING THE MAN INTERVAL,THE MAN INTERVAL SHALL TERMINATE IMMEDIATELY, FOLLOWED BY THE FLASHING HAND INTERVAL. THIS INTERVAL SHALL TIME OUT FOLLOWED BY THE APPROPRIATE SELECTIVE CLEARANCES, BEFORE GOING INTO EMERGENCY PRE–EMPTION.

UPON COMPLETION OF PRE–EMPTION PHASE A,B,C OR D IN RETURNING TO NORMAL OPERATION, PHASE 2+6 INTERVAL 10 SHALL FOLLOW.

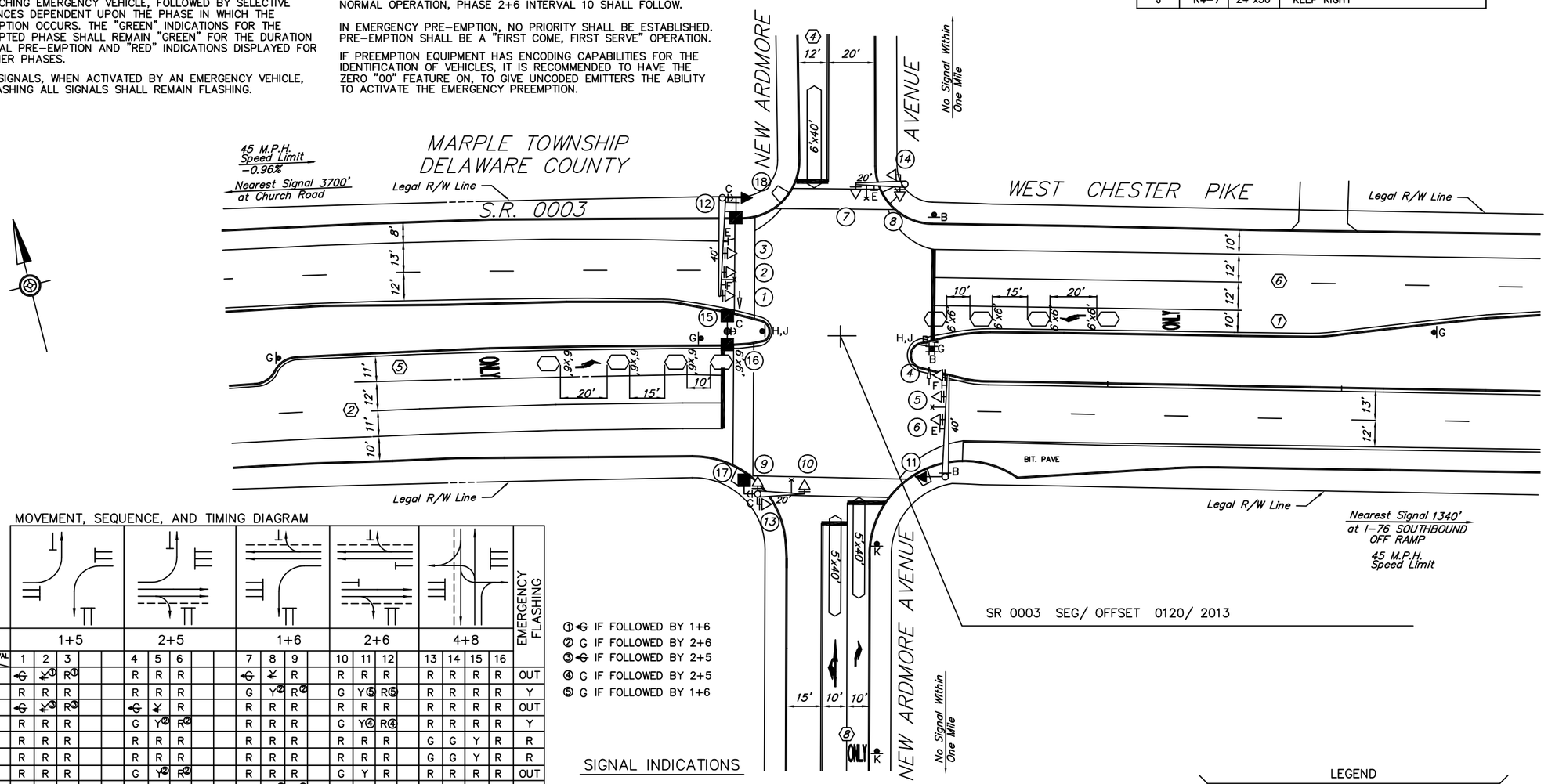
IN EMERGENCY PRE–EMPTION, NO PRIORITY SHALL BE ESTABLISHED. PRE–EMPTION SHALL BE A "FIRST COME, FIRST SERVE" OPERATION.

IF PREEMPTION EQUIPMENT HAS ENCODING CAPABILITIES FOR THE IDENTIFICATION OF VEHICLES, IT IS RECOMMENDED TO HAVE THE ZERO "00" FEATURE ON, TO GIVE UNCODED EMITTERS THE ABILITY TO ACTIVATE THE EMERGENCY PREEMPTION.

COORDINATION NOTES:

THIS INTERSECTION TO BE COORDINATED WITH ADJACENT INTERSECTION AT I–476 SOUTHBOUND OFF RAMP ON WEST CHESTER PIKE USING A TIME BASED COORDINATOR. THE ON–STREET MASTER CONTROLLER LOCATED AT SOUTH LAWRENCE ROAD SHALL SUPPLY A TBC CLOCK SYNCHRONIZING PULSE BY MEANS OF A CLOSED LOOP CAPABLE SYSTEM.

SIGN TABULATION			
PLAN SYMBOL	SERIES NUMBER	SIZE	REMARKS
B	R3–9	18"x18"	NO PEDESTRIAN CROSSING
C	R10–3B	9"x12"	EDUCATIONAL PUSH BUTTON FOR WALKING PERSON SIGNAL SIGN
E	R10–11	30"x36"	NO TURN ON RED
F	R10–10L	30"x36"	LEFT TURN SIGNAL
G	R3–7L	30"x30"	LEFT LANE MUST TURN LEFT
K	R3–7R	30"x30"	RIGHT LANE MUST TURN RIGHT
H	W16–1	18"x18"	HAZARD MARKER
J	R4–7	24"x30"	KEEP RIGHT



MOVEMENT, SEQUENCE, AND TIMING DIAGRAM

PHASE	1+5				2+5				1+6				2+6				4+8				EMERGENCY FLASHING
INTERVAL / SIGNALS	1	2	3		4	5	6		7	8	9		10	11	12		13	14	15	16	
1	⟲	↓①	R①		R	R	R		⟲	↓	R		R	R	R		R	R	R	R	OUT
2,3	R	R	R		R	R	R		G	Y②	R②		G	Y⑤	R⑤		R	R	R	R	Y
4	⟲	↓③	R③		⟲	↓	R		R	R	R		R	R	R		R	R	R	R	OUT
5,6	R	R	R		G	Y②	R②		R	R	R		G	Y④	R④		R	R	R	R	Y
7,8,	R	R	R		R	R	R		R	R	R		R	R	R		G	G	Y	R	R
9,10	R	R	R		R	R	R		R	R	R		R	R	R		G	G	Y	R	R
11,13	R	R	R		G	Y②	R②		R	R	R		G	Y	R		R	R	R	R	OUT
14,18	R	R	R		R	R	R		G	Y②	R②		G	Y	R		R	R	R	R	OUT
12,15,16,17	H	H	H		H	H	H		H	H	H		H	H	H		M	FH	H	H	OUT

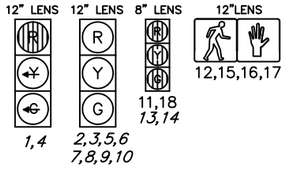
FIXED		4	2			4	2			4	2			4	2				4	2
MINIMUM	3				3				3								3			
PASSAGE	3				3				3								3			
MAXIMUM 1	7				7				7				60				15			
MAXIMUM 2	7				7				7				60				15			
PEDESTRIAN *																	7	8		
MEMORY	NL				NL				NL				MR				NL			

*ON PEDESTRIAN ACTUATION ONLY

NOTE: REFER TO SYSTEM PERMIT # I–0097 FOR PROGRAM TIMING & WEEKLY PROGRAM CHART

① ⟲ IF FOLLOWED BY 1+6
② G IF FOLLOWED BY 2+6
③ ⟲ IF FOLLOWED BY 2+5
④ G IF FOLLOWED BY 2+5
⑤ G IF FOLLOWED BY 1+6

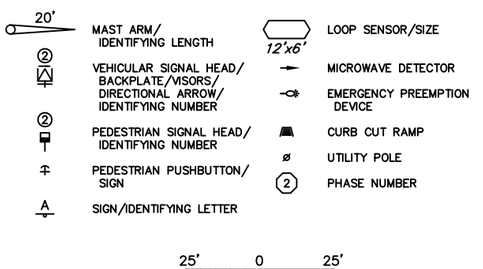
SIGNAL INDICATIONS



RED SIGNAL INDICATION ON SIGNAL HEADS 1 & 4 SHALL BE EQUIPPED WITH TUNNEL VISORS AND LOUVERS

SIGNAL HEADS 11, 13, 14 & 18 SHALL BE EQUIPPED WITH FULL TUNNEL VISORS AND LOUVERS

LEGEND



25' 0 25'
SCALE

GENERAL NOTES

NO MODIFICATIONS OF THIS INSTALLATION ARE PERMITTED UNLESS PRIOR APPROVAL IS GRANTED IN WRITING BY A REPRESENTATIVE OF 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 DRAWING ARE CONSIDERED PART OF THE PERMIT AND SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH PUBLICATION NO. 68.

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

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

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

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

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

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

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

THIS DRAWING CANNOT BE USED AS A CONSTRUCTION DRAWING UNLESS THE PERMITTEE COMPLIES WITH THE PROVISIONS OF ACT 187, PREVENTION OF DAMAGE TO UNDERGROUND UTILITIES, EFFECTIVE DATE DECEMBER 19, 1996.

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

PERMITTEE SHALL OBTAIN A HIGHWAY OCCUPANCY PERMIT FOR ANY CHANGES IN INTERSECTION GEOMETRY REGARDING EXCAVATION.

CONDUIT INSTALLED IN BITUMINOUS ROADWAY LESS THAN 5 YEARS OLD, OR CONCRETE ROADWAY REGARDLESS OF AGE, MUST BE BORED OR JACKED UNDER THE ROADWAY. INSTALL IN ACCORDANCE WITH

SYSTEM PERMIT # I–0097

PENNSYLVANIA DEPARTMENT OF TRANSPORTATION
ENGINEERING DISTRICT 6–0

COUNTY: DELAWARE
MUNICIPALITY: MARPLE TOWNSHIP
INTERSECTION: WEST CHESTER PIKE (SR 0003) AND NEW ARDMORE ROAD

REVIEWED:

DATE

MUNICIPAL OFFICIAL DATE

RECOMMENDED:

DATE

DISTRICT TRAFFIC ENGINEER DATE

NO.	REVISION	DES./ REVW.	DATE	REVW.	DATE	RECOM.	DATE
1	Modernization						
2							
3							
4							
5							
6							
7							
8							

SHEET 2 OF 2 | PERMIT # 63–0002 | FILE # 0002

EMERGENCY PRE-EMPTION PHASING
MOVEMENT, SEQUENCE AND TIMING DIAGRAM

PHASE	A					B					C				
INTERVAL / SIGNALS	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1,2	SELECTIVE YELLOW	SELECTIVE RED	G	Y①	R①	SELECTIVE YELLOW	SELECTIVE RED	R	R	R	SELECTIVE YELLOW	SELECTIVE RED	R	R	R
3,4			R	R	R			G	Y①	R①			R	R	R
5,6			R	R	R			R	R	R			G	Y	R
7			R	R	R			R	R	R			R	R	R
8			R	R	R			R	R	R			R	R	R
9, 10			H	H	H			H	H	H			H	H	H
FIXED TIME			**	5	2			**	5	2			**	4	2

**FOR DURATION OF PREEMPTION

① G IF FOLLOWED BY NORMAL OPERATION

EMERGENCY PRE-EMPTION NOTES:

CONTROLLER TO BE EQUIPPED WITH EMERGENCY PRE-EMPTION FOR THE EASTBOUND AND WESTBOUND APPROACHES OF WEST CHESTER PIKE WITH A FAIL DSAFE 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 APPROACH.

