

Roadway Sufficiency Analysis

West Bradford Township, Chester County, PA

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Prepared for

West Bradford Township

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Introduction

Overview

This *Roadway Sufficiency Analysis* has been prepared in accordance with the requirements set forth in Pennsylvania Act 209 on behalf of West Bradford Township in Chester County, Pennsylvania. Pennsylvania Act 209 was signed into law effective December 19, 1990. It amends the Pennsylvania Municipalities Code (Act 247 of 1968, as amended) to permit municipalities to assess transportation impact fees on new development within their boundaries, provided they have adopted a municipal transportation impact fee ordinance in accordance with the procedures set forth in the Act.

Impact fees under Act 209 generally may only be used for those costs incurred for improvements designated in the adopted transportation capital improvements plan of the municipality that are attributable to new development. The impact fees cannot be used for municipal, non-transportation-related capital improvements; for the repair, maintenance, or operation of existing or new municipal transportation capital improvements; or for the upgrade or replacement of existing municipal transportation capital improvements due to operational or safety deficiencies not related to new development. The Act specifically and only applies to off-site transportation capital improvements attributable to new development; it neither applies to, nor restricts the procedures or powers of the municipality to require on-site transportation improvements to remedy impacts of new development, nor is it intended to replace the municipality's ordinance requirements for submission of traffic impact studies.

All appendices supporting the *Roadway Sufficiency Analysis* referenced in this report are contained in a separate bound document entitled *West Bradford Township Act 209 Transportation Impact Fee Study Technical Appendices*, dated August 11, 2014.

Process

The process that West Bradford Township has undertaken includes the completion of the necessary milestones pursuant to the Act 209 legislation, as follows:

1. Appointment of a Transportation Advisory Committee (also referred to as a Traffic Impact Fee Advisory Committee) and designation of the geographic area(s) of the municipality that will be subject to the transportation impact fee ordinance. The meeting minutes of the Transportation Advisory Committee are included in **Appendix A**. The Transportation Advisory Committee consisted of the following members appointed by the Township Board of Supervisors:

Ed Hill	Bob Smiley
Dave McClung	George Supplee, Jr.
Chris Parker	Steve Williams
Joe Shorn	

2. Development and adoption of land use assumptions within the Township and the designated geographic areas known as the Transportation Service Areas (TSAs), which together with existing development are the subject of a roadway sufficiency analysis and development of a transportation capital improvement plan.
3. Completion and approval of a roadway sufficiency analysis for each Transportation Service Area, identifying traffic deficiencies and needed improvements attributable to existing traffic, future traffic not originating from within the service area (i.e., pass-through traffic), and future traffic originating from new development within the service area for a preferred level(s) of service in terms of desired traffic operations during the designated peak hour of study.
4. Development and adoption of a transportation capital improvement plan, including costs, implementation priorities, and funding sources, specifically and separately addressing improvements required to remedy:
 - a. current traffic deficiencies resulting from **existing** traffic volumes and capacity limitations;
 - b. traffic deficiencies attributable to future **pass-through** traffic after existing deficiencies have been remedied; and
 - c. traffic deficiencies attributable to expected **new development** within the service area after pass-through traffic and after existing deficiencies have been remedied.
5. Adoption of a Transportation Impact Fee Ordinance based on the total cost of identified transportation improvements attributable to **new development** within the Transportation Service Area to be assessed on a “per trip” basis.

Act 209 requires a minimum future planning horizon of five years. A 17-year planning horizon has been selected for the purpose of this analysis, and the future year 2030 will be considered the design year. However, this document is not a static, “one-time” effort, as the Act 209 legislation has provisions for periodic updates of the roadway sufficiency analysis, capital improvement plan, and impact fees, as changes in the land use assumptions, transportation improvement needs, or funding conditions occur.

Land Use Assumptions

As required by Act 209, the West Bradford Township Transportation Advisory Committee approved the West Bradford Township *Land Use Assumptions Report – 2014 Update*, dated February 11, 2014, as prepared by Brandywine Conservancy, at a public hearing on February 4, 2014. Subsequently, the Board of Supervisors adopted the *Land Use Assumptions Report – 2014*

Update by resolution on February 11, 2014, as required by Act 209. A copy of the *Land Use Assumptions Report – 2014 Update* is provided in **Appendix B**.

The *Land Use Assumptions Report – 2014 Update* identifies the anticipated long-term development build-out over the next 30 years within West Bradford Township, as well as the projected short-term 2030 build-out. The projected short-term 2030 build-out, which is the basis of this analysis, is summarized below in **Table 1**.

Table 1. Land Use Assumptions Report 2030 Build-out Summary

Land Use Classification	17-Year Build-out Projection
Residential	1,751 dwelling units
Non-Residential	1,055,716 square feet

Existing Transportation Network

This section includes a designation of the roadways and intersections selected to be evaluated as part of this *Roadway Sufficiency Analysis*, as well as an inventory of physical and operational characteristics of the existing Township transportation system required for the completion of the *Roadway Sufficiency Analysis*. This section also delineates the Transportation Service Areas required by the Act 209 legislation.

Transportation Service Areas

Act 209 requires the establishment of specific study boundaries, or transportation service areas, for evaluation and application of transportation impact fees. By law, each transportation service area is required to be completely contiguous and is limited to a maximum size of seven square miles. Moreover, traffic impact fees for each transportation service area are applicable only to development located within that respective service area, and therefore, development traffic from one service area is considered pass-through traffic within the other service area(s). Further explanation of pass-through and development traffic will be provided in subsequent sections.

The Transportation Advisory Committee established two transportation service areas within West Bradford Township in accordance with the requirements of Act 209, and they are hereafter referred to as the Western Transportation Service Area and Southern Transportation Service Area. Both contiguous transportation service areas measure less than the maximum seven square miles required by the Act 209 legislation. A more definitive delineation of the service area boundaries is included in Appendix B.

Western Transportation Service Area

The Western Transportation Service Area (Western TSA) generally consists of the area of the Township west of Poorhouse Road and south of Marshallton-Thorndale Road. The eighteen (18) study intersections located within the approximate 5.7 square mile service area are defined in **Table 3** and shown in **Figure 1A**.

Southern Transportation Service Area

The Southern Transportation Service Area (Southern TSA) generally consists of the area of the Township east of Broad Run Road, and south of Shadyside Road. The eighteen (18) study intersections located within the approximate 6.8 square mile service area are defined in **Table 3** and shown in **Figure 1B**.

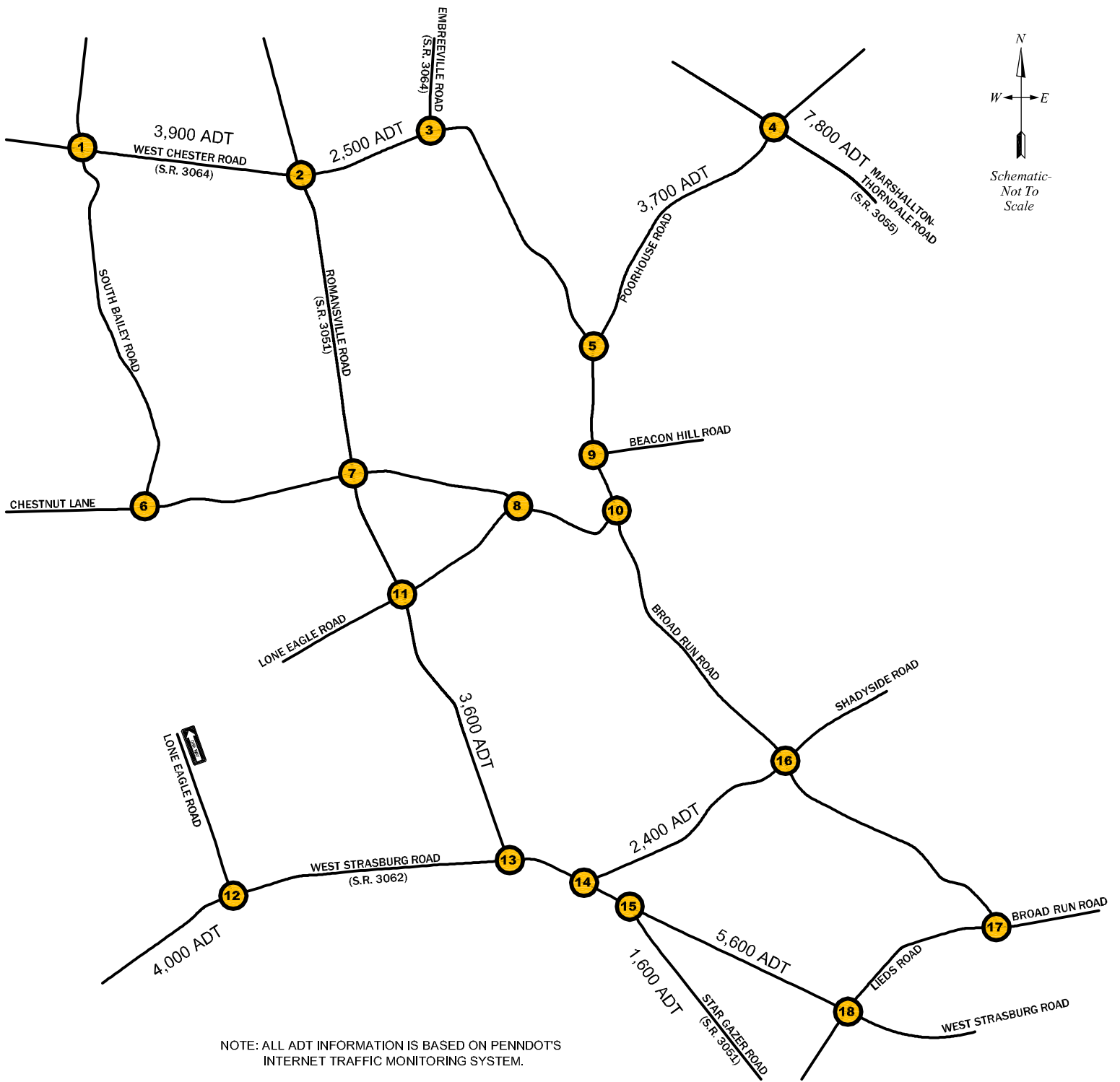
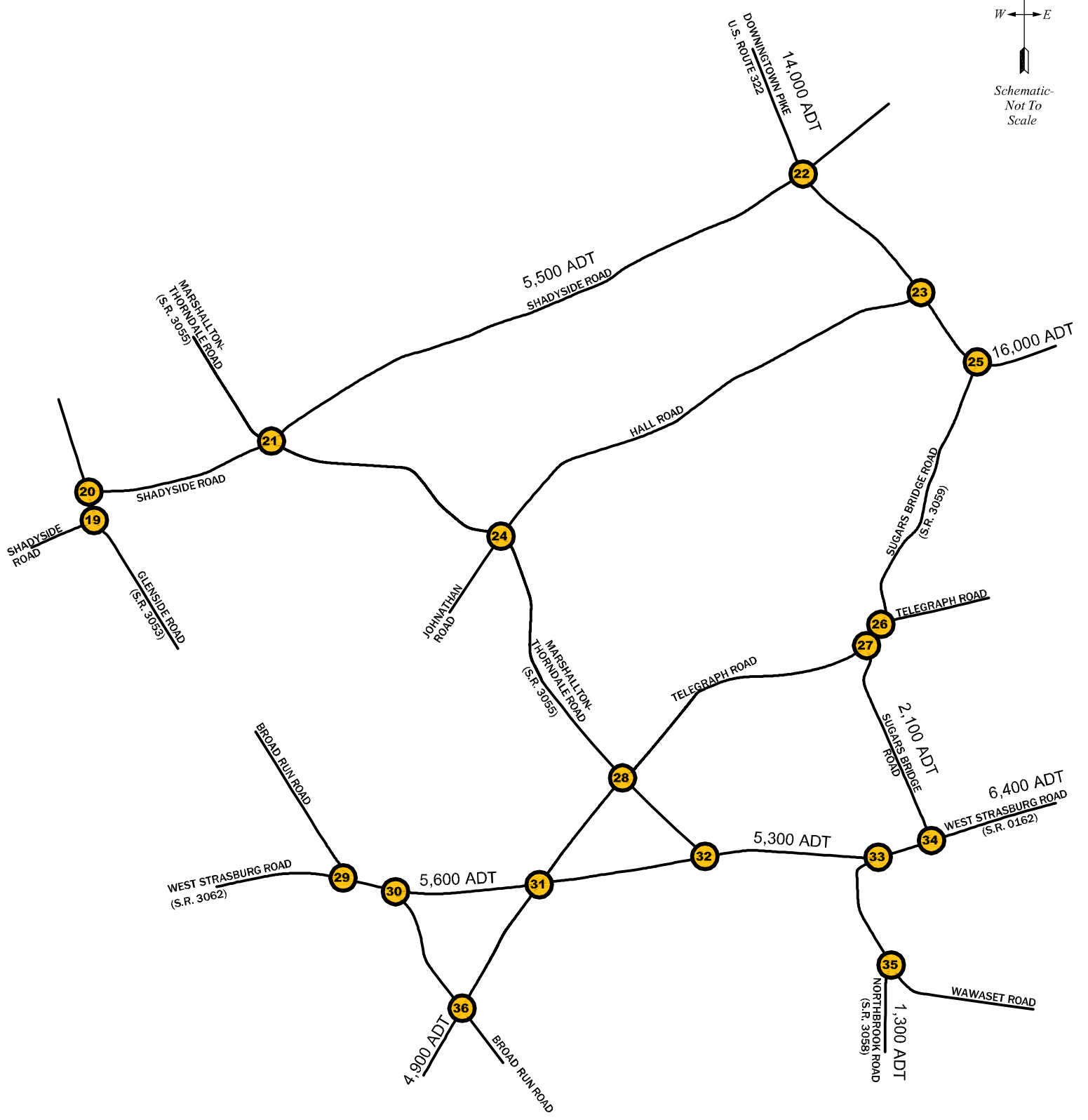
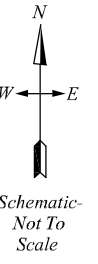


FIGURE 1A
 Study Roadway Network - Western Service Area
WEST BRADFORD TOWNSHIP
ACT 209 STUDY
 WEST BRADFORD TOWNSHIP, CHESTER COUNTY, PA





NOTE: ALL ADT INFORMATION IS BASED ON PENNDOT'S INTERNET TRAFFIC MONITORING SYSTEM.

FIGURE 1B
 Study Roadway Network - Southern Service Area
WEST BRADFORD TOWNSHIP
ACT 209 STUDY
WEST BRADFORD TOWNSHIP, CHESTER COUNTY, PA



Roadway Characteristics

The West Bradford Township roadway system, as illustrated in **Figure 1A and 1B**, consists primarily of two-lane, undivided roadways. Many of the roadways in the Township are narrow two-lane, rural roads. Major regional access to the Township is provided via U.S. Route 322. West Strasburg Road and Marshallton-Thorndale Road, both minor arterials, also provide regional access to the east/west and north/south, respectively. The roadway network shown in Figures 1A and 1B, including both roadway segments and intersections constitutes the transportation roadway network analyzed pursuant to Act 209. The operating characteristics of each of the major study roadways are summarized as shown in **Table 2**.

