

Preliminary Land Use Service (PLUS)
Comprehensive Plan Amendments and Municipal Ordinances

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Ordinance: _____

Other: _____

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Please describe the submission: The Town of Middletown is requesting an amendment to the Town of Middletown Comprehensive Plan to incorporate two master planned traffic studies into the transportation section of the plan. The two plans are entitled “Westown Circulation Concept Plan” and the “East Middletown Master Transportation Plan”.

Background

During the creation of the concept for Westown, the Town of Middletown, DelDOT and the developers within Westown created a mechanism for planning the ultimate traffic improvements needed for build-out. The goal was to have the needed traffic improvements designed and built ahead of development. The plan included a framework for developers to contribute their fair share of the overall cost. The Town realized that planned development on the east side of Town along Rt. 299 would also benefit from utilizing a strategy to master plan the needed traffic improvements similar to Westown. As a result, the Town worked with DelDOT and the developers on the east side of Town to prepare the East Middletown Transportation Plan. This plan mirrors the framework created for Westown.

Comprehensive Plan Amendment

Both traffic plans were created with developers that were present in the Town at the time the studies were being conducted. However, both areas have planned future development that will occur through annexation and re-development. Given this, the Town felt it would be necessary to ensure that future developers participate in the plans by paying their share of the cost based on their development's traffic impact. Therefore, the Mayor and Council of Middletown recently adopted an ordinance approving both traffic studies for inclusion into the Town's comprehensive plan. Inclusion into the comprehensive plan will help the Town to ensure that future annexations and re-development are required to comply with the recommendations of the traffic studies.

WESTTOWN

CIRCULATION CONCEPT PLAN

Prepared for:

Town of Middletown
Delaware Department of Transportation

Prepared by:

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June 2005



**McCormick
Taylor**
Engineers & Planners
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EXECUTIVE SUMMARY

The Westown Project is a public-private partnership that addresses the growth of the Town of Middletown on approximately 2500 acres of recently annexed land on the west side of town. The study area is expected to develop rapidly with new housing, commercial, office, and industrial facilities. In cooperation with the local developers, the Town of Middletown has taken the lead on coordinating infrastructure improvements required to serve the new developments, including transportation facilities and utilities. The Delaware Department of Transportation (DelDOT) is also a partner in the effort to ensure adequate transportation improvements were implemented in a timely manner, consistent with the planned development.

The planning, design, and implementation of infrastructure improvements within the study area is being carried out based on the Westown Master Plan. Following a Master Plan approach for an area such as this has many benefits. The Master Plan approach:

- Meets the goals of the Governor's Livable Delaware program by ensuring that development takes place in targeted growth areas, in coordination with transportation and other infrastructure improvements.
- Establishes a partnership between the Town of Middletown, Delaware Department of Transportation, other state agencies and developers in the coordination of land planning and infrastructure improvements on a larger and more meaningful scale.
- Provides for regional planning for recreational, educational and transportation facilities.
- Provides an opportunity to plan, design, engineer, and build a community, coordinating and scheduling residential, commercial, and recreational components together with the appropriate transportation and other infrastructure improvements.
- Reduces time and cost for all parties by:
 1. Consolidating traffic studies required by developers, rather than each developer conducting independent studies, resulting in an improved circulation system.
 2. Facilitating a program of transportation system improvements that can be developed comprehensively rather than in a piecemeal fashion, minimizing the need to construct and then reconstruct improvements at the same location.
 3. Allowing for the development and implementation of an integrated stormwater management program, comprehensively addressing stormwater issues as development and roadway improvements are considered together.

Westown Circulation Concept Plan

This report, the Westown Circulation Concept Plan, documents the traffic analysis conducted for this project, outlines the required transportation infrastructure improvements, and describes a schedule for implementation of these improvements. The document covers all Town of Middletown and DelDOT requirements for a traffic impact study.