THE SIGNALS, WHEN ACTIVATED BY EMERGENCY VEHICLE, SHALL TERMINATE ALL GREEN INDICATIONS, EXCEPT THE GREEN INDICATIONS FOR THE PHASE GOVERNED BY THE APPROACHING EMERGENCY VEHICLE, FOLLOWED BY SELECTIVE CLEARANCES DEPENDENT UPON THE PHASE IN WHICH THE PRE-EMPTION OCCURS. THE "GREEN" INDICATIONS FOR THE PRE-EMPTED PHASE SHALL REMAIN "GREEN" FOR THE DURATION OF SIGNAL PRE-EMPTION AND "RED" INDICATIONS DISPLAYED FOR ALL OTHER PHASES.

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

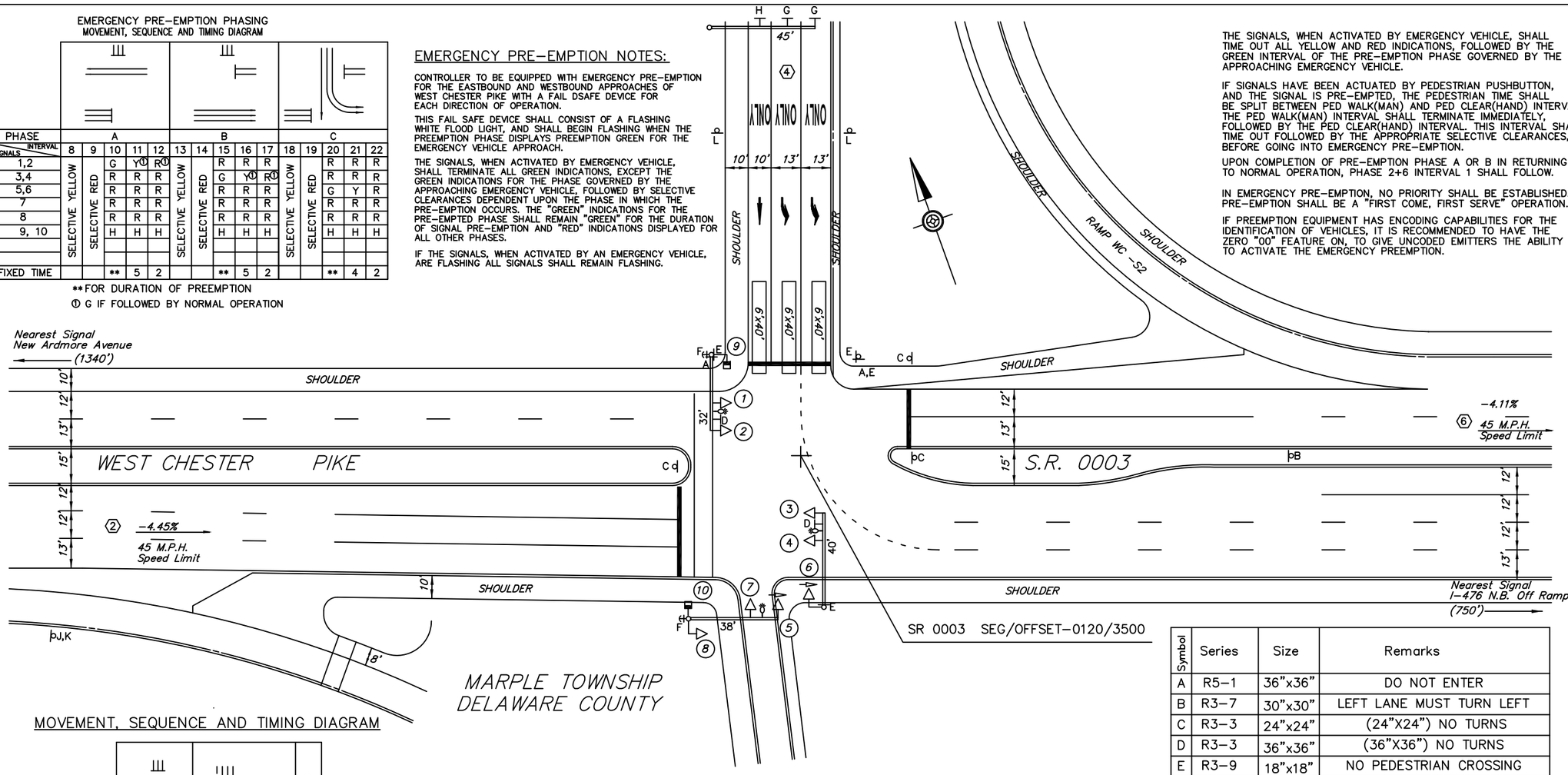
THE SIGNALS, WHEN ACTIVATED BY EMERGENCY VEHICLE, SHALL TIME OUT ALL YELLOW AND RED INDICATIONS, FOLLOWED BY THE GREEN INTERVAL OF THE PRE-EMPTION PHASE GOVERNED BY THE APPROACHING EMERGENCY VEHICLE.

IF SIGNALS HAVE BEEN ACTUATED BY PEDESTRIAN PUSHBUTTON, AND THE SIGNAL IS PRE-EMPTED, THE PEDESTRIAN TIME SHALL BE SPLIT BETWEEN PED WALK(MAN) AND PED CLEAR(HAND) INTERVAL. THE PED WALK(MAN) INTERVAL SHALL TERMINATE IMMEDIATELY, FOLLOWED BY THE PED CLEAR(HAND) INTERVAL. THIS INTERVAL SHALL TIME OUT FOLLOWED BY THE APPROPRIATE SELECTIVE CLEARANCES, BEFORE GOING INTO EMERGENCY PRE-EMPTION.

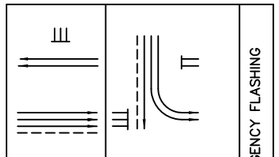
UPON COMPLETION OF PRE-EMPTION PHASE A OR B IN RETURNING TO NORMAL OPERATION, PHASE 2+6 INTERVAL 1 SHALL FOLLOW.

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

IF PREEMPTION EQUIPMENT HAS ENCODING CAPABILITIES FOR THE IDENTIFICATION OF VEHICLES, IT IS RECOMMENDED TO HAVE THE ZERO "00" FEATURE ON, TO GIVE UNCODED EMITTERS THE ABILITY TO ACTIVATE THE EMERGENCY PREEMPTION.



MOVEMENT, SEQUENCE AND TIMING DIAGRAM



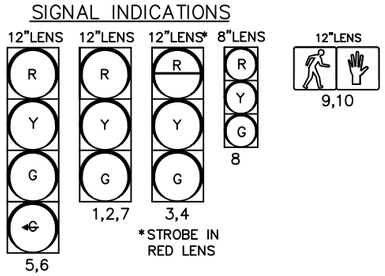
PHASE	2+6			4				EMERGENCY FLASHING
INTERVAL / SIGNAL	1	2	3	4	5	6	7	
1,2	G	Y	R	R	R	R	R	Y
3,4	G	Y	R	R	R	R	R	Y
5,6	R	R	R	G	G	Y	R	R
7	R	R	R	G	G	Y	R	R
8	G	Y	R	R	R	R	R	OUT
9,10	H	H	H	M	FH	H	H	OUT

FIXED		5	2			4	2
MINIMUM	29			3			
PASSAGE				3			
MAXIMUM 1	47			26			
MAXIMUM 2	59			36			
PEDESTRIAN *				7	19		
MEMORY	MR			NL			

*UPON PEDESTRIAN ACTUATION ONLY

NOTE: REFER TO SYSTEM PERMIT # I-0097 FOR PROGRAM TIMING & WEEKLY PROGRAM CHART

SIGNAL INDICATIONS



Symbol	Series	Size	Remarks
A	R5-1	36"x36"	DO NOT ENTER
B	R3-7	30"x30"	LEFT LANE MUST TURN LEFT
C	R3-3	24"x24"	(24"X24") NO TURNS
D	R3-3	36"x36"	(36"X36") NO TURNS
E	R3-9	18"x18"	NO PEDESTRIAN CROSSING
F	R10-3(R)	9"x12"	PUSH BUTTON FOR GREEN LIGHT
G	R3-5L	30"x36"	LEFT TURN SIGN
H	R3-5S	30"x36"	STRAIGHT THRU SIGN
J	R1-5	24"x18"	YIELD TO PEDESTRIAN SIGN
K	W11-2	36"x36"	PEDESTRIAN CROSSING SIGN
L	R5-9	36"x24"	WRONG WAY SIGN

LEGEND

- 20' — MAST ARM/ IDENTIFYING LENGTH
- ② — VEHICULAR SIGNAL HEAD/ BACKPLATE/VISORS/ DIRECTIONAL ARROW/ IDENTIFYING NUMBER
- ② — PEDESTRIAN SIGNAL HEAD/ IDENTIFYING NUMBER
- PEDESTRIAN PUSHBUTTON/ SIGN
- A — SIGN/IDENTIFYING LETTER
- 12'x6' — LOOP SENSOR/SIZE
- MICROWAVE DETECTOR
- EMERGENCY PREEMPTION DEVICE
- CURB CUT RAMP
- UTILITY POLE
- ② — PHASE NUMBER

25' 0 25'
SCALE

GENERAL NOTES

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

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

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

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

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

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

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

THIS DRAWING CANNOT BE USED AS A CONSTRUCTION DRAWING UNLESS THE PERMITTEE COMPLIES WITH THE PROVISIONS OF ACT 187, PREVENTION OF DAMAGE TO UNDERGROUND UTILITIES, EFFECTIVE DATE DECEMBER 19, 1996.

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PERMITTEE SHALL OBTAIN A HIGHWAY OCCUPANCY PERMIT FOR ANY CHANGES IN INTERSECTION GEOMETRY REGARDING EXCAVATION.

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SYSTEM PERMIT # I-0097

PENNSYLVANIA DEPARTMENT OF TRANSPORTATION
ENGINEERING DISTRICT 6-0

COUNTY: DELAWARE

MUNICIPALITY: MARPLE TOWNSHIP

INTERSECTION: WEST CHESTER PIKE (SR 0003) AND I-476 SOUTHBOUND OFF RAMP

REVIEWED:

DATE

MUNICIPAL OFFICIAL DATE

RECOMMENDED:

DATE

DISTRICT TRAFFIC ENGINEER DATE

NO.	REVISION	DES./ REVW.	DATE	REVW.	DATE	RECOM.	DATE
1	Modernization						
2							
3							
4							
5							
6							
7							
8							

SHEET 2 OF 2 | PERMIT # 63-2418 | FILE # 2418

EMERGENCY PRE-EMPTION NOTES:

CONTROLLER TO BE EQUIPPED WITH EMERGENCY PRE-EMPTION FOR THE EASTBOUND AND WESTBOUND APPROACHES OF WEST CHESTER PIKE 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 APPROACH.

THE SIGNALS, WHEN ACTIVATED BY EMERGENCY VEHICLE, SHALL TERMINATE ALL GREEN INDICATIONS, EXCEPT THE GREEN INDICATIONS FOR THE PHASE GOVERNED BY THE APPROACHING EMERGENCY VEHICLE, FOLLOWED BY SELECTIVE CLEARANCES DEPENDENT UPON THE PHASE IN WHICH THE PRE-EMPTION OCCURS. THE "GREEN" INDICATIONS FOR THE PRE-EMPTED PHASE SHALL REMAIN "GREEN" FOR THE DURATION OF SIGNAL PRE-EMPTION AND "RED" INDICATIONS DISPLAYED FOR ALL OTHER PHASES.

