McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

Transportation Impact Study for the Crebilly Residential Development

Westtown Township, Chester County, PA

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Revised January 20, 2017
October 13, 2016
McMahon Project Number 816451.11

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Executive Summary

Toll Brothers, Inc. proposes a residential development, to be located on the Crebilly Farm property along the west side of U.S. Route 202 (Wilmington Pike), between West Pleasant Grove Road and Street Road (S.R. 0926), in Westtown Township, Chester County, Pennsylvania. Three potential alternatives are proposed for the development. Site plans for the three alternatives, prepared by ESE Consultants, Inc. and dated October 7, 2016, are described below and illustrated in **Figures 1A and 1B**.

- ***Alternative A (Plan A – Proposed Development):*** The plan includes 317 new dwelling units and 2 existing dwelling units. Access is provided via two full-movement accesses along West Pleasant Grove Road, a right-in/right-out access along U.S. Route 202 (Wilmington Pike), and a full-movement access along Street Road (S.R. 0926). This development alternative does not provide a public connector road.

- ***Alternative B (Plan B – Proposed Density Bonus Development):*** The plan includes 395 new dwelling units and 2 existing dwelling units. Access is identical to Alternative A. This development alternative does not provide a public connector road.

- ***Alternative C (Plan B – Proposed Density Bonus Development with Connector Road):*** The plan includes 395 new dwelling units and 2 existing dwelling units. Access is identical to Alternatives A and B, with the addition of a third full-movement access along West Pleasant Grove Road, which will serve as a connector road provided for public use between U.S. Route 202 (Wilmington Pike), Street Road (S.R. 0926), and West Pleasant Grove Road.

A Transportation Impact Study, dated October 13, 2016, was submitted to Westtown Township. Westtown Township's Traffic Engineer, Kimley-Horn, issued a comment letter dated December 27, 2016. Additionally, a Scoping Meeting Application was submitted to PennDOT and Westtown Township on November 7, 2016. A scoping meeting was held at the PennDOT Engineering District's offices on December 2, 2016. PennDOT provided scoping comments in a letter dated December 6, 2016. The scope of this transportation impact study is based on the comments received to date, PennDOT's guidelines, per the Department's publication *Policies and Procedures for Transportation Impact Studies Related to Highway Occupancy Permits*, dated January 28, 2009, and the requirements of the Township ordinances. Correspondence with PennDOT and the Township is contained in **Appendix A**.

The purpose of this transportation impact study is to evaluate the traffic impacts of the proposed development. The scope of this study includes an evaluation of the existing weekday morning and weekday afternoon peak hours, as well as the future 2023 build-out year and 2028 design year, five years beyond the anticipated build-out year, both without and with each development alternative at the following study intersections:

- U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926) (signalized)
- U.S. Route 202 (Wilmington Pike) and West Pleasant Grove Road (unsignalized)
- Street Road (S.R. 0926) and Bridlewood Boulevard (unsignalized)
- Street Road (S.R. 0926) and New Street (signalized)

- New Street and West Pleasant Grove Road (unsignalized)
- U.S. Route 202 (Wilmington Pike) and Proposed Site Access (unsignalized)
- Street Road (S.R. 0926) and Proposed Site Access (signalized)
- West Pleasant Grove Road and Proposed West Site Access (unsignalized)
- West Pleasant Grove Road and Proposed East Site Access (unsignalized)
- West Pleasant Grove Road and Proposed Connector Road (unsignalized)

Based on trip generation data compiled for Residential Condominium / Townhouse (ITE Land Use Code 230) and Single Family Detached Housing (ITE Land Use Code 210) contained in the Institute of Transportation Engineers (ITE) publication entitled, *Trip Generation Manual, 9th Edition,* the proposed development alternatives will generate the following trips:

- ***Alternative A:*** A total of approximately 210 "new" trips during the weekday morning peak hour and 266 "new" trips during the weekday afternoon peak hour.

- ***Alternatives B & C:*** A total of approximately 223 "new" trips during the weekday morning peak hour and 280 "new" trips during the weekday afternoon peak hour.

Committed Improvements

Per the traffic evaluation, the following on-site and off-site traffic improvements are committed by the applicant to mitigate the proposed development traffic impacts, pending further coordination and approvals from the Township and PennDOT. Since some of these improvements are within the state's right-of-way, or located at traffic signals under the jurisdiction of PennDOT, coordination with PennDOT will be required to implement these improvements. The Township will be included in all correspondence with PennDOT.

Site Accesses

U.S. Route 202 (Wilmington Pike) and Site Access

- Classified as a low volume driveway for Alternatives A and B, and a medium volume driveway for Alternative C with the connector road based on the anticipated daily traffic volumes.
- Provide one ingress lane and one egress lane for the site access.
- Provide a 150-foot (Alternatives A & B) or 175-foot (Alternative C) right-turn deceleration lane.
- Provide stop-control on the egress of the site access.
- Based on comments received from the Township's Traffic Engineer, the applicant will consider removing this access, pending further coordination.

Street Road (S.R. 0926) and Site Access

- Classified as a medium volume driveway for Alternatives A and B, and a high volume driveway for Alternative C with the connector road, based on the anticipated daily traffic volumes.

- Provide one ingress lane and two egress lanes for the site access.
- Provide a 150-foot long left-turn lane.
- Provide a 150-foot (Alternatives A & B) or 175-foot (Alternative C) right-turn deceleration lane.
- Install a traffic signal, which is preliminarily warranted based on the criteria for Warrant 2 (Four-Hour Vehicular Volume) and Warrant 3 (Peak Hour).
- The applicant will relocate signalized site access opposite Bridlewood Boulevard, pending further coordination and concurrence with Westtown Township, Thornbury Township, and PennDOT.

West Pleasant Grove Road and West Site Access

- Classified as a low volume driveway based on the anticipated daily traffic volumes for all three alternatives.
- Provide one ingress lane and one egress lane for the site access.
- Provide stop-control on the egress of the site access.

West Pleasant Grove Road and East Site Access

- Classified as a low volume driveway based on the anticipated daily traffic volumes for all three alternatives.
- Provide one ingress lane and one egress lane for the site access.
- Provide stop-control on the egress of the site access.

West Pleasant Grove Road and Connector Road (Alternative C Only)

- Classified as a medium volume driveway based on the anticipated daily traffic volumes.
- Provide one ingress lane and one egress lane for the site access.
- Provide stop-control on the egress of the site access.

Off-Site Traffic Improvements

Street Road (S.R. 0926) and New Street

- The applicant will complete traffic signal retiming optimization.

U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926)

- If PennDOT requires mitigation of the traffic impact of the development to the overall intersection level of service and delay, the applicant will provide a separate southbound U.S. Route 202 right-turn lane.

- If PennDOT requires mitigation of the traffic impact of the development on both overall and individual intersection movement levels of service and delay, the applicant will provide a second westbound Street Road (S.R. 0926) left-turn lane and the necessary traffic signal modifications to eliminate the split phasing along Street Road (S.R. 0926).

The traffic analyses contained herein reveal that efficient access to and from the proposed development can be provided, and furthermore, site-generated traffic is mitigated at the study area intersections

with the committed improvements. Detailed results of the level-of-service and queueing analysis are contained in the matrices provided in **Tables 6 and 7.**

Existing Transportation Settings and Conditions

The proposed development will be located on the Crebilly Farm property along the west side of U.S. Route 202 (Wilmington Pike), between West Pleasant Grove Road and Street Road (S.R. 0926), in Westtown Township, Chester County, Pennsylvania (**Figure 2**). The existing roadways and intersections in the vicinity of the site, which comprise the study area roadway network, are described in this section.

Roadway Characteristics

The study area roadway network and characteristics are summarized below in **Table 1**.

Table 1 - Existing Roadway Characteristics

Roadway Name (Jurisdiction)	Average Daily Traffic Volumes (vehicles per day)	Roadway Classification		Travel Lanes (per direction)	Posted Speed Limit (mph)
		Smart Transportation (1)	PennDOT/ Township (2)		
U.S. Route 202 (Wilmington Pike)	46,427 (3)	Regional Arterial	Urban – Principal Arterial	2	45
Street Road (S.R. 0926 – PA)	12,713 (3)	Community Arterial	Urban – Minor Arterial	1	45
New Street (Local)	3,615	Neighborhood Collector	Urban – Minor Collector	1	35
West Pleasant Grove Road (Local)	n/a	Local Road	Local Road	1	35
Bridlewood Boulevard (Local)	n/a	Local Road	Local Road	1	25

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

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

- U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926) (signalized)
- U.S. Route 202 (Wilmington Pike) and West Pleasant Grove Road (unsignalized)
- Street Road (S.R. 0926) and Bridlewood Boulevard (unsignalized)
- Street Road (S.R. 0926) and New Street (signalized)
- New Street and West Pleasant Grove Road (unsignalized)
- U.S. Route 202 (Wilmington Pike) and Proposed Site Access (unsignalized)
- Street Road (S.R. 0926) and Proposed Site Access (unsignalized)
- West Pleasant Grove Road and Proposed West Site Access (unsignalized)
- West Pleasant Grove Road and Proposed East Site Access (unsignalized)
- West Pleasant Grove Road and Proposed Connector Road (unsignalized)

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

Crash Summary

Reportable crash data was provided by the Pennsylvania Department of Transportation's Bureau of Highway Safety and Traffic Engineering for the five-year period from January 1, 2011 to December 31, 2015 throughout the study area. Reportable crashes are defined as crashes in which personal injuries occur or the vehicle must be towed from the scene. Tables summarizing the crash data by location, crashes per year, and type of crash are provided in Appendix B.

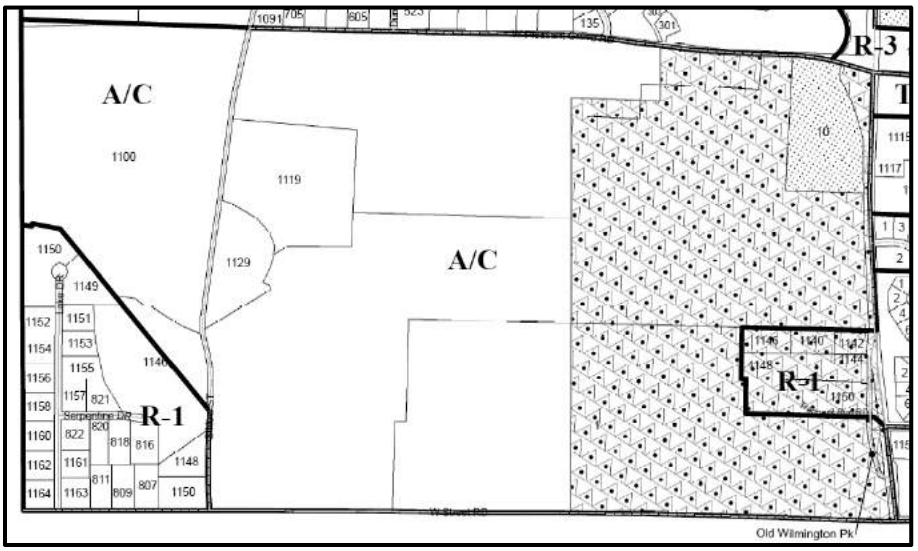
Based on the crash data, a total of 49 reportable crashes occurred at the study area intersections. The majority of the study area intersection crashes were rear-end incidents (33 crashes or 67 percent) and angle incidents (9 crashes or 18 percent). The signalized intersection of U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926) experienced twenty-five (25) crashes, with the majority of these crashes being rear-end incidents (19 crashes) occurring along both northbound (8 crashes) and southbound (11 crashes) U.S. Route 202 (Wilmington Pike). Additionally, the unsignalized intersection of U.S. Route 202 (Wilmington Pike) and West Pleasant Grove Road experienced thirteen (13) crashes, with the majority of these crashes being rear-end incidents (10 crashes). Eight (8) of the rear-end incidents occurred along southbound U.S. Route 202 (Wilmington Pike), which is likely associated with the congestion and queuing that occurs at the signalized intersection of U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926).

Based on the crash summary, a total of 41 reportable crashes occurred at midblock locations within the study area. The majority of the midblock crashes along U.S. Route 202 (Wilmington Pike) were rear-end incidents (11 crashes) and hit-fixed object incidents (8 crashes). Ten (10) of the rear-end incidents occurred along southbound U.S. Route 202 (Wilmington Pike), which is likely associated with the congestion experienced at the signalized intersection of U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926). Seven (7) of the hit-fixed object incidents occurred along southbound U.S. Route 202 (Wilmington Pike), with vehicles striking guiderails, curbs, embankments, and utility poles. The majority of the midblock crashes along Street Road (S.R. 0926) between U.S. Route 202 (Wilmington Pike) and Bridlewood Boulevard were angle incidents (4 crashes) and rear-end incidents (4 crashes). All four (4) of the angle incidents occurred at the existing CVS driveway along Street Road (S.R. 0926) with vehicles entering and exiting the site. Three (3) of the rear-end incidents occurred along eastbound Street Road (S.R. 0926), which is likely associated with the congestion experienced at the signalized intersection of U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926).

Land Use Context

The proposed development is located in Westtown Township within the A/C – Agriculture/Cluster Residential District, as well as the R-1 – Rural/Suburban Residential District. The development is located along the west side of U.S. Route 202 (Wilmington Pike), between West Pleasant Grove Road

and Street Road (S.R. 0926), as shown below on a portion of the Westtown Township Zoning Map. Per Westtown Township's Zoning Ordinance, the proposed residential development is permitted through conditional use within the A/C – Agriculture/Cluster Residential District in accordance with Article V and Article IX.



Source: Westtown Township Zoning Map

Area Transit Services

Transit services are currently not provided within the study area. The nearest SEPTA bus stop (SEPTA Bus Route 92) is located just north of the S.R. 0322 (High Street) and U.S. Route 202 intersection, approximately a mile and a half north of the site.

Pedestrian-Bicycle Facilities

Currently, there are no sidewalks along U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926). The signalized intersection of U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926) has limited pedestrian crossing amenities. There are pedestrian crosswalks, signals, and pushbuttons provided to cross the eastern leg of Street Road (S.R. 0926) and the southern leg of U.S. Route 202.

Traffic Count Data

Daily traffic counts were obtained from PennDOT's Internet Traffic Monitoring System (iTMS) website. The traffic count data is provided in **Appendix C**.

Manual turning movement traffic counts were conducted on Thursday, September 8, 2016, during the weekday morning peak period (7:00 AM to 9:00 AM) and the weekday afternoon peak period (4:00 PM to 6:00 PM) in accordance with Westtown Township's Ordinance Chapter 149-804.A(3)(g). Traffic

counts were completed at the intersection of New Street and West Pleasant Grove Road on Thursday, January 12, 2017, during the weekday morning peak period (7:00 AM to 9:00 AM) and the weekday afternoon peak period (4:00 PM to 6:00 PM). Since this count was completed outside of the range of the months required per the Township's Ordinance, the traffic volumes were compared to the immediately adjacent study intersection of New Street and Street Road (S.R. 0926) and balanced upwardly, as needed. The results of these traffic counts are tabulated by 15-minute intervals in **Appendix D**. The four highest consecutive 15-minute peak intervals during these traffic count periods constitute the peak hours that are the basis of this traffic analysis. For clarification based on comments received from the Township, the heavy vehicle percentages documented within the traffic counts sheets are calculated for each movement. At signalized intersections, the traffic counts worksheets calculate the heavy vehicle percentages for right-turns versus right-turns on red separately. This information must be combined and the heavy vehicle percentages must be recalculated for input into the traffic analysis. For ease of review, the heavy vehicle percentages for the combined right-turn movements at signalized intersections are included within the traffic counts worksheets provided in Appendix D.

Due to typical day-to-day fluctuations and varying traffic signal operations, some traffic movements counted at the intersection of U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926) increased and some movements decreased as compared to previous traffic counts at the intersection. The northbound and southbound U.S. Route 202 (Wilmington Pike) traffic volumes counted for this study were generally consistent between the study intersections. The northbound and southbound through volumes counted along U.S. Route 202 (Wilmington Pike) were balanced upwards between West Pleasant Grove Road and Street Road (S.R. 0926) as needed.

The resultant peak hour traffic volumes are depicted in **Figure 3A** for the weekday morning and weekday afternoon peak hours. The traffic volumes in Figure 3A were then analyzed to determine the existing operating conditions, and the results of this analysis are shown in **Figure 3B.** Specific details regarding the analysis results and traffic operations are provided later in this report.

Existing Queue Observations

At the intersection of U.S. Route 202 (Wilmington Pike) and PA Route 926 (Street Road) under existing conditions during the weekday morning and weekday afternoon commuter peak periods, oversaturation occurs on some movements. In accordance with the methodology contained in the *2010 Highway Capacity Manual*, queue observations were completed at the beginning of the weekday morning and weekday afternoon peak hours in order to account for these initial queues. The initial queues have been included in the detailed capacity/level-of-service analyses. Documentation of the queue observations is provided in **Appendix E**.

Site Characteristics

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

Trip Generation

Traffic volumes generated by the proposed development alternatives were prepared based on trip generation data compiled from numerous studies contained in the Institute of Transportation Engineers (ITE) publication, *Trip Generation, 9th Edition*. **Table 2** presents the anticipated vehicular trip generation for each of the proposed development alternatives. The detailed trip generation calculations are contained in **Appendix F.** All three development alternatives generate very similar weekday daily and peak hour site trips.

Table 2. Vehicular Trip Generation

Land Use	Size	Daily	Weekday Morning Peak Hour			Weekday Afternoon Peak Hour		
			In	Out	Total	In	Out	Total
Alternative A (1)	319 units	2,742	48	162	210	171	95	266
Alternatives B & C (2)	397 units	2,955	48	175	223	182	98	280

(1) Consisting of 2 existing and 200 new single-family dwelling units and 117 new carriage homes.
(2) Consisting of 2 existing and 152 new single-family dwelling units and 243 new carriage homes.

Trip Distribution and Assignment

Site-generated traffic will approach and depart the site via different routes depending on factors such as the existing traffic patterns, location of major roadways, and the location of the development's site accesses. The location of the dwelling units and the roadway connections throughout the proposed development were also considered upon development of the site trip distributions. Previously, the distributions to/from New Street were based on previous studies that included two to three percent of the site traffic along New Street. Upon further review based on the recent 2016 traffic counts, five percent along each direction of New Street is appropriate. The distribution percentages for the anticipated directions of approach and departure, as well as the traffic assignment percentages at each intersection for Alternatives A and B are illustrated in **Figure 4A**, and in **Figure 4B** for Alternative C which includes a connector road. Application of the percentages illustrated in **Figures 4A and 4B** to the new peak hour trips contained in Table 2, provides an estimate of site traffic to be added to the study area. The site-generated trips are also shown in **Figures 4C through 4E** for the weekday morning and weekday afternoon peak hours for the three development alternatives.

Site Access Configuration and Traffic Control

Access to the site for Alternatives A and B is proposed via two unsignalized full-movement accesses along West Pleasant Grove Road (one access opposite Dunvegan Road and one access opposite Hidden Pond Way), a right-in/right-out access along U.S. Route 202 (Wilmington Pike) approximately 1,850 feet north of Street Road (S.R. 0926), and a full-movement access along Street Road (S.R. 0926) approximately 1,400 feet west of U.S. Route 202 (Wilmington Pike).

Access to the site for Alternative C is proposed to be provided at the same locations as Alternatives A and B, with the addition of a third unsignalized full-movement access along West Pleasant Grove Road approximately 700 feet west of U.S. Route 202 (Wilmington Pike), which will also serve as a connector road provided for public use between U.S. Route 202 (Wilmington Pike), Street Road (S.R. 0926), and West Pleasant Grove Road.

Alternatively, the applicant will relocate the signalized access along Street Road (S.R. 0926) opposite Bridlewood Boulevard, pending further coordination and concurrence with Westtown Township, Thornbury Township, and PennDOT.

The recommendations for the proposed access designs, including auxiliary turn lanes, traffic control, and geometric design, were based on industry accepted criteria and guidelines. Specifically, the need for left- and right-turn deceleration lanes was based on the current PennDOT guidelines in accordance with *Publication 46, Chapter 11 – Traffic Studies*. In addition, a preliminary traffic signal warrant analysis was conducted in accordance with PennDOT criteria contained in the Department's *Publication 212, Official Traffic Control Devices*, for the Four-Hour and Peak Hour Volume Warrants, which is based on the guidelines contained in the Federal Highway Administration's, *Manual on Uniform Traffic Control Devices (MUTCD)*. The various warrant/guideline analysis worksheets are contained in **Appendix G**.

Additionally, the geometric design of the proposed site accesses were preliminarily evaluated based on guidelines contained in the *Pennsylvania Code, Chapter 441, Access to and Occupancy of Highways by Driveways and Local Roads*, as well as local PennDOT District policies.

Based on the results of this evaluation, the following access configurations and traffic controls are recommended, subject to the detailed engineering of the site accesses:

U.S. Route 202 (Wilmington Pike) and Site Access

- Average Daily Traffic for each alternative:
  - Alternative A – 274 vehicles per day, Low Volume Driveway
  - Alternative B – 296 vehicles per day, Low Volume Driveway
  - Alternative C – 851 vehicles per day, Medium Volume Driveway
- Provide one ingress lane and one egress lane for the site access.
- Provide stop-control on the egress of the site access.
- *Alternatives A and B*: A right-turn deceleration lane is warranted based on PennDOT guidelines, and therefore, provide a 150-foot right-turn deceleration lane.

- *Alternative C*: A right-turn deceleration lane is warranted based on PennDOT guidelines, and therefore, provide a 175-foot right-turn deceleration lane.