The types of transportation improvements required in the study area include:

- **Improvements to existing state roadways:** includes addition of shoulders; roadway shifts and realignments; the addition of capacity including additional through lanes, turn lanes, and signalization; and drainage improvements.
- **Construction of internal development connector roadways:** these roadways will be built by individual property owners as the land develops, and will serve as cross circulation between land uses in the study area, thereby reducing the amount of traffic required to use existing state roadways.
- **Pedestrian facilities:** includes sidewalks along roadways, sidewalks within developments, and pedestrian signals as appropriate at signalized intersections.
- **Bicycle accommodations:** includes shoulders wide enough for bicycle usage, bicycle lanes in the appropriate locations at intersections, and the potential re-routing of Delaware Bicycle Route 1.
- **Transit facilities:** includes bus pull-outs and shelters strategically located within the proposed developments.

There are two main categories of the improvements summarized above and detailed in the body of the report: those to be implemented by individual developers and those implemented through state-sponsored projects. The state-sponsored projects are listed below:

Road	Limits	Completed In	Preliminary Construction Cost Estimate (May 24, 2005)
Bunker Hill Road	US 301 to Choptank Road	2006	\$2,096,000
Levels Road	US 301 to MOT Charter School	2006	\$3,315,000
US 301 Dualization	Peterson Road to Middle Neck Road	2008	\$24,293,000
St. Annes Church Road	Levels Road to Route 71	2009	\$2,875,000
St. Annes Church Road	Railroad Bridge	to be determined	\$4,000,000
Wiggins Mill Road	Green Giant Road to St. Annes Church Road	2010	\$1,766,000

The preliminary scopes of these projects are detailed in the body of the report. The exact implementation schedule of projects may change as sections are combined or broken into smaller sub-sections.

I. INTRODUCTION

A. Project History

In early 2003, the Town of Middletown and a group of landowners and developers on the west side of Middletown worked together to develop a Master Plan of proposed development and future land use. The goal of the Master Plan was to establish an orderly growth pattern that incorporated “smart growth” techniques, including higher density, mixed-use developments, a compact arrangement of streets and houses, a mixture of housing choices, preservation of farmland and natural resources, and internal multi-modal transportation connections allowing for efficient infrastructure and a better quality of life. Additionally, the Master Plan allowed for the close coordination with the Town for future services such as sewer and electrical improvements.

Later in 2003, the Town and developers approached the Delaware Department of Transportation (DelDOT) to become a partner in the effort. The goal of DelDOT’s participation was to ensure adequate transportation improvements were implemented in a timely manner, consistent with the planned development. Without DelDOT’s involvement as a partner in this process, each individual development would be required to perform a separate Traffic Impact Study, and would then be required to perform certain roadway improvements based on the result of that study. This would result in a piece-meal set of roadway improvements that could encourage sprawl and loss of natural resources. In addition, some of the potential improvements would be difficult to accomplish if studied separately due to right of way limitations. Therefore, DelDOT, the Town, and developers entered into an agreement, with each agreeing to the following responsibilities:

- **Developers:** contribute a set amount of money to the roadway improvement projects, donate required right-of-way for roadway improvements and utility relocations, provide shared stormwater management facilities for both development and roadway impervious areas, cooperate with the project team on issues such as development roadway connections, transit amenities (bus pull-offs), and bicycle/pedestrian connections.
- **Town:** coordinate overall planning effort, plan for and provide sewer and electrical service.
- **DelDOT:** oversee overall traffic analysis to determine required roadway improvements; prioritize and schedule roadway improvements; design, bid, and manage the construction of individual roadway projects and contribute funding for roadway improvements.

B. Project Description

This Circulation Concept Plan will serve as a guide for transportation improvements required as part of the Westown Master Plan, which encompasses approximately 2500 acres of proposed development. Proposed improvements to state roadways may include: widening for additional travel lanes, turn lanes, and shoulders; roadway realignments, intersection improvements, signalization, and multi-modal improvements. Several new, internal development roadway connections are planned, which will be integral in the cross-circulation of the various developments. Although not detailed in this report, coordination on relocation of existing utilities, location of new utilities, and development of shared stormwater management facilities is ongoing. Specific improvements are detailed on the following roadways included in the study area:

- US 301 (N443, Middletown-Warwick Road), from Peterson Road (N58) to Middle Neck Road (N444)
- Bunker Hill Road (N437), from US 301 to Choptank Road (N435)
- Main Street (N438), from US 301 to Industrial Boulevard
- Levels Road (N10), from US 301 to the MOT Charter School
- St. Annes Church Road (N447), from Route 71 (N14) to Levels Road
- Wiggins Mill Road (N446), from St. Annes Church Road to Green Giant Road (N458)

Figure 1 shows the project location area with relation to the entire Town of Middletown. **Figure 2** shows an aerial view of the study area. **Figure 3** shows the Westown Master Plan as of the summer of 2004.

C. Area DeIDOT Projects

DeIDOT currently has many other roadway and intersection improvements in progress in the Southern New Castle County Area. **Figure 4** graphically depicts the location of these projects as well as the approximate schedule of each.

Currently DeIDOT is in the beginning stages of the Project Development process to determine long range transportation improvements needed along US 301 from the Maryland state line to the I-95 corridor. This effort is expected to result in the preparation of an Environmental Impact Statement. An origin-destination study has been conducted and a Purpose and Need Report defining the project has been completed. The two alternatives that are being studied for US 301 in the Westown area include a potential future US 301 Expressway along the western edge of the Westown developments called the Ridge Alignment and a local expressway alternative along the existing US 301. For the purposes of this study one traffic model option will