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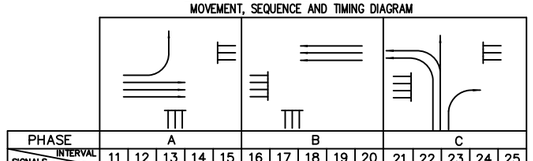
IF SIGNALS HAVE BEEN ACTUATED BY PEDESTRIAN PUSHBUTTON, AND THE SIGNAL IS PRE-EMPTED, THE PEDESTRIAN TIME SHALL BE SPLIT BETWEEN PED WALK(MAN) AND PED CLEAR(HAND) INTERVAL. THE PED WALK(MAN) INTERVAL SHALL TERMINATE IMMEDIATELY, FOLLOWED BY THE PED CLEAR(HAND) INTERVAL. THIS INTERVAL SHALL TIME OUT FOLLOWED BY THE APPROPRIATE SELECTIVE CLEARANCES, BEFORE GOING INTO EMERGENCY PRE-EMPTION.

UPON COMPLETION OF PRE-EMPTION PHASE A,B,C OR D IN RETURNING TO NORMAL OPERATION, PHASE 2+6 INTERVAL 10 SHALL FOLLOW.

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

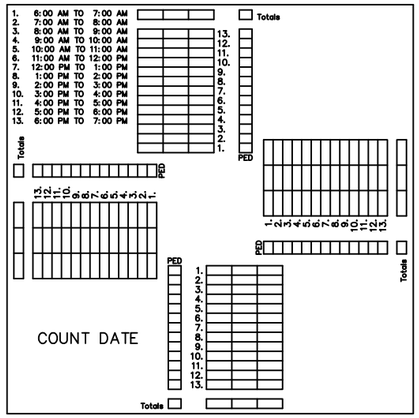
IF PREEMPTION EQUIPMENT HAS ENCODING CAPABILITIES FOR THE IDENTIFICATION OF VEHICLES, IT IS RECOMMENDED TO HAVE THE ZERO "00" FEATURE ON, TO GIVE UNCODED EMITTERS THE ABILITY TO ACTIVATE THE EMERGENCY PREEMPTION.

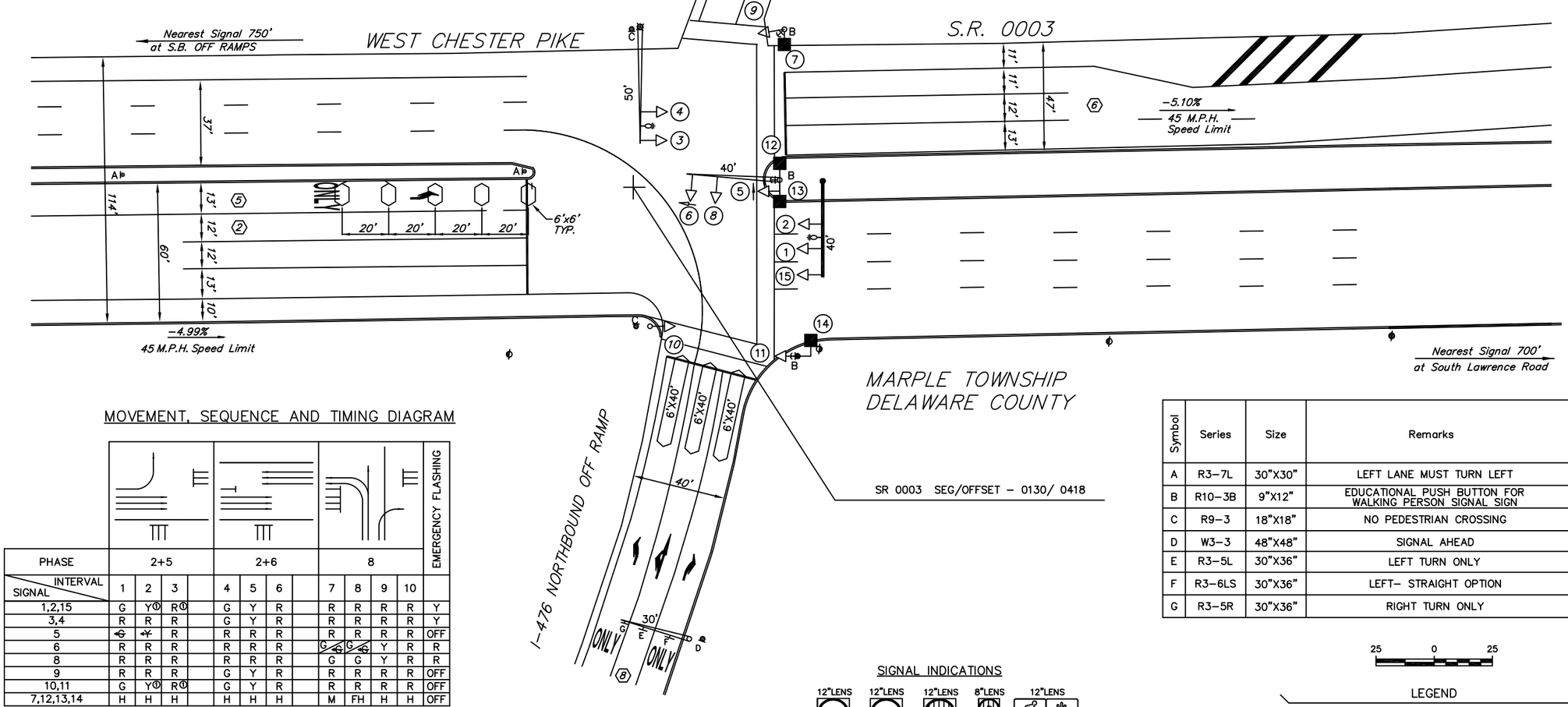
EMERGENCY PRE-EMPTION PHASING
MOVEMENT, SEQUENCE AND TIMING DIAGRAM



PHASE	A					B					C				
INTERVAL / SIGNALS	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1,2,15	SELECTIVE YELLOW	SELECTIVE RED	G	Y①	R①	SELECTIVE YELLOW	SELECTIVE RED	R	R	R	SELECTIVE YELLOW	SELECTIVE RED	R	R	R
3,4			R	R	R			G	Y①	R①			R	R	R
5			~~G~~	~~Y~~	R			R	R	R			R	R	R
6			R	R	R			R	R	R			G	Y	R
8			R	R	R			R	R	R			G	Y	R
9			R	R	R			R	R	R			R	R	R
10,11			R	R	R			R	R	R			R	R	R
7,12,13,14			H	H	H			H	H	H			H	H	H
FIXED TIME			**	4	2			**	4	2			**	4	2

** FOR DURATION OF PREEMPTION





MOVEMENT, SEQUENCE AND TIMING DIAGRAM

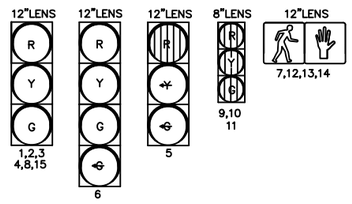
PHASE	2+5				2+6				8				EMERGENCY FLASHING
INTERVAL / SIGNAL	1	2	3		4	5	6		7	8	9	10	
1,2,15	G	Y①	R①		G	Y	R		R	R	R	R	Y
3,4	R	R	R		G	Y	R		R	R	R	R	Y
5	~~G~~	~~Y~~	R		R	R	R		R	R	R	R	OFF
6	R	R	R		R	R	R		~~G~~ G	~~G~~ G	Y	R	R
8	R	R	R		R	R	R		G	G	Y	R	R
9	R	R	R		G	Y	R		R	R	R	R	OFF
10,11	G	Y①	R①		G	Y	R		R	R	R	R	OFF
7,12,13,14	H	H	H		H	H	H		M	FH	H	H	OFF

FIXED		4	2			4	2				4	2
MINIMUM	3				3				3			
PASSAGE	3								3			
MAXIMUM I	25				30				25			
MAXIMUM II	25				30				25			
PEDESTRIAN *									7	12		
MEMORY	NL				MR					NL		

*UPON PEDESTRIAN ACTUATION ONLY

NOTE: REFER TO SYSTEM PERMIT # I-0097 FOR PROGRAM TIMING & WEEKLY PROGRAM CHART

SIGNAL INDICATIONS



SIGNALS TO BE EQUIPPED WITH STROBE IN RED LENSES 1,2,15

SIGNALS TO BE EQUIPPED WITH TUNNEL VISORS & LOUVERS 9,10,11 & 5(RED ONLY)

Symbol	Series	Size	Remarks
A	R3-7L	30"X30"	LEFT LANE MUST TURN LEFT
B	R10-3B	9"X12"	EDUCATIONAL PUSH BUTTON FOR WALKING PERSON SIGNAL SIGN
C	R9-3	18"X18"	NO PEDESTRIAN CROSSING
D	W3-3	48"X48"	SIGNAL AHEAD
E	R3-5L	30"X36"	LEFT TURN ONLY
F	R3-6LS	30"X36"	LEFT- STRAIGHT OPTION
G	R3-5R	30"X36"	RIGHT TURN ONLY

25 0 25

LEGEND

- 20' — MAST ARM/ IDENTIFYING LENGTH
- ② — VEHICULAR SIGNAL HEAD/ BACKPLATE/VISORS/ DIRECTIONAL ARROW/ IDENTIFYING NUMBER
- ② — PEDESTRIAN SIGNAL HEAD/ IDENTIFYING NUMBER
- PEDESTRIAN PUSHBUTTON/ SIGN
- A — SIGN/IDENTIFYING LETTER
- 12'x6' — LOOP SENSOR/SIZE
- MICROWAVE DETECTOR
- EMERGENCY PREEMPTION DEVICE
- CURB CUT RAMP
- UTILITY POLE
- (2) — PHASE NUMBER

GENERAL NOTES

NO MODIFICATIONS OF THIS INSTALLATION ARE PERMITTED UNLESS PRIOR APPROVAL IS GRANTED IN WRITING BY A REPRESENTATIVE OF 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 DRAWING ARE CONSIDERED PART OF THE PERMIT AND SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH PUBLICATION NO. 68.

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

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

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

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

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

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

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

THIS DRAWING CANNOT BE USED AS A CONSTRUCTION DRAWING UNLESS THE PERMITTEE COMPLIES WITH THE PROVISIONS OF ACT 38, PREVENTION OF DAMAGE TO UNDERGROUND UTILITIES, EFFECTIVE DATE DECEMBER 12, 1991.

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

PERMITTEE SHALL OBTAIN A HIGHWAY OCCUPANCY PERMIT FOR ANY CHANGES IN INTERSECTION GEOMETRY REGARDING EXCAVATION.

CONDUIT INSTALLED IN BITUMINOUS ROADWAY LESS THAN 5 YEARS OLD, OR CONCRETE ROADWAY REGARDLESS OF AGE, MUST BE BORED OR JACKED UNDER THE ROADWAY. INSTALL IN ACCORDANCE WITH TRAFFIC SIGNAL STANDARDS TC-7800 SERIES.

SYSTEM PERMIT # I-0097

PENNSYLVANIA DEPARTMENT OF TRANSPORTATION
ENGINEERING DISTRICT 6-0

COUNTY: DELAWARE

MUNICIPALITY: MARPLE_TOWNSHIP

INTERSECTION: WEST_CHESTER_PIKE_(SR_0003) AND_I-476_NORTHBOUND_OFF_RAMP

REVIEWED:

DATE

MUNICIPAL OFFICIAL DATE

RECOMMENDED:

MUNICIPAL SIGNALS ENGINEER DATE

DISTRICT TRAFFIC ENGINEER DATE

NO.	REVISION	DES./ REVW.	DATE	REVW.	DATE	RECOM.	DATE
1	MODERNIZATION						
NO	DESCR						
NO	DESCR						
NO	DESCR						
NO	DESCR						
NO	DESCR						
NO	DESCR						
NO	DESCR						

SHEET 2 OF 2 | PERMIT # 63-2419 | FILE # 2419

EMERGENCY PRE-EMPTION NOTES:

CONTROLLER TO BE EQUIPPED WITH EMERGENCY PRE-EMPTION FOR THE EASTBOUND AND WESTBOUND APPROACHES OF WEST CHESTER PIKE 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 APPROACH.