Street Road (S.R. 0926) and Site Access

- Average Daily Traffic for each alternative:
  - Alternative A – 761 vehicles per day, Medium Volume Driveway
  - Alternative B – 820 vehicles per day, Medium Volume Driveway
  - Alternative C – 2,225 vehicles per day, High Volume Driveway
- Provide one ingress lane and two egress lanes for the site access.
- A left-turn lane is warranted based on PennDOT guidelines, and therefore, provide a 150-foot long left-turn lane.
- *Alternatives A and B*: A right-turn deceleration lane is warranted based on PennDOT guidelines, and therefore, provide a 150-foot right-turn deceleration lane.
- *Alternative C*: A right-turn deceleration lane is warranted based on PennDOT guidelines, and therefore, provide a 175-foot right-turn deceleration lane.
- Install a traffic signal, which is preliminarily warranted based on the criteria for Warrant 2 (Four-Hour Vehicular Volume) and Warrant 3 (Peak Hour).
- The applicant will relocate signalized site access opposite Bridlewood Boulevard, pending further coordination and concurrence with Westtown Township, Thornbury Township, and PennDOT.

West Pleasant Grove Road and West Site Access

- Average Daily Traffic for each alternative:
  - Alternative A – 247 vehicles per day, Low Volume Driveway
  - Alternative B – 266 vehicles per day, Low Volume Driveway
  - Alternative C – 96 vehicles per day, Low Volume Driveway
- Provide one ingress lane and one egress lane for the site access.
- Provide stop-control on the egress of the site access.
- A left-turn lane is not warranted based on PennDOT guidelines.
- A right-turn deceleration lane is not warranted based on PennDOT guidelines.

West Pleasant Grove Road and East Site Access

- Average Daily Traffic for each alternative:
  - Alternative A – 90 vehicles per day, Low Volume Driveway
  - Alternative B – 96 vehicles per day, Low Volume Driveway
  - Alternative C – 89 vehicles per day, Low Volume Driveway
- Provide one ingress lane and one egress lane for the site access.
- Provide stop-control on the egress of the site access.
- A left-turn lane is not warranted based on PennDOT guidelines.
- A right-turn deceleration lane is not warranted based on PennDOT guidelines.

West Pleasant Grove Road and Connector Road (Alternative C Only)

- Average Daily Traffic is 1,027 vehicles per day, and therefore, the driveway is classified as a Medium Volume Driveway.
- Provide one ingress lane and one egress lane for the site access.
- Provide stop-control on the egress of the site access.
- A left-turn lane is not warranted based on PennDOT guidelines.
- A right-turn deceleration lane is not warranted based on PennDOT guidelines.

Sight Distance

Sight distance field measurements and an evaluation were performed at each of the proposed site accesses. Generally, the prevailing (85th percentile) travel speed, roadway grades and profiles, and the number of travel lanes play a role in determining if safe sight distances are available for egress and ingress at the proposed accesses. The existing sight distances at the proposed accesses were measured and compared to PennDOT's sight distance requirements. These sight distance requirements are contained in *Pennsylvania Code, Chapter 441, Access to and Occupancy of Highways by Driveways and Local Roads*. **Table 3** summarizes the available sight distance measurements, as well as PennDOT's sight distance requirements at the proposed access locations.

Table 3. Sight Distance Evaluation

U.S. Route 202 (Wilmington Pike) and Site Access

Movement	Direction	Posted Speed (mph)	Approximate Grade	PennDOT Requirements (feet)	Available Sight Distance (feet)
				Desirable[1]	
Exiting	Looking Left	45	-1.2%	500′	1,000′+

Street Road (S.R. 0926) and Site Access

Movement	Direction	Posted Speed (mph)	Approximate Grade	PennDOT Requirements (feet)		Available Sight Distance (feet)
				Desirable[1]	Acceptable[2]	
Exiting	Looking Left	45	-2.6%	635′	N/A	684′
	Looking Right	45	+4.4%	570′	N/A	750′
Left turn Entering	Looking Ahead	45	-2.6%	445′	N/A	1,051′
	From the Rear	45	+4.4%	N/A	50 mph=426′	750′

West Pleasant Grove Road and West Site Access

Movement	Direction	Posted Speed (mph)	Approximate Grade	PennDOT Requirements (feet)		Township Requirements (feet)[(3)]	Available Sight Distance (feet)
				Desirable[1]	Acceptable[2]		
Exiting	Looking Left	35	+2.6%	440′	N/A	440′	630′
	Looking Right	35	-2.2%	350′	N/A	440′	1,000′+
Left turn Entering	Looking Ahead	35	+2.6%	300′	N/A	N/A	665′
	From the Rear	35	-2.2%	N/A	40 mph=339′	N/A	1,000′+

West Pleasant Grove Road and East Site Access

Movement	Direction	Posted Speed (mph)	Approximate Grade	PennDOT Requirements (feet)		Township Requirements (feet)(3)	Available Sight Distance (feet)
				Desirable[1]	Acceptable[2]		
Exiting	Looking Left	35	-5.4%	440′	40 mph=364′	440′	249′
	Looking Right	35	+1.4%	350′	N/A	440′	800′+
Left turn Entering	Looking Ahead From the Rear	35	-5.4%	300′	N/A	N/A	348′
		35	+1.4%	N/A	40 mph=317′	N/A	800′+

West Pleasant Grove Road and Connector Road (Alternative C Only)

Movement	Direction	Posted Speed (mph)	Approximate Grade	PennDOT Requirements (feet)		Township Requirements (feet)(3)	Available Sight Distance (feet)
				Desirable[1]	Acceptable[2]		
Exiting	Looking Left	35	+2.1%	440′	N/A	440′	440′
	Looking Right	35	0.0%	350′	N/A	440′	495′
Left turn Entering	Looking Ahead From the Rear	35	+2.1%	300′	N/A	N/A	415′
		35	0.0%	N/A	40 mph=325′	N/A	650′

(1) Based on the desirable sight distance requirements contained in the *Pennsylvania Code, Chapter 441, Access to and Occupancy of Highways by Driveways and Local Roads* and the posted speed limit, unless otherwise noted.

(2) Based on the safe stopping sight distance requirements contained in the *Pennsylvania Code, Chapter 441, Access to and Occupancy of Highways by Driveways and Local Roads* and an estimated 85th percentile travel speed of five miles over the posted speed limit.

(3) Based on the clear sight triangle requirements per Westtown Township Code Chapter 149 Article IX Section 149 -915, and the posted speed limit.

As shown in **Table 3**, the existing available sight distances at the proposed site access intersections along U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926) meet PennDOT's sight distance criteria. The existing available sight distances at the proposed site access intersections along West Pleasant Grove Road, which is a Township roadway, meet PennDOT and Township requirements for all movements, with one exception. The available sight distance at the West Pleasant Grove Road and East Site Access does not meet PennDOT or Township sight distance criteria for the left-turn exiting movement due to the vertical curvature of the roadway. The applicant is committed to relocate this site access to the crest of the vertical curve to provide adequate sight distance.

Proper landscaping must be maintained along the site frontage along U.S. Route 202 (Wilmington Pike), Street Road (S.R. 0926), and West Pleasant Grove Road for provision of adequate sight distance according to the above tables. The actual available sight distances should be verified during detailed engineering of the site access. The PennDOT M-950S forms are completed and provided in **Appendix H** for the State road site access intersections.

Off-Site Intersection Turn Lane Warrants

As requested by the Township Traffic Engineer, turn lane warrants were completed based on existing and future with-development peak hour traffic volumes at three off-site study intersections in accordance with PennDOT guidelines. The various warrant/guideline analysis worksheets are contained in **Appendix I**.

Based on the analyses, the following turn lanes are warranted under existing conditions:

- Street Road (S.R. 0926) and New Street
  - Eastbound Street Road (S.R. 0926) left-turn lane
  - Westbound Street Road (S.R. 0926) left- and right-turn lanes
  - Southbound New Street left- and right-turn lanes

- New Street and West Pleasant Grove Road
  - No turn lanes are warranted

- U.S. Route 202 (Wilmington Pike) and West Pleasant Grove Road
  - Southbound U.S. Route 202 (Wilmington Pike) right-turn lane

No additional turn lanes are warranted in the future 2028 conditions with the proposed development.

Future Traffic Conditions

With an estimated opening in 2018, a five-year build out was assumed based on the proposed development, the residential market, and past projects. This assumption equates to an average delivery of five to seven units per month. Therefore, the traffic analysis was completed for a future build-out year of 2023 and a future design year of 2028, or five years beyond the anticipated build-out year, both without and with the proposed development. The future 2023 build-out year and 2028 design year without-development traffic volumes were estimated by increasing the existing traffic volumes to account for regional growth, as described below. The incremental increase due to the anticipated trip generation for the site was then added, resulting in the future 2023 build-out year and 2028 design year with-development traffic volumes.

Regional Traffic Growth

To account for regional traffic growth, the existing traffic volumes were increased by an annual traffic growth rate of 1.71 percent per year compounded for seven (7) years to 2023 and 12 years to 2028, or 12.60 percent total to 2023 and 22.56 percent total to 2028. This growth rate is consistent with the traffic growth rate recommended by the PennDOT Bureau of Planning and Research *Growth Factors for August 2016 to July 2017* for similar, non-interstate urban roadways in Westtown Township.

Local Traffic Growth

To account for local traffic growth, the municipality was contacted to identify any other nearby future developments. Based upon coordination with Westtown Township, the existing traffic volumes were also increased by nearby approved developments in the vicinity of the proposed development. Specifically, the following developments were included:

- **Police Station Redevelopment:** 30,000 square feet of office space located on the northeast corner of the intersection of U.S. 202 (Wilmington Pike) and Pleasant Grove Road.

- **Arborview:** 16,800 square feet of office space and an 8,665 square-foot daycare center located on the west side of U.S. Route 202 (Wilmington Pike) between Skiles Boulevard and Pleasant Grove Road. As part of the development, it is our understanding that a connector road between Skiles Boulevard and West Pleasant Grove Road will also be provided.

- **Condominium Development:** 39 condominiums in two buildings remain to be occupied/constructed on the west side of Gilpin Drive just north of Skiles Boulevard.

Additionally, the Township identified two additional developments, a 91-unit residential development along Tigue Road in East Bradford Township and a 15-unit residential development currently under review along U.S. Route 202 (Wilmington Pike) at Jacqueline Drive. Both developments are assumed to be part of the regional traffic growth described above since both developments will generate little

additional traffic within the study area. Information regarding the nearby approved developments, obtained from Westtown Township, are provided in **Appendix J.**

Planned Roadway Improvements

U.S. Route 202/S.R. 0926/West Pleasant Grove Road Connector Road

In conjunction with the proposed development under Alternative C, access to the site would be provided along a connector road that will be constructed between U.S. Route 202 (Wilmington Pike), Street Road (S.R. 0926), and West Pleasant Grove Road, including a right-in/right-out access along U.S. Route 202 (Wilmington Pike), a full-movement access along Street Road (S.R. 0926), and two full-movement accesses along West Pleasant Grove Road. This connector road concept has been planned by the Township for a number of years, and it will alleviate traffic at the congested U.S. Route 202 (Wilmington Pike)/Street Road (S.R. 0926) intersection, and reroute traffic currently using West Pleasant Grove Road and New Street as an alternate route. In this analysis, we have utilized traffic diversions due to the provision of the connector road based on previous studies completed and accepted by the Township. The traffic diversions are provided in **Appendix K**.

West Pleasant Grove Road/Skiles Boulevard Connector Road

Ultimately through other development projects, the Township plans to extend this connector road further north from West Pleasant Grove Road to Skiles Boulevard. This will provide a fully connected roadway network on the west side of U.S. Route 202 from Street Road (S.R. 0926) to Skiles Boulevard, which will provide drivers with access to and from U.S. Route 202 via two signalized intersections. It is our understanding that the proposed Arborview development will construct the connector road from Skiles Boulevard to West Pleasant Grove Road upon development. However, there is no timetable or written financial commitment for the construction of this connector road.

PennDOT U.S. Route 202, Section 100

Additionally within this section of U.S. Route 202 (Wilmington Pike), designated as Section 100, several studies completed through PennDOT and the Delaware Valley Regional Planning Commission have identified the need for additional roadway capacity. At this time, PennDOT is underway with preliminary engineering for improvements at the U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926) intersection. Based on the current State Transportation Improvement Program (TIP) and the Conceptual Intersection Layout prepared by Urban Engineers and dated June 5, 2014, the project will include improvements that will help reduce traffic congestion and increase safety at the intersection through lane reconfigurations, striping, upgrades to the traffic signal, signal timing, and bicycle and pedestrian improvements. It is our understanding that the following roadway improvements are to be included:

- Southbound 130-foot right-turn deceleration lane on U.S. Route 202.
- Additional eastbound left-turn lane on PA Route 926, creating a double left-turn lane configuration with 380 feet of storage for each lane.
- Pedestrian and bicycle intersection improvements, including high-visibility crosswalks, ADA ramps, and sidewalk extension from the intersection east to Dalmally Drive.
- Traffic signal equipment upgrades, including pedestrian push buttons, countdown signal heads, and lighting.

Based on the TIP and coordination with PennDOT's consultant project manager, the current project schedule indicates an estimated construction start date in late 2018 or early 2019, with a construction completion date by the end of 2019. However, this schedule is dependent on moving through the project development process, with activities such as evaluation of project effect on the Westtown Inn (eligible for the historic register), Consulting Parties consultations, approval of overall environmental document, preliminary plan approvals, utility coordination, property acquisitions, and preparation of design plans and construction bid package.

S.R. 0926 Bridge Replacement over Radley Run

Through coordination with PennDOT, the Street Road (S.R. 0926) bridge located approximately 700 feet west of Bridlewood Boulevard is scheduled to be replaced. Design activity has recently begun, which is being combined with other locations in Bridge Group M (MPMS 102318). The tentative schedule estimates a construction start in early 2019. As with other bridge groups, there is some flexibility in scheduling any one particular bridge within the overall construction duration. The schedule is dependent on moving through the project development process with activities such as historic eligibility determination of Crebilly Farm, possible evaluation of project effect on the Crebilly Farm, possible Consulting Parties consultations, approval of overall environmental document, preliminary plan approvals, utility coordination, possible property acquisitions, and preparation of design plans and construction bid package.

Future Traffic Conditions

The total background growth and nearby approved development traffic volumes were then added to the existing traffic volumes, resulting in the future 2023 and 2028without development traffic volumes. Next, the site generated traffic volumes, as shown in **Figures 4C through 4E**, were added to the future 2023 and 2028 without-development traffic volumes, resulting in the future 2023 and 2028 with development traffic volumes.

The resultant future 2023 build-out year peak hour traffic volumes without-development are illustrated in **Figure 5A,** and the future 2023 build-out year with-development peak hour traffic volumes are illustrated in **Figure 5B through 5D** for the weekday morning and weekday afternoon peak hours for each development alternative. These traffic volumes were then analyzed to determine the future 2023 without- and with- development operating conditions, and the results of this analysis are shown in **Figures 5E through 5H.** Detailed spreadsheets summarizing the 2023 traffic projections, including

regional growth, other development trip assignments, and the site trip assignments for each intersection, are provided in **Appendix L.**

The resultant future 2028 design year peak hour traffic volumes without-development are illustrated in **Figure 6A,** and the future 2028 design year with-development peak hour traffic volumes are illustrated in **Figure 6B through 6D** for the weekday morning and weekday afternoon peak hours for each development alternative. These traffic volumes were then analyzed to determine the future 2028 without- and with- development operating conditions, and the results of this analysis are shown in **Figures 6E through 6H.** Detailed spreadsheets summarizing the 2028 traffic projections, including regional growth, other development trip assignments, and the site trip assignments for each intersection, are provided in **Appendix M.**

Capacity/Level-of-Service Results

The peak hour traffic volumes were analyzed to determine the existing and future operating conditions, both without and with the proposed development, in accordance with the standard techniques contained in the current *Highway Capacity Manual (2010)* for both signalized and unsignalized intersections. The HCM 2010 Methodology within Synchro 8.0 (build 806, rev. 77) traffic analysis software was utilized in the traffic analyses.

These standard capacity/level-of-service analysis techniques, which calculate total control delay, are described in **Appendix N** for both signalized and unsignalized intersections, as well as the correlation between average total control delay and the respective level-of-service (LOS) criteria for each intersection type.

According to PennDOT's *Policies and Procedures for Transportation Impact Studies Related to Highway Occupancy Permit Plans,* the following procedures and assumptions were utilized:

- For signalized intersections, the Pennsylvania base saturation flow rate (Exhibit 10-9) and Pennsylvania traffic signal control calibration parameters (Exhibit 10-10) outlined in PennDOT's *Publication 46, Traffic Engineering Manual*, were used.

- For unsignalized intersections, the base critical headways at TWSC intersections (Exhibit 10-11) and base follow-up headways at TWSC intersections (Exhibit 10-12) outlined in PennDOT's *Publication 46, Traffic Engineering Manual*, were used.

- All traffic signal timings at signalized intersections were optimized in without development conditions.

- If the evaluation of without-development to with-development indicates the overall intersection level of service has dropped, the applicant will be required to mitigate the level of service if the increase is greater than 10 seconds. If the overall intersection delay increase is less than or equal to 10 seconds, mitigation of the intersection will not be required.

The existing, future build-out year (2023) and design year (2028) traffic conditions, both without and with the proposed development, are summarized in **Figures 3B, 5E through 5H, and 6E through 6H** while the detailed capacity/level-of-service analysis worksheets are provided in **Appendices O through W.**

Tables 4 and 5 below summarize the overall intersection results of the level-of-service analyses for the off-site study intersections for each peak hour. Detailed results of the level-of-service and queueing analysis are contained in the matrices provided in **Tables 6 and 7.**

Table 4. Overall Intersection Level-of-Service
Weekday Morning Peak Hour

Intersection	Existing	Without Dev Base	Future 2028 With Development		
			Alternative A	Alternative B	Alternative C (With Connector Road)
U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926)	F 104.1	F 201.3	F 198.1 (signal retiming)	F 199.6 (signal retiming)	F 190.9 (signal retiming)
U.S. Route 202 (Wilmington Pike) and Pleasant Grove Road	A 0.7	A 1.4	A 1.7	A 1.7	A 1.7
Street Road (S.R. 0926) and New Street	E 70.5	F 109.5	E 56.4 (signal retiming)	E 56.9 (signal retiming)	D 41.7 (signal retiming)
Street Road (S.R. 0926) and Bridlewood Boulevard	A 1.3	A 1.9	A 1.9	A 1.9	A 1.9
New Street and West Pleasant Grove Road	A 4.6	A 6.6	A 7.5	A 7.6	A 7.4

Table 5. Overall Intersection Level-of-Service
Weekday Afternoon Peak Hour

Intersection	Existing	Without Dev Base	Future 2028 With Development		
			Alternative A	Alternative B	Alternative C (With Connector Road)
U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926)	F 140.1	F 228.8	F 216.9 (signal retiming)	F 217.8 (signal retiming)	F 206.3 (signal retiming)
U.S. Route 202 (Wilmington Pike) and Pleasant Grove Road	A 0.9	A 2.0	A 2.1	A 2.1	A 2.1
Street Road (S.R. 0926) and New Street	E 70.1	F 118.3	F 85.7 (signal retiming)	F 85.9 (signal retiming)	E 57.5 (signal retiming)
Street Road (S.R. 0926) and Bridlewood Boulevard	A 1.4	A 2.0	A 2.1	A 2.1	A 2.1
New Street and West Pleasant Grove Road	A 8.0	C 21.8	D 28.1	D 28.6	C 15.4

The off-site study intersection of U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926) does not satisfy PennDOT's mitigation criteria with the proposed development under the three alternatives since the increase in overall intersection delay is greater than 10 seconds. If PennDOT requires traffic improvements at this intersection to mitigate the overall intersection delay, provision of a separate southbound U.S. Route 202 (Wilmington Pike) right-turn lane is required. In addition to overall intersection delay, the three development alternatives have a traffic impact on individual movements at the intersection. Alternatively if PennDOT requires traffic improvements to mitigate both overall and movement intersection delay, provision of a second westbound Street Road (S.R. 0926) left-turn lane is required, with traffic signal modifications to eliminate the existing split phasing along Street Road (S.R. 0926). If required by PennDOT, the applicant is committed to provide one of these intersection improvements, which mitigates the traffic impact of the development.

At the intersection of Street Road (S.R. 0926) and New Street, traffic signal retiming mitigates the traffic impact of the development, which the applicant is committed to complete. It is noted that based on PennDOT mitigation criteria, the development has no traffic impact at this intersection.

The proposed development has no traffic impact at the other study area intersections.

Queuing Analysis

A queuing analysis was completed at the study intersections based on the HCM 2010 methodology. Matrix tables which outline the results of the queuing analysis are provided at the end of this report. Based on the results of the queuing analysis and with the recommended site access designs, as outlined previously, the queues at the site access intersections are accommodated within the existing and proposed lane storages for all three alternatives. Additionally, based on the results of the queuing analysis, the queues are accommodated within the available lane storages at the majority of the off-site study intersections. Significant queues occur at the U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926) intersection during both peak hours. With the improvements committed by the applicant pending coordination with PennDOT, the impact of the development on queues is mitigated.

PennDOT U.S. Route 202, Section 100 Intersection Improvement Project

As requested by Westtown Township and PennDOT, traffic analysis has also been completed with construction of the PennDOT improvement project in preliminary engineering for the intersection of U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926). The detailed capacity/level-of-service worksheets are provided in **Appendix X**.