Table 2. Existing Transportation Network Summary

Roadway	Roadway Classification ¹	Roadway Ownership ²	Posted Speed Limit (mph)
U.S. Route 322 (Downingtown Pike)	Major Arterial	State	45
West Strasburg Road	Minor Arterial	State	35 and 45
Marshallton-Thorndale Road	Minor Arterial	State	40
Romansville Road	Minor Collector	State	40
West Chester Road	Minor Collector	State	40
Glenside Road	Minor Collector	State/Township	40
Telegraph Road	Minor Collector	State	35 and 40
Embreeville Road	Minor Collector	State	40
Sugars Bridge Road	Minor Collector	State	35
Broad Run Road	Minor Collector	Township	20 to 35
Shadyside Road	Major Collector/Minor Arterial	Township	35 and 40
Telegraph Road	Major/Minor Collector	State/Township	35
Stouff Road	Minor Collector	Township	40
Hall Road	Minor Collector	Township	35

(1) Based on recommendations of the *West Bradford Township Comprehensive Plan, June 23, 2009* (Chapter 5).

(2) See Figure 1A and 1B for numerical state roadway designations.

Several other Township roadways also comprise the transportation roadway network of the Township; however, these roadways are generally classified as local roadways that provide access to the major arterials and collector roadways, but limited accessibility through the Township. The *West Bradford Township Comprehensive Plan* and *Land Use Assumptions Report* provide a further description of the existing Township roadway network. In particular, Map 2 in the *Land Use Assumptions Report* depicts the roadway classification and also shows the boundaries for the two TSAs.

Thirty six (36) study intersections have been selected by the Township to be evaluated and included in the *Roadway Sufficiency Analysis* and *Capital Improvement Plan*, and include the following intersections, as indicated in **Table 3** and shown in **Figures 1A and 1B**:

Table 3. Study Intersections

ID No.	TSA	Intersection	Current Traffic Control
1	Western	West Chester Road and South Bailey Road	Stop Sign
2	Western	Romansville Road/Stouff Road and West Chester Road	Stop Sign
3	Western	West Chester Road/Broad Run Road and Embreeville Road	Stop Sign
4	Western	Marshallton-Thorndale Road and Poorhouse Road	Traffic Signal
5	Western	Broad Run Road and Poorhouse Road	Stop Sign
6	Western	Chestnut Lane and Oakwood Road	Stop Sign
7	Western	Romansville Road and Chestnut Lane	Stop Sign
8	Western	Chestnut Lane and Lone Eagle Road	Stop Sign
9	Western	Broad Run Road and Beacon Hill Road	Stop Sign
10	Western	Broad Run Road and Chestnut Lane	Stop Sign
11	Western	Romansville Road and Lone Eagle Road	Stop Sign
12	Western	West Strasburg Road and Lone Eagle Road	Stop Sign
13	Western	Romansville Road and West Strasburg Road	Stop Sign
14	Western	West Strasburg Road and Shadyside Road	Stop Sign
15	Western	West Strasburg Road and Stargazer Road	Stop Sign
16	Western	Broad Run Road and Shadyside Road	Stop Sign
17	Western	Broad Run Road and Lieds Road	Stop Sign
18	Western	West Strasburg Road and Lieds Road	Stop Sign
19	Southern	Shadyside Road and Glenside Road (south)	Stop Sign
20	Southern	Shadyside Road and Glenside Road (north)	Stop Sign
21	Southern	Marshallton-Thorndale Road and Shadyside Road	Traffic Signal
22	Southern	Downingtown Pike (U.S. Route 322) and Shadyside Road	Traffic Signal
23	Southern	Downingtown Pike (U.S. Route 322) and Hall Road	Stop Sign
24	Southern	Marshallton-Thorndale Road and Hall Road	Stop Sign
25	Southern	Downingtown Pike (U.S. Route 322) and Sugars Bridge Road	Traffic Signal
26	Southern	Telegraph Road and Sugars Bridge Road (north)	Stop Sign
27	Southern	Telegraph Road and Sugars Bridge Road (south)	Stop Sign
28	Southern	Telegraph Road and Marshallton-Thorndale Road	Stop Sign
29	Southern	West Strasburg Road and Broad Run Road (east)	Stop Sign
30	Southern	West Strasburg Road and Broad Run Road (west)	Stop Sign
31	Southern	West Strasburg Road and Telegraph Road	Stop Sign
32	Southern	West Strasburg Road and Marshallton-Thorndale Road	Stop Sign
33	Southern	West Strasburg Road and Northbrook Road	Stop Sign
34	Southern	West Strasburg Road and Sugars Bridge Road	Stop Sign
35	Southern	Northbrook Road and Wawaset Road	Stop Sign
36	Southern	Telegraph Road and Broad Run Road	Stop Sign

Existing Traffic Volumes

Traffic operating conditions are influenced by the relationships between traffic volumes and the service capacities of the roadways or intersections. In order to evaluate the existing conditions on area roadways, manual turning movement traffic counts were conducted at each of the 36 study intersections during the weekday morning (7:00 AM to 9:00 AM) and weekday afternoon (4:00 PM to 6:00 PM) peak periods. The actual traffic counts are provided in **Appendix C**.

These traffic counts were tabulated by fifteen-minute periods to establish the four highest consecutive 15-minute periods, which constitute the peak hours, and serve as the basis for this analysis. It is noted that the Transportation Advisory Committee has selected the weekday afternoon peak hour as the basis of this *Roadway Sufficiency Analysis*, and as such, **Figures 2A and 2B** illustrate the 2013 existing weekday afternoon peak hour traffic volumes at the study area intersections. The weekday morning peak hour traffic volumes and associated analysis for existing, pass-through and development conditions is provided in the appendix of this report.

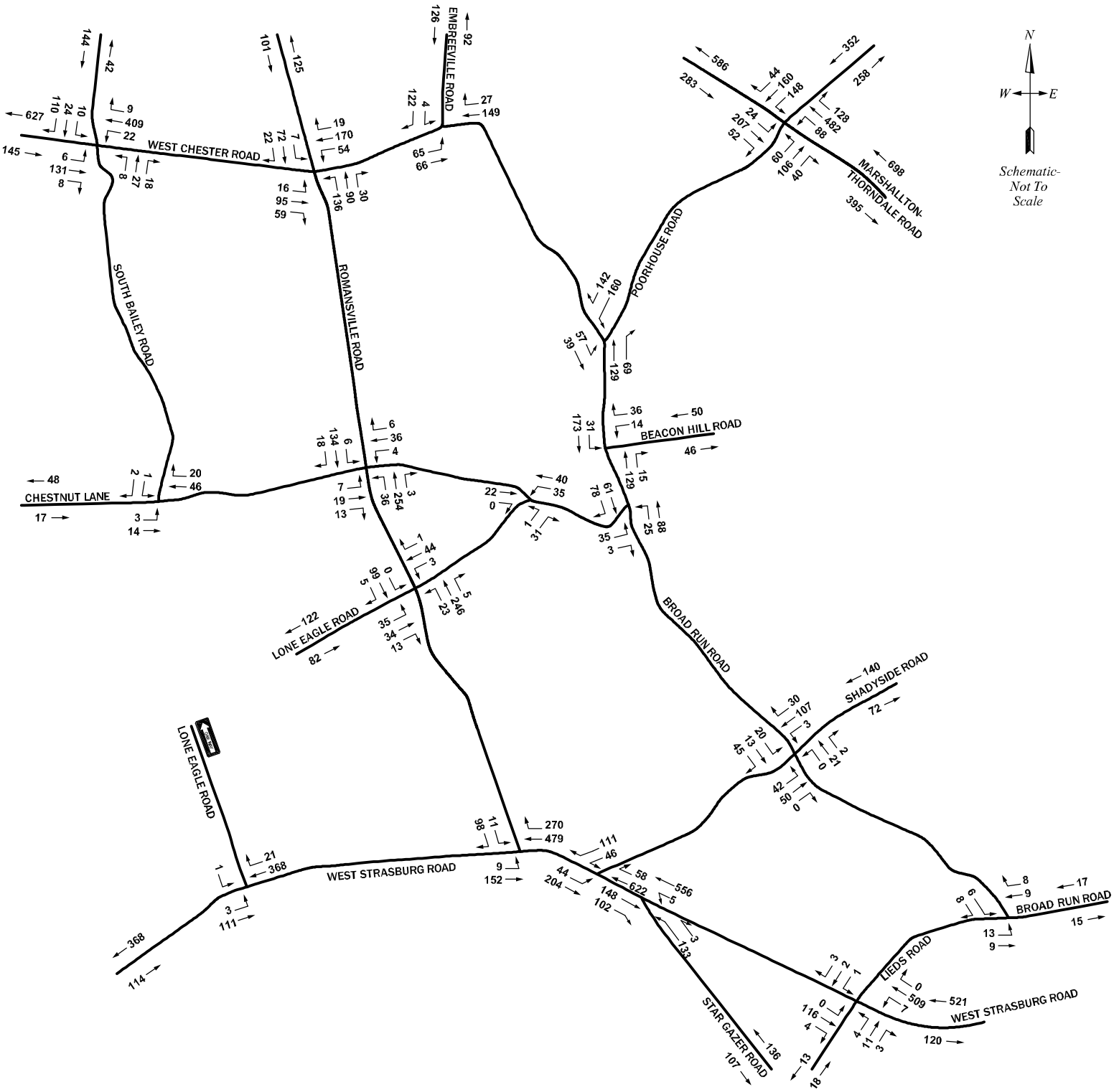


FIGURE 2A
 2013 Existing Weekday Afternoon Peak Hour Traffic Volumes - Western Service Area
WEST BRADFORD TOWNSHIP
ACT 209 STUDY
WEST BRADFORD TOWNSHIP, CHESTER COUNTY, PA



(8/1/2014) E:\eng\813041\dwg\Figure 2A.dwg

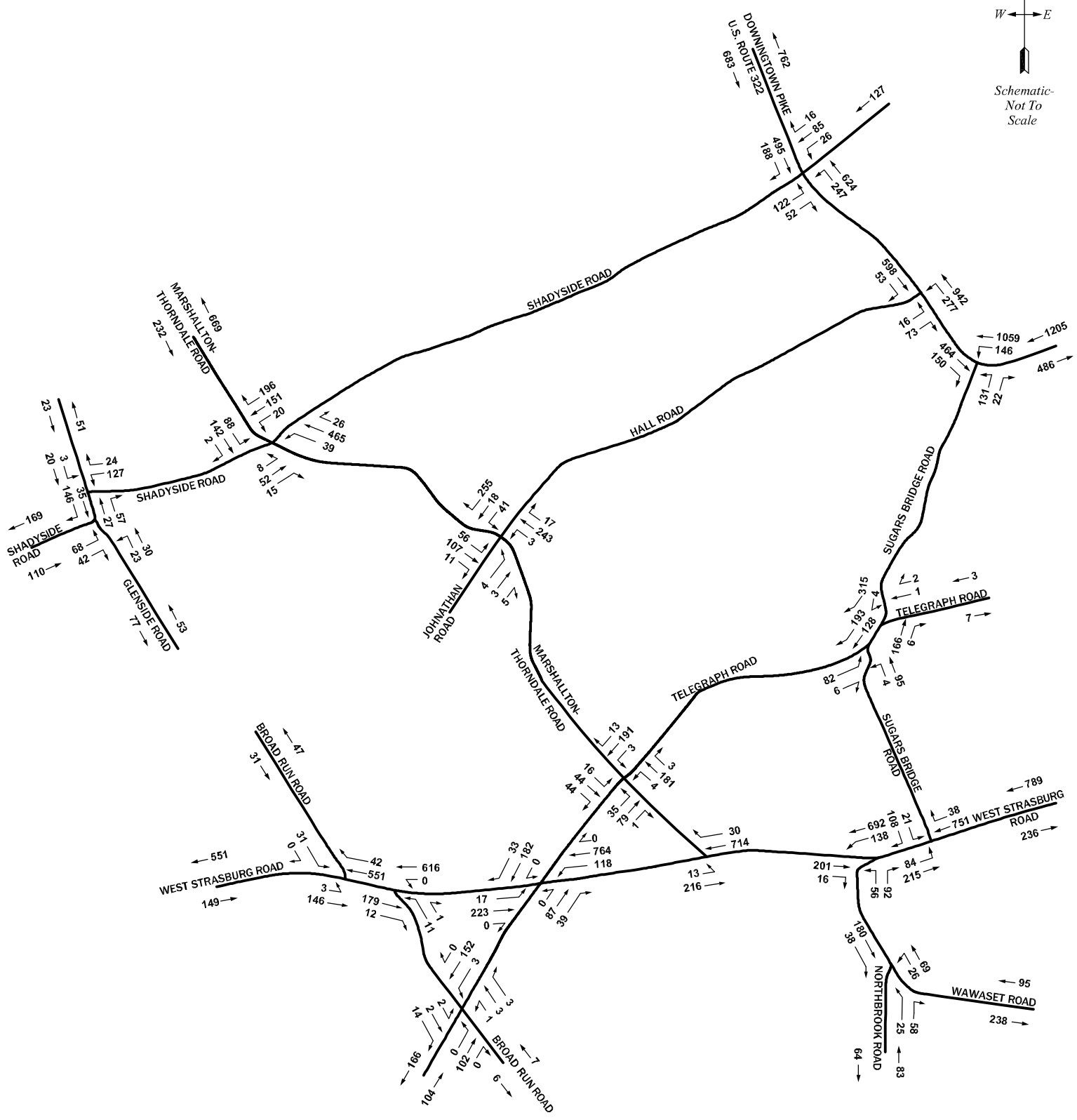
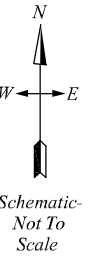


FIGURE 2B
 2013 Existing Weekday Afternoon Peak Hour Traffic Volumes - Southern Service Area
WEST BRADFORD TOWNSHIP
ACT 209 STUDY
WEST BRADFORD TOWNSHIP, CHESTER COUNTY, PA



(8/1/2014) I:\eng\813041\dwg\Figure 2B.dwg

Existing Transportation Conditions

Evaluation of the existing transportation network is based on the physical (i.e., traffic control, intersection geometry, lane usage, etc.) and operational (i.e., traffic volumes, signal timing/phasing) characteristics of the study intersections during the peak operational period.

Analysis Methodology

The peak hour traffic volumes shown in Figures 2A and 2B were analyzed to determine the existing operating conditions, in accordance with the standard techniques contained in the *Highway Capacity Manual (2010)*. These standard capacity/level-of-service analysis techniques, which calculate total control delay, are more thoroughly described in **Appendix D** for both signalized and unsignalized intersections, as well the correlation between average total control delay and the respective level of service (LOS) criteria for each intersection type.

Preferred Levels of Service

Consistent with the Act 209 legislation, the Transportation Advisory Committee has adopted preferred level-of-service criteria for the various intersections studied. The preferred level of service is considered the operational design standard by which each study intersection must operate under existing conditions, future pass-through conditions, and future development conditions in this *Roadway Sufficiency Analysis*. Capacity improvements are identified for any deficient (worsened) operations that do not satisfy the preferred levels of service at the study intersections.