WESTOWN

CIRCULATION CONCEPT PLAN

Legend

- Municipalities
- Study Area Limits
- US/State Numbered Routes

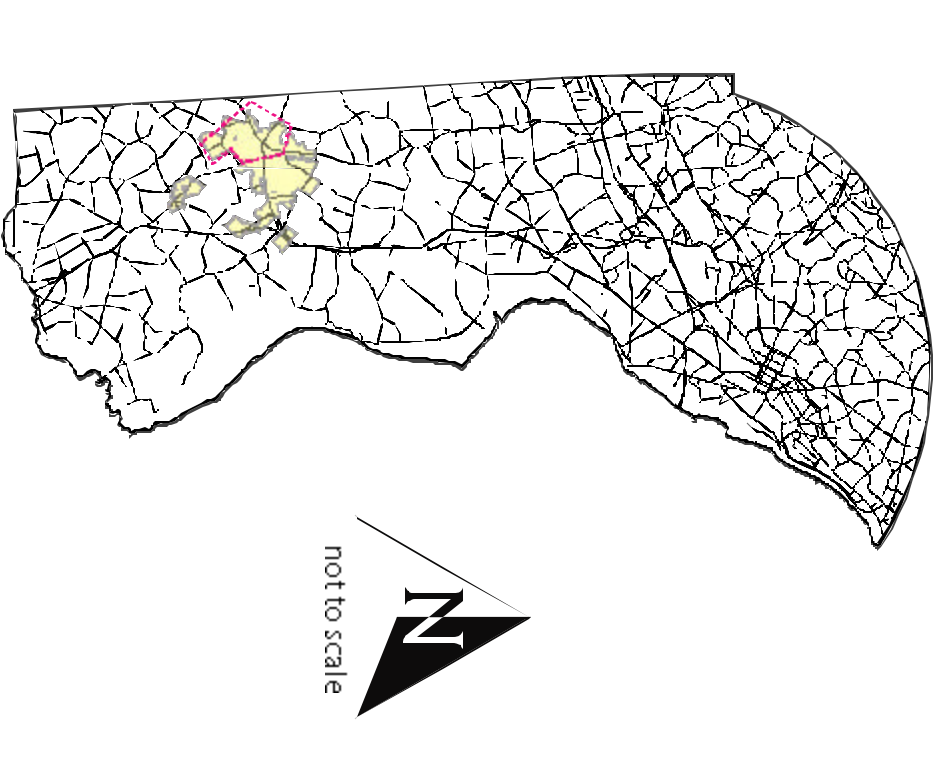
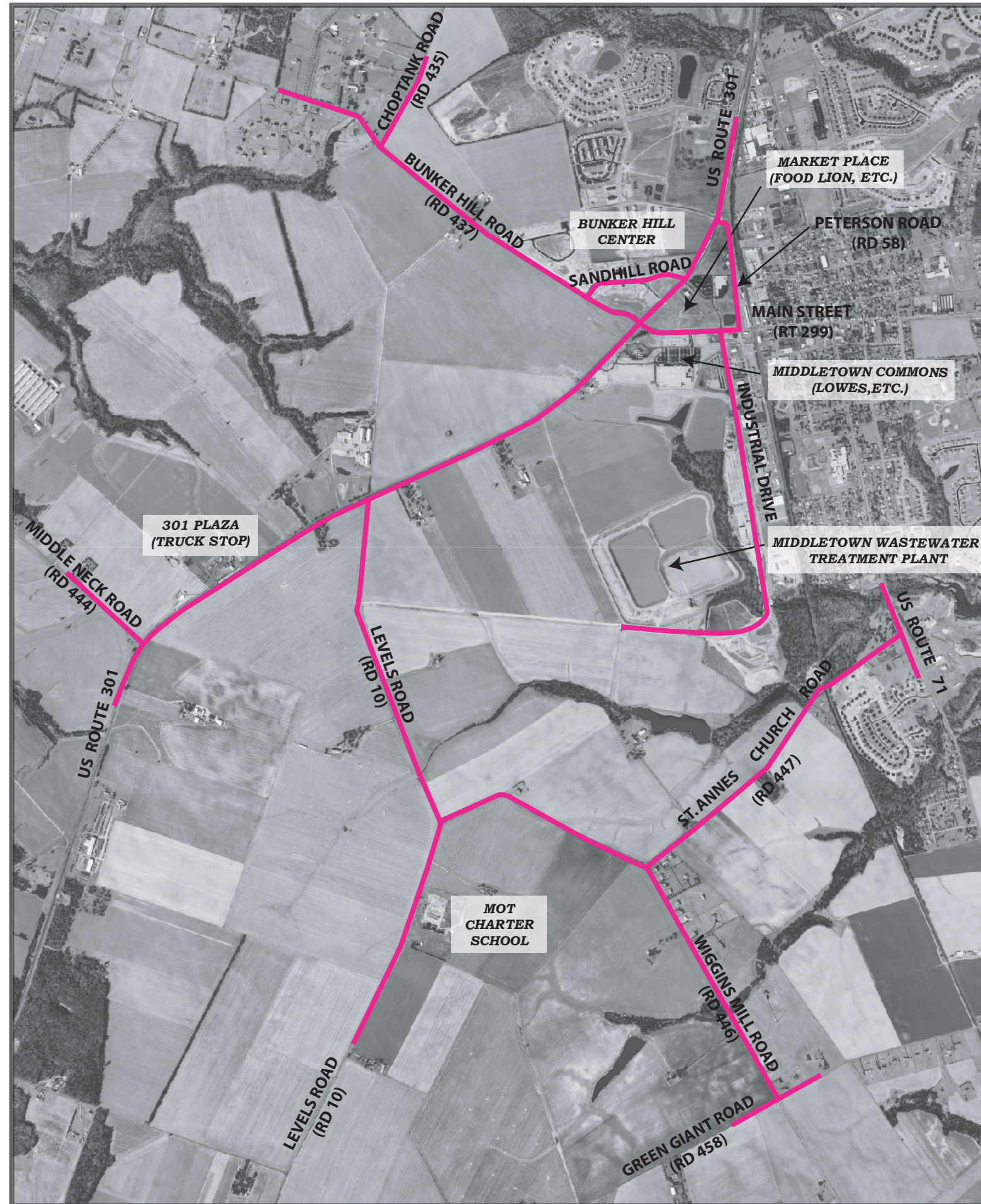
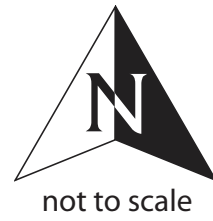