Conclusions and Recommendations

Based on trip generation data compiled for Residential Condominium / Townhouse (ITE Land Use Code 230) and Single Family Detached Housing (ITE Land Use Code 210) contained in the Institute of Transportation Engineers (ITE) publication entitled, *Trip Generation Manual, 9th Edition,* the proposed development alternatives will generate the following trips:

- ***Alternative A:*** A total of approximately 210 "new" trips during the weekday morning peak hour and 266 "new" trips during the weekday afternoon peak hour.

- ***Alternatives B & C:*** A total of approximately 223 "new" trips during the weekday morning peak hour and 280 "new" trips during the weekday afternoon peak hour.

Committed Improvements

Per the traffic evaluation, the following on-site and off-site traffic improvements are committed by the applicant to mitigate the proposed development traffic impacts, pending further coordination and approvals from the Township and PennDOT. Since some of these improvements are within the state's right-of-way, or located at traffic signals under the jurisdiction of PennDOT, coordination with PennDOT will be required to implement these improvements. The Township will be included in all correspondence with PennDOT.

Site Accesses

U.S. Route 202 (Wilmington Pike) and Site Access

- Classified as a low volume driveway for Alternatives A and B, and a medium volume driveway for Alternative C with the connector road based on the anticipated daily traffic volumes.
- Provide one ingress lane and one egress lane for the site access.
- Provide a 150-foot (Alternatives A & B) or 175-foot (Alternative C) right-turn deceleration lane.
- Provide stop-control on the egress of the site access.
- Based on comments received from the Township's Traffic Engineer, the applicant will consider removing this access, pending further coordination.

Street Road (S.R. 0926) and Site Access

- Classified as a medium volume driveway for Alternatives A and B, and a high volume driveway for Alternative C with the connector road, based on the anticipated daily traffic volumes.
- Provide one ingress lane and two egress lanes for the site access.
- Provide a 150-foot long left-turn lane.
- Provide a 150-foot (Alternatives A & B) or 175-foot (Alternative C) right-turn deceleration lane.

- Install a traffic signal, which is preliminarily warranted based on the criteria for Warrant 2 (Four-Hour Vehicular Volume) and Warrant 3 (Peak Hour).
- The applicant will relocate signalized site access opposite Bridlewood Boulevard, pending further coordination and concurrence with Westtown Township, Thornbury Township, and PennDOT.

West Pleasant Grove Road and West Site Access

- Classified as a low volume driveway based on the anticipated daily traffic volumes for all three alternatives.
- Provide one ingress lane and one egress lane for the site access.
- Provide stop-control on the egress of the site access.

West Pleasant Grove Road and East Site Access

- Classified as a low volume driveway based on the anticipated daily traffic volumes for all three alternatives.
- Provide one ingress lane and one egress lane for the site access.
- Provide stop-control on the egress of the site access.

West Pleasant Grove Road and Connector Road (Alternative C Only)

- Classified as a medium volume driveway based on the anticipated daily traffic volumes.
- Provide one ingress lane and one egress lane for the site access.
- Provide stop-control on the egress of the site access.

Off-Site Traffic Improvements

Street Road (S.R. 0926) and New Street

- The applicant will complete traffic signal retiming optimization.

U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926)

- If PennDOT requires mitigation of the traffic impact of the development to the overall intersection level of service and delay, the applicant will provide a separate southbound U.S. Route 202 right-turn lane.

- If PennDOT requires mitigation of the traffic impact of the development on both overall and individual intersection movement levels of service and delay, the applicant will provide a second westbound Street Road (S.R. 0926) left-turn lane and the necessary traffic signal modifications to eliminate the split phasing along Street Road (S.R. 0926).

The traffic analyses contained herein reveal that efficient access to and from the proposed development can be provided, and furthermore, site-generated traffic is mitigated at the study area intersections with the committed improvements.

Since U.S. Route 202 (Wilmington Pike) and New Street (S.R. 0926) are State roads, the proposed site accesses along U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926) will be subject to the review and approval of PennDOT for issuance of a Highway Occupancy Permit, as well as any traffic signal timing changes.

Table 6. Level of Service Matrices

U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926)

Time Period			Weekday Morning Peak Hour						Weekday Afternoon Peak Hour					
Design Year			2016	2028 Design Year					2016	2028 Design Year				
Development Condition			Existing	w/o Dev Base	w/o Dev[1] Optimized	w/ Dev Optimized[1]			Existing	w/o Dev Base	w/o Dev[1] Optimized	w/ Dev Optimized[1]		
						Alternative A	Alternative B	Alternative C				Alternative A	Alternative B	Alternative C
Street Road (S.R. 0926)	EB	Left	F 208.0	F 320.7	F 270.6	F 321.1	F 325.5	F 325.5	F 100.0	F 191.2	F 161.4	F 190.6	F 191.7	F 191.7
		Left Thru Right	F 209.8	F 342.5	F 287.8	F 348.1	F 353.6	F 353.6	F 110.9	F 213.4	F 180.9	F 215.3	F 216.6	F 216.6
	WB	Left	E 70.2	E 75.8	F 140.3	F 159.2	F 159.3	F 141.7	E 63.9	E 65.8	F 95.0	F 95.0	F 95.0	F 95.0
		Thru	E 66.4	E 67.6	F 104.6	F 126.8	F 126.9	F 112.1	E 79.7	F 92.7	F 198.7	F 223.9	F 225.4	F 225.4
		Right	E 58.8	E 58.1	E 65.6	E 66.9	E 66.9	E 65.9	E 56.8	E 55.2	E 62.1	E 62.1	E 62.1	E 62.1
U.S. Route 202 (Wilmington Pike)	NB	Left	D 37.8	D 39.5	D 41.7	D 42.3	D 42.4	D 42.4	D 41.0	D 43.1	D 42.9	E 60.6	E 64.0	E 64.0
		Thru	F 92.9	F 200.0	F 180.9	F 175.6	F 175.8	F 182.9	F 99.0	F 204.4	F 165.3	F 165.3	F 165.3	F 165.3
		Right	C 23.1	C 26.2	C 25.8	C 25.4	C 25.5	C 26.1	C 26.1	C 29.4	C 26.3	C 26.3	C 26.3	C 26.3
	SB	Left	D 39.6	D 47.5	D 53.3	E 59.1	E 60.0	E 59.9	E 62.5	F 129.5	F 105.5	F 117.1	F 117.1	F 117.1
		Thru	F 73.5 v/c> 1.0	F 170.9	F 154.0	F 163.8	F 164.4	F 140.0	F 227.5	F 324.2	F 277.1	F 306.1	F 308.4	F 283.6
		Thru Right	F 77.6 v/c > 1.0	F 192.2	F 174.3	F 184.2	F 184.7	F 147.5	F 221.5	F 328.1	F 279.9	F 309.7	F 312.0	F 280.5
Overall			F 104.1	F 201.3	F 182.5	F 198.1	F 199.6	F 190.9	F 140.1	F 228.8	F 200.6	F 216.8	F 217.8	F 206.3

(1) Future traffic signal timings have been optimized.

Table 6. Level of Service Matrices

U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926)
Intersection Improvement Alternatives

Time Period			Weekday Morning Peak Hour						Weekday Afternoon Peak Hour					
Design Year			2028 Design Year						2028 Design Year					
Development Condition			w/ Dev[1]						w/ Dev[1]					
			U.S. Route 202 Southbound Right-Turn Lane			Street Road (S.R. 0926) Improvements			U.S. Route 202 Southbound Right-Turn Lane			Street Road (S.R. 0926) Improvements		
			Alternative A	Alternative B	Alternative C	Alternative A	Alternative B	Alternative C	Alternative A	Alternative B	Alternative C	Alternative A	Alternative B	Alternative C
Street Road (S.R. 0926)	EB	Left	F 288.5	F 292.4	F 292.4	F	F	F	F 190.6	F 191.7	F 191.7	F	F	F
		Left	F	F	F	240.9	244.7	244.7	F	F	F	200.5	201.5	201.5
		Thru				F	F	F				F	F	F
		Right	312.7	317.6	317.6	215.7	219.2	219.2	215.3	216.6	216.6	140.6	142.1	142.1
	WB	Left	F 141.7	F 141.7	F 141.7	E 63.0	E 63.1	E 63.1	F 95.0	F 95.0	F 95.0	D 46.2	D 46.2	D 46.2
		Thru	F 112.1	F 112.1	F 112.1	F 98.7	F 98.8	F 98.8	F 223.9	F 225.4	F 225.4	F 188.2	F 189.6	F 189.6
		Right	E 65.9	E 65.9	E 65.9	D 48.0	D 48.0	D 48.0	E 62.1	E 62.1	E 62.1	D 44.9	D 44.9	D 44.9
U.S. Route 202 (Wilmington Pike)	NB	Left	D 42.4	D 42.4	D 42.4	C 29.8	C 29.8	C 29.8	E 60.6	E 64.0	E 64.0	C 34.0	C 34.9	C 34.9
		Thru	F 197.5	F 197.5	F 197.5	F 170.7	F 170.9	F 170.9	F 165.3	F 165.3	F 165.3	F 146.2	F 146.2	F 146.2
		Right	C 27.3	C 27.3	C 27.3	B 18.9	B 18.9	B 18.9	C 26.3	C 26.3	C 26.3	B 18.8	B 18.8	B 18.8
	SB	Left	E 58.9	E 60.0	E 60.0	C 31.8	C 32.0	C 32.0	F 117.1	F 117.1	F 117.1	D 45.7	D 45.7	D 45.7
		Thru	F	F	F	F 155.7	F 156.3	F 125.1	F	F	F	F 276.8	F 278.5	F 255.2
		Thru	132.6	133.5	133.5	F	F	F	273.5	275.6	275.4	F	F	F
		Right	C 27.5	C 27.5	C 24.8	176.3	176.9	132.5	C 28.1	C 28.2	C 25.9	279.9	281.7	251.9
Overall			F 178.5	F 179.8	F 183.1	F 166.9	F 168.0	F 155.0	F 196.9	F 197.9	F 201.3	F 190.1	F 191.0	F 179.9

(1) Future traffic signal timings have been optimized.

Table 6. Level of Service Matrices

Street Road (S.R. 0926) and New Street

Time Period		Weekday Morning Peak Hour						Weekday Afternoon Peak Hour					
Design Year		2016	2028 Design Year					2016	2028 Design Year				
Development Condition		Existing	w/o Dev Base	w/o Dev[(1)] Optimized	w/ Dev Optimized[(1)]			Existing	w/o Dev Base	w/o Dev[(1)] Optimized	w/ Dev Optimized[(1)]		
					Alternative A	Alternative B	Alternative C				Alternative A	Alternative B	Alternative C
Street Road (S.R. 0926)	EB Left	A	B	D	D	D	D	B	B	C	C	C	C
	EB Thru	9.8	16.0	41.8	44.1	44.2	44.1	12.4	16.3	21.9	23.1	23.1	23.0
	WB Left	A	A	B	B	B	B	A	B	B	B	B	C
	WB Thru	5.8	6.6	12.4	12.7	12.8	14.1	9.8	11.4	14.8	15.1	15.1	21.4
New Street	NB Left	C	C	C	C	C	C	C	D	C	C	C	D
	NB Thru	33.3	34.1	25.1	25.2	25.2	25.2	34.9	37.5	31.8	32.1	32.2	35.6
	SB Left	F	F	F	F	F	E	F	F	F	F	F	F
	SB Thru	243.7	384.5	113.8	123.9	125.4	70.1	207.1	369.7	239.0	247.5	248.1	165.2
Overall		E	F	D	E	E	D	E	F	F	F	F	E
		70.5	109.5	52.6	56.4	56.9	41.7	70.1	118.3	83.2	85.7	85.9	57.5

(1) Future traffic signal timings have been optimized.

Table 6. Level of Service Matrices

Street Road (S.R. 0926) and Bridlewood Boulevard

Time Period			Weekday Morning Peak Hour					Weekday Afternoon Peak Hour				
Design Year			2016	2028 Design Year				2016	2028 Design Year			
Development Condition			Existing	w/o Dev	w/ Dev			Existing	w/o Dev	w/ Dev		
					Alternative A	Alternative B	Alternative C			Alternative A	Alternative B	Alternative C
Street Road (S.R. 0926)	EB	Thru	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
		Right	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
	WB	Left	B 11.6	B 12.9	B 12.9	B 12.9	B 12.6	B 10.5	B 11.4	B 11.5	B 11.5	B 11.3
		Thru	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
		Right										
Bridlewood Boulevard	NB	Left	C 23.5	E 39.3	E 40.3	E 40.3	E 38.3	D 25.5	E 44.0	E 45.7	E 46.1	E 47.6
		Right	B 14.6	C 17.8	C 17.9	C 17.9	C 17.2	B 13.4	C 15.9	C 16.2	C 16.2	C 15.6
Overall			A 1.3	A 1.9	A 1.9	A 1.9	A 1.9	A 1.4	A 2.0	A 2.1	A 2.1	A 2.1

(1) Movement operates at free-flow conditions.

Table 6. Level of Service Matrices

U.S. Route 202 (Wilmington Pike) and West Pleasant Grove Road

Time Period		Weekday Morning Peak Hour					Weekday Afternoon Peak Hour				
Design Year		2016	2028 Design Year				2016	2028 Design Year			
Development Condition		Existing	w/o Dev	w/ Dev			Existing	w/o Dev	w/ Dev		
				Alternative A	Alternative B	Alternative C			Alternative A	Alternative B	Alternative C
West Pleasant Grove Road	EB Right	C 24.3	E 41.3	E 45.9	E 46.4	E 46.4	C 22.1	D 31.8	D 33.6	D 33.6	D 33.6
	WB Right	C 23.4	E 35.3	E 37.5	E 37.8	E 37.8	C 20.4	D 31.9	D 32.9	D 32.9	D 32.9
U.S. Route 202 (Wilmington Pike)	NB Left	C 19.2	D 27.4	D 27.9	D 27.9	D 27.9	C 20.8	D 33.5	E 36.2	E 36.2	E 36.2
	NB Thru	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
	NB Thru/ Right	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
	SB Left	C 21.5	E 44.5	E 49.6	E 49.6	E 49.6	C 23.0	F 52.4	F 56.5	F 56.5	F 56.5
	SB Thru	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
	SB Thru/ Right	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Overall		A 0.7	A 1.4	A 1.7	A 1.7	A 1.7	A 0.9	A 2.0	A 2.1	A 2.1	A 2.1

(1) Movement operates at free-flow conditions.

Table 6. Level of Service Matrices

New Street and West Pleasant Grove Road

Time Period		Weekday Morning Peak Hour					Weekday Afternoon Peak Hour				
Design Year		2016	2028 Design Year				2016	2028 Design Year			
Development Condition		Existing	w/o Dev	w/ Dev			Existing	w/o Dev	w/ Dev		
				Alternative A	Alternative B	Alternative C			Alternative A	Alternative B	Alternative C
West Pleasant Grove Road	WB Left	C	C	C	C	C	C	F	F	F	E
	WB Right	15.0	21.5	23.4	23.5	21.7	22.6	61.5	79.2	80.7	45.1
New Street	NB Thru	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
	NB Right										
	SB Left	A	A	A	A	A	A	A	A	A	A
	SB Thru	8.8	9.0	9.0	9.0	9.0	8.8	9.1	9.1	9.1	9.2
Overall		A	A	A	A	A	A	C	D	D	C
		4.6	6.6	7.5	7.6	7.4	8.0	21.8	28.1	28.6	15.4

(1) Movement operates at free-flow conditions.

Table 6. Level of Service Matrices

U.S. Route 202 (Wilmington Pike) and Site Access

Time Period		Weekday Morning Peak Hour			Weekday Afternoon Peak Hour		
Design Year		2028 Design Year			2028 Design Year		
Development Condition		w/ Dev			w/ Dev		
		Alternative A	Alternative B	Alternative C	Alternative A	Alternative B	Alternative C
Site Access	EB Right	C 24.7	D 25.0	C 22.7	D 25.0	D 25.1	C 23.0
U.S. Route 202 (Wilmington Pike)	Thru (2)	(1)	(1)	(1)	(1)	(1)	(1)
	SB Right	(1)	(1)	(1)	(1)	(1)	(1)
Overall		A 0.2	A 0.2	A 0.2	A 0.1	A 0.1	A 0.1

(1) Movement operates at free-flow conditions.

Table 6. Level of Service Matrices

Street Road (S.R. 0926) and Site Access

Time Period		Weekday Morning Peak Hour			Weekday Afternoon Peak Hour		
Design Year		2028 Design Year			2028 Design Year		
Development Condition		w/ Dev			w/ Dev		
		Alternative A	Alternative B	Alternative C	Alternative A	Alternative B	Alternative C
Street Road (S.R. 0926)	EB Left	A 4.7	A 4.8	A 5.7	A 6.5	A 6.5	A 8.2
	EB Thru	B 10.2	B 10.6	B 18.0	A 6.9	A 7.0	B 13.3
	WB Thru	A 3.6	A 3.7	A 4.7	A 4.5	A 4.5	A 6.2
	WB Right	A 2.5	A 2.5	A 3.9	A 2.7	A 2.8	A 4.6
Site Access	SB Left	C 21.5	C 21.6	B 19.7	B 17.6	B 17.7	B 16.6
	SB Right	B 18.3	C 18.4	C 22.1	B 16.4	B 16.5	C 20.7
Overall		A 8.9	A 9.2	B 15.6	A 6.2	A 6.3	B 11.8

Table 6. Level of Service Matrices

Alternate Street Road (S.R. 0926) Site Access Opposite Bridlewood Boulevard

Time Period			Weekday Morning Peak Hour			Weekday Afternoon Peak Hour		
Design Year			2028 Design Year			2028 Design Year		
Development Condition			w/ Dev			w/ Dev		
			Alternative A	Alternative B	Alternative C	Alternative A	Alternative B	Alternative C
Street Road (S.R. 0926)	EB	Left	A 5.8	A 5.8	A 5.6	A 7.5	A 7.8	A 7.8
		Thru	B 13.6	B 13.7	B 15.5	A 8.6	A 9.2	B 11.2
		Right	A 3.2	A 3.2	A 3.9	A 3.3	A 3.5	A 4.4
	WB	Left	B 17.5	B 17.6	B 19.4	B 13.9	B 14.6	B 17.0
		Thru	A 4.5	A 4.5	A 4.7	A 5.3	A 5.5	A 6.0
		Right	A 3.1	A 3.1	A 3.9	A 3.4	A 3.5	A 4.6
Bridlewood Boulevard	NB	Left	B 19.8	B 19.9	C 25.0	B 17.3	B 17.4	C 22.9
		Thru	B 19.7	B 19.7	B 18.8	B 18.2	B 18.3	B 17.2
		Right						
Site Access	SB	Left	C 20.8	C 20.9	C 20.8	B 18.6	B 18.7	B 18.5
		Thru	B 19.2	B 19.3	C 28.7	B 17.1	B 17.1	C 25.7
		Right						
Overall			B 11.7	B 11.8	B 15.3	A 8.3	A 8.6	B 12.2

(1) Movement operates at free-flow conditions.

Table 6. Level of Service Matrices

West Pleasant Grove Road and West Site Access

Time Period			Weekday Morning Peak Hour			Weekday Afternoon Peak Hour		
Design Year			2028 Design Year			2028 Design Year		
Development Condition			w/ Dev			w/ Dev		
			Alternative A	Alternative B	Alternative C	Alternative A	Alternative B	Alternative C
West Pleasant Grove Road	EB	Thru/ Right	(1)	(1)	(1)	(1)	(1)	(1)
	WB	Left/ Thru	A 8.2	A 8.2	A 8.3	A 8.2	A 8.2	A 8.2
West Site Access	NB	Left	A	A	A	B	B	B
		Right	9.4	9.4	9.3	10.9	10.9	10.1
Overall			A 0.9	A 0.9	A 0.3	A 0.7	A 0.7	A 0.3

(1) Movement operates at free-flow conditions.

Table 6. Level of Service Matrices

West Pleasant Grove Road and East Site Access

Time Period			Weekday Morning Peak Hour			Weekday Afternoon Peak Hour		
Design Year			2028 Design Year			2028 Design Year		
			w/ Dev			w/ Dev		
Development Condition			Alternative A	Alternative B	Alternative C	Alternative A	Alternative B	Alternative C
West Pleasant Grove Road	EB	Thru/ Right	(1)	(1)	(1)	(1)	(1)	(1)
	WB	Left/ Thru	A 8.2	A 8.2	A 8.3	A 8.1	A 8.1	A 8.2
East Site Access	NB	Left	A	A	A	B	B	B
		Right	9.1	9.1	9.4	10.2	10.2	10.6
Overall			A 0.3	A 0.4	A 0.3	A 0.3	A 0.3	A 0.3

(1) Movement operates at free-flow conditions.

Table 6. Level of Service Matrices

West Pleasant Grove Road and Site Access/Connector Road

Time Period			Weekday Morning Peak Hour			Weekday Afternoon Peak Hour		
Design Year			2028 Design Year			2028 Design Year		
Development Condition			w/ Dev			w/ Dev		
			Alternative A	Alternative B	Alternative C	Alternative A	Alternative B	Alternative C
West Pleasant Grove Road	EB	Thru/ Right	- - -	- - -	(1)	- - -	- - -	(1)
	WB	Left/ Thru	- - -	- - -	A 8.4	- - -	- - -	A 8.6
Site Access/ Connector Road	NB	Left	- - -	- - -	B	- - -	- - -	C
		Right			10.4			15.0
Overall			- - -	- - -	A 2.5	- - -	- - -	A 2.9

(1) Movement operates at free-flow conditions.