THE SIGNALS, WHEN ACTIVATED BY EMERGENCY VEHICLE, SHALL TERMINATE ALL GREEN INDICATIONS, EXCEPT THE GREEN INDICATIONS FOR THE PHASE GOVERNED BY THE APPROACHING EMERGENCY VEHICLE, FOLLOWED BY SELECTIVE CLEARANCES DEPENDENT UPON THE PHASE IN WHICH THE PRE-EMPTION OCCURS. THE "GREEN" INDICATIONS FOR THE PRE-EMPTED PHASE SHALL REMAIN "GREEN" FOR THE DURATION OF SIGNAL PRE-EMPTION AND "RED" INDICATIONS DISPLAYED FOR ALL OTHER PHASES.

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

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

IF SIGNALS HAVE BEEN ACTUATED BY PEDESTRIAN PUSHBUTTON, AND THE SIGNAL IS PRE-EMPTED, THE PEDESTRIAN TIME SHALL BE SPLIT BETWEEN PED WALK AND PED CLEAR INTERVAL. THE PED WALK INTERVAL SHALL TERMINATE IMMEDIATELY, FOLLOWED BY THE PED CLEAR INTERVAL. THIS INTERVAL SHALL TIME OUT FOLLOWED BY THE APPROPRIATE SELECTIVE CLEARANCES, BEFORE GOING INTO EMERGENCY PRE-EMPTION.

UPON COMPLETION OF PRE-EMPTION PHASE A OR B IN RETURNING TO NORMAL OPERATION, PHASE 2+6 INTERVAL 4 SHALL FOLLOW.

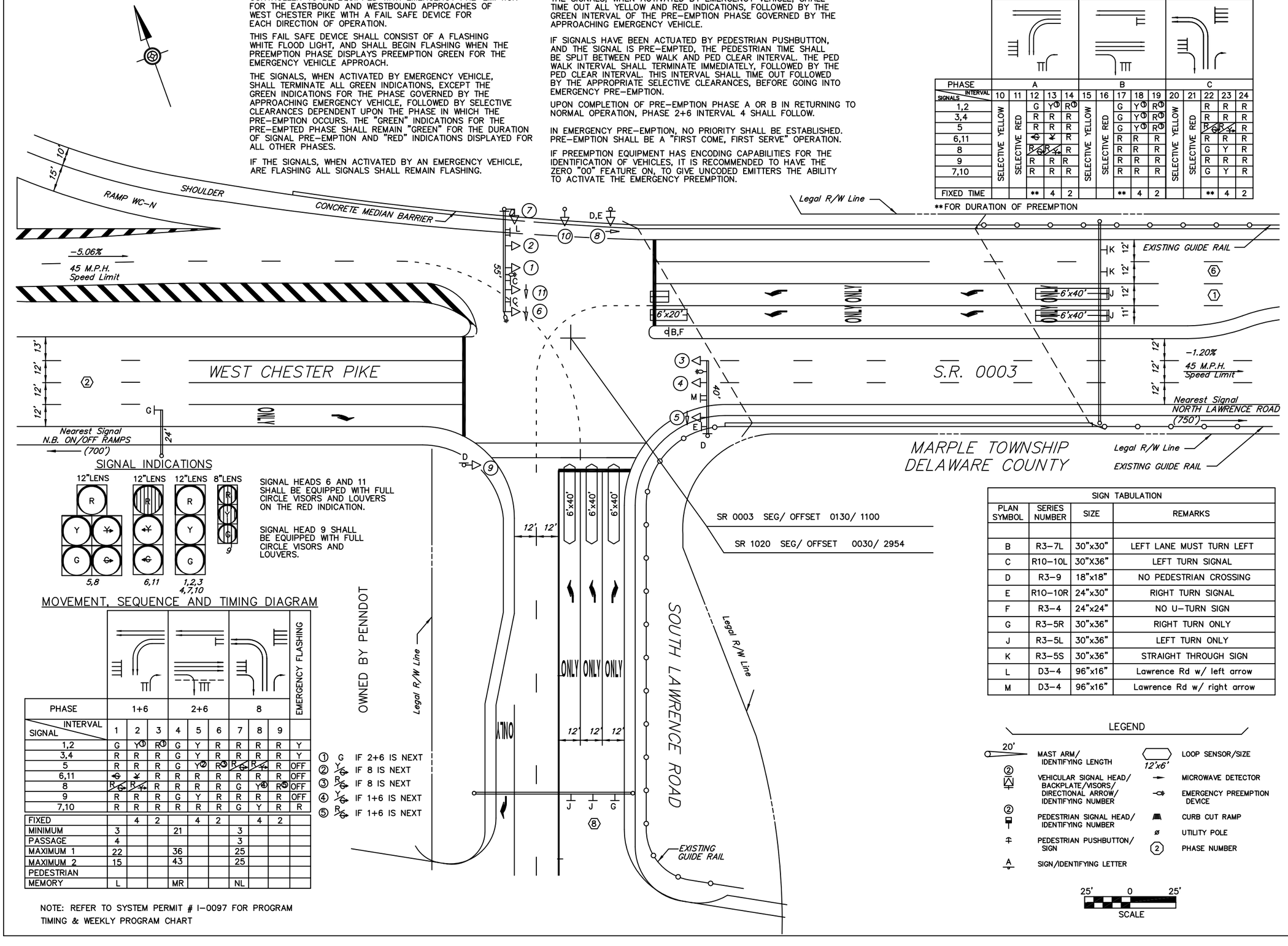
IN EMERGENCY PRE-EMPTION, NO PRIORITY SHALL BE ESTABLISHED. PRE-EMPTION SHALL BE A "FIRST COME, FIRST SERVE" OPERATION.

IF PREEMPTION EQUIPMENT HAS ENCODING CAPABILITIES FOR THE IDENTIFICATION OF VEHICLES, IT IS RECOMMENDED TO HAVE THE ZERO "00" FEATURE ON, TO GIVE UNCODED EMITTERS THE ABILITY TO ACTIVATE THE EMERGENCY PREEMPTION.

EMERGENCY PRE-EMPTION PHASING
MOVEMENT, SEQUENCE AND TIMING DIAGRAM

PHASE			A					B					C				
INTERVAL / SIGNALS	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1,2	SELECTIVE YELLOW	SELECTIVE RED	G	Y①	R①	SELECTIVE YELLOW	SELECTIVE RED	G	Y①	R①	SELECTIVE YELLOW	SELECTIVE RED	R	R	R
3,4			R	R	R			G	Y①	R①			R	R	R
5			R	R	R			G	Y①	R①			R	R	R
6,11			~~G~~	~~Y~~	R			R	R	R			R	R	R
8			R ~~G~~	R ~~Y~~	R			R	R	R			G	Y	R
9			R	R	R			R	R	R			R	R	R
7,10			R	R	R			R	R	R			G	Y	R
FIXED TIME			**	4	2			**	4	2			**	4	2

**FOR DURATION OF PREEMPTION



SIGNAL INDICATIONS

SIGNAL HEADS 6 AND 11 SHALL BE EQUIPPED WITH FULL CIRCLE VISORS AND LOUVERS ON THE RED INDICATION.

SIGNAL HEAD 9 SHALL BE EQUIPPED WITH FULL CIRCLE VISORS AND LOUVERS.

MOVEMENT, SEQUENCE AND TIMING DIAGRAM

PHASE	1+6			2+6			8			EMERGENCY FLASHING
INTERVAL / SIGNAL	1	2	3	4	5	6	7	8	9	
1,2	G	Y①	R①	G	Y	R	R	R	R	Y
3,4	R	R	R	G	Y	R	R	R	R	Y
5	R	R	R	G	Y②	R③	R ~~G~~	R ~~Y~~	R	OFF
6,11	~~G~~	~~Y~~	R	R	R	R	R	R	R	OFF
8	R ~~G~~	R ~~Y~~	R	R	R	R	G	Y④	R⑤	OFF
9	R	R	R	G	Y	R	R	R	R	OFF
7,10	R	R	R	R	R	R	G	Y	R	R
FIXED		4	2		4	2		4	2	
MINIMUM	3			21			3			
PASSAGE	4						3			
MAXIMUM 1	22			36			25			
MAXIMUM 2	15			43			25			
PEDESTRIAN										
MEMORY	L			MR			NL			

① G IF 2+6 IS NEXT
② ~~Y~~ IF 8 IS NEXT
③ R ~~G~~ IF 8 IS NEXT
④ ~~Y~~ IF 1+6 IS NEXT
⑤ R ~~G~~ IF 1+6 IS NEXT

NOTE: REFER TO SYSTEM PERMIT # I-0097 FOR PROGRAM TIMING & WEEKLY PROGRAM CHART

SIGN TABULATION

PLAN SYMBOL	SERIES NUMBER	SIZE	REMARKS
B	R3-7L	30"x30"	LEFT LANE MUST TURN LEFT
C	R10-10L	30"X36"	LEFT TURN SIGNAL
D	R3-9	18"x18"	NO PEDESTRIAN CROSSING
E	R10-10R	24"x30"	RIGHT TURN SIGNAL
F	R3-4	24"x24"	NO U-TURN SIGN
G	R3-5R	30"x36"	RIGHT TURN ONLY
J	R3-5L	30"x36"	LEFT TURN ONLY
K	R3-5S	30"x36"	STRAIGHT THROUGH SIGN
L	D3-4	96"x16"	Lawrence Rd w/ left arrow
M	D3-4	96"x16"	Lawrence Rd w/ right arrow

LEGEND

- 20' — MAST ARM/ IDENTIFYING LENGTH
- ② — VEHICULAR SIGNAL HEAD/ BACKPLATE/VISORS/ DIRECTIONAL ARROW/ IDENTIFYING NUMBER
- ② — PEDESTRIAN SIGNAL HEAD/ IDENTIFYING NUMBER
- PEDESTRIAN PUSHBUTTON/ SIGN
- A — SIGN/IDENTIFYING LETTER
- 12'x6' — LOOP SENSOR/SIZE
- MICROWAVE DETECTOR
- EMERGENCY PREEMPTION DEVICE
- CURB CUT RAMP
- UTILITY POLE
- (2) — PHASE NUMBER

25' 0 25'
SCALE

GENERAL NOTES

NO MODIFICATIONS OF THIS INSTALLATION ARE PERMITTED UNLESS PRIOR APPROVAL IS GRANTED IN WRITING BY A REPRESENTATIVE OF 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 DRAWING ARE CONSIDERED PART OF THE PERMIT AND SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH PUBLICATION NO. 68.

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

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

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

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

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

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

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

THIS DRAWING CANNOT BE USED AS A CONSTRUCTION DRAWING UNLESS THE PERMITTEE COMPLIES WITH THE PROVISIONS OF ACT 187, PREVENTION OF DAMAGE TO UNDERGROUND UTILITIES, EFFECTIVE DATE DECEMBER 19, 1996.

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

PERMITTEE SHALL OBTAIN A HIGHWAY OCCUPANCY PERMIT FOR ANY CHANGES IN INTERSECTION GEOMETRY REGARDING EXCAVATION.

CONDUIT INSTALLED IN BITUMINOUS ROADWAY LESS THAN 5 YEARS OLD, OR CONCRETE ROADWAY REGARDLESS OF AGE, MUST BE BORED OR JACKED UNDER THE ROADWAY. INSTALL IN ACCORDANCE WITH TRAFFIC SIGNAL STANDARDS TC-7800 SERIES.