According to Act 209, the preferred level of service may be waived by the municipality at individual intersections based upon difficulty in implementing various improvements (i.e., geometric design limitations, topographic limitations, or the unavailability of necessary right-of-way). Similarly, for unsignalized intersections where the preferred level of service criterion is not satisfied most often only signalization can mitigate the traffic deficiency; however, where traffic volumes do not meet traffic signal warrant criteria, as required by PennDOT, these intersections cannot be improved through signalization. Therefore, the required signalization/improvement must be waived or deferred until traffic volumes warrant signalization. As shown in **Table 4**, the Transportation Advisory Committee has adopted specific preferred level-of-service criteria for the purposes of this *Roadway Sufficiency Analysis*.

Table 4. Preferred Level-of-Service Criteria

Intersection/Roadway Type	Western TSA	Southern TSA
Signalized	LOS D movements LOS D overall	LOS D movements LOS D overall
Unsignalized	LOS D movements	LOS D movements

For signalized intersections, the preferred levels of service indicated above apply to individual movements, as well as overall intersection operations, whereas, for unsignalized intersections, the preferred levels of service apply only to the critical turning or through movements at the intersections.

Programmed Improvements

The following improvements have previously been planned for and committed to for various West Bradford Township roadways and intersections, which will directly affect traffic operations:

- West Strasburg Road and Romansville Road/Shadyside Road/Stargazer Road –** This intersection will be improved in association with the Stargazer Village development. As part of this improvement, a roundabout will be constructed along West Strasburg Road, which will include the southbound Romansville Road, southbound Shadyside Road, and northbound Stargazer Road approaches to West Strasburg Road. The eastbound and westbound West Strasburg Road approaches will be realigned, and the eastbound West Strasburg Road approach will be widened to provide two lanes entering the intersection. In addition, the northbound Stargazer Road approach will be realigned to intersect West Strasburg Road opposite Romansville Road and Shadyside Road, and the existing intersection of West Strasburg Road and Stargazer Road will be eliminated. Furthermore, the roundabout will provide two lanes for eastbound West Strasburg Road traffic entering and exiting the roundabout, as well as within the roundabout. The roundabout is considered a development commitment in both the pass-through and development future conditions analysis.
- U.S. Route 322 (Downingtown Pike) Bridge –** Rehabilitation or replacement of the U.S. Route 322 Bridge over the East Branch of the Brandywine Creek is programmed on the Delaware Valley Regional Planning Commission’s FY2015-2018 Transportation Improvement Program (TIP). This state owned bridge is just east of the intersection of U.S. Route 322 and Sugars Bridge Road and is located on the border between West Bradford Township and East Bradford Township. This project is currently in the preliminary design phase, and the final scope and bridge

alternative has not been selected as of the date of this report. Without a current commitment for capacity improvements as part of this project, the future conditions analysis is based on a bridge configuration with one-lane in each direction on U.S. Route 322. The Township is coordinating with PennDOT regarding the design of the bridge and associated roadway improvements for the bridge approaches.

Existing Levels of Service

The existing weekday peak hour traffic volumes presented in Figures 2A and 2B were subject to detailed capacity/level-of-service analysis according to the methodology previously described. The results of the analysis are illustrated in **Figures 3A and 3B**, and the detailed capacity/level-of-service analysis worksheets are contained in **Appendix E**. In addition, for informational purposes, the existing weekday morning peak hour traffic volumes and level-of-service analysis worksheets are also contained in Appendix E.

As shown in Figures 3A and 3B, of the 36 study intersections, 33 presently operate with acceptable levels of service with respect to the adopted preferred levels of service during the weekday afternoon peak hour. The remaining three study intersections, which do not satisfy the preferred levels of service criteria, are situated in Southern TSA. The following unsignalized intersections operate below LOS D on at least one of the approaches:

Southern TSA

- U.S. Route 322 and Hall Road
- West Strasburg Road and Telegraph Road
- West Strasburg Road and Marshallton-Thorndale Road

Existing Improvement Plan

The improvements necessary to mitigate existing traffic deficiencies and satisfy the preferred level-of-service criteria are described in **Table 5**, and the geometric and traffic signal improvements are also illustrated in **Figure 4**. Improvements are required at three study intersections within the Southern TSA in order to achieve the preferred levels of service under present traffic conditions.

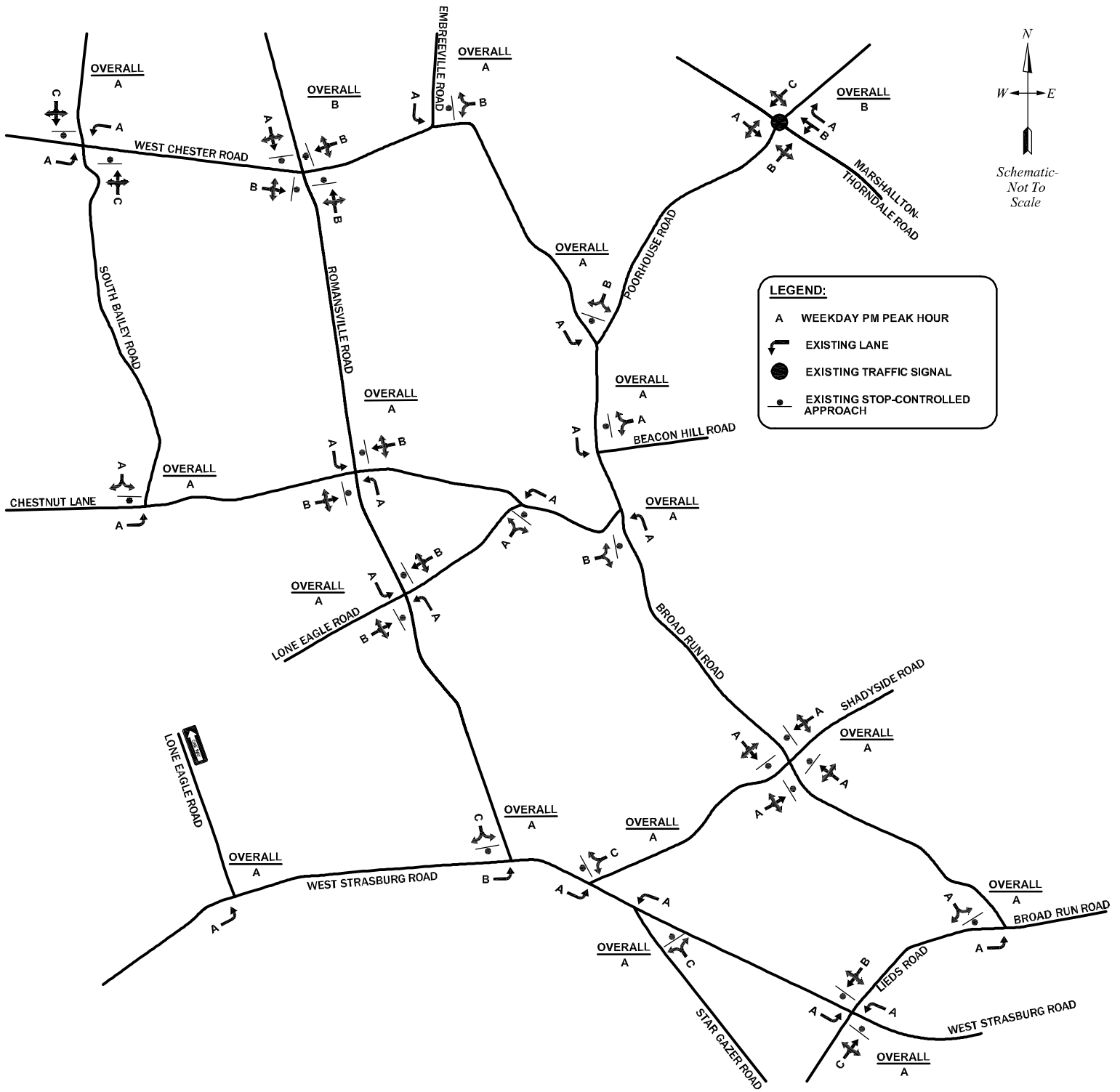
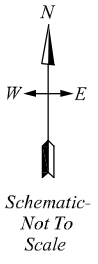


FIGURE 3A
 2013 Existing Peak Hour Levels of Service - Western Service Area
WEST BRADFORD TOWNSHIP
ACT 209 STUDY
 WEST BRADFORD TOWNSHIP, CHESTER COUNTY, PA



(8/1/2014) I:\eng\813041\dwg\Figure 3A.dwg



LEGEND:

- A WEEKDAY PM PEAK HOUR
- EXISTING LANE
- EXISTING TRAFFIC SIGNAL
- EXISTING STOP-CONTROLLED APPROACH

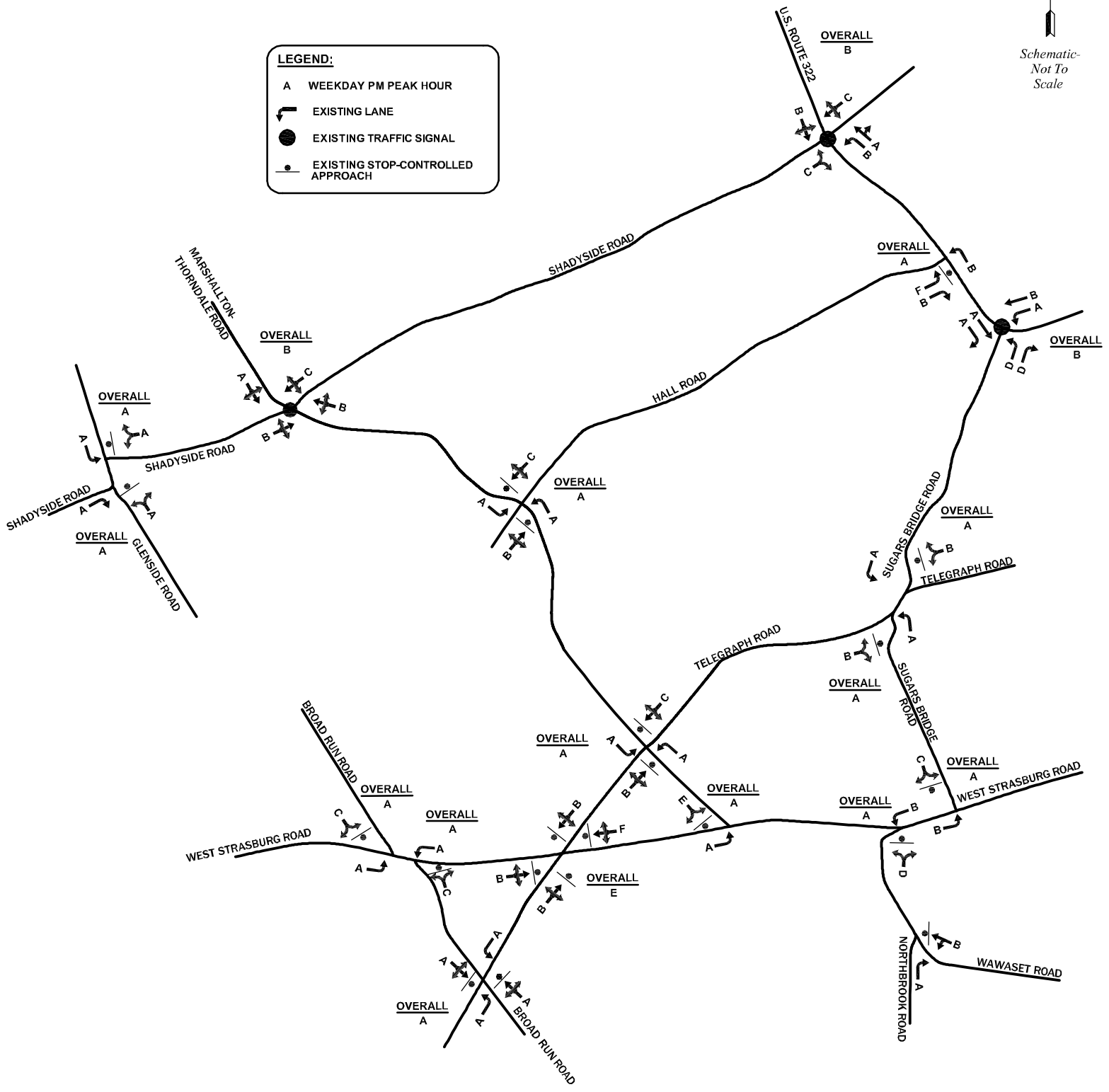


FIGURE 3B
 2013 Existing Peak Hour Levels of Service - Southern Service Area
WEST BRADFORD TOWNSHIP
ACT 209 STUDY
WEST BRADFORD TOWNSHIP, CHESTER COUNTY, PA



(8/1/2014) I:\eng\813041\dwg\Figure 3B.dwg

Table 5. Existing Improvements

Int No.	Intersection	Service Area	Current Traffic Control	Recommended Capacity Improvements
1	West Chester Road and South Bailey Road	Western	Stop Sign	No improvements required or recommended.
2	Romansville Road/Stouff Road and West Chester Road	Western	Stop Sign	No improvements required or recommended.
3	West Chester Road/Broad Run Road and Embreeville Road	Western	Stop Sign	No improvements required or recommended.
4	Marshallton-Thorndale Road and Poorhouse Road	Western	Traffic Signal	No improvements required or recommended.
5	Broad Run Road and Poorhouse Road	Western	Stop Sign	No improvements required or recommended.
6	Chestnut Lane and Oakwood Road	Western	Stop Sign	No improvements required or recommended.
7	Romansville Road and Chestnut Lane	Western	Stop Sign	No improvements required or recommended.
8	Chestnut Lane and Lone Eagle Road	Western	Stop Sign	No improvements required or recommended.
9	Broad Run Road and Beacon Hill Road	Western	Stop Sign	No improvements required or recommended.
10	Broad Run Road and Chestnut Lane	Western	Stop Sign	No improvements required or recommended.
11	Romansville Road and Lone Eagle Road	Western	Stop Sign	No improvements required or recommended.
12	West Strasburg Road and Lone Eagle Road	Western	Stop Sign	No improvements required or recommended.
13	Romansville Road and West Strasburg Road	Western	Stop Sign	No improvements required or recommended.
14	West Strasburg Road and Shadyside Road	Western	Stop Sign	No improvements required or recommended.
15	West Strasburg Road and Stargarzer Road	Western	Stop Sign	No improvements required or recommended.
16	Broad Run Road and Shadyside Road	Western	Stop Sign	No improvements required or recommended.
17	Broad Run Road and Lieds Road	Western	Stop Sign	No improvements required or recommended.
18	West Strasburg Road and Lieds Road	Western	Stop Sign	No improvements required or recommended.
19	Shadyside Road and Glenside Road (south)	Southern	Stop Sign	No improvements required or recommended.
20	Shadyside Road and Glenside Road (north)	Southern	Stop Sign	No improvements required or recommended.
21	Marshallton-Thorndale Road and Shadyside Road	Southern	Traffic Signal	No improvements required or recommended.
22	U.S. Route 322 and Shadyside Road	Southern	Traffic Signal	No improvements required or recommended.
23	U.S. Route 322 and Hall Road	Southern	Stop Sign	Widen westbound U.S. Route 322 for a separate left-turn lane. Install a traffic signal.
24	Marshallton-Thorndale Road and Hall Road	Southern	Stop Sign	No improvements required or recommended.
25	U.S. Route 322 and Sugars Bridge Road	Southern	Traffic Signal	No improvements required or recommended.
26	Telegraph Road and Sugars Bridge Road (north)	Southern	Stop Sign	No improvements required or recommended.
27	Telegraph Road and Sugars Bridge Road (south)	Southern	Stop Sign	No improvements required or recommended.
28	Telegraph Road and Marshallton-Thorndale Road	Southern	Stop Sign	No improvements required or recommended.
29	West Strasburg Road and Broad Run Road (east)	Southern	Stop Sign	No improvements required or recommended.
30	West Strasburg Road and Broad Run Road (west)	Southern	Stop Sign	No improvements required or recommended.
31	West Strasburg Road and Telegraph Road	Southern	Stop Sign	Ban the through and left-turn movements along northbound and southbound Telegraph Road. Remove the eastbound and westbound Strasburg Road stop signs.
32	West Strasburg Road and Marshallton-Thorndale Road	Southern	Stop Sign	Install a traffic signal.
33	West Strasburg Road and Northbrook Road	Southern	Stop Sign	No improvements required or recommended.
34	West Strasburg Road and Sugars Bridge Road	Southern	Stop Sign	No improvements required or recommended.
35	Northbrook Road and Wawaset Road	Southern	Stop Sign	No improvements required or recommended.
36	Telegraph Road and Broad Run Road	Southern	Stop Sign	No improvements required or recommended.