Table 7. 95th Percentile Queue Matrices

U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926)

Time Period			Current Storage [1]	Weekday Morning Peak Hour						Weekday Afternoon Peak Hour					
Design Year				2016	2028 Design Year					2016	2028 Design Year				
Development Condition				Existing	w/o Dev Base	w/o Dev [2] Optimized	w/ Dev Optimized [2]			Existing	w/o Dev Base	w/o Dev [2] Optimized	w/ Dev Optimized [2]		
							Alternative A	Alternative B	Alternative C				Alternative A	Alternative B	Alternative C
Street Road (S.R. 0926)	EB	Left	450'	1230	1753	1690	1953	1975	1975	625	1205	1153	1283	1288	1288
		Left Thru Right	*4,700*	1363	1985	1915	2230	2258	2258	958	1398	1333	1493	1500	1500
	WB	Left	200'	285	358	580	595	595	583	285	363	423	423	423	423
		Thru	*680'*	258	318	390	435	435	415	450	603	975	1060	1065	1065
		Right	215'	45	58	65	65	65	65	48	68	73	73	73	73
U.S. Route 202 (Wilmington Pike)	NB	Left	305'	25	25	25	38	38	38	45	60	55	228	238	238
		Thru	*2,800'*	1328	2783	2773	2758	2760	2790	1348	2805	2640	2640	2640	2640
		Right	170'	130	180	185	185	185	185	103	145	135	135	135	135
	SB	Left	375'	63	93	100	118	118	120	148	385	310	333	333	333
		Thru	*4,400'*	1788	2693	2698	2788	2805	2528	2800	3868	3670	3828	3840	3540
		Thru Right	*4,400'*	1850	2930	2933	3028	3045	2688	2863	4060	3855	4023	4033	3688

(1) Distance to adjacent signalized intersections shown in italics.

(2) Future traffic signal timings have been optimized.

Table 7. 95th Percentile Queue Matrices

U.S. Route 202 (Wilmington Pike) and Street Road (S.R. 0926)
Intersection Improvement Alternatives

Time Period			Weekday Morning Peak Hour						Weekday Afternoon Peak Hour					
Design Year			2028 Design Year						2028 Design Year					
Development Condition			w/ Dev[2]						w/ Dev[2]					
			U.S. Route 202 Southbound Right-Turn Lane			Street Road (S.R. 0926) Improvements			U.S. Route 202 Southbound Right-Turn Lane			Street Road (S.R. 0926) Improvements		
			Alternative A	Alternative B	Alternative C	Alternative A	Alternative B	Alternative C	Alternative A	Alternative B	Alternative C	Alternative A	Alternative B	Alternative C
Street Road (S.R. 0926)	EB	Left	1888	1910	1910	1035	1048	1048	1283	1288	1288	745	748	748
		Left Thru	2158	2185	2185				1493	1500	1500			
		Right				998	1013	1013				690	695	695
	WB	Left	583	583	583	293	293	293	423	423	423	268	268	268
		Thru	415	415	415	345	345	345	1060	1065	1065	883	888	888
		Right	65	65	65	48	48	48	73	73	73	53	53	53
U.S. Route 202 (Wilmington Pike)	NB	Left	38	38	38	28	28	28	228	238	238	88	93	93
		Thru	2855	2855	2855	2338	2340	2340	2640	2640	2640	2173	2173	2173
		Right	190	190	190	135	135	135	135	135	135	98	98	98
	SB	Left	120	123	123	70	73	73	333	333	333	220	220	220
		Thru	2383	2393	2393	2358	2365	2058	3445	3458	3455	3313	3325	3030
		Thru				2590	2598	2203				3488	3498	3153
		Right	268	268	120				220	223	75			

(1) Distance to adjacent signalized intersections shown in italics.

(2) Future traffic signal timings have been optimized.

Table 7. 95th Percentile Queue Matrices

Street Road (S.R. 0926) and New Street

Time Period			Current Storage [1]	Future Storage [1]	Weekday Morning Peak Hour						Weekday Afternoon Peak Hour					
Design Year					2016	2028 Design Year					2016	2028 Design Year				
Development Condition					Existing	w/o Dev Base	w/o Dev[2] Optimized	w/ Dev Optimized[2]			Existing	w/o Dev Base	w/o Dev[2] Optimized	w/ Dev Optimized[2]		
								Alternative A	Alternative B	Alternative C				Alternative A	Alternative B	Alternative C
Street Road (S.R. 0926)	EB	Left / Thru / Right	*2,200'*	*2,200'*	440	700	1015	1035	1035	1033	440	628	710	750	750	780
	WB	Left / Thru / Right	*4,700'*	*3,300'*	188	238	305	318	320	335	288	383	428	433	433	635
New Street	NB	Left / Thru / Right	-	-	113	140	120	123	123	123	240	295	275	285	288	298
	SB	Left / Thru / Right	-	-	1178	1748	1055	1118	1128	610	1410	2175	1845	1890	1890	1295

(1) Distance to adjacent signalized intersections shown in italics.

(2) Future traffic signal timings have been optimized.

Table 7. 95th Percentile Queue Matrices

Street Road (S.R. 0926) and Bridlewood Boulevard

Time Period			Current Storage [1]	Future Storage [1]	Weekday Morning Peak Hour					Weekday Afternoon Peak Hour				
Design Year					2016	2028 Design Year				2016	2028 Design Year			
Development Condition					Existing	w/o Dev	w/ Dev			Existing	w/o Dev	w/ Dev		
							Alternative A	Alternative B	Alternative C			Alternative A	Alternative B	Alternative C
Street Road (S.R. 0926)	EB	Thru	*2,400'*	*2,400'*	-	-	-	-	-	-	-	-	-	-
		Right	350'	350'	-	-	-	-	-	-	-	-	-	-
	WB	Left	120'	120'	0	25	25	25	25	25	25	25	25	25
		Thru	*2,300'*	*1500'*	-	-	-	-	-	-	-	-	-	-
Bridlewood Boulevard	NB	Left	125'	125'	25	38	40	40	38	25	35	38	38	38
		Right			25	25	25	25	25	25	25	25	25	25

(1) Distance to adjacent signalized intersections shown in italics.

Table 7. 95th Percentile Queue Matrices

U.S. Route 202 (Wilmington Pike) and West Pleasant Grove Road

Time Period			Current Storage [1]	Weekday Morning Peak Hour					Weekday Afternoon Peak Hour				
Design Year				2016	2028 Design Year				2016	2028 Design Year			
Development Condition				Existing	w/o Dev	w/ Dev			Existing	w/o Dev	w/ Dev		
						Alternative A	Alternative B	Alternative C			Alternative A	Alternative B	Alternative C
West Pleasant Grove Road	EB	Right	-	25	45	55	55	55	25	25	25	25	25
	WB	Right	-	25	25	25	25	25	25	25	25	25	25
U.S. Route 202 (Wilmington Pike)	NB	Left	350'	25	25	25	25	25	25	28	30	30	30
		Thru	*3,100'*	-	-	-	-	-	-	-	-	-	-
		Thru/ Right	*3,100'*	-	-	-	-	-	-	-	-	-	-
	SB	Left	380'	25	60	65	65	65	40	105	113	113	113
		Thru	*1,200'*	-	-	-	-	-	-	-	-	-	-
		Thru/ Right	*1,200'*	-	-	-	-	-	-	-	-	-	-

(1) Distance to adjacent signalized intersections shown in italics.

Table 7. 95th Percentile Queue Matrices

New Street and West Pleasant Grove Road

Time Period		Current Storage [1]	Weekday Morning Peak Hour					Weekday Afternoon Peak Hour				
Design Year			2016	2028 Design Year				2016	2028 Design Year			
Development Condition			Existing	w/o Dev	w/ Dev			Existing	w/o Dev	w/ Dev		
					Alternative A	Alternative B	Alternative C			Alternative A	Alternative B	Alternative C
West Pleasant Grove Road	WB Left	-	45	88	103	103	93	108	275	323	325	205
	WB Right											
New Street	NB Thru	*3,350'*	-	-	-	-	-	-	-	-	-	-
	NB Right											
	SB Left	-	0	0	25	25	25	0	0	25	25	25
	SB Thru											

(1) Distance to adjacent signalized intersections shown in italics.

Table 7. 95th Percentile Queue Matrices

U.S. Route 202 (Wilmington Pike) and Site Access

Time Period			Future Storage	Weekday Morning Peak Hour			Weekday Afternoon Peak Hour		
Design Year				2028 Design Year			2028 Design Year		
Development Condition				w/ Dev			w/ Dev		
				Alternative A	Alternative B	Alternative C	Alternative A	Alternative B	Alternative C
Site Access	EB	Right	-	25	25	25	25	25	25
U.S. Route 202 (Wilmington Pike)	SB	Thru (2)	-	-	-	-	-	-	-
		Right	225'	-	-	-	-	-	-

Table 7. 95th Percentile Queue Matrices

Street Road (S.R. 0926) and Site Access

Time Period			Future Storage [1]	Weekday Morning Peak Hour			Weekday Afternoon Peak Hour		
Design Year				2028 Design Year			2028 Design Year		
Development Condition				w/ Dev			w/ Dev		
				Alternative A	Alternative B	Alternative C	Alternative A	Alternative B	Alternative C
Street Road (S.R. 0926)	EB	Left	150'	0	0	0	25	25	25
		Thru	*1,350'*	405	418	533	315	315	410
	WB	Thru	*1,050'*	115	120	95	185	185	170
		Right	150'	25	25	25	25	25	30
Site Access	SB	Left	100'	55	60	80	28	28	50
		Right	-	25	25	118	25	25	135

(1) Distance to adjacent signalized intersections shown in italics.

Table 7. 95th Percentile Queue Matrices

Alternate Street Road (S.R. 0926) Site Access Opposite Bridlewood Boulevard

Time Period			Future Storage [1]	Weekday Morning Peak Hour			Weekday Afternoon Peak Hour		
Design Year				2028 Design Year			2028 Design Year		
Development Condition				w/ Dev			w/ Dev		
				Alternative A	Alternative B	Alternative C	Alternative A	Alternative B	Alternative C
Street Road (S.R. 0926)	EB	Left	150'	0	0	0	25	25	25
		Thru	*2,400'*	473	473	488	335	345	375
		Right	350'	25	25	25	25	25	25
	WB	Left	120'	25	25	25	25	25	25
		Thru	*2,300'*	135	140	93	193	200	155
		Right	175'	25	25	25	25	25	28
Bridlewood Boulevard	NB	Left	125'	35	35	40	25	25	30
		Thru	125'	25	25	25	38	38	38
		Right							
Site Access	SB	Left	100'	53	58	80	28	28	50
		Thru	-	25	25	153	25	25	160
		Right							

(1) Distance to adjacent signalized intersections shown in italics.

Table 7. 95th Percentile Queue Matrices

West Pleasant Grove Road and West Site Access

Time Period		Weekday Morning Peak Hour			Weekday Afternoon Peak Hour		
Design Year		2028 Design Year			2028 Design Year		
Development Condition		w/ Dev			w/ Dev		
		Alternative A	Alternative B	Alternative C	Alternative A	Alternative B	Alternative C
West Pleasant Grove Road	EB Thru	-	-	-	-	-	-
	EB Right						
	WB Left	0	0	0	25	25	0
	WB Thru						
West Site Access	NB Left	25	25	0	25	25	0
	NB Right						

Table 7. 95th Percentile Queue Matrices

West Pleasant Grove Road and Eastern Site Access

Time Period		Weekday Morning Peak Hour			Weekday Afternoon Peak Hour		
Design Year		2028 Design Year			2028 Design Year		
		w/ Dev			w/ Dev		
Development Condition		Alternative A	Alternative B	Alternative C	Alternative A	Alternative B	Alternative C
West Pleasant Grove Road	EB Thru	-	-	-	-	-	-
	EB Right						
	WB Left	0	0	0	0	0	0
	WB Thru						
East Site Access	NB Left	0	0	0	0	0	0
	NB Right						

Table 7. 95th Percentile Queue Matrices

West Pleasant Grove Road and Site Access/Connector Road

Time Period		Weekday Morning Peak Hour			Weekday Afternoon Peak Hour		
Design Year		2028 Design Year			2028 Design Year		
		w/ Dev			w/ Dev		
Development Condition		Alternative A	Alternative B	Alternative C	Alternative A	Alternative B	Alternative C
West Pleasant Grove Road	EB Thru	-	-	-	-	-	-
	EB Right						
	WB Left	-	-	25	-	-	25
	WB Thru						
Site Access/ Connector Road	NB Left	-	-	25	-	-	25
	NB Right						

Schematic-Not To Scale

FIGURE 1A

Site Plan

Alternative A - Proposed Development

CREBILLY FARM RESIDENTIAL DEVELOPMENT

McMAHON TRANSPORTATION ENGINEERS & PLANNERS

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(10/13/2016) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 1A.dwg

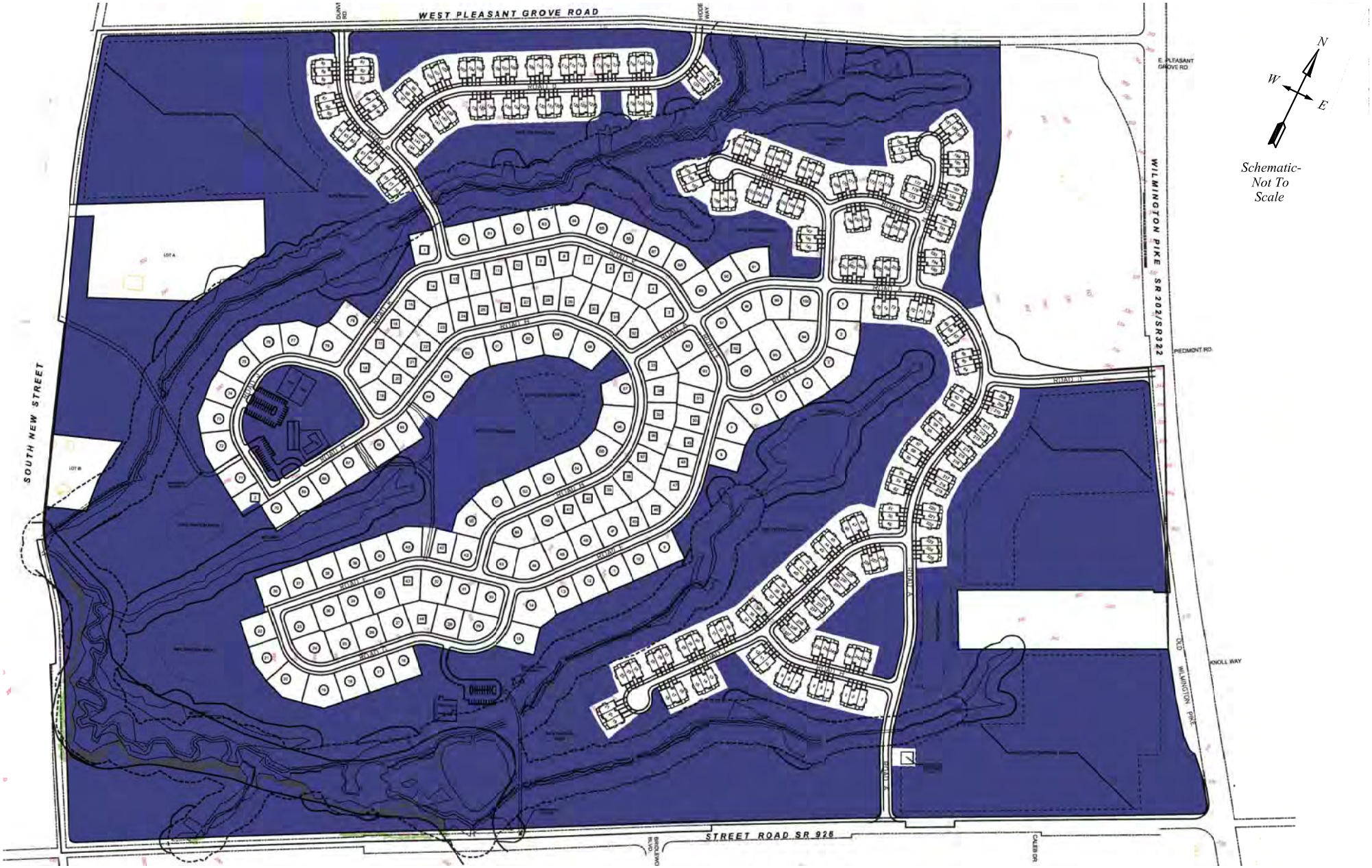


FIGURE 1B

Site Plan

Alternatives B & C - Proposed Density Bonus Development

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(10/13/2016) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 1B.dwg

FIGURE 2

Site Location Map

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(10/7/2016) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 2.dwg