SYSTEM PERMIT # I-0097

PENNSYLVANIA DEPARTMENT OF TRANSPORTATION
ENGINEERING DISTRICT 6-0

COUNTY: DELAWARE
MUNICIPALITY: MARPLE TOWNSHIP
INTERSECTION: WEST CHESTER PIKE (S.R. 0003) AND SOUTH LAWRENCE ROAD

REVIEWED:
DATE
MUNICIPAL OFFICIAL DATE

RECOMMENDED:
DATE
DISTRICT TRAFFIC ENGINEER DATE

NO.	REVISION	DES./ REVW.	DATE	REVW.	DATE	RECOM.	DATE
1	Modernization						
2							
3							
4							
5							
6							
7							
8							

SHEET 2 OF 2 | PERMIT # 63-0827 | FILE # 0827

EMERGENCY PRE-EMPTION NOTES:

CONTROLLER TO BE EQUIPPED WITH EMERGENCY PRE-EMPTION FOR THE NORTHBOUND AND SOUTHBOUND APPROACHES OF NORTH LAWRENCE ROAD AND THE EASTBOUND AND WESTBOUND APPROACHES OF WEST CHESTER PIKE 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 APPROACH.

THE SIGNALS, WHEN ACTIVATED BY EMERGENCY VEHICLE, SHALL TERMINATE ALL GREEN INDICATIONS, EXCEPT THE GREEN INDICATIONS FOR THE PHASE GOVERNED BY THE APPROACHING EMERGENCY VEHICLE, FOLLOWED BY SELECTIVE CHANGE AND CLEARANCES DEPENDENT UPON THE PHASE IN WHICH THE PRE-EMPTION OCCURS. THE "GREEN" INDICATIONS FOR THE PRE-EMPTED PHASE SHALL REMAIN "GREEN" FOR THE DURATION OF SIGNAL PRE-EMPTION AND "RED" INDICATIONS DISPLAYED FOR ALL OTHER PHASES.

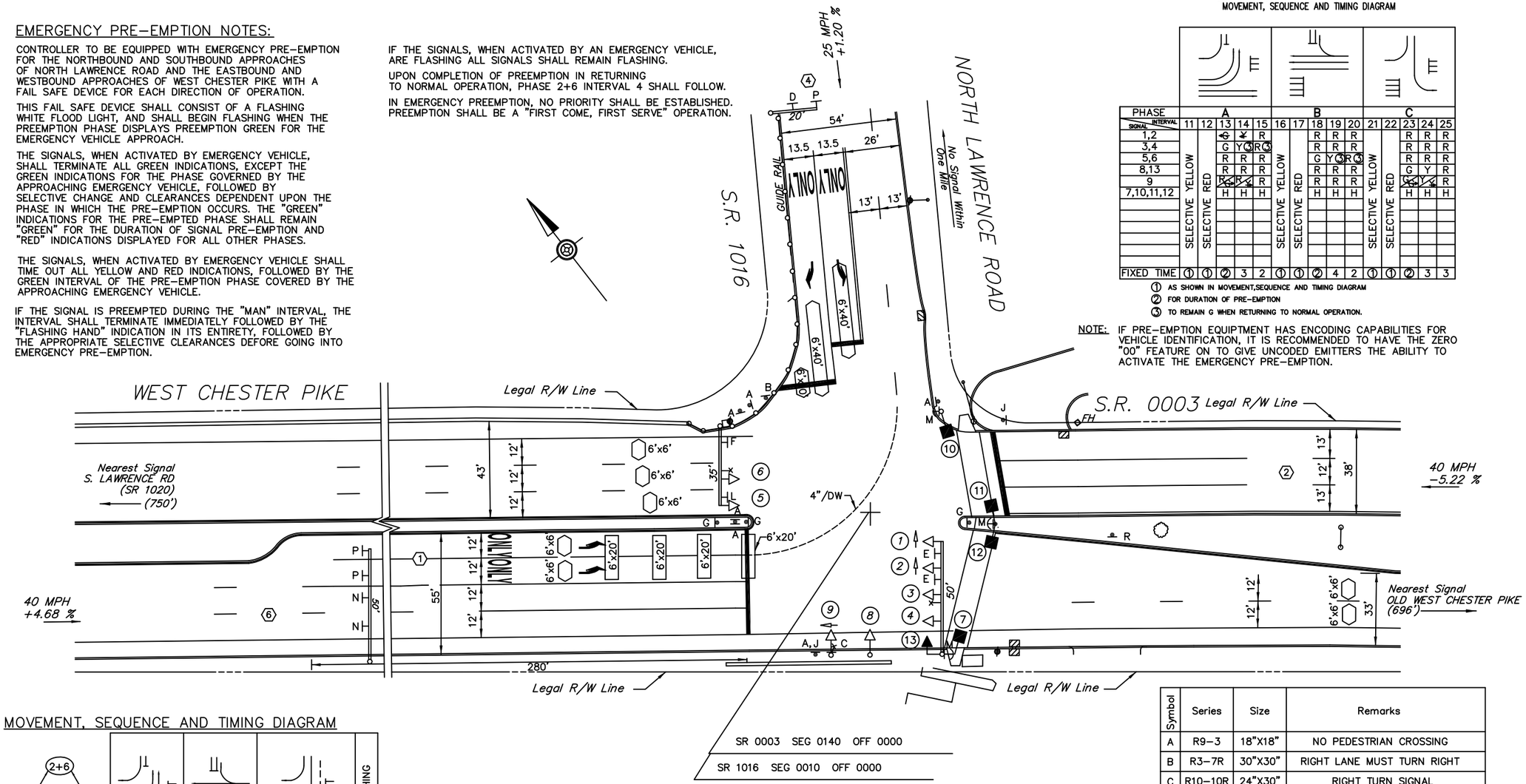
THE SIGNALS, WHEN ACTIVATED BY EMERGENCY VEHICLE SHALL TIME OUT ALL YELLOW AND RED INDICATIONS, FOLLOWED BY THE GREEN INTERVAL OF THE PRE-EMPTION PHASE COVERED BY THE APPROACHING EMERGENCY VEHICLE.

IF THE SIGNAL IS PREEMPTED DURING THE "MAN" INTERVAL, THE INTERVAL SHALL TERMINATE IMMEDIATELY FOLLOWED BY THE "FLASHING HAND" INDICATION IN ITS ENTIRETY, FOLLOWED BY THE APPROPRIATE SELECTIVE CLEARANCES DEFORE GOING INTO EMERGENCY PRE-EMPTION.

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

UPON COMPLETION OF PREEMPTION IN RETURNING TO NORMAL OPERATION, PHASE 2+6 INTERVAL 4 SHALL FOLLOW.

IN EMERGENCY PREEMPTION, NO PRIORITY SHALL BE ESTABLISHED. PREEMPTION SHALL BE A "FIRST COME, FIRST SERVE" OPERATION.



EMERGENCY PRE-EMPTION PHASING
MOVEMENT, SEQUENCE AND TIMING DIAGRAM

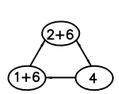
PHASE	A					B					C				
SIGNAL / INTERVAL	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1,2			G	Y ③	R ③			R	R	R			R	R	R
3,4			R	R	R			R	R	R			R	R	R
5,6			R	R	R			G	Y ③	R ③			R	R	R
8,13			R	R	R			R	R	R			G	Y	R
9			R	R	R			R	R	R			Y	Y	R
7,10,11,12			H	H	H			H	H	H			H	H	H
FIXED TIME	①	①	②	3	2	①	①	②	4	2	①	①	②	3	3

SELECTIVE YELLOW / SELECTIVE RED

① AS SHOWN IN MOVEMENT, SEQUENCE AND TIMING DIAGRAM
② FOR DURATION OF PRE-EMPTION
③ TO REMAIN G WHEN RETURNING TO NORMAL OPERATION.

NOTE: IF PRE-EMPTION EQUIPTMENT 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.

MOVEMENT, SEQUENCE AND TIMING DIAGRAM



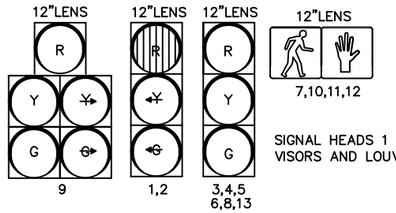
PHASE	1+6			2+6			4				EMERGENCY FLASHING
SIGNAL / INTERVAL	1	2	3	4	5	6	7	8	9	10	
1,2	G	Y ①	R ①	G	Y	R	R	R	R	R	OFF
3,4	R	R	R	G	Y	R	R	R	R	R	Y
5,6	R	R	R	R	R	R	G	G	Y	R ①	Y
8,13	R	R	R	G	Y	R	R	R	R	R	R
9	R	R	R	R	R	R	G	G	Y	R ①	R
7,10,11,12	H	H	H	H	H	H	M	FH	H	H	OFF

FIXED		3	2		4	2			3	3	
MINIMUM	3			34			3				
PASSAGE	3						3				
MAXIMUM	18						10				
PEDESTRIAN *							8	10			
MEMORY	NL			MN			NL				

① G IF FOLLOWED BY 2+6
② Y/6 IF FOLLOWED BY 1+6
③ R/6 IF FOLLOWED BY 1+6

* UPON PEDESTRIAN ACTUATION ONLY
NOTE: REFER TO SYSTEM PERMIT # I-0084 FOR PROGRAM TIMING & WEEKLY PROGRAM CHART

SIGNAL INDICATIONS



SIGNAL HEADS 1 AND 2 HAVE FULL CIRCLE VISORS AND LOUVERS ON RED INDICATORS.

25 0 25

LEGEND

- 20' — MAST ARM/ IDENTIFYING LENGTH
- ② — VEHICULAR SIGNAL HEAD/ BACKPLATE/VISORS/ DIRECTIONAL ARROW/ IDENTIFYING NUMBER
- ② — PEDESTRIAN SIGNAL HEAD/ IDENTIFYING NUMBER
- PEDESTRIAN PUSHBUTTON/ SIGN
- A — SIGN/IDENTIFYING LETTER
- 12'x6' — LOOP SENSOR/SIZE
- MICROWAVE DETECTOR
- EMERGENCY PREEMPTION DEVICE
- CURB CUT RAMP
- UTILITY POLE
- ② — PHASE NUMBER

Symbol	Series	Size	Remarks
A	R9-3	18"X18"	NO PEDESTRIAN CROSSING
B	R3-7R	30"X30"	RIGHT LANE MUST TURN RIGHT
C	R10-10R	24"X30"	RIGHT TURN SIGNAL
D	R3-5R	30"X36"	RIGHT TURN SIGN
E	R10-10L	30"X36"	LEFT TURN SIGNAL
F	D3-4	84"X16"	LAWRENCE RD
J	R10-11	30"X36"	NO TURN ON RED
G	R3-4	24"X24"	NO U-TURN SIGN
L	R3-4	30"X30"	NO U-TURN SIGN
M	R10-3B	9"X12"	EDUCATIONAL PUSH BUTTON FOR WALKING PERSON SIGNAL SIGN
N	R3-5S	30"X36"	STRAIGHT THROUGH SIGN
P	R3-5L	30"X36"	LEFT TURN SIGN
R	R6-1R	12"X36"	HORZ RIGHT - ONE WAY

GENERAL NOTES

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

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

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

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SYSTEM PERMIT # I-0084

PENNSYLVANIA DEPARTMENT OF TRANSPORTATION
ENGINEERING DISTRICT 6-0

COUNTY: DELAWARE
MUNICIPALITY: HAVERFORD TOWNSHIP
INTERSECTION: WEST CHESTER PIKE (SR 0003) AND NORTH LAWRENCE ROAD (SR 1016)

REVIEWED:

DATE

MUNICIPAL OFFICIAL DATE

RECOMMENDED:

WARNER J. EICHORN 5-27-87
DISTRICT TRAFFIC ENGINEER DATE

NO.	REVISION	DES./ REVW.	DATE	REVW.	DATE	RECOM.	DATE
1	H/M Heads,Preemp',Coordinat'n						
2							
3							
4							
5							
6							
7							
8							

SHEET 2 OF 2 | PERMIT # 63-0384 | FILE # 0384

Appendix S

Manual Intersection Turning Vehicle Counts

Orth-Rodgers & Associates

Note:
WB WCP thru volume
counted @ Mather Ave

File Name : WCP&NewArdmore_AM
Site Code : 00000000
Start Date : 1/26/2010
Page No : 1