LEGEND:

- A WEEKDAY PM PEAK HOUR
- EXISTING LANE
- LANE REQUIRED BY EXISTING TRAFFIC
- EXISTING TRAFFIC SIGNAL
- TRAFFIC SIGNAL BY EXISTING TRAFFIC
- EXISTING STOP-CONTROLLED APPROACH
- TURNING MOVEMENT POTENTIALLY RESTRICTED UNDER EXISTING CONDITIONS IF NECESSARY

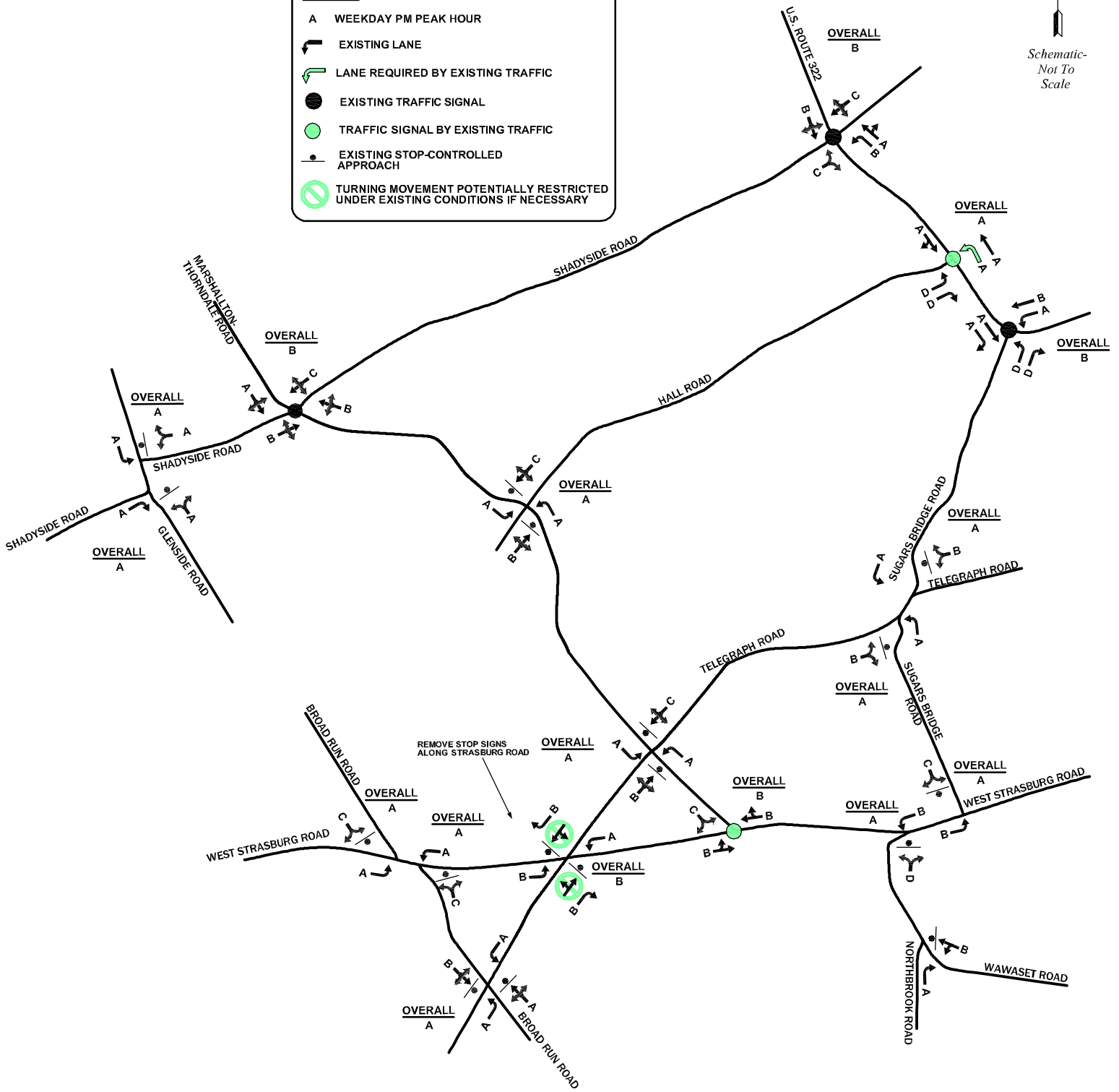
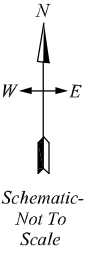


FIGURE 4
 2013 Existing Peak Hour Levels of Service With Improvements - Southern Service Area

**WEST BRADFORD TOWNSHIP
 ACT 209 STUDY
 WEST BRADFORD TOWNSHIP, CHESTER COUNTY, PA**



Future Traffic Conditions

Act 209 requires a minimum five-year future time horizon for the development of the *Transportation Capital Improvements Plan* and *Transportation Impact Fee Ordinance*. A 17-year time frame was selected by consensus of the Transportation Advisory Committee for the West Bradford Township Act 209 traffic analysis, which is consistent with the short-term development projections contained in the *Land Use Assumptions Report*, and produces a forecast year of 2030.

Future Traffic Components

Total future traffic volume forecasts for 2030 include three components: existing traffic, pass-through traffic, and development traffic. The first component, **existing traffic** was described in the previous section. The second component of future traffic projections is **pass-through traffic**, which is subdivided into the following two elements:

- The first element reflects future increases in regional traffic, which includes traffic generated by specific approved future developments located within West Bradford Township, as outlined in the *Land Use Assumptions Report*, as well as a regional background traffic growth factor of 1.0 percent per year, compounded for 17 years to 2030 (or 18.4 percent total).
- The second element of pass-through traffic includes future development traffic generated from other designated transportation service areas within the Township. Specifically, since West Bradford Township has two transportation service areas, development traffic in one service area constitutes pass-through traffic in the other service area. For example, while traffic generated from within the Western TSA is considered “development” traffic in the Western TSA, this same traffic is considered “pass-through” traffic when it traverses through the Southern TSA.

Development traffic that is generated by new development within each respective/designated transportation service area constitutes the third and final component of future 2030 traffic volumes. Therefore, this section first addresses trip generation for each service area, based upon the development projections contained in the *Land Use Assumptions Report*, as well as the trip distribution assumptions utilized in the analysis.

Trip Generation

Based upon the *Land Use Assumptions Report*, vehicular trip generation was estimated for the 2030 weekday afternoon peak hour utilizing the Institute of Transportation Engineers publication, *Trip Generation, 9th Edition*. The resulting 2030 weekday afternoon peak hour trip

generation is summarized in **Table 6** for Western and Southern TSAs. In addition, the detailed trip generation estimates are shown in **Appendix F**.

Table 6. Future Weekday Afternoon Peak Hour Trip Generation by Transportation Service Area⁽¹⁾

<u>Service Areas</u>	<u>Pass-Through⁽²⁾ New Trips</u>	<u>Development New Trips</u>	<u>Total New Trips</u>
Western TSA	1,761 trips	916 trips	2,677 trips
Southern TSA	916 trips	1,761 trips	2,677 trips

(1) Based on the *Land Use Assumptions Report*.

(2) Exclusive of regional background traffic growth, and traffic from known developments in the Township.

Trip Distribution

Vehicular traffic volumes generated by new development over the next 17 years were generally distributed to the area roadway network based on existing travel patterns determined from the existing peak hour traffic volumes entering and exiting the Township, as well as the location of specific future development parcels with respect to the study roadway network and other major traffic generators and destinations. The resultant overall directions of approach and departure are indicated in **Tables 7 and 8**.

Table 7. Directions of Approach and Departure Western Transportation Service Area Development

<u>Roadway</u>	<u>External Location (to/from)</u>	<u>Arrival/Departure</u>
West Chester Road	west of S. Bailey Road	12 %
S. Bailey Road	north of West Chester Road	3 %
Stouff Road	north of West Chester Road	3 %
Embreeville Road	north of West Chester Road	4 %
Marshallton-Thorndale Road	north of Poorhouse Road	15 %
Poorhouse Road	north of Marshallton-Thorndale Road	10 %
Marshallton-Thorndale Road	south of Poorhouse Road	20 %
Shadyside Road	east of Broad Run Road	5 %
West Strasburg Road	east of Lieds Road	13 %
Stargazer Road	south of West Strasburg Road	4 %
West Strasburg Road	west of Lone Eagle Road	10%
Chestnut Lane	west of S. Bailey Road	1 %

**Table 8. Directions of Approach and Departure
Southern Transportation Service Area Development**

Roadway	External Location (to/from)	Arrival/Departure
Shadyside Road	west of Glenside Road	5 %
Marshallton-Thorndale Road	north of Shadyside Road	15 %
U.S. Route 322	west of Shadyside Road	20 %
U.S. Route 322	east of Sugars Bridge Road	25 %
West Strasburg Road	east of Sugars Bridge Road	15 %
Wawaset Road	south of Northbrook Road	2 %
Northbrook Road	south of Wawaset Road	2 %
Telegraph Road	south of Broad Run Road	3 %
West Strasburg Road	west of Broad Run Road	13 %

2030 Future Pass-Through Traffic

Traffic generated by new development was generally assigned to the study intersections based on the trip distribution assumptions previously described. Also, an annual traffic growth rate of one percent per year was applied to the existing peak hour traffic volumes to reflect regional traffic growth.

Moreover, future development traffic associated with several approved residential subdivisions within West Bradford Township, have also been included in the future traffic projections.

The 2030 future pass-through weekday afternoon peak hour traffic volumes are illustrated in **Figures 5A and 5B**.

2030 Future Pass-Through Traffic Levels of Service

The future 2030 pass-through traffic volumes illustrated in Figures 5A and 5B were subject to the previously described capacity/level-of-service analysis procedures to determine 2030 pass-through levels of service, and the detailed analyses are provided in **Appendix G**. In addition, for informational purposes, the pass-through weekday morning peak hour traffic volumes and level-of-service analysis worksheets are also contained in Appendix G. As required by Act 209, the future conditions analysis was completed for future 2030 pass-through volumes for each study intersection, assuming implementation of the improvements identified in the Existing Improvement Plan, in order to determine the incremental traffic impacts and required mitigation of future pass-through traffic. The future conditions analysis also assumes completion of the previously described programmed improvements.

Figures 6A and 6B summarizes the results of the 2030 future pass-through traffic capacity/level-of-service analyses for the study intersections. Traffic operating conditions at the following

study intersections will not satisfy the preferred level of service criteria under 2030 future pass-through conditions.

- Marshallton-Thorndale Road and Poorhouse Road
- West Strasburg Road and Romansville Road/Shadyside Road/Stargazer Road
- West Strasburg Road and Lieds Road
- Marshallton-Thorndale Road and Shadyside Road
- U.S. Route 322 and Shadyside Road
- U.S. Route 322 and Sugars Bridge Road
- Marshallton-Thorndale Road and Telegraph Road
- West Strasburg Road and Marshallton-Thorndale Road
- West Strasburg Road and Northbrook Road
- West Strasburg Road and Sugars Bridge Road

2030 Future Pass-Through Improvement Plan

The additional improvements required to accommodate pass-through traffic, beyond those improvements necessary to accommodate existing traffic at the preferred levels of service are illustrated in **Figures 7A and 7B**. Also, these specific improvements required by future pass-through traffic to achieve the preferred level of service criteria are summarized in more detail in **Table 9** for each study intersection. Improvements are required at 10 study intersections (three in the Western TSA and seven in the Southern TSA), in order to achieve the preferred levels of service.

It is noted that at the intersection of Marshallton-Thorndale Road and Telegraph Road, preferred level of service criteria is not met for westbound Telegraph Road. However, the unsignalized intersection fails to meet PennDOT's traffic signal warrant criteria, and therefore, improvements (i.e., signalization) must be deferred (waived) until such time that traffic volumes satisfy traffic signal warrant criteria.