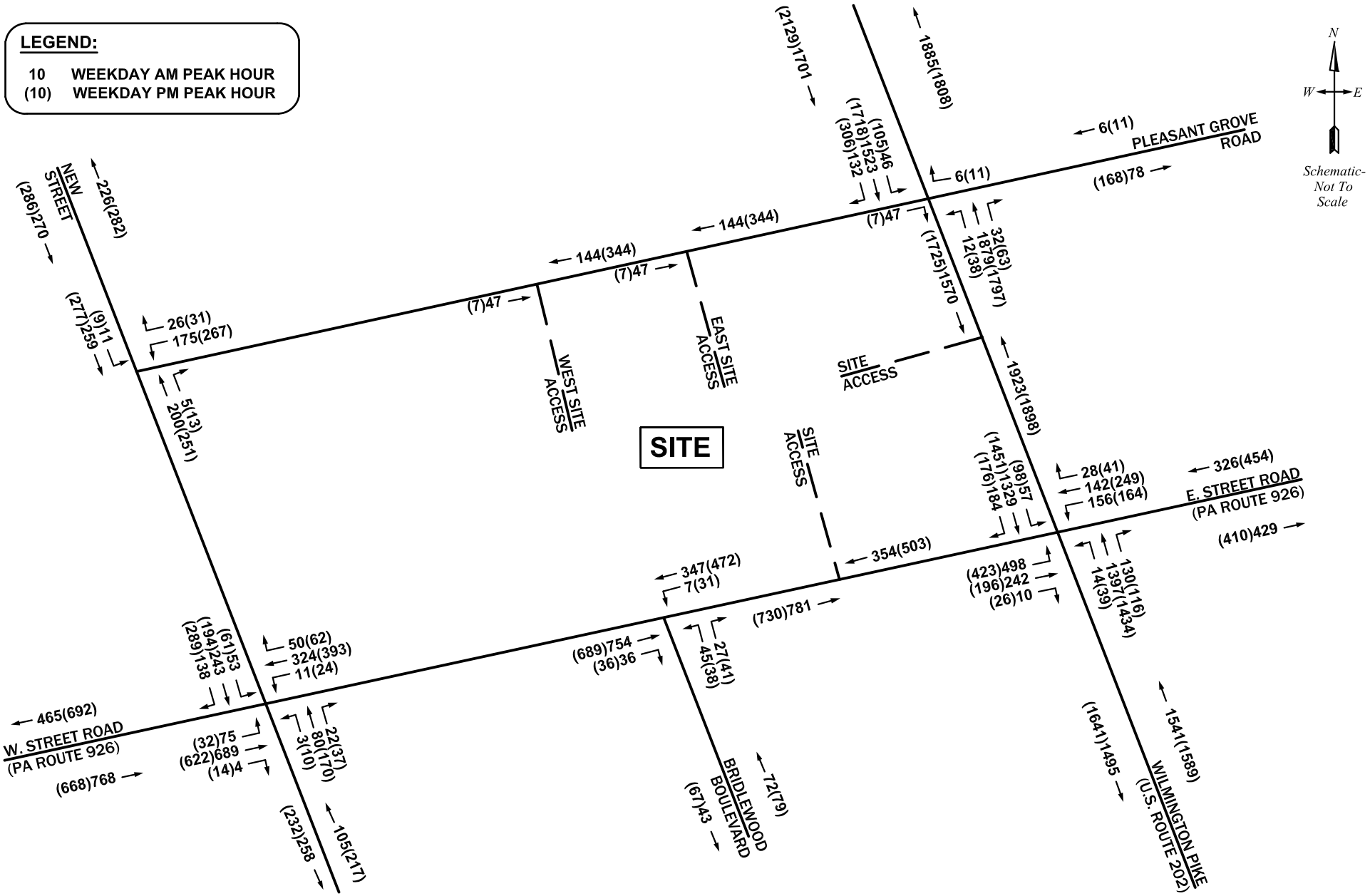


FIGURE 3A

Existing Peak Hour Traffic Volumes

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 3A.dwg

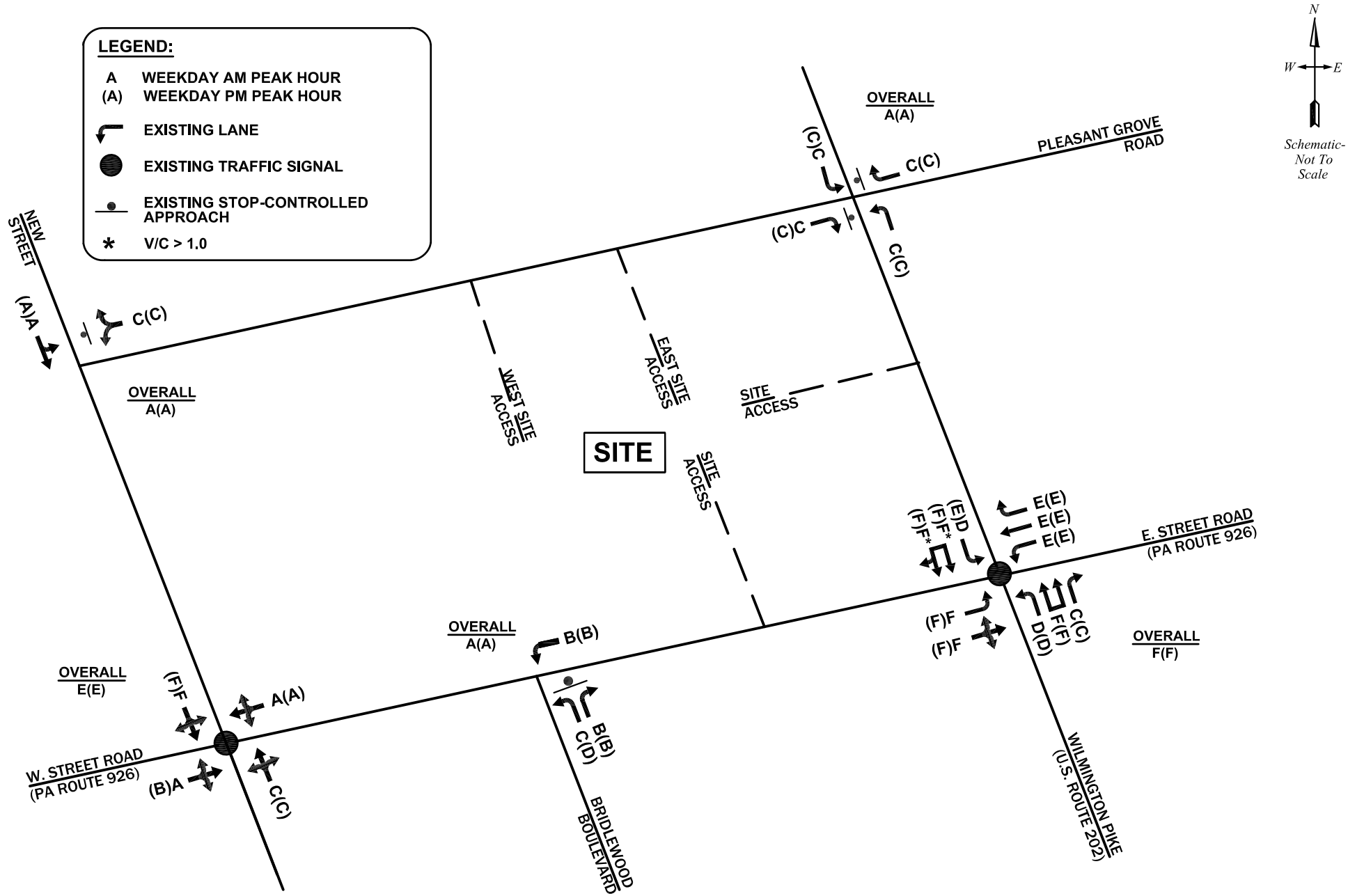


FIGURE 3B

Existing Peak Hour Levels of Service

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 3B.dwg

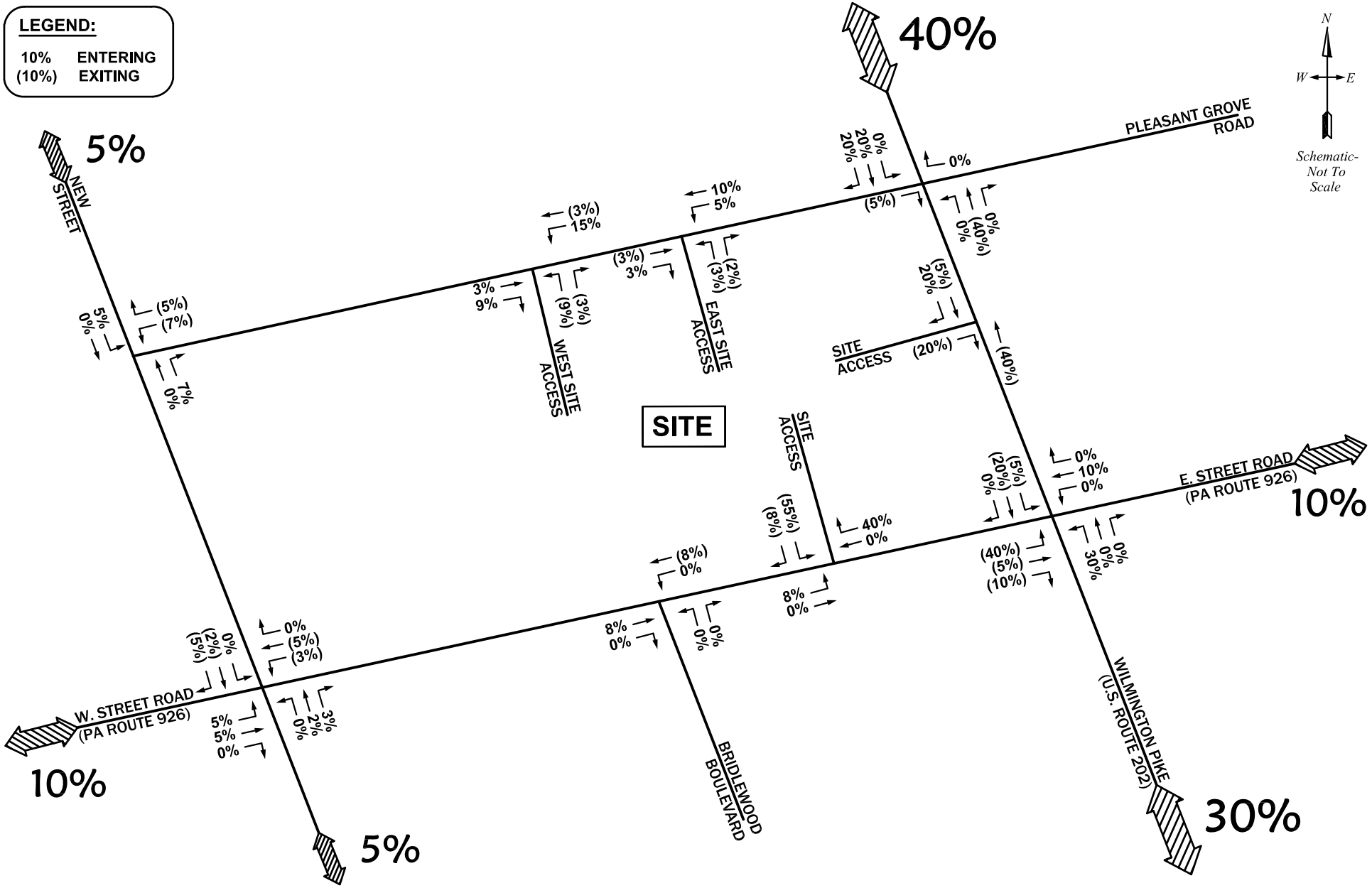


FIGURE 4A
Site Trip Distribution
Alternatives A and B

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 4A.dwg

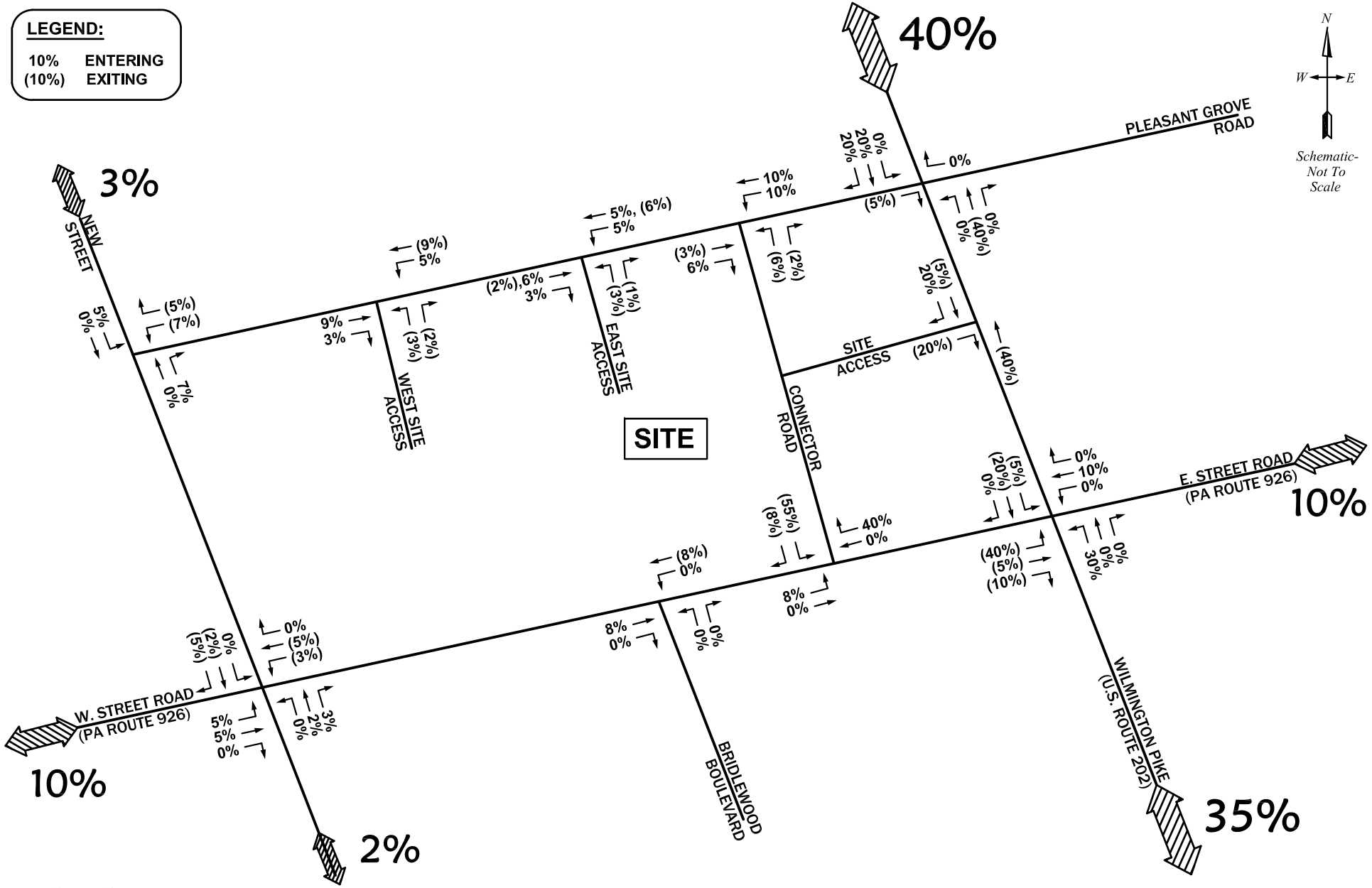


FIGURE 4B

Site Trip Distribution

Alternative C

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 4B.dwg

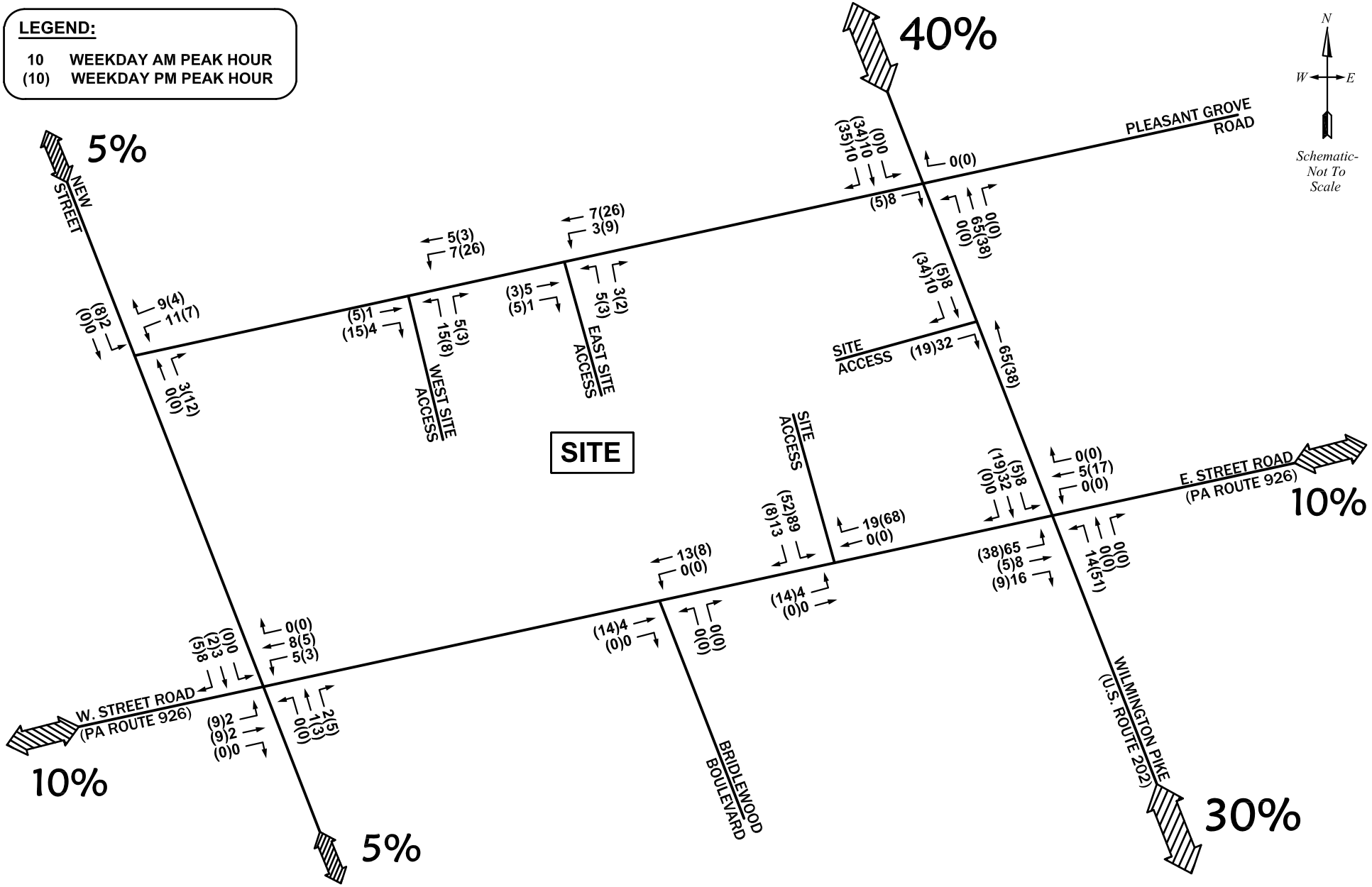


FIGURE 4C
Site Trip Assignment
Alternative A

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 4C.dwg

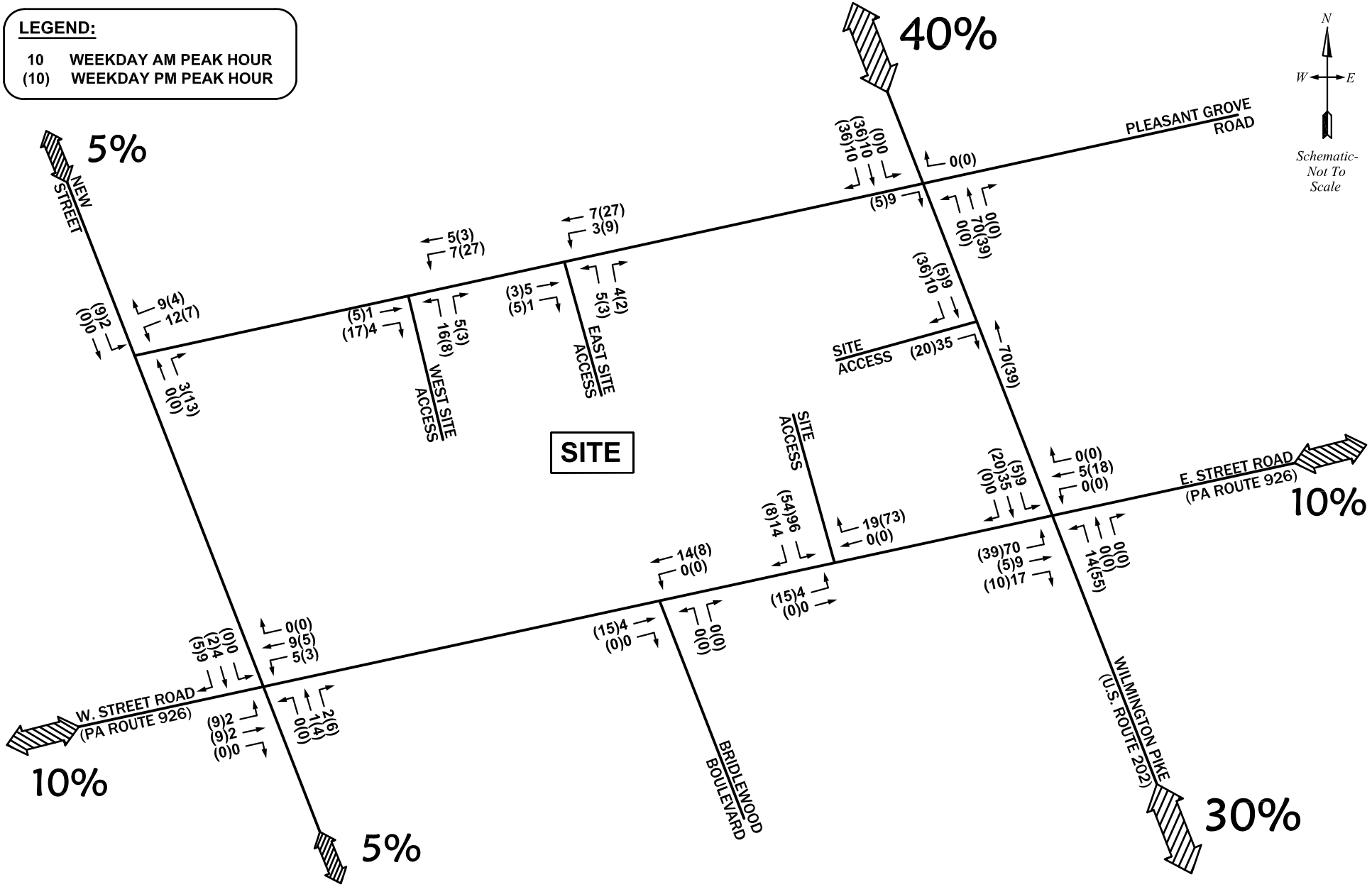


FIGURE 4D
Site Trip Assignment
Alternative B

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 4D.dwg

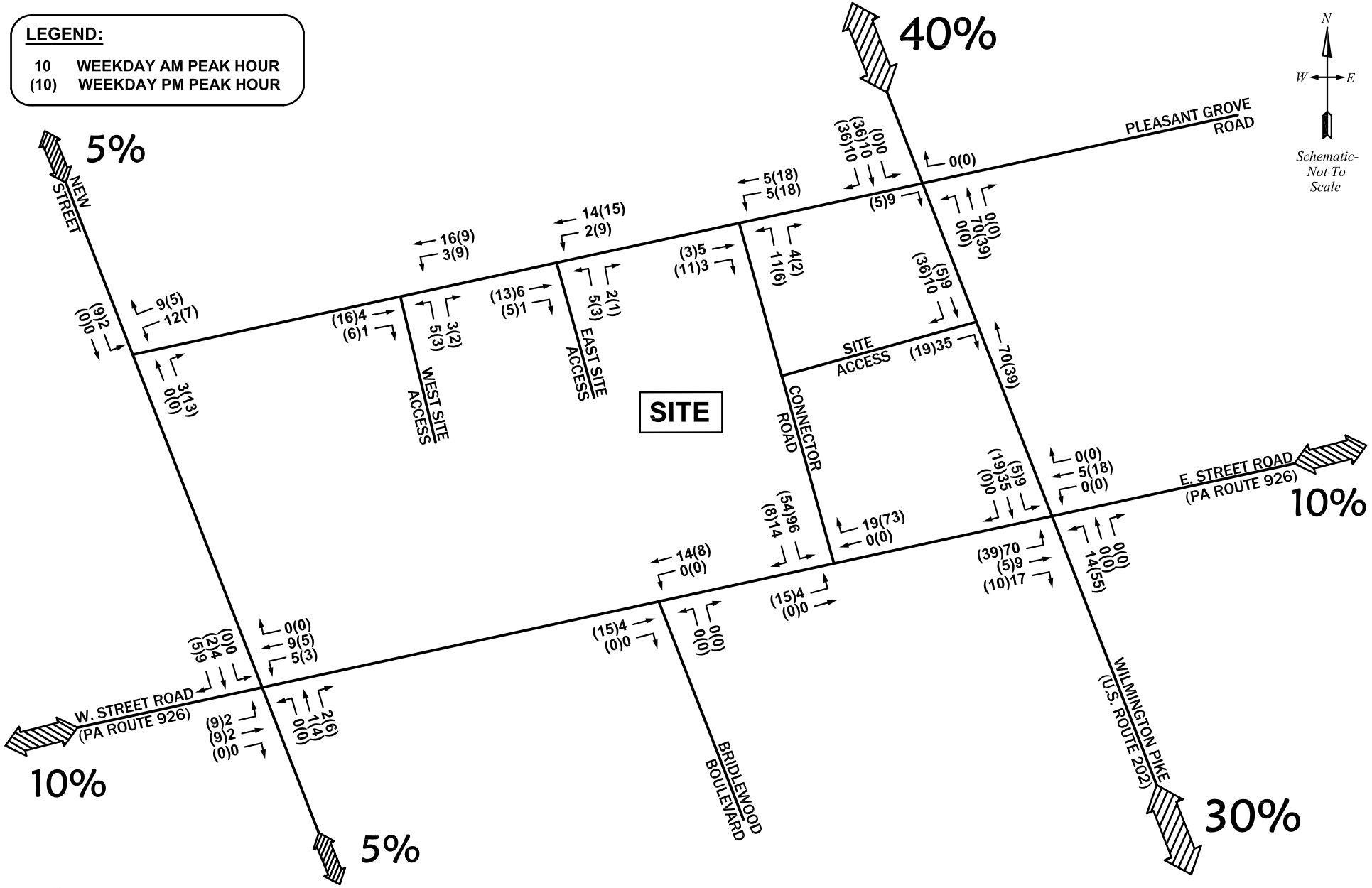


FIGURE 4E

Site Trip Assignment

Alternative C

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 4E.dwg

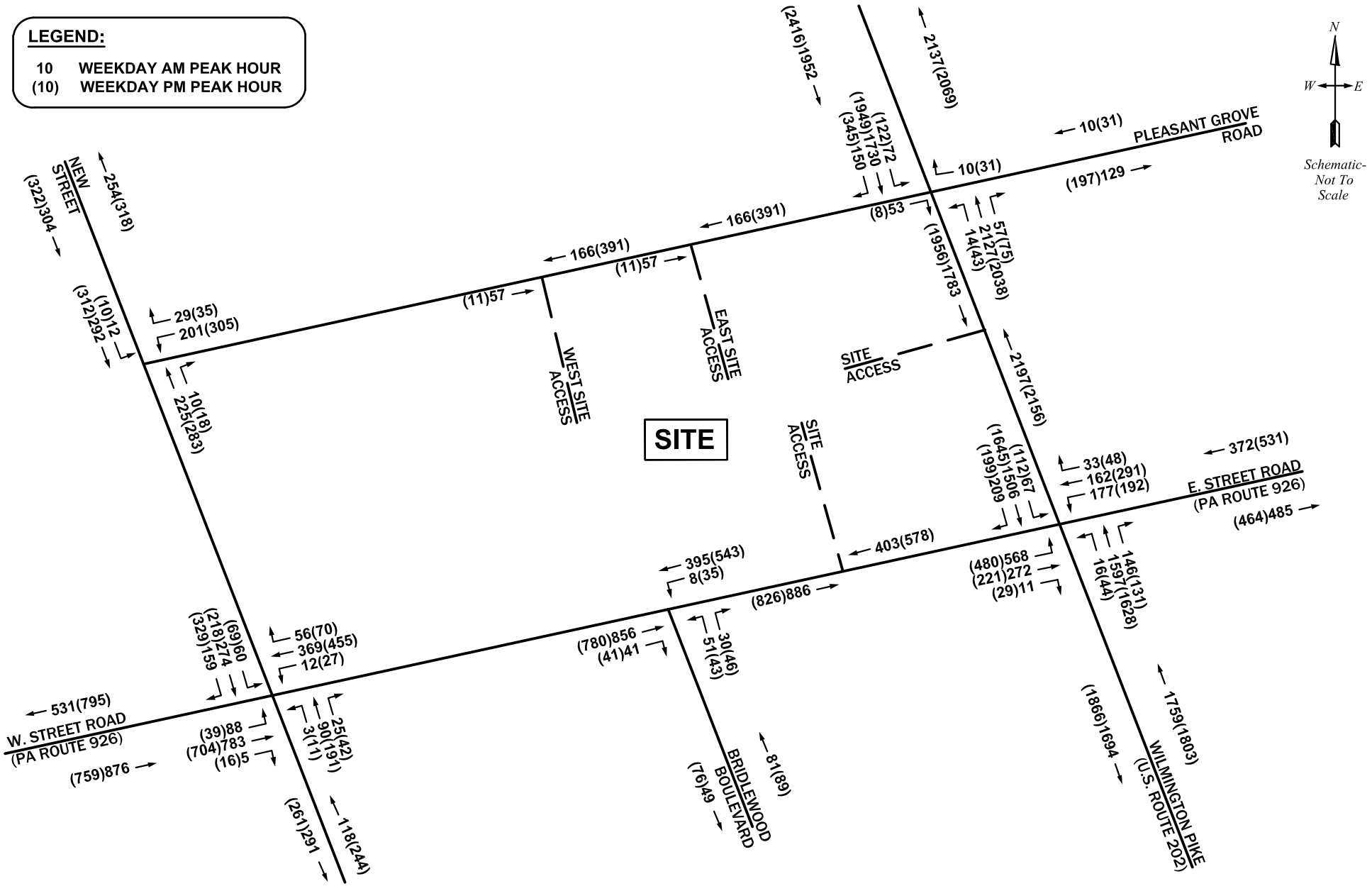


FIGURE 5A

2023 Future Peak Hour Traffic Volumes without Development