Groups Printed- Unshifted - HV - Turn/RTOR

	New Ardmore Ave SB					West Chester Pike WB					New Ardmore Ave NB					West Chester Pike EB					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	9	0	3	0	12	3	0	3	0	6	5	2	15	0	22	0	287	2	0	289	329
07:15 AM	28	10	4	0	42	10	0	3	0	13	8	4	17	0	29	3	327	5	0	335	419
07:30 AM	25	7	6	0	38	3	0	4	0	7	8	4	16	0	28	2	322	3	0	327	400
07:45 AM	26	8	1	0	35	4	0	4	0	8	5	4	15	0	24	6	280	2	0	288	355
Total	88	25	14	0	127	20	0	14	0	34	26	14	63	0	103	11	1216	12	0	1239	1503
08:00 AM	23	7	2	0	32	9	0	4	0	13	8	6	19	0	33	2	300	7	0	309	387
08:15 AM	20	6	3	0	29	5	0	3	0	8	7	2	19	2	30	1	315	5	0	321	388
08:30 AM	24	4	3	0	31	7	0	3	0	10	4	5	17	1	27	2	288	5	0	295	363
08:45 AM	19	5	2	0	26	5	0	8	0	13	4	4	11	0	19	4	296	3	0	303	361
Total	86	22	10	0	118	26	0	18	0	44	23	17	66	3	109	9	1199	20	0	1228	1499
Grand Total	174	47	24	0	245	46	0	32	0	78	49	31	129	3	212	20	2415	32	0	2467	3002
Apprch %	71	19.2	9.8	0		59	0	41	0		23.1	14.6	60.8	1.4		0.8	97.9	1.3	0		
Total %	5.8	1.6	0.8	0	8.2	1.5	0	1.1	0	2.6	1.6	1	4.3	0.1	7.1	0.7	80.4	1.1	0	82.2	
Unshifted	171	45	17	0	233	29	0	32	0	61	46	30	119	3	198	16	2325	29	0	2370	2862
% Unshifted	98.3	95.7	70.8	0	95.1	63	0	100	0	78.2	93.9	96.8	92.2	100	93.4	80	96.3	90.6	0	96.1	95.3
HV	3	2	0	0	5	1	0	0	0	1	3	1	2	0	6	2	90	3	0	95	107
% HV	1.7	4.3	0	0	2	2.2	0	0	0	1.3	6.1	3.2	1.6	0	2.8	10	3.7	9.4	0	3.9	3.6
U-Turn/RTOR	0	0	7	0	7	16	0	0	0	16	0	0	8	0	8	2	0	0	0	2	33
% U-Turn/RTOR	0	0	29.2	0	2.9	34.8	0	0	0	20.5	0	0	6.2	0	3.8	10	0	0	0	0.1	1.1

	New Ardmore Ave SB					West Chester Pike WB					New Ardmore Ave NB					West Chester Pike EB					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	28	10	4	0	42	10	0	3	0	13	8	4	17	0	29	3	327	5	0	335	419
07:30 AM	25	7	6	0	38	3	0	4	0	7	8	4	16	0	28	2	322	3	0	327	400
07:45 AM	26	8	1	0	35	4	0	4	0	8	5	4	15	0	24	6	280	2	0	288	355
08:00 AM	23	7	2	0	32	9	0	4	0	13	8	6	19	0	33	2	300	7	0	309	387
Total Volume	102	32	13	0	147	26	0	15	0	41	29	18	67	0	114	13	1229	17	0	1259	1561
% App. Total	69.4	21.8	8.8	0		63.4	0	36.6	0		25.4	15.8	58.8	0		1	97.6	1.4	0		
PHF	.911	.800	.542	.000	.875	.650	.000	.938	.000	.788	.906	.750	.882	.000	.864	.542	.940	.607	.000	.940	.931
Unshifted	101	30	9	0	140	16	0	15	0	31	27	17	62	0	106	11	1189				
% Unshifted	99.0	93.8	69.2	0	95.2	61.5	0	100	0	75.6	93.1	94.4	92.5	0	93.0	84.6	96.7	94.1	0	96.6	95.6
HV	1	2	0	0	3	0	0	0	0	0	2	1	2	0	5	1	40	1	0	42	50
% HV	1.0	6.3	0	0	2.0	0	0	0	0	0	6.9	5.6	3.0	0	4.4	7.7	3.3	5.9	0	3.3	3.2
U-Turn/RTOR	0	0	4	0	4	10	0	0	0	10	0	0	3	0	3	1	0	0	0	1	18
% U-Turn/RTOR	0	0	30.8	0	2.7	38.5	0	0	0	24.4	0	0	4.5	0	2.6	7.7	0	0	0	0.1	1.2

Orth-Rodgers & Associates

File Name : WCP&NewArdmore_PM
Site Code : 00000000
Start Date : 4/7/2009
Page No : 1

Groups Printed- Unshifted - HV - Turns

	New Ardmore Rd SB					West Chester Pike WB					New Ardmore Rd NB					West Chester Pike EB					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	2	4	7	0	13	2	333	2	1	338	13	3	5	0	21	15	229	4	0	248	620
04:15 PM	1	4	3	0	8	4	357	7	0	368	13	5	0	0	18	28	293	9	0	330	724
04:30 PM	0	4	3	0	7	4	301	4	0	309	10	6	2	0	18	25	288	9	0	322	656
04:45 PM	8	5	7	0	20	4	323	3	0	330	13	5	1	0	19	28	307	11	0	346	715
Total	11	17	20	0	48	14	1314	16	1	1345	49	19	8	0	76	96	1117	33	0	1246	2715
05:00 PM	6	2	4	0	12	4	387	5	0	396	13	2	1	0	16	32	272	6	0	310	734
05:15 PM	6	5	5	0	16	1	263	2	0	266	10	4	1	0	15	12	227	6	0	245	542
05:30 PM	8	6	7	0	21	4	338	5	0	347	19	3	4	0	26	17	271	13	0	301	695
05:45 PM	4	4	4	0	12	2	260	8	0	270	4	3	5	0	12	19	187	5	0	211	505
Total	24	17	20	0	61	11	1248	20	0	1279	46	12	11	0	69	80	957	30	0	1067	2476
Grand Total	35	34	40	0	109	25	2562	36	1	2624	95	31	19	0	145	176	2074	63	0	2313	5191
Apprch %	32.1	31.2	36.7	0		1	97.6	1.4	0		65.5	21.4	13.1	0		7.6	89.7	2.7	0		
Total %	0.7	0.7	0.8	0	2.1	0.5	49.4	0.7	0	50.5	1.8	0.6	0.4	0	2.8	3.4	40	1.2	0	44.6	
Unshifted	35	34	40	0	109	23	2532	34	1	2590	94	31	16	0	141	152	2046	62	0	2260	5100
% Unshifted	100	100	100	0	100	92	98.8	94.4	100	98.7	98.9	100	84.2	0	97.2	86.4	98.6	98.4	0	97.7	98.2
HV	0	0	0	0	0	0	29	2	0	31	1	0	3	0	4	4	28	1	0	33	68
% HV	0	0	0	0	0	0	1.1	5.6	0	1.2	1.1	0	15.8	0	2.8	2.3	1.4	1.6	0	1.4	1.3
U-Turns	0	0	0	0	0	2	1	0	0	3	0	0	0	0	0	20	0	0	0	20	23
% U-Turns	0	0	0	0	0	8	0	0	0	0.1	0	0	0	0	0	11.4	0	0	0	0.9	0.4

	New Ardmore Rd SB					West Chester Pike WB					New Ardmore Rd NB					West Chester Pike EB					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 4:00:00 PM to 4:30:00 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 4:00:00 PM																					
4:00:00 PM	2	4	7	0	13	2	333	2	1	338	13	3	5	0	21	15	229	4	0	248	620
4:15:00 PM	1	4	3	0	8	4	357	7	0	368	13	5	0	0	18	28	293	9	0	330	724
4:30:00 PM	0	3	2	0	5	2	192	4	0	198	7	5	2	0	14	18	194	5	0	217	434
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	3	11	12	0	26	8	882	13	1	904	33	13	7	0	53	61	716	18	0	795	1778
% App. Total	11.5	42.3	46.2	0		0.9	97.6	1.4	0.1		62.3	24.5	13.2	0		7.7	90.1	2.3	0		
PHF	.375	.688	.429	.000	.500	.500	.618	.464	.250	.614	.635	.650	.350	.000	.631	.545	.611	.500	.000	.602	.614
Unshifted	11	17	20	0	48	13	1291										1098				
% Unshifted	366.7	154.5	166.7	0	184.6	162.5	146.4	115.4	100	146.0	145.5	146.2	71.4	0	135.8	131.1	153.4	177.8	0	152.2	149.0
HV	0	0	0	0	0	0	22	1	0	23	1	0	3	0	4	4	19	1	0	24	51
% HV	0	0	0	0	0	0	2.5	7.7	0	2.5	3.0	0	42.9	0	7.5	6.6	2.7	5.6	0	3.0	2.9
U-Turns	0	0	0	0	0	1	1	0	0	2	0	0	0	0	0	12	0	0	0	12	14
% U-Turns	0	0	0	0	0	12.5	0.1	0	0	0.2	0	0	0	0	0	19.7	0	0	0	1.5	0.8

Orth-Rodgers & Associates

File Name : WCP&I-476 South Off Ramp_AM
Site Code : 00000000
Start Date : 1/21/2010
Page No : 1

Groups Printed- Unshifted - HV

	I-476 SB Off Ramp SB					West Chester Pike WB			West Chester Pike EB			
Start Time	Left	Thru	R @ light	R @ ramp	App. Total	Thru	R to 476 S	App. Total	Thru	Right	App. Total	Int. Total
07:00 AM	103	0	2	51	156	207	86	293	236	70	306	755
07:15 AM	147	0	0	57	204	250	154	404	274	91	365	973
07:30 AM	179	1	1	51	232	240	95	335	259	83	342	909
07:45 AM	175	0	1	74	250	231	98	329	321	52	373	952
Total	604	1	4	233	842	928	433	1361	1090	296	1386	3589
08:00 AM	173	0	0	66	239	225	80	305	326	49	375	919
08:15 AM	168	1	0	74	243	252	66	318	340	51	391	952
08:30 AM	169	1	0	76	246	230	91	321	298	46	344	911
08:45 AM	119	2	2	50	173	200	40	240	248	49	297	710
Total	629	4	2	266	901	907	277	1184	1212	195	1407	3492
Grand Total	1233	5	6	499	1743	1835	710	2545	2302	491	2793	7081
Apprch %	70.7	0.3	0.3	28.6		72.1	27.9		82.4	17.6		
Total %	17.4	0.1	0.1	7	24.6	25.9	10	35.9	32.5	6.9	39.4	
Unshifted	1163	3	6	475	1647	1750	698	2448	2213	480	2693	6788
% Unshifted	94.3	60	100	95.2	94.5	95.4	98.3	96.2	96.1	97.8	96.4	95.9
HV	70	2	0	24	96	85	12	97	89	11	100	293
% HV	5.7	40	0	4.8	5.5	4.6	1.7	3.8	3.9	2.2	3.6	4.1

	I-476 SB Off Ramp SB					West Chester Pike WB			West Chester Pike EB			
Start Time	Left	Thru	R @ light	R @ ramp	App. Total	Thru	R to 476 S	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 07:15 AM												
07:15 AM	147	0	0	57	204	250	154	404	274	91	365	973
07:30 AM	179	1	1	51	232	240	95	335	259	83	342	909
07:45 AM	175	0	1	74	250	231	98	329	321	52	373	952
08:00 AM	173	0	0	66	239	225	80	305	326	49	375	919
Total Volume	674	1	2	248	925	946	427	1373	1180	275	1455	3753
% App. Total	72.9	0.1	0.2	26.8		68.9	31.1		81.1	18.9		
PHF	.941	.250	.500	.838	.925	.946	.693	.850	.905	.755	.970	.964
Unshifted	635	0	2	236	873	904	418	1322	1141	266	1407	3602
% Unshifted	94.2	0	100	95.2	94.4	95.6	97.9	96.3	96.7	96.7	96.7	96.0
HV	39	1	0	12	52	42	9	51	39	9	48	151
% HV	5.8	100	0	4.8	5.6	4.4	2.1	3.7	3.3	3.3	3.3	4.0