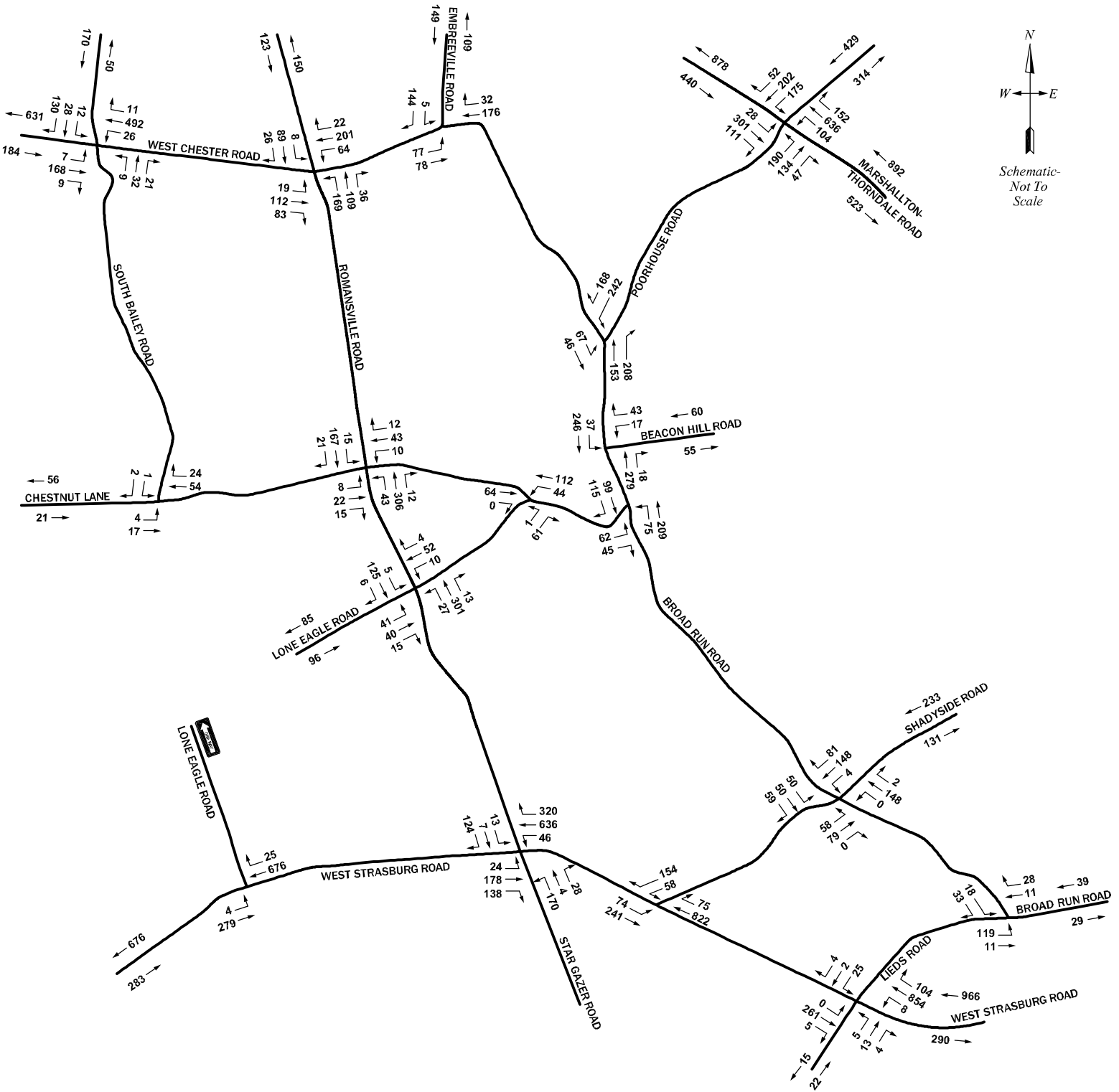


FIGURE 5A
 2030 Future Pass-Through Weekday Afternoon Peak Hour Traffic Volumes - Western Service Area
WEST BRADFORD TOWNSHIP
ACT 209 STUDY
WEST BRADFORD TOWNSHIP, CHESTER COUNTY, PA



(8/5/2014) I:\eng\813041\dwg\Figure 5A.dwg

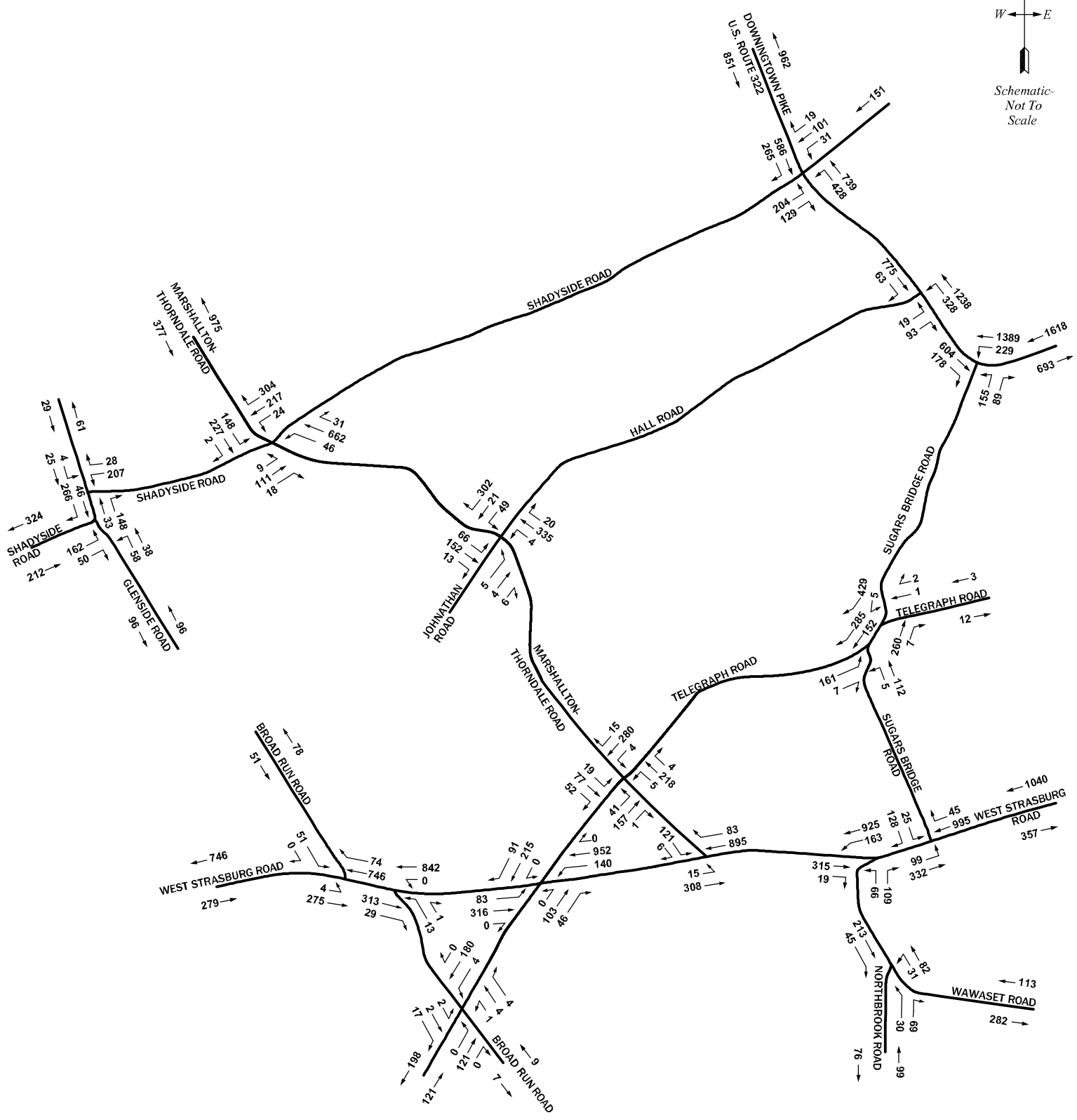
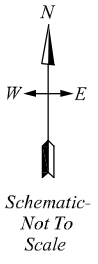


FIGURE 5B
 2030 Future Pass-Through Weekday Afternoon Peak Hour Traffic Volumes - Southern Service Area
WEST BRADFORD TOWNSHIP
ACT 209 STUDY
WEST BRADFORD TOWNSHIP, CHESTER COUNTY, PA



(8/1/2014) I:\eng\813041\dwg\Figure 5B.dwg

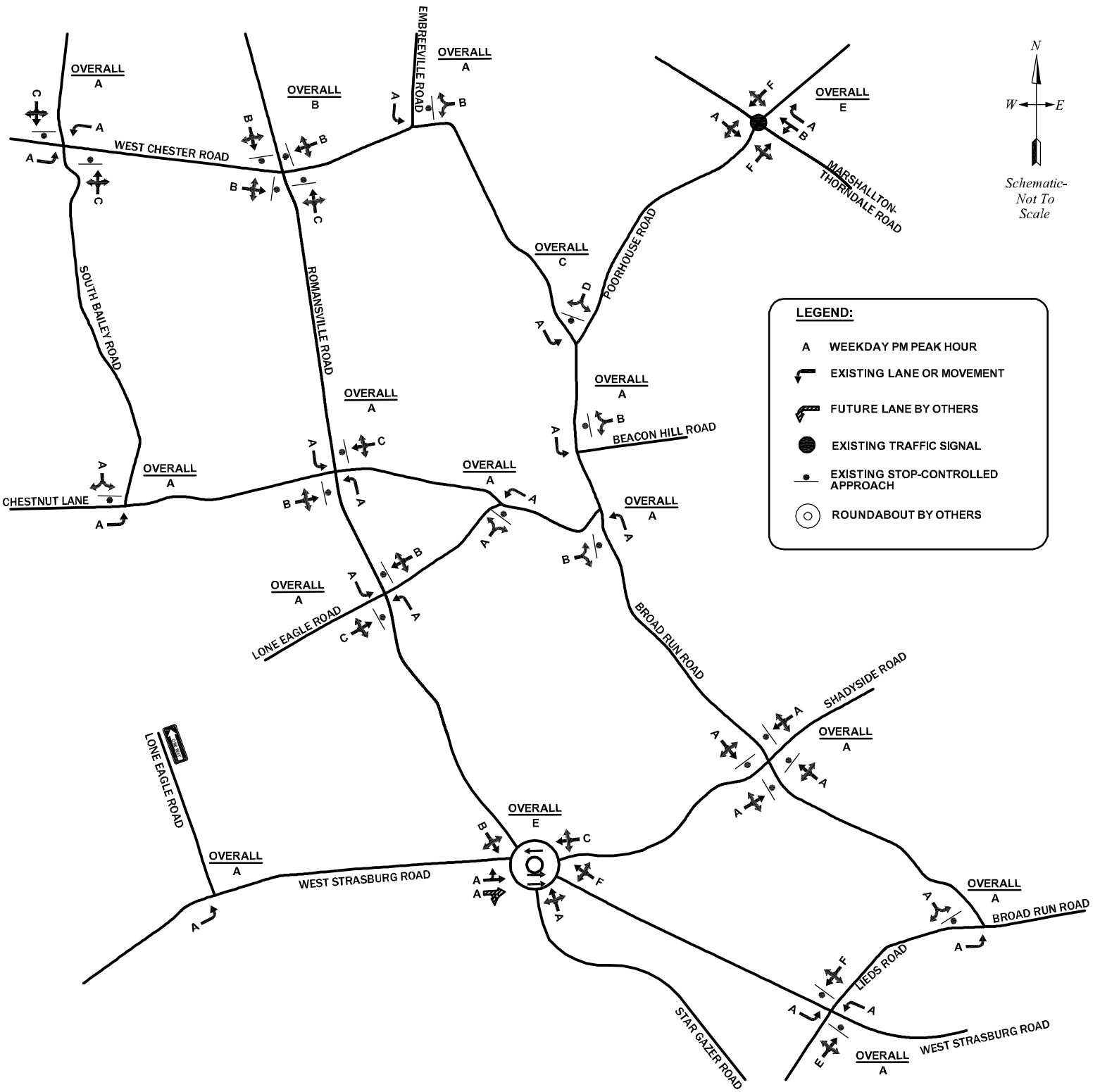


FIGURE 6A
 2030 Future Pass-Through Levels of Service - Western Service Area
WEST BRADFORD TOWNSHIP
ACT 209 STUDY
WEST BRADFORD TOWNSHIP, CHESTER COUNTY, PA



(8/5/2014) I:eng.813041.dwg:Figure 6A.dwg

LEGEND:

- A WEEKDAY PM PEAK HOUR
- EXISTING LANE OR MOVEMENT
- LANE REQUIRED BY EXISTING TRAFFIC
- EXISTING TRAFFIC SIGNAL
- TRAFFIC SIGNAL BY EXISTING TRAFFIC
- EXISTING STOP-CONTROLLED APPROACH
- TURNING MOVEMENT POTENTIALLY RESTRICTED UNDER EXISTING CONDITIONS IF NECESSARY

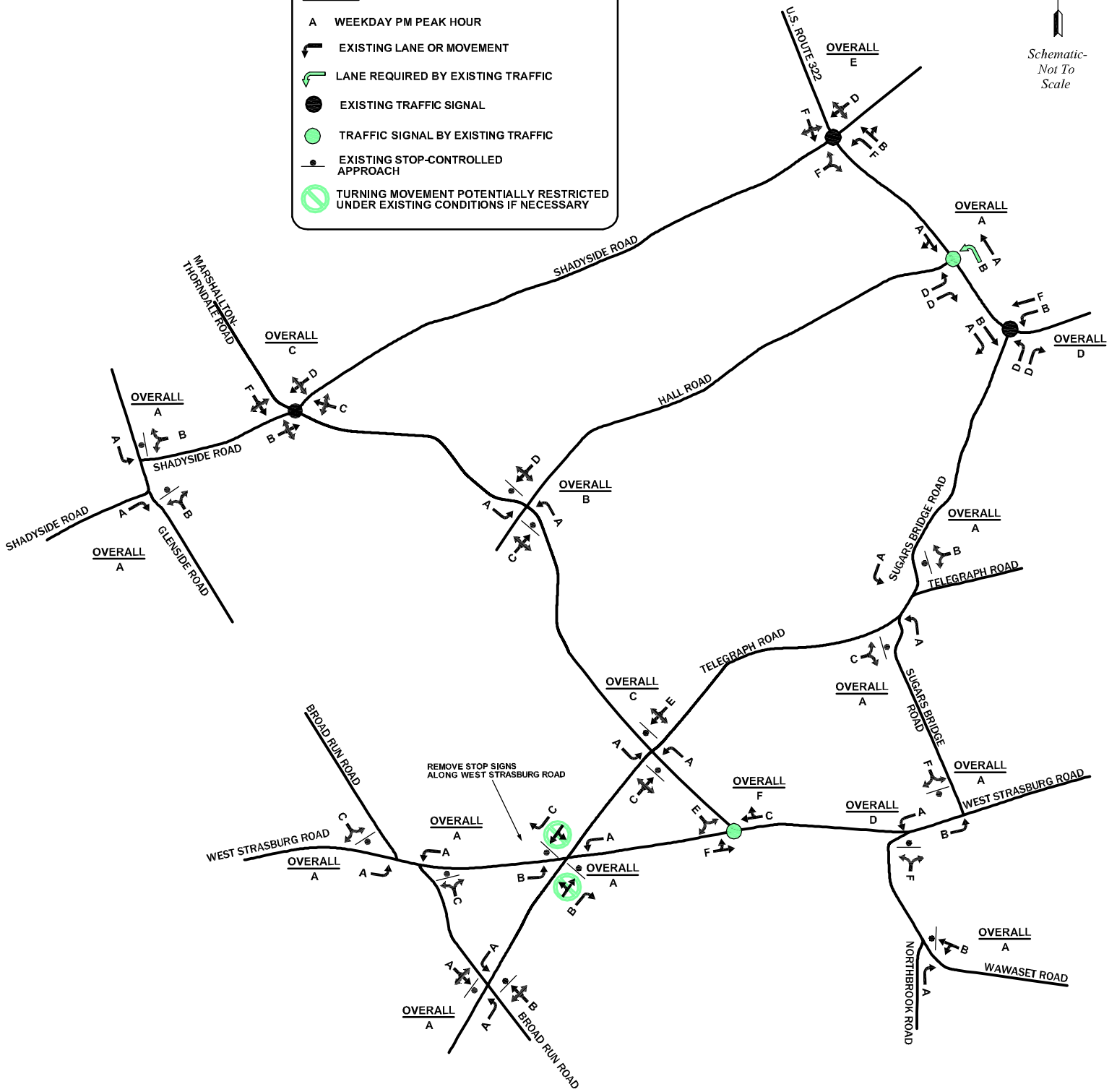
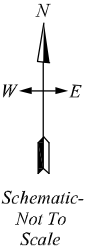