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 5A.dwg

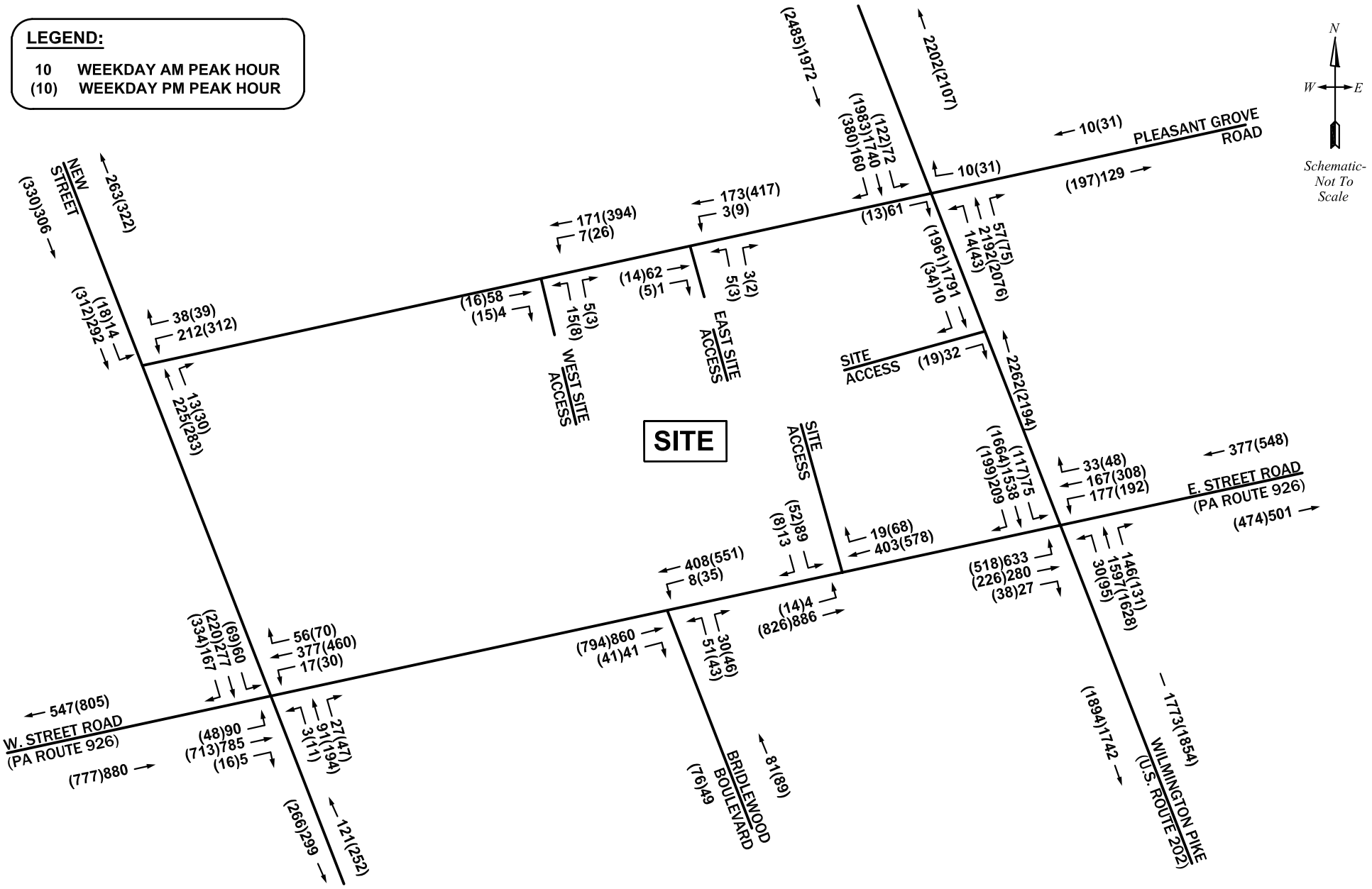


FIGURE 5B

2023 Future Peak Hour Traffic Volumes with Development
Alternative A - 317 New Units with No Traffic Diversions

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 5B.dwg

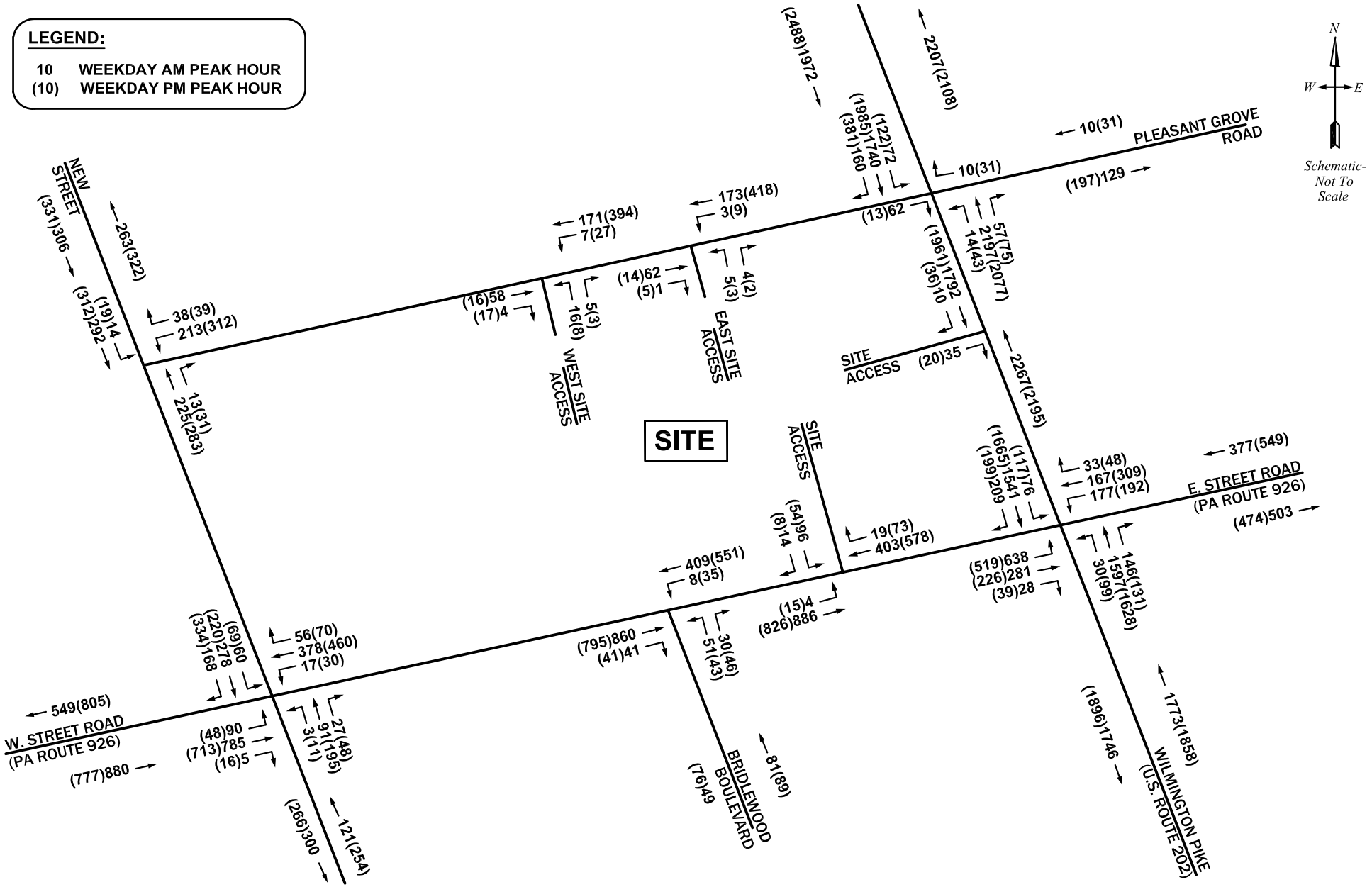


FIGURE 5C

2023 Future Peak Hour Traffic Volumes with Development
Alternative B - 395 New Units with No Traffic Diversions

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 5C.dwg

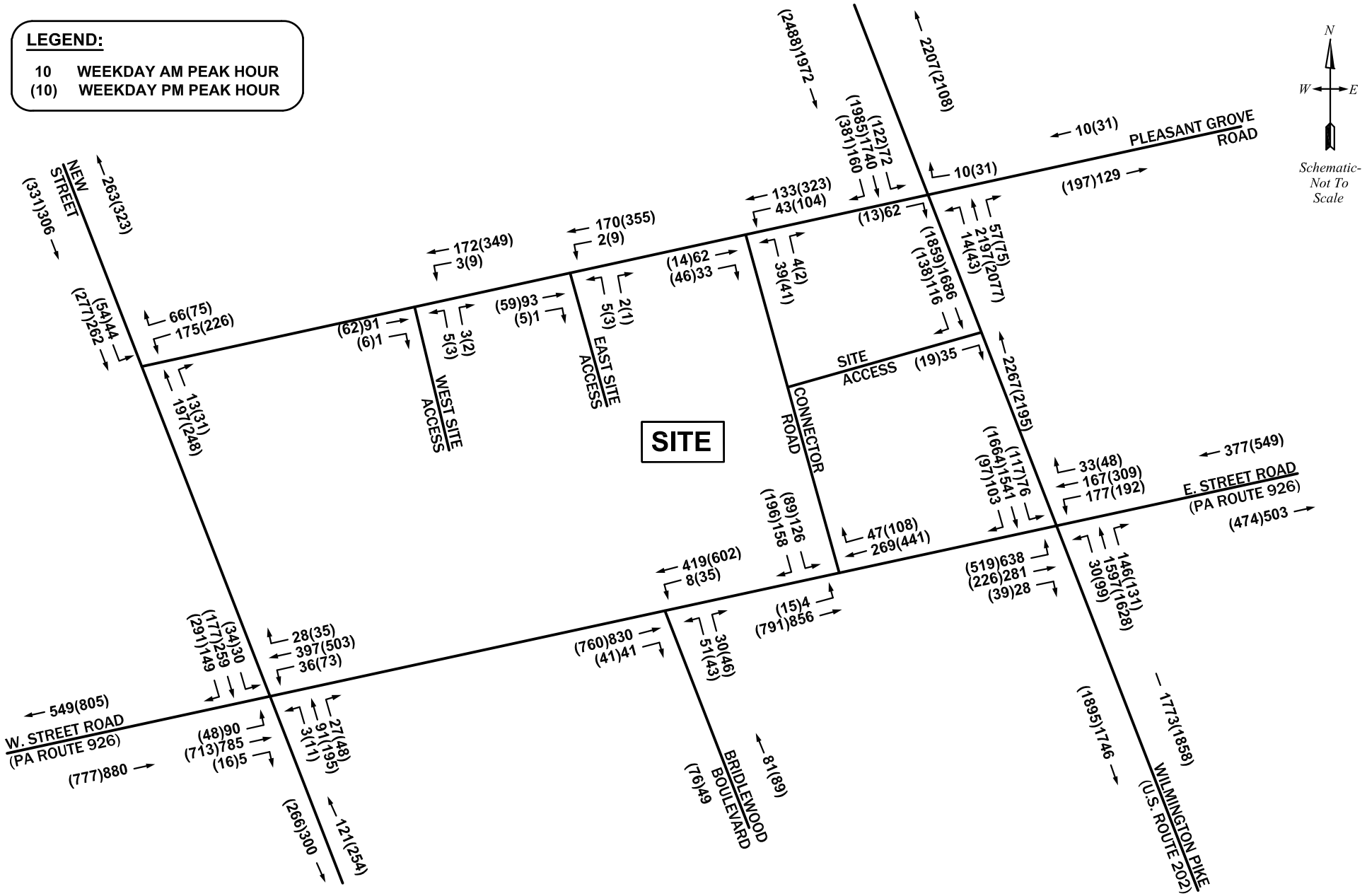


FIGURE 5D

2023 Future Peak Hour Traffic Volumes with Development
Alternative C - 395 New Units and Provision of Connector Road

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 5D.dwg

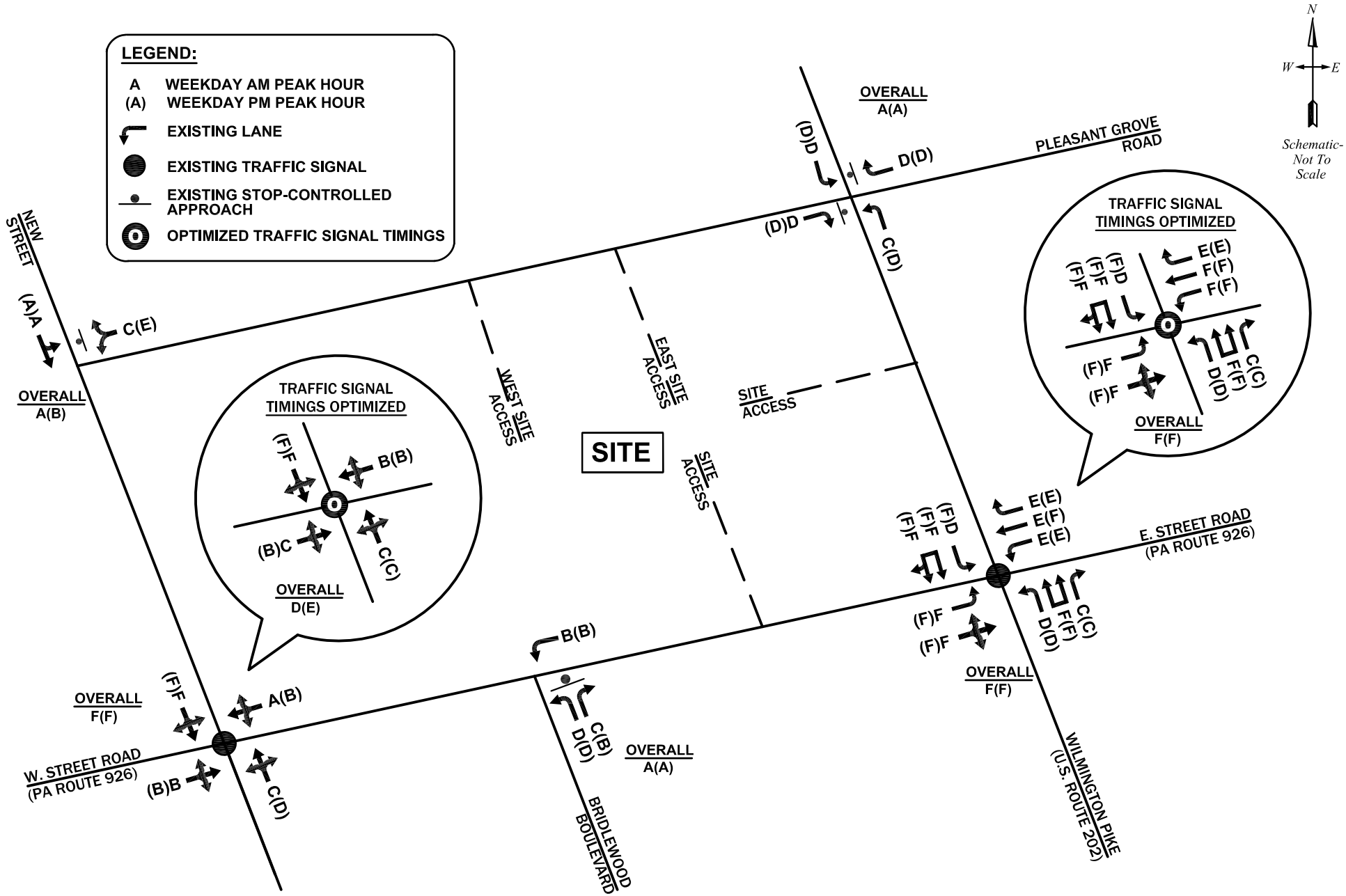


FIGURE 5E

2023 Future Peak Hour Levels of Service without Development

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 5E.dwg

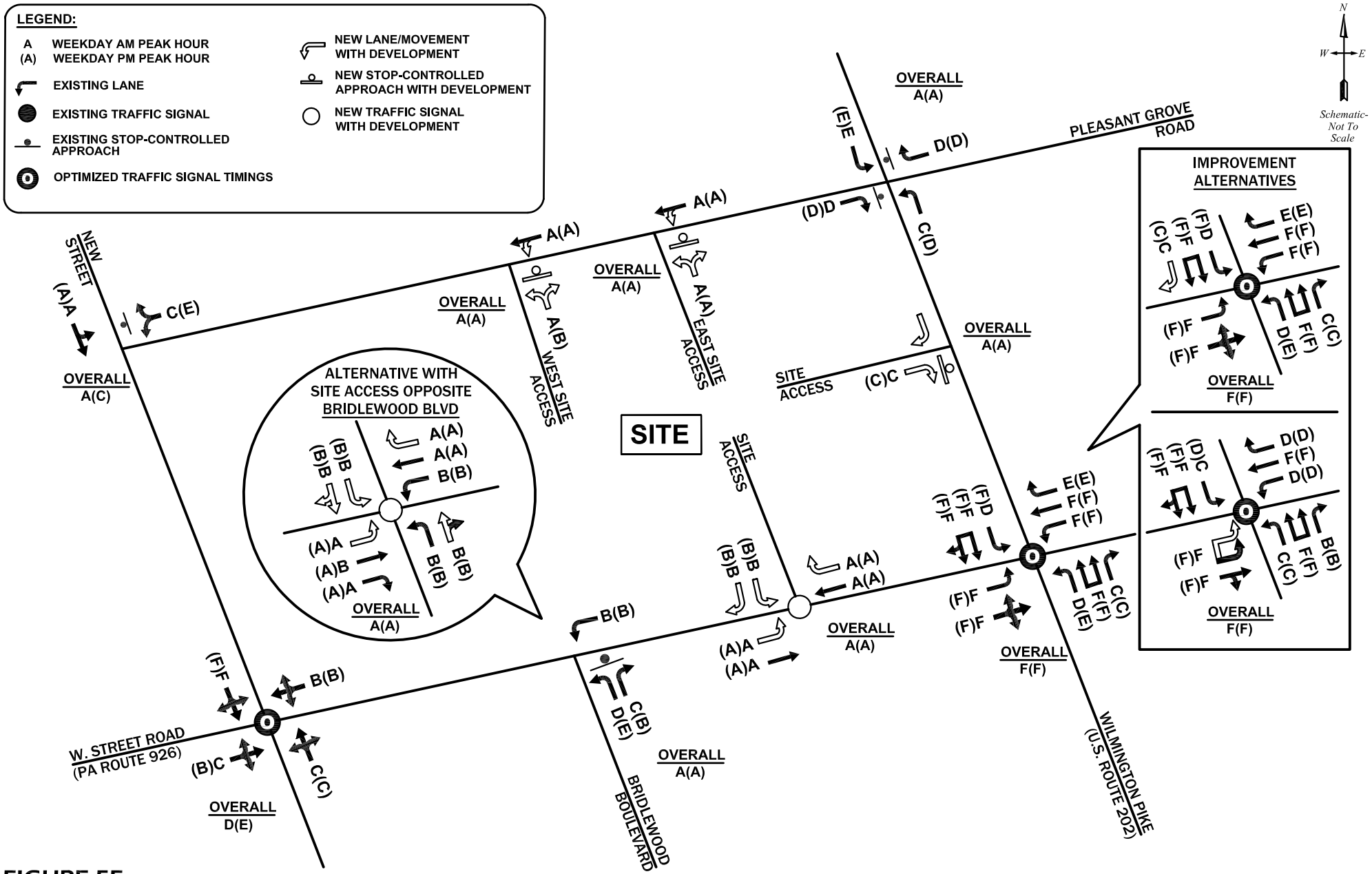


FIGURE 5F

2023 Future Peak Hour Levels of Service with Development

Alternative A - 317 New Units with No Traffic Diversions

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 5F.dwg

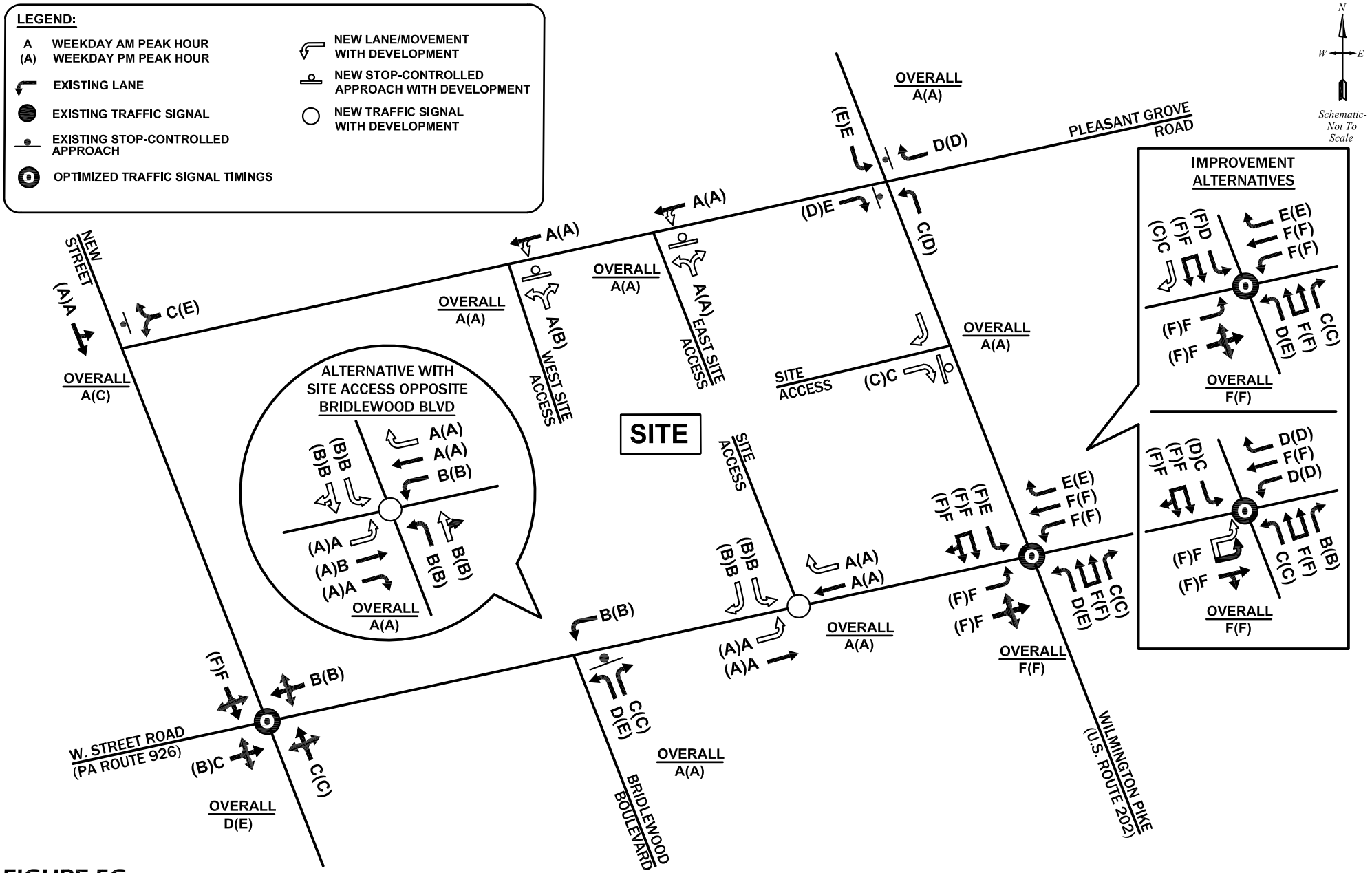