Orth-Rodgers & Associates

File Name : WCP&I-476 South Off Ramp_PM
Site Code : 00000000
Start Date : 3/31/2009
Page No : 1

Groups Printed- Unshifted - HV

	I-476 SB Off Ramp SB					West Chester Pike WB			West Chester Pike EB			
Start Time	Left	Thru	R @ light	R @ ramp	App. Total	Thru	R to 476 S	App. Total	Thru	Right	App. Total	Int. Total
04:00 PM	161	0	0	82	243	144	47	191	330	61	391	825
04:15 PM	359	1	0	68	428	269	80	349	382	56	438	1215
04:30 PM	301	0	0	84	385	291	75	366	284	50	334	1085
04:45 PM	346	1	0	84	431	312	68	380	350	40	390	1201
Total	1167	2	0	318	1487	1016	270	1286	1346	207	1553	4326
05:00 PM	332	3	1	102	438	283	73	356	370	48	418	1212
05:15 PM	390	1	0	84	475	290	49	339	370	48	418	1232
05:30 PM	378	4	0	111	493	317	71	388	342	45	387	1268
05:45 PM	358	3	0	94	455	296	71	367	311	44	355	1177
Total	1458	11	1	391	1861	1186	264	1450	1393	185	1578	4889
Grand Total	2625	13	1	709	3348	2202	534	2736	2739	392	3131	9215
Apprch %	78.4	0.4	0	21.2		80.5	19.5		87.5	12.5		
Total %	28.5	0.1	0	7.7	36.3	23.9	5.8	29.7	29.7	4.3	34	
Unshifted	2607	13	1	699	3320	2160	522	2682	2692	381	3073	9075
% Unshifted	99.3	100	100	98.6	99.2	98.1	97.8	98	98.3	97.2	98.1	98.5
HV	18	0	0	10	28	42	12	54	47	11	58	140
% HV	0.7	0	0	1.4	0.8	1.9	2.2	2	1.7	2.8	1.9	1.5

	I-476 SB Off Ramp SB					West Chester Pike WB			West Chester Pike EB			
Start Time	Left	Thru	R @ light	R @ ramp	App. Total	Thru	R to 476 S	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 04:45 PM												
04:45 PM	346	1	0	84	431	312	68	380	350	40	390	1201
05:00 PM	332	3	1	102	438	283	73	356	370	48	418	1212
05:15 PM	390	1	0	84	475	290	49	339	370	48	418	1232
05:30 PM	378	4	0	111	493	317	71	388	342	45	387	1268
Total Volume	1446	9	1	381	1837	1202	261	1463	1432	181	1613	4913
% App. Total	78.7	0.5	0.1	20.7		82.2	17.8		88.8	11.2		
PHF	.927	.563	.250	.858	.932	.948	.894	.943	.968	.943	.965	.969
Unshifted	1437	9	1	377	1824	1177	252	1429	1412	179	1591	4844
% Unshifted	99.4	100	100	99.0	99.3	97.9	96.6	97.7	98.6	98.9	98.6	98.6
HV	9	0	0	4	13	25	9	34	20	2	22	69
% HV	0.6	0	0	1.0	0.7	2.1	3.4	2.3	1.4	1.1	1.4	1.4

Orth-Rodgers & Associates

Note:
WB WCP thru volume
counted @ N Lawrence

File Name : WCP&I-476 North Off Ramp_AM
Site Code : 00000000
Start Date : 1/20/2010
Page No : 1

Groups Printed- Unshifted - HV - RTOR

	West Chester Pike WB		I-476 NB Off-Ramp NB				West Chester Pike EB			
Start Time	R to 476 N	App. Total	Left	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
08:00 AM	1	1	68	2	56	126	83	313	396	523
08:15 AM	1	1	43	0	76	119	78	270	348	468
08:30 AM	9	9	38	0	57	95	83	353	436	540
08:45 AM	24	24	30	0	43	73	92	383	475	572
Total	35	35	179	2	232	413	336	1319	1655	2103
09:00 AM	77	77	37	0	39	76	118	412	530	683
09:15 AM	70	70	43	0	51	94	93	440	533	697
09:30 AM	24	24	35	0	71	106	91	406	497	627
09:45 AM	6	6	30	10	78	118	79	423	502	626
Total	177	177	145	10	239	394	381	1681	2062	2633
Grand Total	212	212	324	12	471	807	717	3000	3717	4736
Apprch %	100		40.1	1.5	58.4		19.3	80.7		
Total %	4.5	4.5	6.8	0.3	9.9	17	15.1	63.3	78.5	
Unshifted	212	212	316	12	343	671	707	2834	3541	4424
% Unshifted	100	100	97.5	100	72.8	83.1	98.6	94.5	95.3	93.4
HV	0	0	8	0	15	23	10	166	176	199
% HV	0	0	2.5	0	3.2	2.9	1.4	5.5	4.7	4.2
RTOR	0	0	0	0	113	113	0	0	0	113
% RTOR	0	0	0	0	24	14	0	0	0	2.4

	West Chester Pike WB		I-476 NB Off-Ramp NB				West Chester Pike EB			
Start Time	R to 476 N	App. Total	Left	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 08:00 AM to 09:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 09:00 AM										
09:00 AM	77	77	37	0	39	76	118	412	530	683
09:15 AM	70	70	43	0	51	94	93	440	533	697
09:30 AM	24	24	35	0	71	106	91	406	497	627
09:45 AM	6	6	30	10	78	118	79	423	502	626
Total Volume	177	177	145	10	239	394	381	1681	2062	2633
% App. Total	100		36.8	2.5	60.7		18.5	81.5		
PHF	.575	.575	.843	.250	.766	.835	.807	.955	.967	.944
Unshifted	177	177	143	10	192	345	378	1573	1951	2473
% Unshifted	100	100	98.6	100	80.3	87.6	99.2	93.6	94.6	93.9
HV	0	0	2	0	7	9	3	108	111	120
% HV	0	0	1.4	0	2.9	2.3	0.8	6.4	5.4	4.6
RTOR	0	0	0	0	40	40	0	0	0	40
% RTOR	0	0	0	0	16.7	10.2	0	0	0	1.5

Orth-Rodgers & Associates

Note:
WB WCP thru volume
counted @ N Lawrence

File Name : WCP&I-476 North Off Ramp_PM
Site Code : 00000000
Start Date : 4/2/2009
Page No : 1

Groups Printed- Unshifted - HV

	I-476 NB Off-Ramp NB				West Chester Pike EB			
Start Time	Left	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
04:00 PM	49	2	82	133	50	448	498	631
04:15 PM	49	0	97	146	62	544	606	752
04:30 PM	67	0	111	178	53	552	605	783
04:45 PM	62	0	83	145	52	611	663	808
Total	227	2	373	602	217	2155	2372	2974
05:00 PM	59	0	130	189	60	628	688	877
05:15 PM	68	0	125	193	86	590	676	869
05:30 PM	64	0	120	184	90	589	679	863
05:45 PM	62	0	113	175	63	586	649	824
Total	253	0	488	741	299	2393	2692	3433
Grand Total	480	2	861	1343	516	4548	5064	6407
Apprch %	35.7	0.1	64.1		10.2	89.8		
Total %	7.5	0	13.4	21	8.1	71	79	
Unshifted	476	2	857	1335	509	4505	5014	6349
% Unshifted	99.2	100	99.5	99.4	98.6	99.1	99	99.1
HV	4	0	4	8	7	43	50	58
% HV	0.8	0	0.5	0.6	1.4	0.9	1	0.9

	I-476 NB Off-Ramp NB				West Chester Pike EB			
Start Time	Left	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1								
Peak Hour for Entire Intersection Begins at 05:00 PM								
05:00 PM	59	0	130	189	60	628	688	877
05:15 PM	68	0	125	193	86	590	676	869
05:30 PM	64	0	120	184	90	589	679	863
05:45 PM	62	0	113	175	63	586	649	824
Total Volume	253	0	488	741	299	2393	2692	3433
% App. Total	34.1	0	65.9		11.1	88.9		
PHF	.930	.000	.938	.960	.831	.953	.978	.979
Unshifted	251	0	486	737	297	2369	2666	3403
% Unshifted	99.2	0	99.6	99.5	99.3	99.0	99.0	99.1
HV	2	0	2	4	2	24	26	30
% HV	0.8	0	0.4	0.5	0.7	1.0	1.0	0.9

Orth-Rodgers & Associates

Note:
Thru volumes counted @
N Lawrence (WB) and
476 NB ramps (EB)

File Name : WCP&SLawrence_AM
Site Code : 00000000
Start Date : 1/20/2010
Page No : 1

Groups Printed- Unshifted - HV

	West Chester Pike WB			S Lawrence Rd NB				West Chester Pike EB		
Start Time	Left	R to 476 N	App. Total	L to WCP	L to 476 N	Right	App. Total	Right	App. Total	Int. Total
07:00 AM	15	128	143	6	28	27	61	9	9	213
07:15 AM	36	298	334	22	103	81	206	39	39	579
07:30 AM	58	319	377	28	84	104	216	59	59	652
07:45 AM	81	277	358	36	98	111	245	108	108	711
Total	190	1022	1212	92	313	323	728	215	215	2155
08:00 AM	63	240	303	41	121	94	256	118	118	677
08:15 AM	74	228	302	52	87	108	247	142	142	691
08:30 AM	71	251	322	26	97	104	227	135	135	684
08:45 AM	59	193	252	36	68	69	173	122	122	547
Total	267	912	1179	155	373	375	903	517	517	2599
Grand Total	457	1934	2391	247	686	698	1631	732	732	4754
Apprch %	19.1	80.9		15.1	42.1	42.8		100		
Total %	9.6	40.7	50.3	5.2	14.4	14.7	34.3	15.4	15.4	
Unshifted	434	1888	2322	238	680	678	1596	697	697	4615
% Unshifted	95	97.6	97.1	96.4	99.1	97.1	97.9	95.2	95.2	97.1
HV	23	46	69	9	6	20	35	35	35	139
% HV	5	2.4	2.9	3.6	0.9	2.9	2.1	4.8	4.8	2.9

	West Chester Pike WB			S Lawrence Rd NB				West Chester Pike EB		
Start Time	Left	R to 476 N	App. Total	L to WCP	L to 476 N	Right	App. Total	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:45 AM										
07:45 AM	81	277	358	36	98	111	245	108	108	711
08:00 AM	63	240	303	41	121	94	256	118	118	677
08:15 AM	74	228	302	52	87	108	247	142	142	691
08:30 AM	71	251	322	26	97	104	227	135	135	684
Total Volume	289	996	1285	155	403	417	975	503	503	2763
% App. Total	22.5	77.5		15.9	41.3	42.8		100		
PHF	.892	.899	.897	.745	.833	.939	.952	.886	.886	.972
Unshifted	274	969	1243	151	399	404	954	476	476	2673
% Unshifted	94.8	97.3	96.7	97.4	99.0	96.9	97.8	94.6	94.6	96.7
HV	15	27	42	4	4	13	21	27	27	90
% HV	5.2	2.7	3.3	2.6	1.0	3.1	2.2	5.4	5.4	3.3

Orth-Rodgers & Associates

Note:
Thru volumes counted @
N Lawrence (WB) and
476 NB ramps (EB)

File Name : WCP&SLawrence_PM
Site Code : 00000000
Start Date : 4/2/2009
Page No : 1