FIGURE 6B
 2030 Future Pass-Through Levels of Service - Southern Service Area
WEST BRADFORD TOWNSHIP
ACT 209 STUDY
 WEST BRADFORD TOWNSHIP, CHESTER COUNTY, PA



Table 9. Pass-Through Improvements

Int No.	Intersection	Service Area	Current Traffic Control	Recommended Capacity Improvements
1	West Chester Road and South Bailey Road	Western	Stop Sign	No improvements required or recommended.
2	Romansville Road/Stouff Road and West Chester Road	Western	Stop Sign	No improvements required or recommended.
3	West Chester Road/Broad Run Road and Embreeville Road	Western	Stop Sign	No improvements required or recommended.
4	Marshallton-Thorndale Road and Poorhouse Road	Western	Traffic Signal	Widen northbound and southbound Marshallton-Thorndale Road for separate left-turn lanes. Modify traffic signal timings.
5	Broad Run Road and Poorhouse Road	Western	Stop Sign	No improvements required or recommended.
6	Chestnut Lane and Oakwood Road	Western	Stop Sign	No improvements required or recommended.
7	Romansville Road and Chestnut Lane	Western	Stop Sign	No improvements required or recommended.
8	Chestnut Lane and Lone Eagle Road	Western	Stop Sign	No improvements required or recommended.
9	Broad Run Road and Beacon Hill Road	Western	Stop Sign	No improvements required or recommended.
10	Broad Run Road and Chestnut Lane	Western	Stop Sign	No improvements required or recommended.
11	Romansville Road and Lone Eagle Road	Western	Stop Sign	No improvements required or recommended.
12	West Strasburg Road and Lone Eagle Road	Western	Stop Sign	No improvements required or recommended.
13	West Strasburg Road and Romansville Road/Shadyside Road/Stargazer Road	Western	Stop Sign	Widen westbound West Strasburg Road for a separate right-turn lane. Widen the roundabout for two lanes within the roundabout for westbound traffic.
16	Broad Run Road and Shadyside Road	Western	Stop Sign	No improvements required or recommended.
17	Broad Run Road and Lieds Road	Western	Stop Sign	No improvements required or recommended.
18	West Strasburg Road and Lieds Road	Western	Stop Sign	Install a traffic signal.
19	Shadyside Road and Glenside Road (south)	Southern	Stop Sign	No improvements required or recommended.
20	Shadyside Road and Glenside Road (north)	Southern	Stop Sign	No improvements required or recommended.
21	Marshallton-Thorndale Road and Shadyside Road	Southern	Traffic Signal	Widen northbound and southbound Marshallton-Thorndale Road for separate left-turn lanes. Modify traffic signal timings.
22	U.S. Route 322 and Shadyside Road	Southern	Traffic Signal	Widen eastbound U.S. Route 322 for a separate right-turn lane. Modify traffic signal timings.
23	U.S. Route 322 and Hall Road	Southern	Traffic Signal	No improvements required or recommended.
24	Marshallton-Thorndale Road and Hall Road	Southern	Stop Sign	No improvements required or recommended.
25	U.S. Route 322 and Sugars Bridge Road	Southern	Traffic Signal	Widen westbound U.S. Route 322 for a second through lane. Modify traffic signal timings.
26	Telegraph Road and Sugars Bridge Road (north)	Southern	Stop Sign	No improvements required or recommended.
27	Telegraph Road and Sugars Bridge Road (south)	Southern	Stop Sign	No improvements required or recommended.
28	Telegraph Road and Marshallton Thorndale Road	Southern	Stop Sign	No improvements required or recommended.
29	West Strasburg Road and Broad Run Road (east)	Southern	Stop Sign	No improvements required or recommended.
30	West Strasburg Road and Broad Run Road (west)	Southern	Stop Sign	No improvements required or recommended.
31	West Strasburg Road and Telegraph Road	Southern	Stop Sign	No improvements required or recommended.
32	West Strasburg Road and Marshallton-Thorndale Road	Southern	Traffic Signal	Widen southbound Marshallton-Thorndale Road for a separate right-turn lane. Modify traffic signal timings.
33	West Strasburg Road and Northbrook Road	Southern	Stop Sign	Install a single lane roundabout.
34	West Strasburg Road and Sugars Bridge Road	Southern	Stop Sign	Ban the southbound Sugars Bridge Road left-turn movement.
35	Northbrook Road and Wawaset Road	Southern	Stop Sign	No improvements required or recommended.
36	Telegraph Road and Broad Run Road	Southern	Stop Sign	No improvements required or recommended.

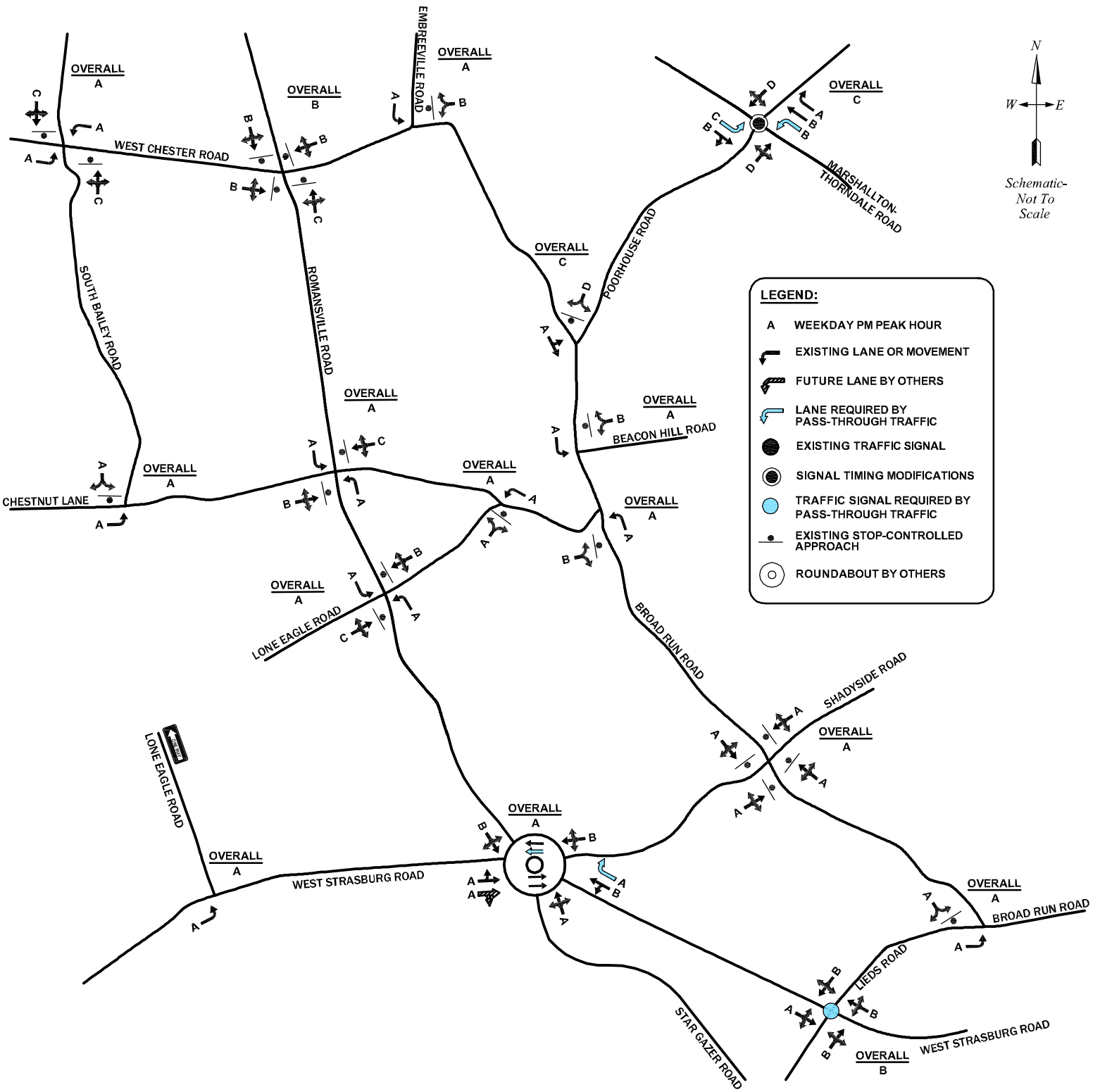


FIGURE 7A

2030 Future Pass-Through Levels of Service With Improvements - Western Service Area

WEST BRADFORD TOWNSHIP ACT 209 STUDY

WEST BRADFORD TOWNSHIP, CHESTER COUNTY, PA



(8/5/2014) I:eng\813041.dwg\Figure 7A.dwg

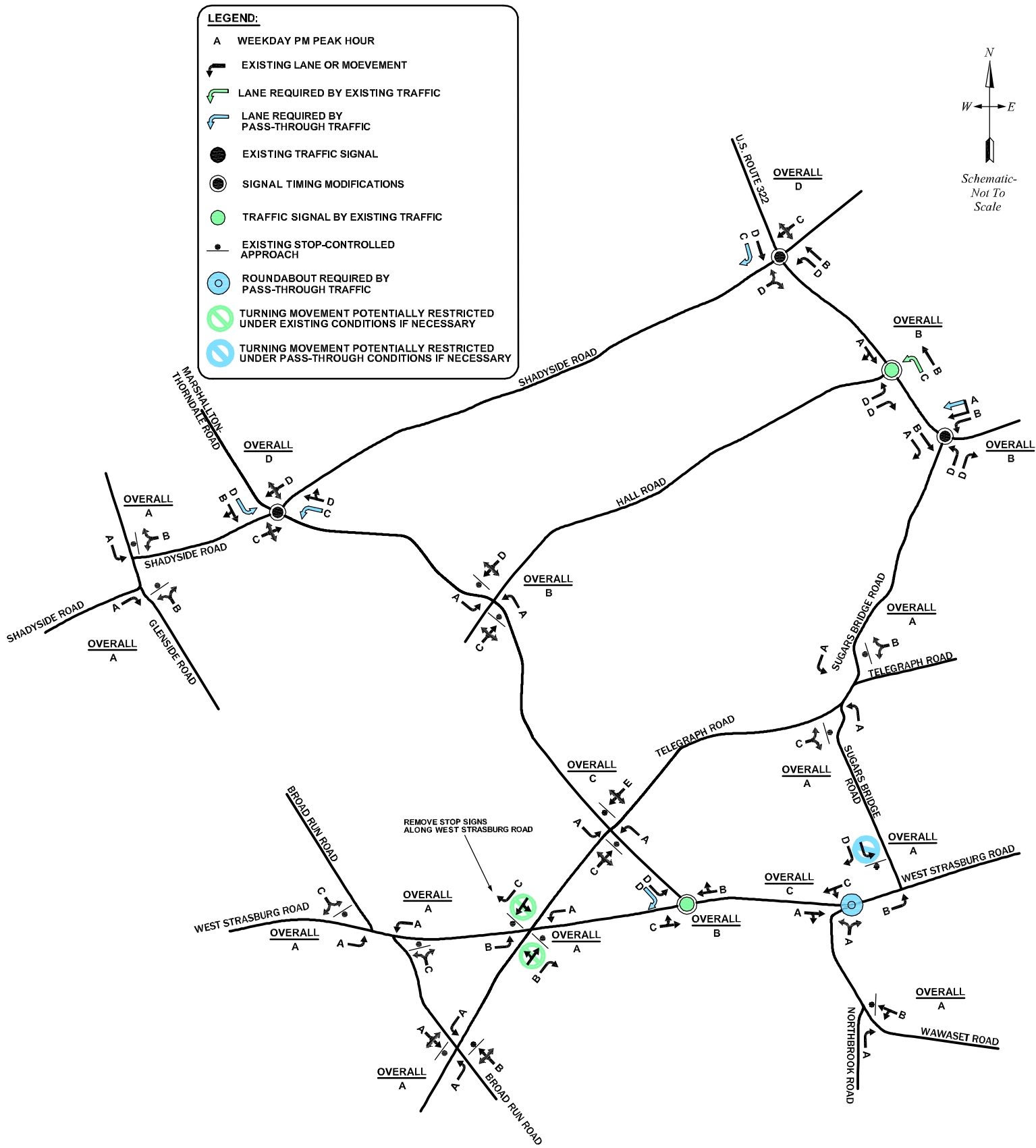


FIGURE 7B
 2030 Future Pass-Through Levels of Service With Improvements - Southern Service Area
WEST BRADFORD TOWNSHIP
ACT 209 STUDY
 WEST BRADFORD TOWNSHIP, CHESTER COUNTY, PA



2030 Future Development Traffic

As previously explained, the traffic generated by new development internal to the designated transportation service areas constitutes the third and final component of future 2030 traffic. The 2030 future development traffic volumes were determined based on assignment of development traffic within each respective transportation service area, and were added to 2030 future pass-through traffic volumes.

Assignment of the development trip generation to the study intersections results in 2030 future development traffic volumes, which are illustrated in **Figures 8A and 8B**.

2030 Future Development Traffic Levels of Service

The future development traffic volumes presented in Figures 8A and 8B were subject to the previously described capacity/level-of-service analysis procedures to determine future 2030 development levels of service, and the detailed analyses are provided in **Appendix H**. In addition, for informational purposes, the development weekday morning peak hour traffic volumes and level-of-service analysis worksheets are also contained in Appendix H. The 2030 future development conditions are illustrated in **Figures 9A and 9B**, and indicate that the following 14 study intersections will not satisfy the preferred levels of service criteria and require further improvements beyond the previously identified existing conditions improvements, programmed/committed improvements, and future pass-through improvements.

Western TSA

- Marshallton-Thorndale Road and Poorhouse Road
- Broad Run Road and Poorhouse Road

Southern TSA

- Marshallton-Thorndale Road and Shadyside Road
- U.S. Route 322 and Shadyside Road
- U.S. Route 322 and Hall Road
- U.S. Route 322 and Sugars Bridge Road
- Marshallton-Thorndale Road and Hall Road
- Marshallton-Thorndale Road and Telegraph Road
- Sugars Bridge Road and Telegraph Road (south)
- West Strasburg Road and Broad Run Road (west)
- West Strasburg Road and Broad Run Road (east)
- West Strasburg Road and Telegraph Road
- West Strasburg Road and Marshallton-Thorndale Road

2030 Future Development Improvement Plan

The improvements necessary to achieve the preferred level of service criteria under 2030 development traffic conditions at the study intersections are summarized in **Table 10**, and are also illustrated in **Figures 10A and 10B**. In summary, improvements are required at eleven study intersections (two in the Western TSA and nine in the Southern TSA) to accommodate development-generated traffic within the transportation service areas in order to achieve the preferred levels of service.

Lastly, it is noted that additional roadway and intersection improvements beyond those identified herein may be required due to developments that may develop at a greater intensity than assumed for this study, that may generate higher traffic volumes outside the weekday afternoon peak hour, or that ultimately provide different access configurations than assumed for the purposes of this study. As such, traffic impact studies completed for these developments should be prepared to determine if additional improvements are required for sufficient traffic mitigation beyond the identified Act 209 improvements, and these additional improvements should ultimately be provided to ensure adequate traffic operations.