FIGURE 5G

2023 Future Peak Hour Levels of Service with Development

Alternative B - 395 New Units with No Traffic Diversions

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 5G.dwg

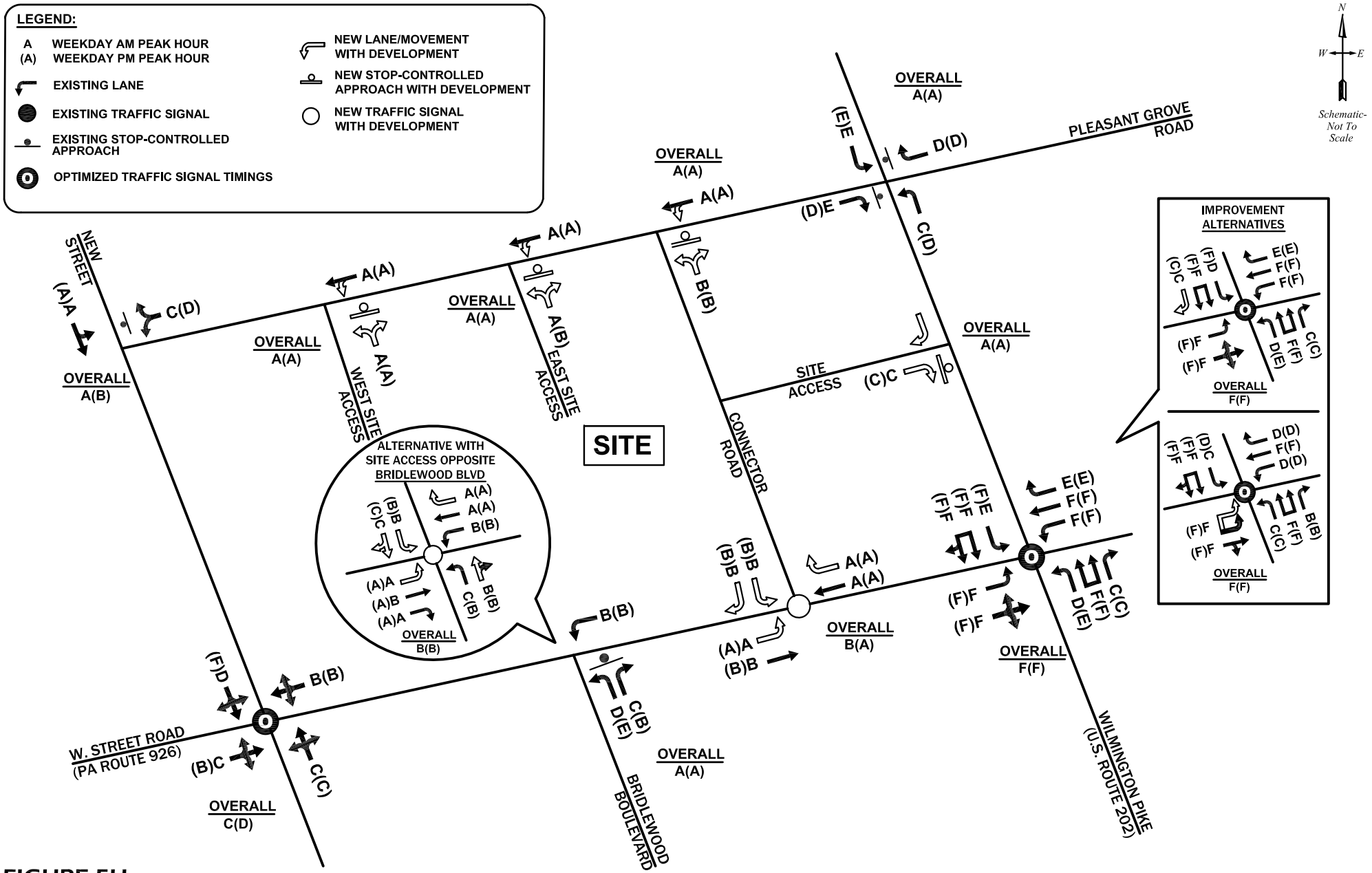


FIGURE 5H

2023 Future Peak Hour Levels of Service with Development

Alternative C - 395 New Units with Provision of Connector Road

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 5H.dwg

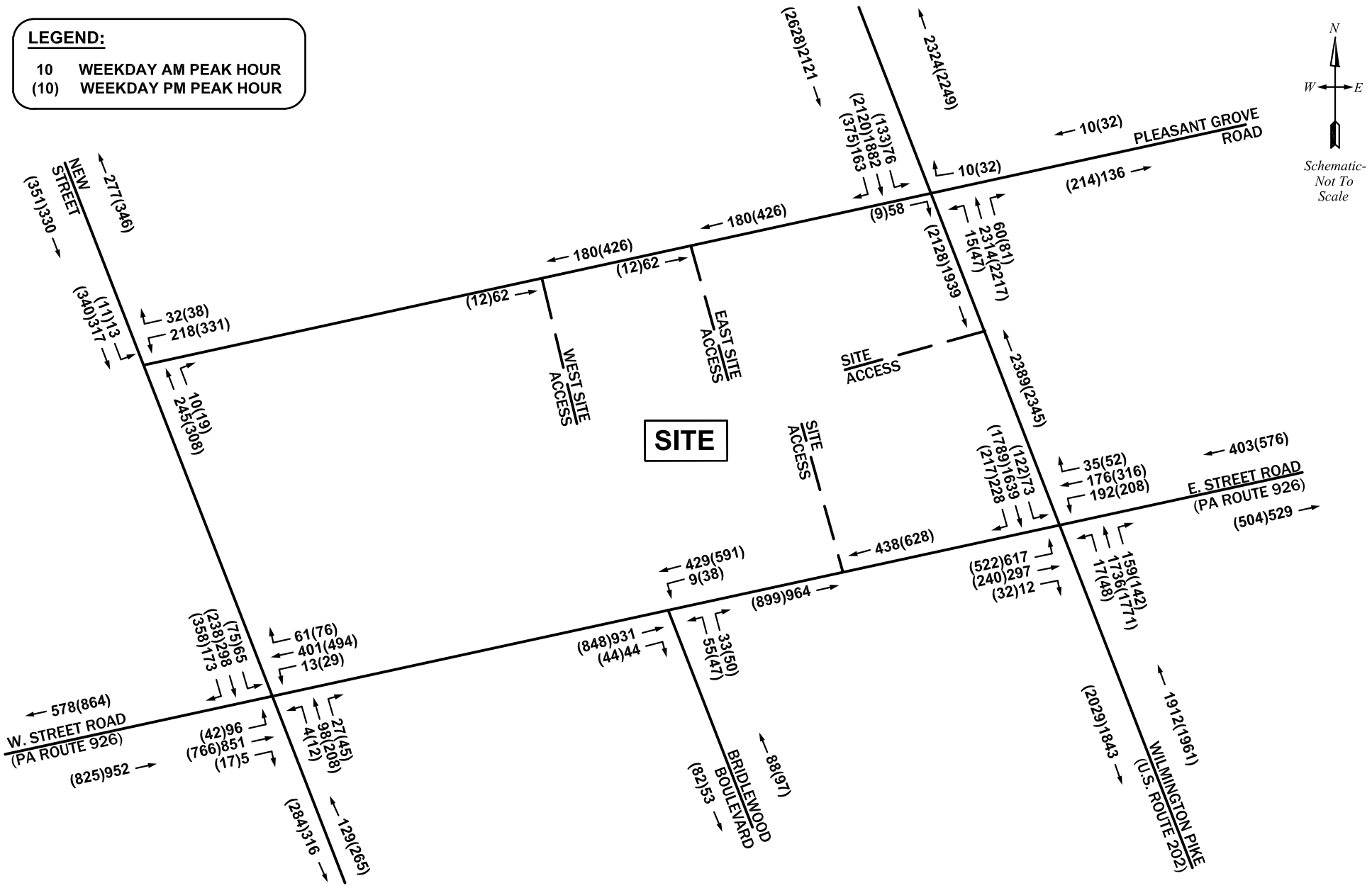


FIGURE 6A

2028 Future Peak Hour Traffic Volumes without Development

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 6A.dwg

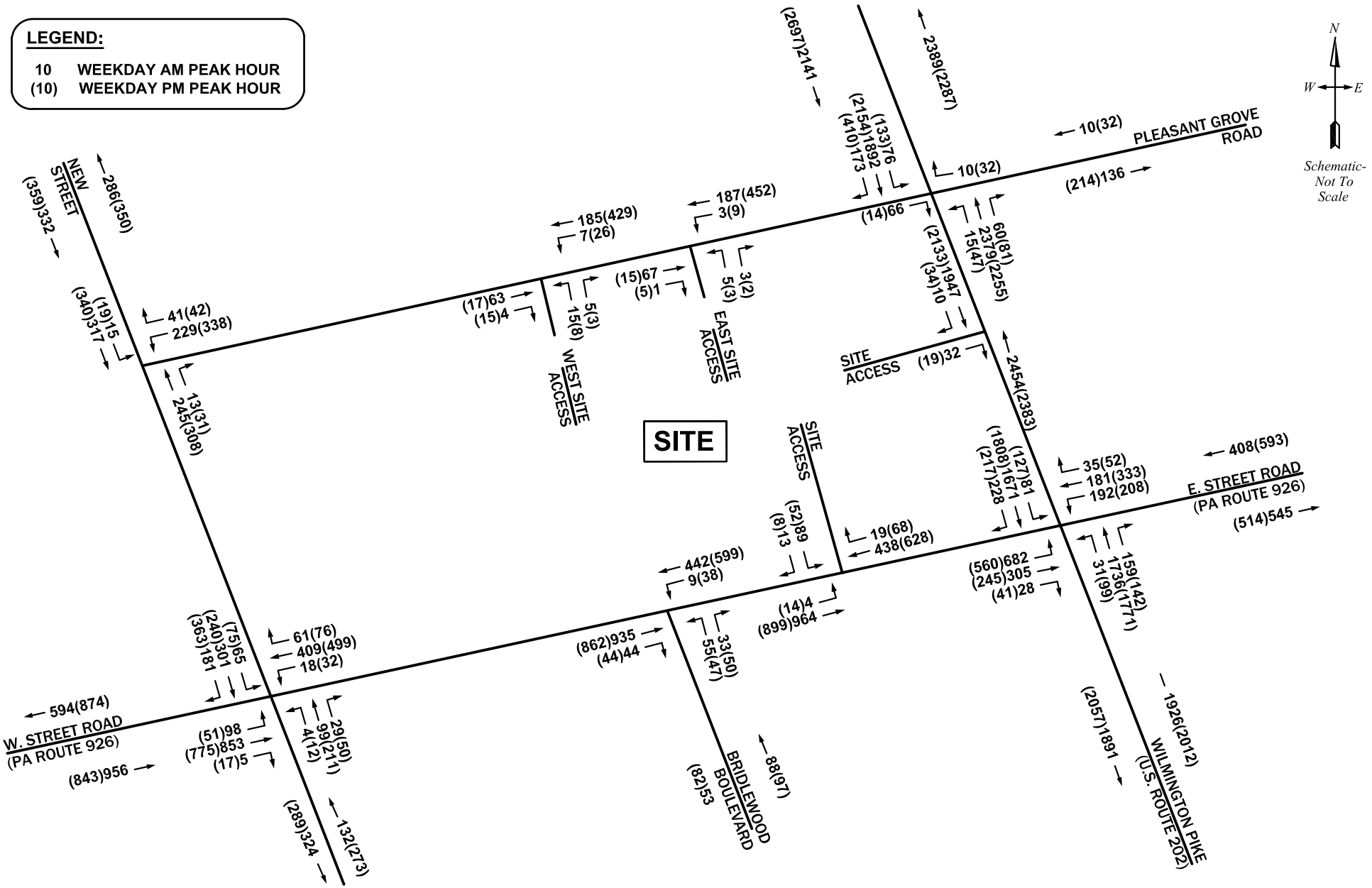


FIGURE 6B

2028 Future Peak Hour Traffic Volumes with Development
Alternative A - 317 New Units with No Traffic Diversions

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 6B.dwg

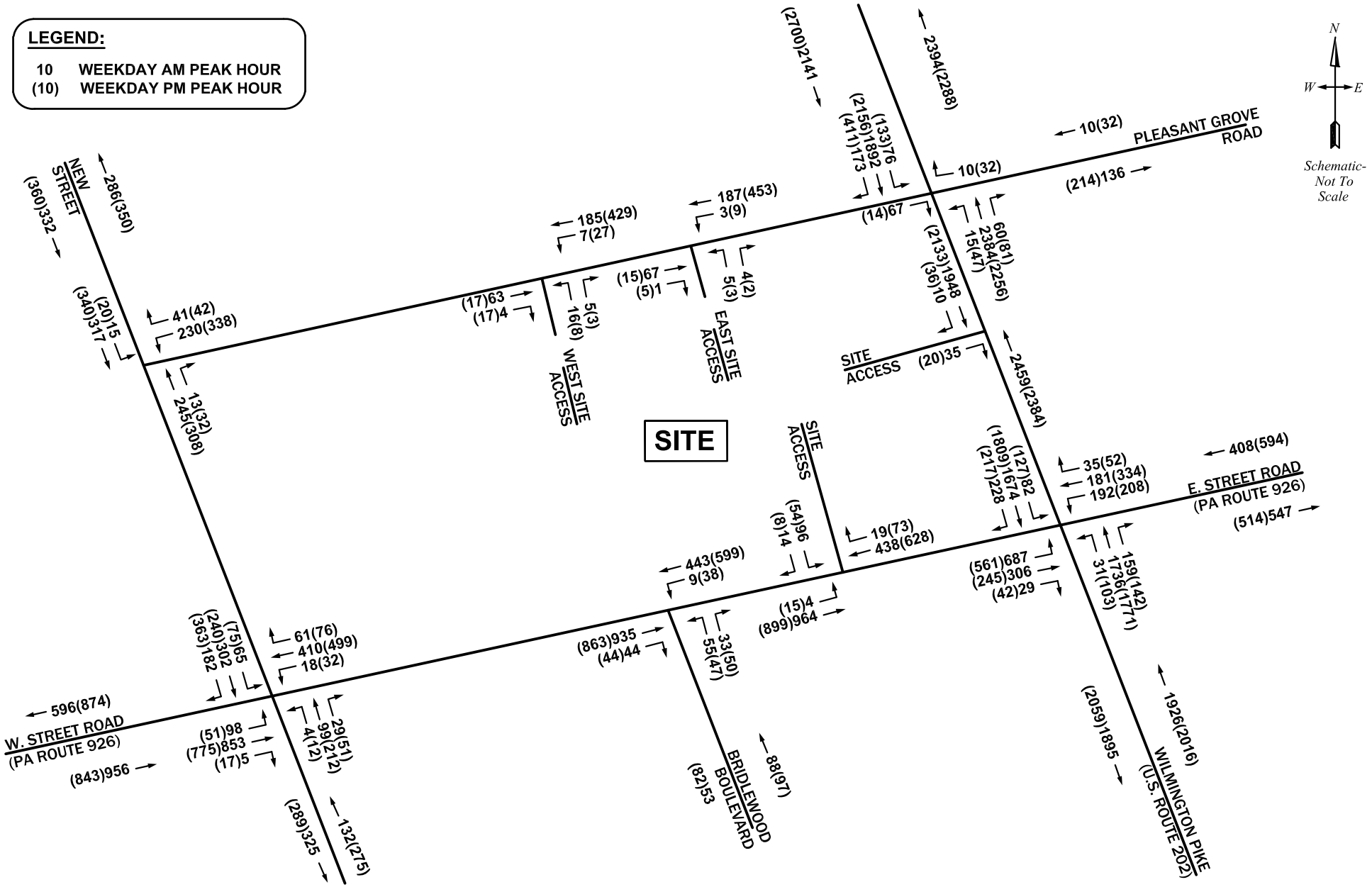


FIGURE 6C

2028 Future Peak Hour Traffic Volumes with Development
Alternative B - 395 New Units with No Traffic Diversions

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 6C.dwg

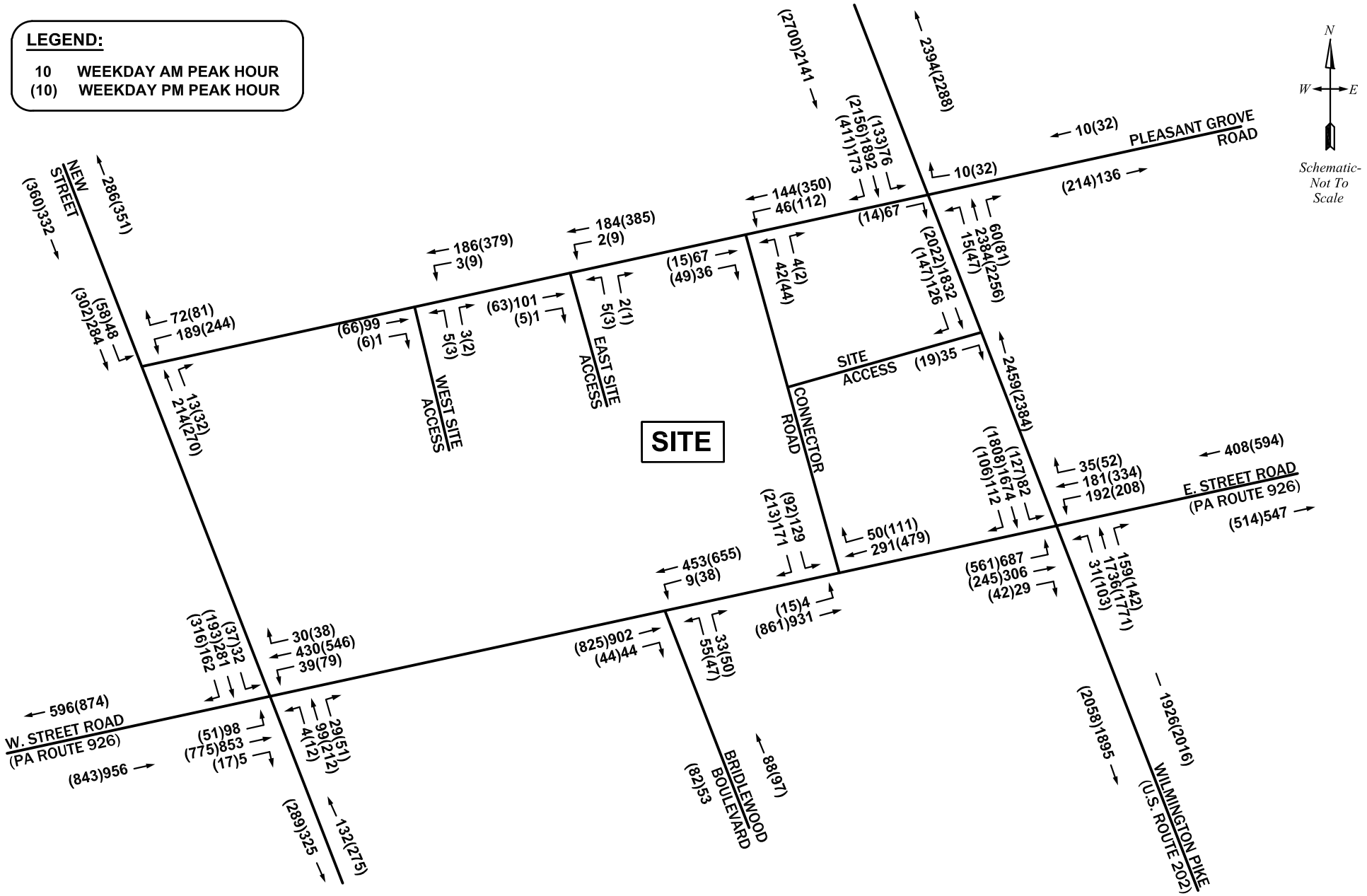


FIGURE 6D

2028 Future Peak Hour Traffic Volumes with Development