Groups Printed- Unshifted - HV - RTOR

	West Chester Pike WB			S Lawrence Road NB				West Chester Pike EB		
Start Time	Left	R to 476	App. Total	L to WCP	L to 476 N	Right	App. Total	Right	App. Total	Int. Total
04:00 PM	101	118	219	27	29	93	149	87	87	455
04:15 PM	115	139	254	15	33	94	142	128	128	524
04:30 PM	141	109	250	18	52	100	170	131	131	551
04:45 PM	107	133	240	28	37	92	157	142	142	539
Total	464	499	963	88	151	379	618	488	488	2069
05:00 PM	142	151	293	36	50	103	189	139	139	621
05:15 PM	128	138	266	22	30	99	151	165	165	582
05:30 PM	130	121	251	42	37	114	193	122	122	566
05:45 PM	138	112	250	32	34	107	173	124	124	547
Total	538	522	1060	132	151	423	706	550	550	2316
Grand Total	1002	1021	2023	220	302	802	1324	1038	1038	4385
Apprch %	49.5	50.5		16.6	22.8	60.6		100		
Total %	22.9	23.3	46.1	5	6.9	18.3	30.2	23.7	23.7	
Unshifted	985	998	1983	212	295	783	1290	927	927	4200
% Unshifted	98.3	97.7	98	96.4	97.7	97.6	97.4	89.3	89.3	95.8
HV	17	23	40	8	7	19	34	13	13	87
% HV	1.7	2.3	2	3.6	2.3	2.4	2.6	1.3	1.3	2
RTOR	0	0	0	0	0	0	0	98	98	98
% RTOR	0	0	0	0	0	0	0	9.4	9.4	2.2

	West Chester Pike WB			S Lawrence Road NB				West Chester Pike EB		
Start Time	Left	R to 476	App. Total	L to WCP	L to 476 N	Right	App. Total	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 05:00 PM										
05:00 PM	142	151	293	36	50	103	189	139	139	621
05:15 PM	128	138	266	22	30	99	151	165	165	582
05:30 PM	130	121	251	42	37	114	193	122	122	566
05:45 PM	138	112	250	32	34	107	173	124	124	547
Total Volume	538	522	1060	132	151	423	706	550	550	2316
% App. Total	50.8	49.2		18.7	21.4	59.9		100		
PHF	.947	.864	.904	.786	.755	.928	.915	.833	.833	.932
Unshifted	530	513	1043	129	150	413	692	498	498	2233
% Unshifted	98.5	98.3	98.4	97.7	99.3	97.6	98.0	90.5	90.5	96.4
HV	8	9	17	3	1	10	14	9	9	40
% HV	1.5	1.7	1.6	2.3	0.7	2.4	2.0	1.6	1.6	1.7
RTOR	0	0	0	0	0	0	0	43	43	43
% RTOR	0	0	0	0	0	0	0	7.8	7.8	1.9

Orth-Rodgers & Associates

Note:
EB thru volume counted
at 476 NB ramps

File Name : WCP&NLawrence_AM
Site Code : 00000000
Start Date : 1/20/2010
Page No : 1

Groups Printed- Unshifted - HV

	N Lawrence Road SB			West Chester Pike WB			West Chester Pike EB		
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	App. Total	Int. Total
07:00 AM	10	210	220	363	39	402	120	120	742
07:15 AM	12	218	230	474	7	481	146	146	857
07:30 AM	12	229	241	475	9	484	143	143	868
07:45 AM	15	218	233	420	20	440	134	134	807
Total	49	875	924	1732	75	1807	543	543	3274
08:00 AM	12	184	196	479	4	483	125	125	804
08:15 AM	22	185	207	439	8	447	131	131	785
08:30 AM	19	191	210	452	20	472	127	127	809
08:45 AM	20	203	223	364	15	379	96	96	698
Total	73	763	836	1734	47	1781	479	479	3096
Grand Total	122	1638	1760	3466	122	3588	1022	1022	6370
Apprch %	6.9	93.1		96.6	3.4		100		
Total %	1.9	25.7	27.6	54.4	1.9	56.3	16	16	
Unshifted	104	1611	1715	3366	112	3478	985	985	6178
% Unshifted	85.2	98.4	97.4	97.1	91.8	96.9	96.4	96.4	97
HV	18	27	45	100	10	110	37	37	192
% HV	14.8	1.6	2.6	2.9	8.2	3.1	3.6	3.6	3

	N Lawrence Road SB			West Chester Pike WB			West Chester Pike EB		
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1									
Peak Hour for Entire Intersection Begins at 07:15 AM									
07:15 AM	12	218	230	474	7	481	146	146	857
07:30 AM	12	229	241	475	9	484	143	143	868
07:45 AM	15	218	233	420	20	440	134	134	807
08:00 AM	12	184	196	479	4	483	125	125	804
Total Volume	51	849	900	1848	40	1888	548	548	3336
% App. Total	5.7	94.3		97.9	2.1		100		
PHF	.850	.927	.934	.965	.500	.975	.938	.938	.961
Unshifted	47	833	880	1809	35	1844	527	527	3251
% Unshifted	92.2	98.1	97.8	97.9	87.5	97.7	96.2	96.2	97.5
HV	4	16	20	39	5	44	21	21	85
% HV	7.8	1.9	2.2	2.1	12.5	2.3	3.8	3.8	2.5

Orth-Rodgers & Associates

Note:
EB thru volume counted
at 476 NB ramps

File Name : WCP&NLawrence_PM
Site Code : 00000000
Start Date : 4/2/2009
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Groups Printed- Unshifted - HV - Buses

	N Lawrence Road SB			West Chester Pike WB			West Chester Pike EB		
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	App. Total	Int. Total
04:00 PM	28	209	237	361	26	387	204	204	828
04:15 PM	39	210	249	358	22	380	238	238	867
04:30 PM	14	173	187	347	22	369	224	224	780
04:45 PM	26	178	204	357	28	385	216	216	805
Total	107	770	877	1423	98	1521	882	882	3280
05:00 PM	20	209	229	417	13	430	269	269	928
05:15 PM	28	203	231	356	25	381	280	280	892
05:30 PM	19	186	205	367	23	390	276	276	871
05:45 PM	34	198	232	302	25	327	272	272	831
Total	101	796	897	1442	86	1528	1097	1097	3522
Grand Total	208	1566	1774	2865	184	3049	1979	1979	6802
Apprch %	11.7	88.3		94	6		100		
Total %	3.1	23	26.1	42.1	2.7	44.8	29.1	29.1	
Unshifted	187	1534	1721	2803	178	2981	1966	1966	6668
% Unshifted	89.9	98	97	97.8	96.7	97.8	99.3	99.3	98
HV	0	26	26	37	2	39	8	8	73
% HV	0	1.7	1.5	1.3	1.1	1.3	0.4	0.4	1.1
Buses	21	6	27	25	4	29	5	5	61
% Buses	10.1	0.4	1.5	0.9	2.2	1	0.3	0.3	0.9

	N Lawrence Road SB			West Chester Pike WB			West Chester Pike EB		
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1									
Peak Hour for Entire Intersection Begins at 05:00 PM									
05:00 PM	20	209	229	417	13	430	269	269	928
05:15 PM	28	203	231	356	25	381	280	280	892
05:30 PM	19	186	205	367	23	390	276	276	871
05:45 PM	34	198	232	302	25	327	272	272	831
Total Volume	101	796	897	1442	86	1528	1097	1097	3522
% App. Total	11.3	88.7		94.4	5.6		100		
PHF	.743	.952	.967	.865	.860	.888	.979	.979	.949
Unshifted	100	779	879	1417	86	1503	1091	1091	3473
% Unshifted	99.0	97.9	98.0	98.3	100	98.4	99.5	99.5	98.6
HV	0	14	14	12	0	12	4	4	30
% HV	0	1.8	1.6	0.8	0	0.8	0.4	0.4	0.9
Buses	1	3	4	13	0	13	2	2	19
% Buses	1.0	0.4	0.4	0.9	0	0.9	0.2	0.2	0.5

Appendix T

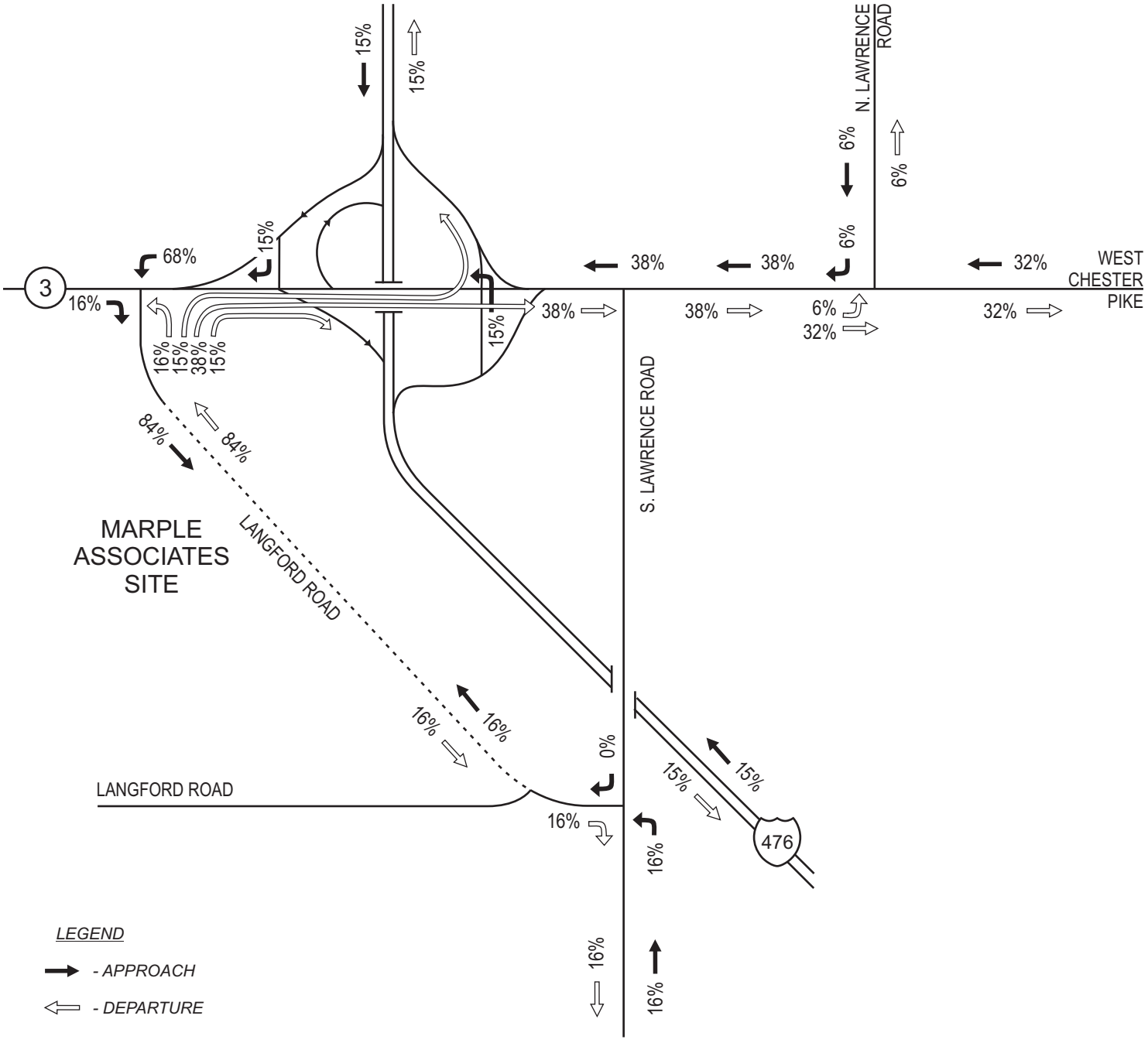
Peak Hour Site Traffic Distribution

Orth-Rodgers & Associates, Inc.
TRANSPORTATION ENGINEERS AND PLANNERS

Estimated Direction of Approach/Departure - New Retail Trips

Point of Access Study - I-476 and West Chester Pike

MARPLE TOWNSHIP, DELAWARE COUNTY, PENNSYLVANIA



Orth-Rodgers & Associates, Inc.
TRANSPORTATION ENGINEERS AND PLANNERS

Estimated Direction of Approach/Departure - Office and Residential Trips

Point of Access Study - I-476 and West Chester Pike

MARPLE TOWNSHIP
DELAWARE COUNTY, PENNSYLVANIA