Other Deficiencies

During development of the RSA, several other roadway deficiencies were identified that are not related to capacity issues in peak period of analysis and are not attributable to new development. As shown on Figure 10B, two capital improvements in the Southern TSA that are associated with other deficiencies were identified and incorporated into the Future Development Plan. The costs for improvements are not eligible for funding with impact fees.

- **Broad Run Road (southern leg) between West Strasburg Road and Telegraph Road:** This roadway segment is currently a narrow gravel road. Based on improvements identified in the Development condition, the Transportation Advisory Committee identified the need to resurface and widen this segment of Broad Run Road in the future.
- **U.S. Route 322 Eastbound at Hall Road:** U.S. Route 322 is currently one lane in each direction within the Southern TSA. With improvements identified in the Development condition, U.S. Route 322 would be widened to two lanes in each direction, except in the eastbound direction at Hall Road. The need for an additional eastbound through lane on U.S. Route 322 at Hall Road was identified based on the desire to provide a consistent cross section that serves the travel demands in the morning and afternoon peak periods and the close spacing between intersections on this segment of U.S. Route 322.

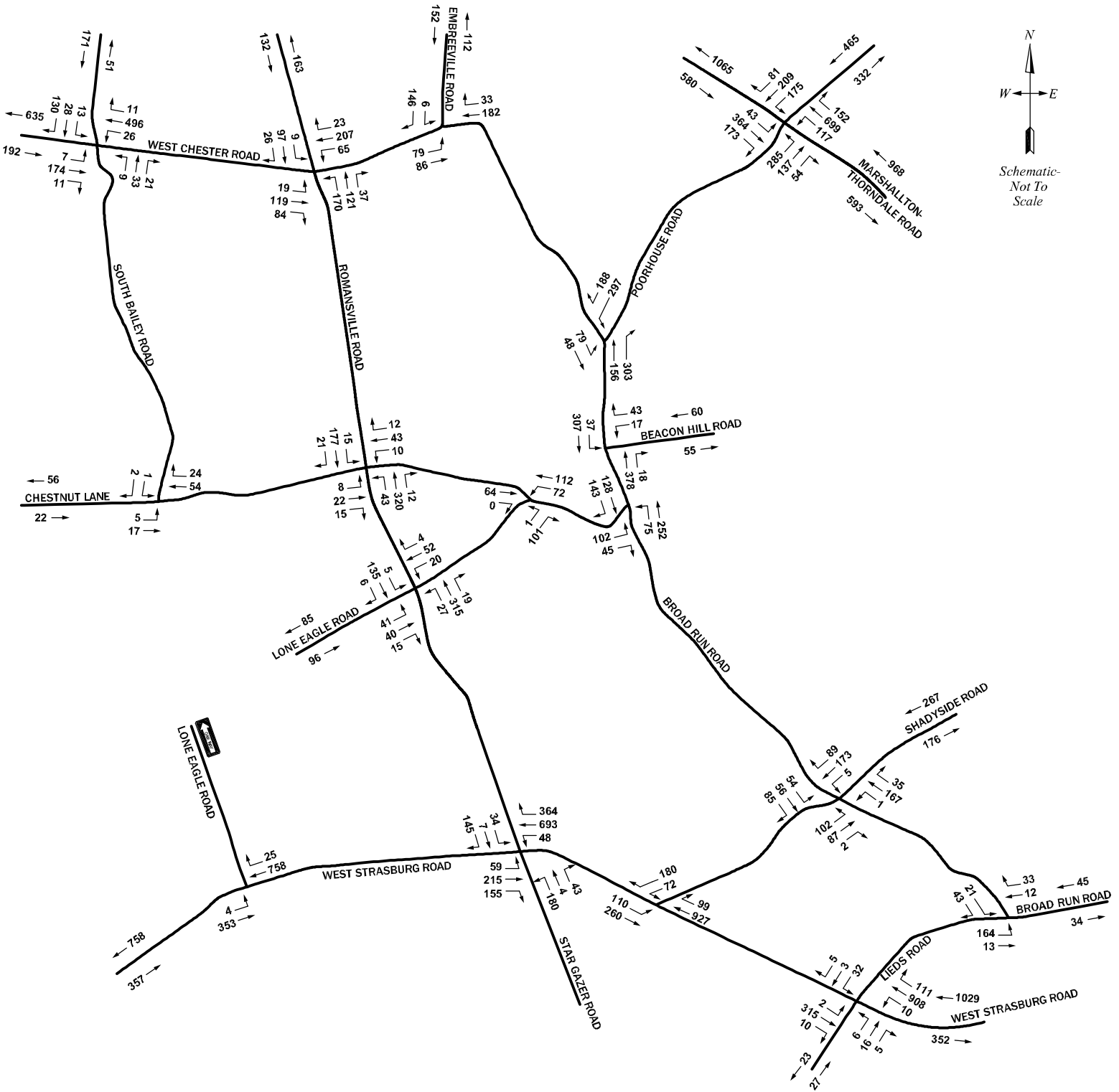


FIGURE 8A
 2030 Future Development Weekday Afternoon Peak Hour Traffic Volumes - Western Service Area
WEST BRADFORD TOWNSHIP
ACT 209 STUDY
WEST BRADFORD TOWNSHIP, CHESTER COUNTY, PA



(8/5/2014) I:\eng\813041\dwg\Figure 8A.dwg

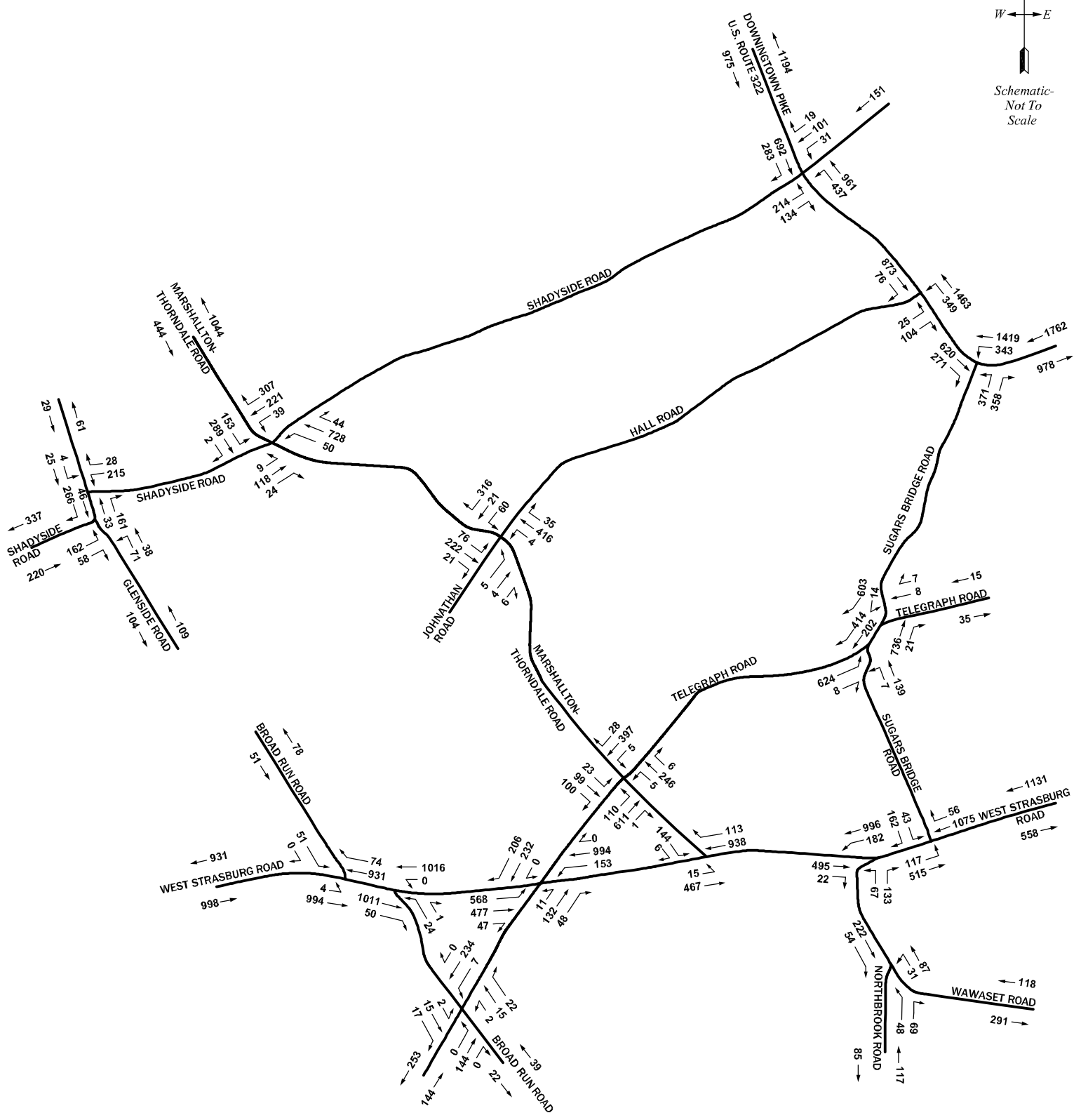
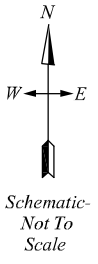


FIGURE 8B
 2030 Future Development Weekday Afternoon Peak Hour Traffic Volumes - Southern Service Area
WEST BRADFORD TOWNSHIP
ACT 209 STUDY
WEST BRADFORD TOWNSHIP, CHESTER COUNTY, PA



(8/5/2014) I:\eng\813041\dwg\Figure 8B.dwg

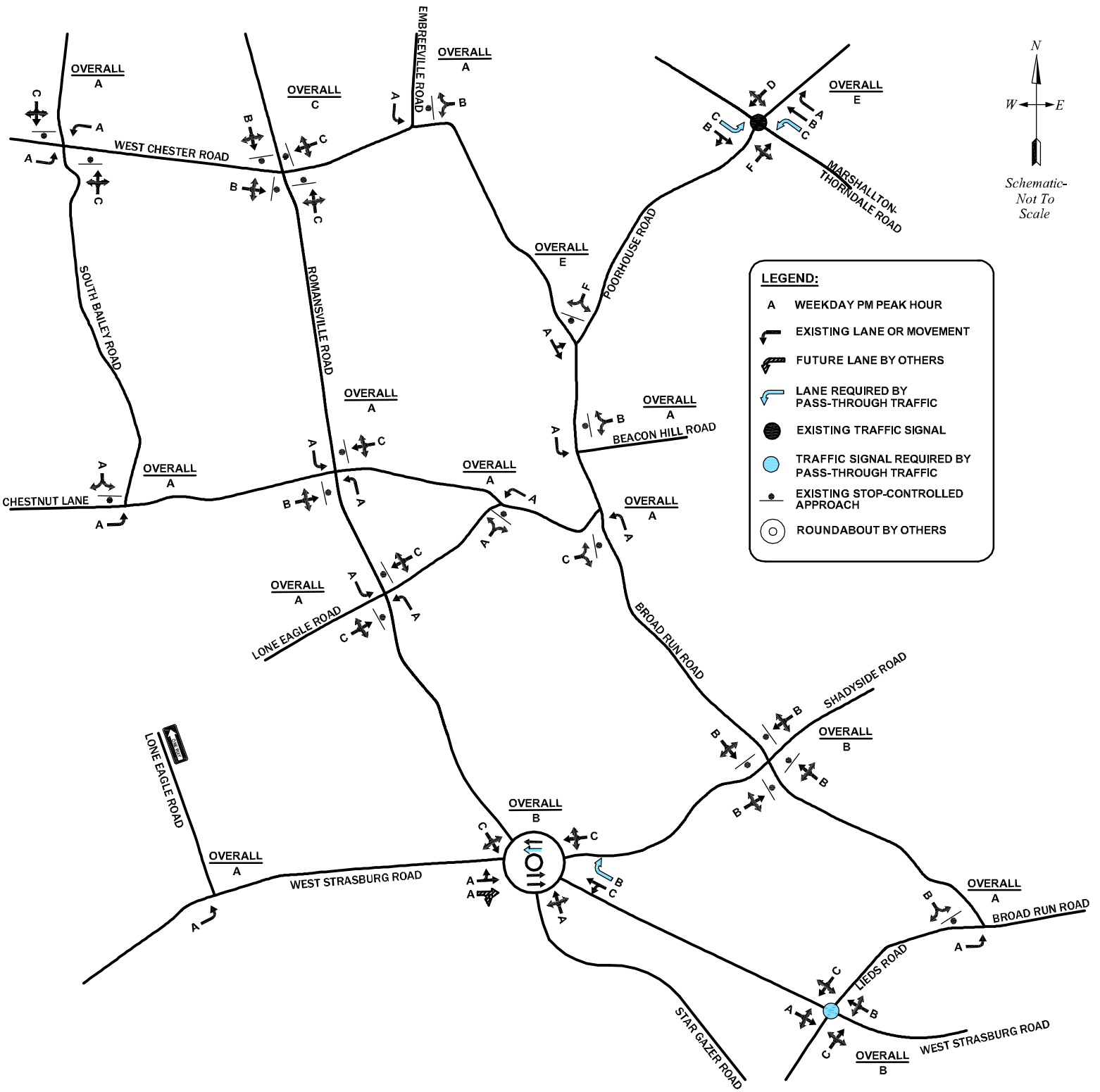


FIGURE 9A
 2030 Future Development Levels of Service - Western Service Area
WEST BRADFORD TOWNSHIP
ACT 209 STUDY
 WEST BRADFORD TOWNSHIP, CHESTER COUNTY, PA