Alternative C - 395 New Units and Provision of Connector Road

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 6D.dwg

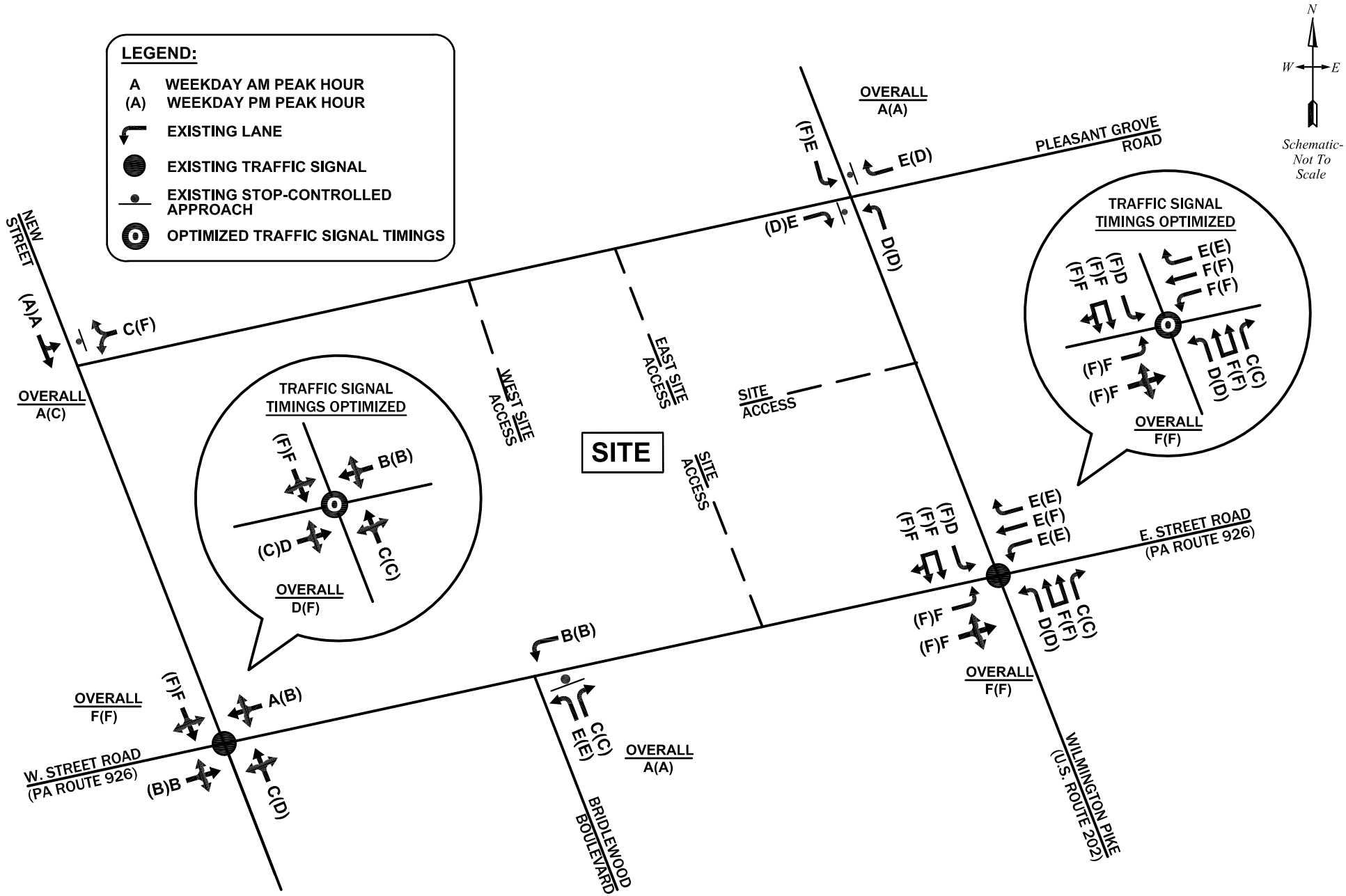


FIGURE 6E

2028 Future Peak Hour Levels of Service without Development

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 6E.dwg

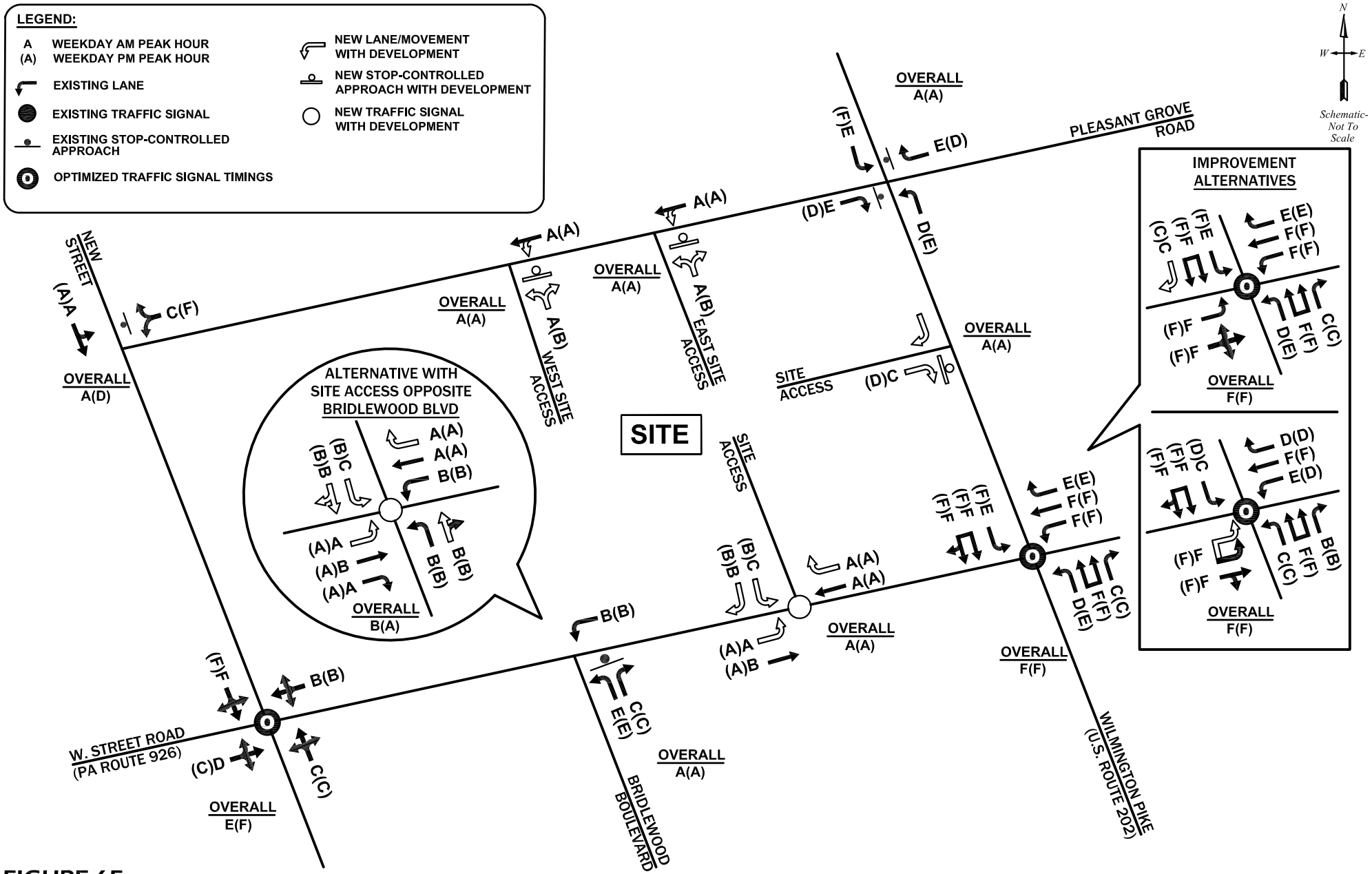


FIGURE 6F

2028 Future Peak Hour Levels of Service with Development

Alternative A - 317 New Units with No Traffic Diversions

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 6F.dwg

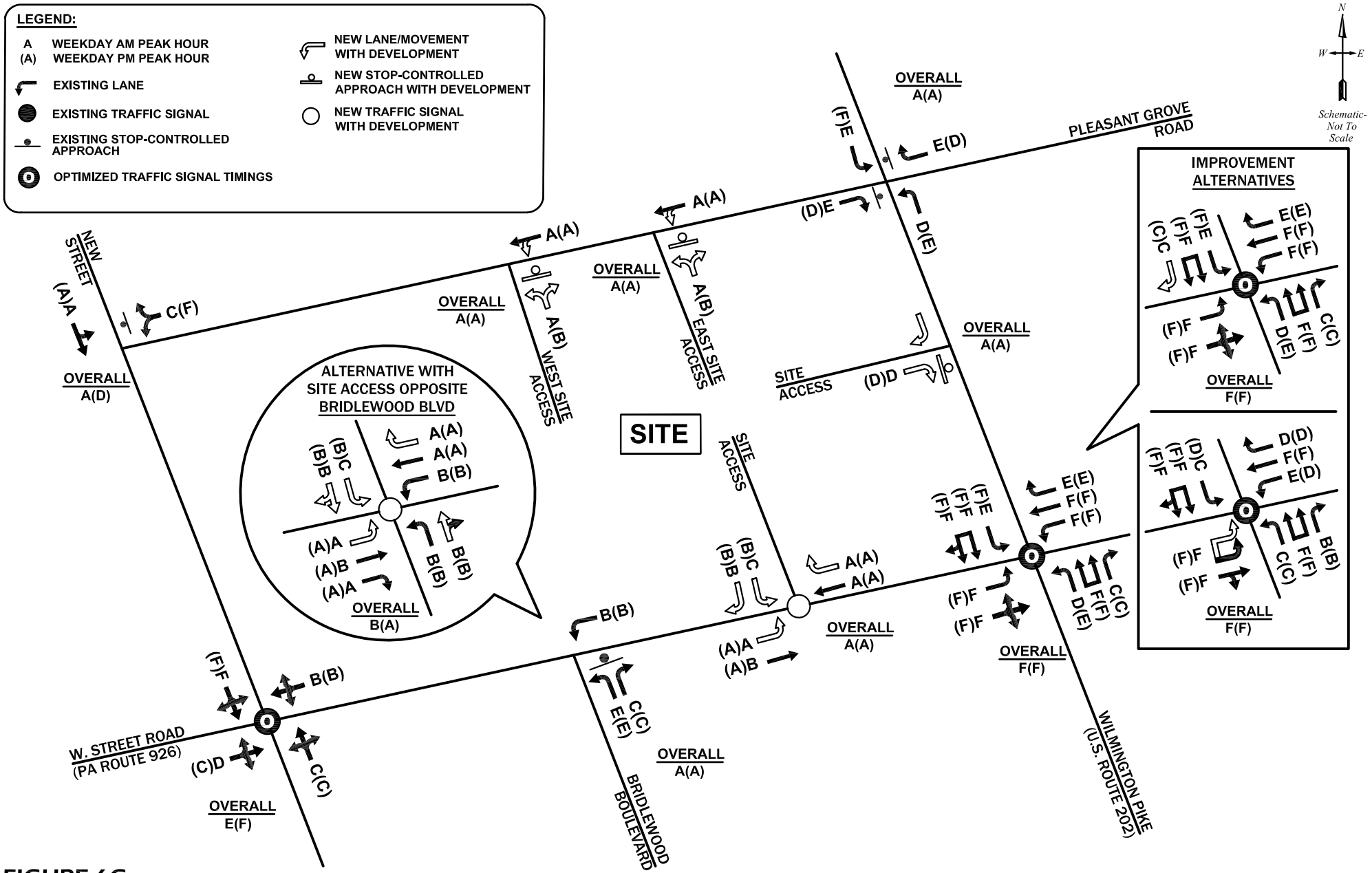


FIGURE 6G

2028 Future Peak Hour Levels of Service with Development

Alternative B - 395 New Units with No Traffic Diversions

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

McMAHON

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 6G.dwg

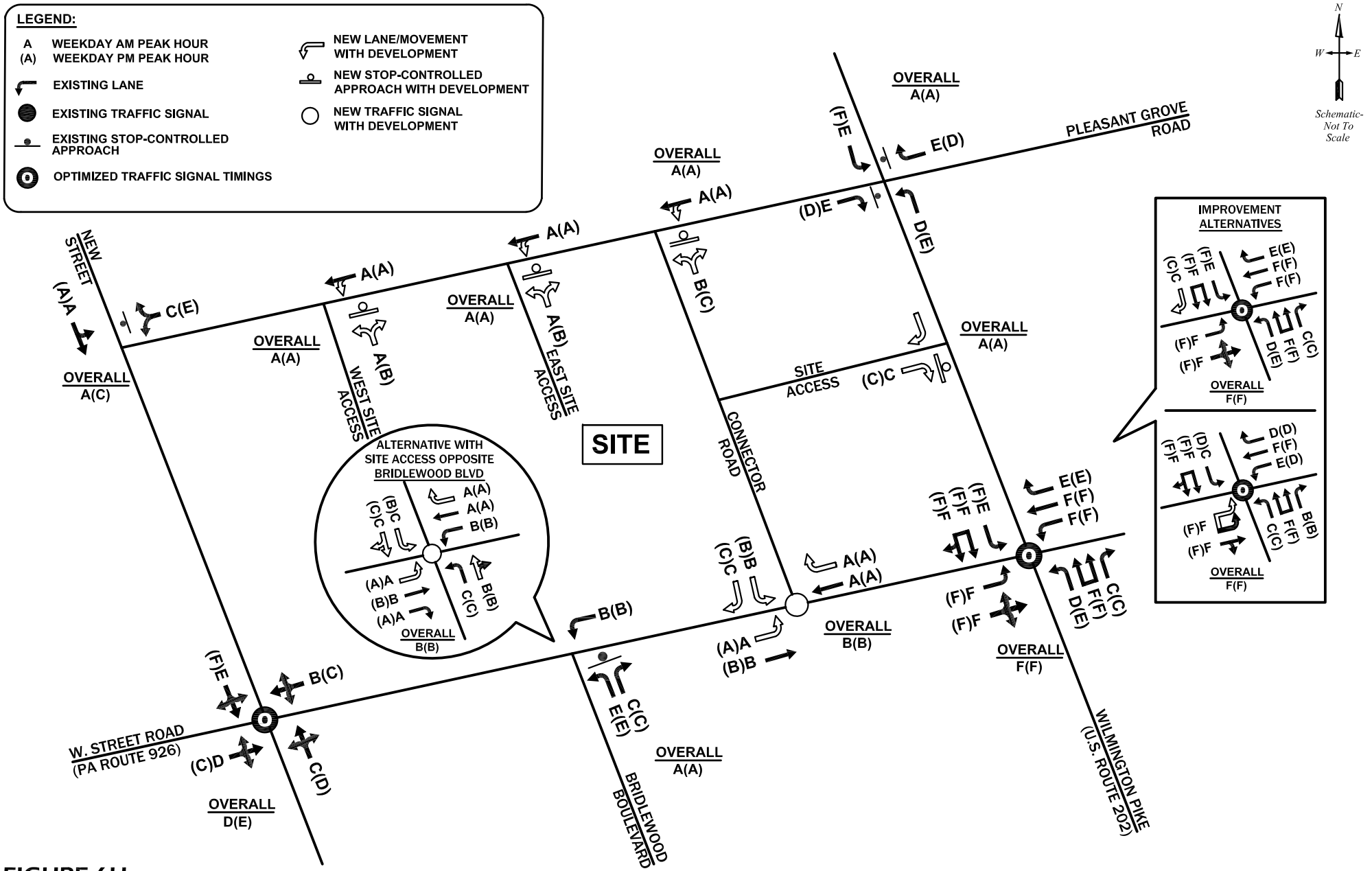


FIGURE 6H

2028 Future Peak Hour Levels of Service with Development

Alternative C - 395 New Units with Provision of Connector Road

CREBILLY FARM RESIDENTIAL DEVELOPMENT

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

(1/18/2017) I:\eng\816451 - Crebilly Farm\dwg\PennDOT Twp Submission 2017-01-20\Figure 6H.dwg