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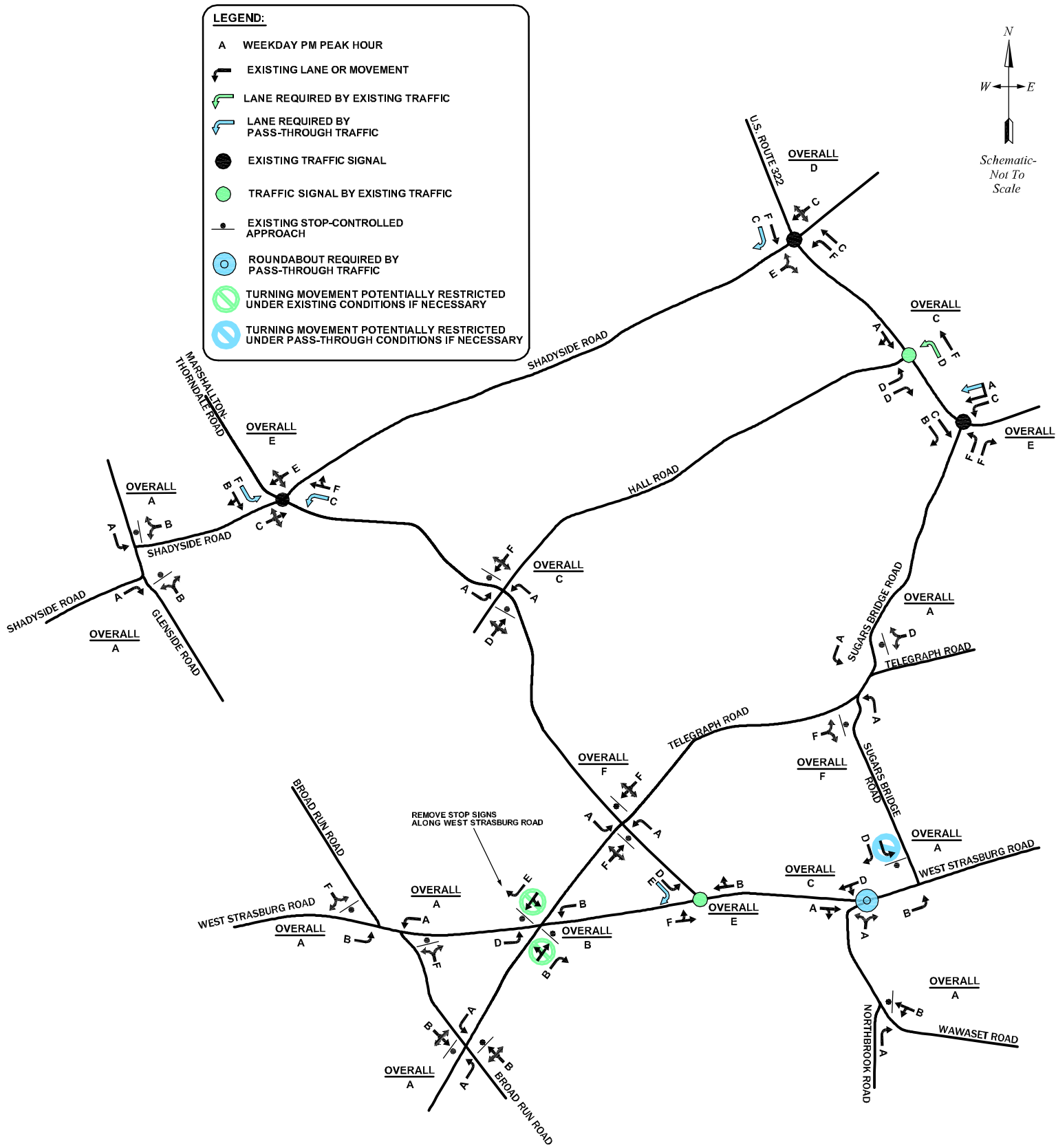


FIGURE 9B
 2030 Future Development Levels of Service - Southern Service Area
WEST BRADFORD TOWNSHIP
ACT 209 STUDY
 WEST BRADFORD TOWNSHIP, CHESTER COUNTY, PA



Table 10. Development Improvements

Int No.	Intersection	Service Area	Current Traffic Control	Recommended Capacity Improvements
1	West Chester Road and South Bailey Road	Western	Stop Sign	No improvements required or recommended.
2	Romansville Road/Stouff Road and West Chester Road	Western	Stop Sign	No improvements required or recommended.
3	West Chester Road/Broad Run Road and Embreeville Road	Western	Stop Sign	No improvements required or recommended.
4	Marshallton-Thorndale Road and Poorhouse Road	Western	Traffic Signal	Widen eastbound and westbound Poorhouse Road for separate left-turn lanes. Modify traffic signal timings.
5	Broad Run Road and Poorhouse Road	Western	Stop Sign	Widen westbound Poorhouse Road for a separate left-turn lane. Install stop signs on northbound and southbound Broad Run Road.
6	Chestnut Lane and Oakwood Road	Western	Stop Sign	No improvements required or recommended.
7	Romansville Road and Chestnut Lane	Western	Stop Sign	No improvements required or recommended.
8	Chestnut Lane and Lone Eagle Road	Western	Stop Sign	No improvements required or recommended.
9	Broad Run Road and Beacon Hill Road	Western	Stop Sign	No improvements required or recommended.
10	Broad Run Road and Chestnut Lane	Western	Stop Sign	No improvements required or recommended.
11	Romansville Road and Lone Eagle Road	Western	Stop Sign	No improvements required or recommended.
12	West Strasburg Road and Lone Eagle Road	Western	Stop Sign	No improvements required or recommended.
13	West Strasburg Road and Romansville Road/Shadyside Road/Stargazer Road	Western	Stop Sign	No improvements required or recommended.
16	Broad Run Road and Shadyside Road	Western	Stop Sign	No improvements required or recommended.
17	Broad Run Road and Lieds Road	Western	Stop Sign	No improvements required or recommended.
18	West Strasburg Road and Lieds Road	Western	Stop Sign	No improvements required or recommended.
19	Shadyside Road and Glenside Road (south)	Southern	Stop Sign	No improvements required or recommended.
20	Shadyside Road and Glenside Road (north)	Southern	Stop Sign	No improvements required or recommended.
21	Marshallton-Thorndale Road and Shadyside Road	Southern	Traffic Signal	Widen westbound Shadyside Road for a separate right-turn lane. Modify traffic signal timings.
22	U.S. Route 322 and Shadyside Road	Southern	Traffic Signal	Widen eastbound U.S. Route 322 for a second through lane, and northbound Shadyside Road for a separate left-turn lane. Modify traffic signal timings.
23	U.S. Route 322 and Hall Road	Southern	Traffic Signal	Widen westbound U.S. Route 322 for a second through lane. Modify traffic signal timings. <i>Widening eastbound U.S. Route 322 identified as another roadway deficiency not attributable to new development.</i>
24	Marshallton-Thorndale Road and Hall Road	Southern	Stop Sign	Install a traffic signal.
25	U.S. Route 322 and Sugars Bridge Road	Southern	Traffic Signal	Widen eastbound U.S. Route 322 for a second through lane. Modify traffic signal timings.
26	Telegraph Road and Sugars Bridge Road (north)	Southern	Stop Sign	No improvements required or recommended.
27	Telegraph Road and Sugars Bridge Road (south)	Southern	Stop Sign	Widen southbound Sugars Bridge Road for a separate right-turn lane. Install a traffic signal.
28	Telegraph Road and Marshallton-Thorndale Road	Southern	Stop Sign	Install a traffic signal.
30	West Strasburg Road and Broad Run Road	Southern	Stop Sign	Realign the northern leg of Broad Run Road to intersect West Strasburg Road opposite the southern leg of Broad Run Road. Install a traffic signal. <i>Widening and pavement upgrades on the southern leg of Broad Run Road between West Strasburg Road and Telegraph Road identified as another roadway deficiency not attributable to development.</i>
31	West Strasburg Road and Telegraph Road	Southern	Stop Sign	No improvements required or recommended.
32	West Strasburg Road and Marshallton-Thorndale Road	Southern	Traffic Signal	Widen eastbound Strasburg Road for a separate left-turn lane, and westbound Strasburg Road for a separate right-turn lane. Modify traffic signal timings.
33	West Strasburg Road and Northbrook Road	Southern	Stop Sign	No improvements required or recommended.
34	West Strasburg Road and Sugars Bridge Road	Southern	Stop Sign	No improvements required or recommended.
35	Northbrook Road and Wawaset Road	Southern	Stop Sign	No improvements required or recommended.
36	Telegraph Road and Broad Run Road	Southern	Stop Sign	No improvements required or recommended.

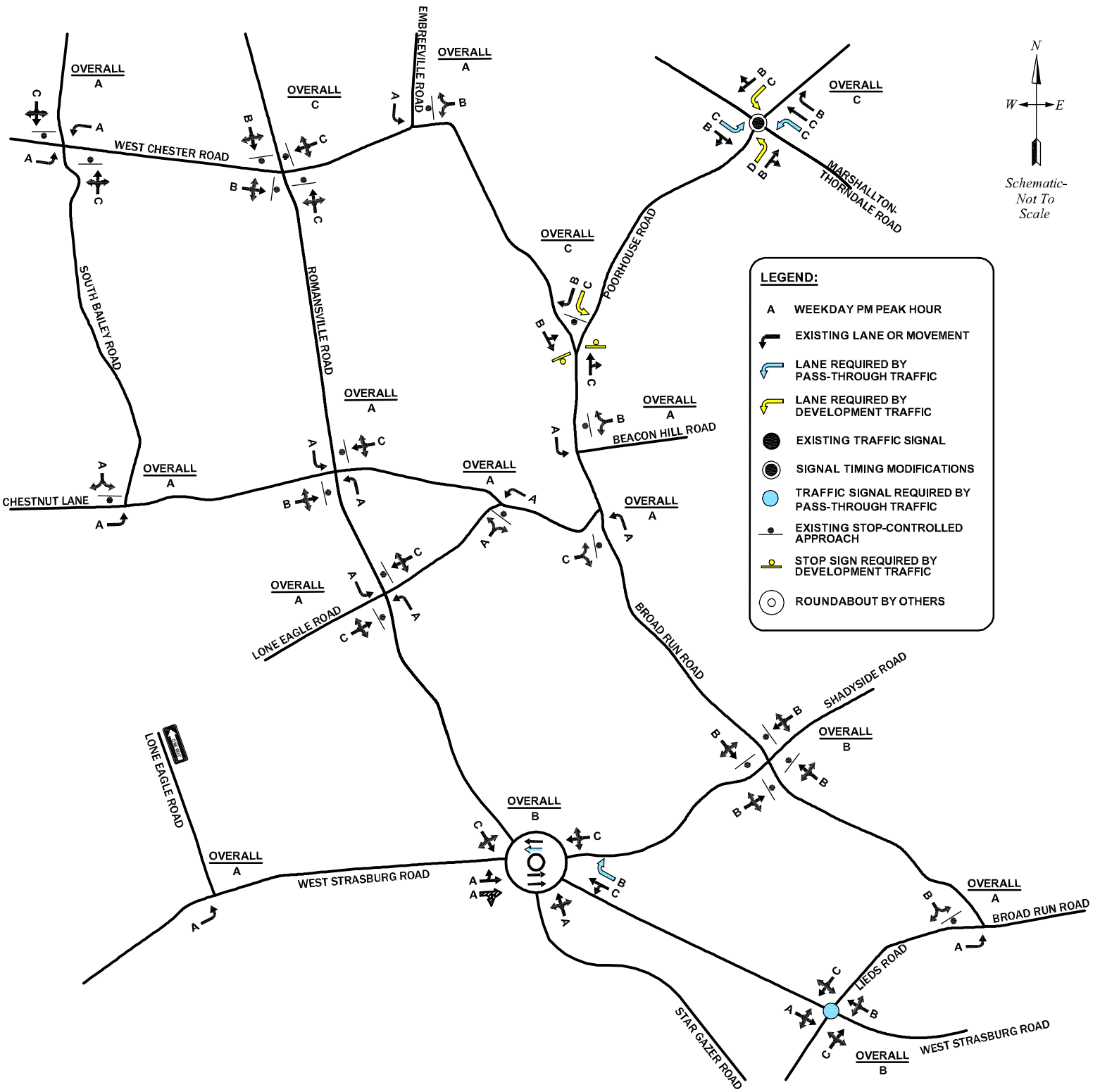


FIGURE 10A

2030 Future Development Levels of Service With Improvements - Western Service Area

WEST BRADFORD TOWNSHIP ACT 209 STUDY

WEST BRADFORD TOWNSHIP, CHESTER COUNTY, PA



(8/5/2014) I:eng/813041.dwg, Figure 10A.dwg

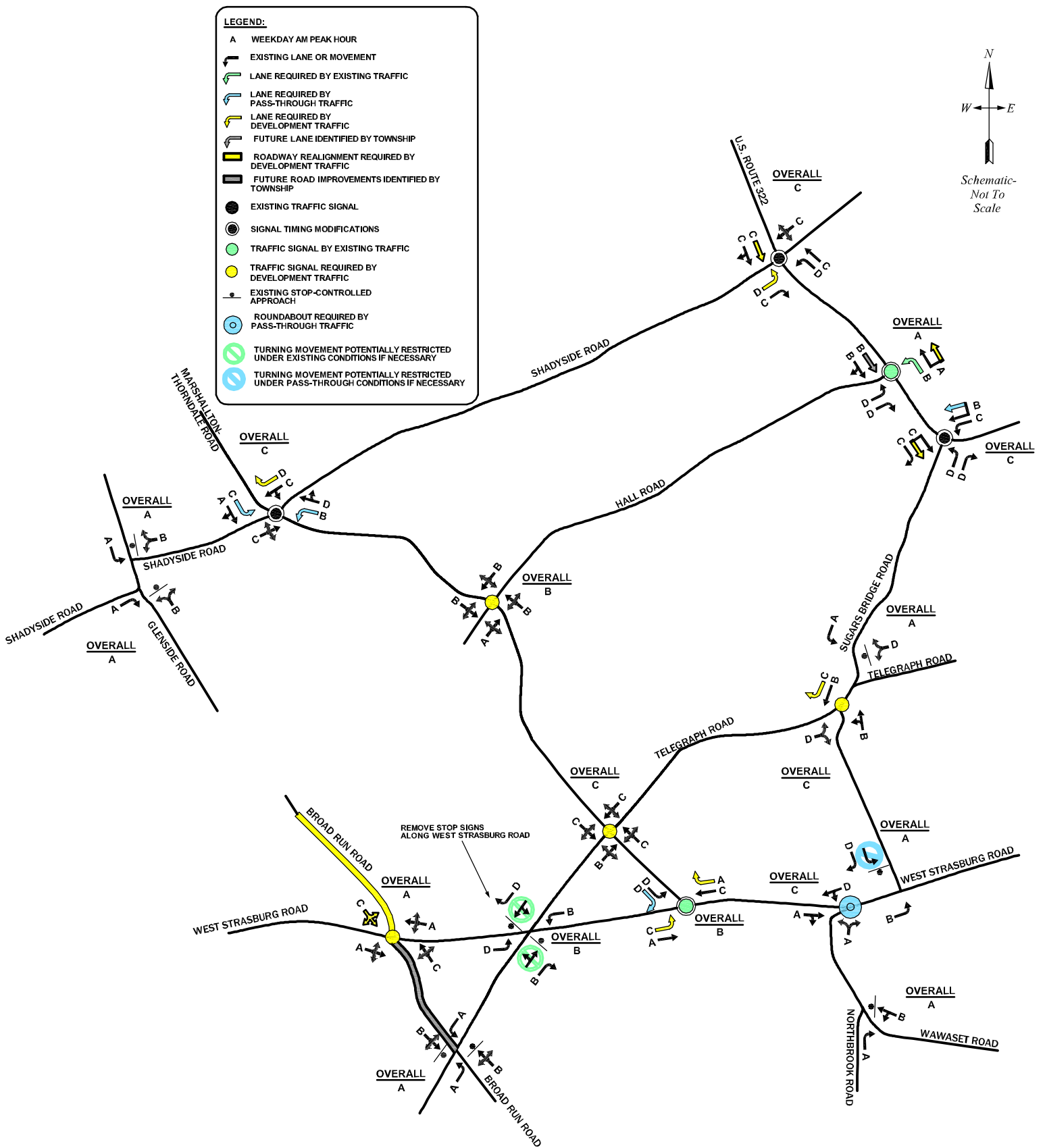


FIGURE 10B

2030 Future Development Levels of Service With Improvements - Southern Service Area

WEST BRADFORD TOWNSHIP ACT 209 STUDY

WEST BRADFORD TOWNSHIP, CHESTER COUNTY, PA