Figure 1

Project Location Map



WESTTOWN

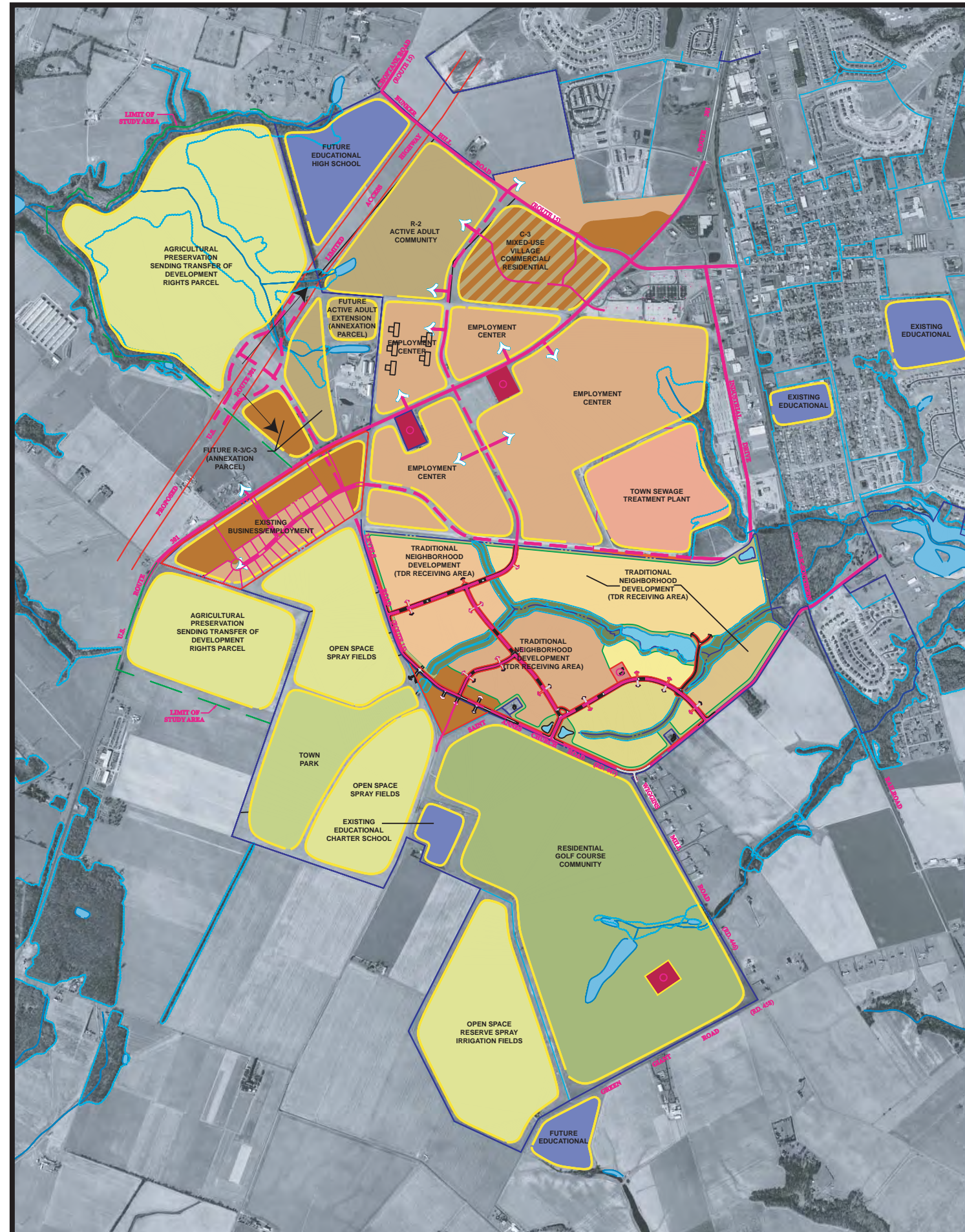
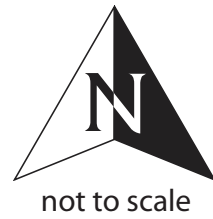
CIRCULATION CONCEPT PLAN

Legend

- Existing Roads Within Study Area

Figure 2

Aerial Map of Study Area

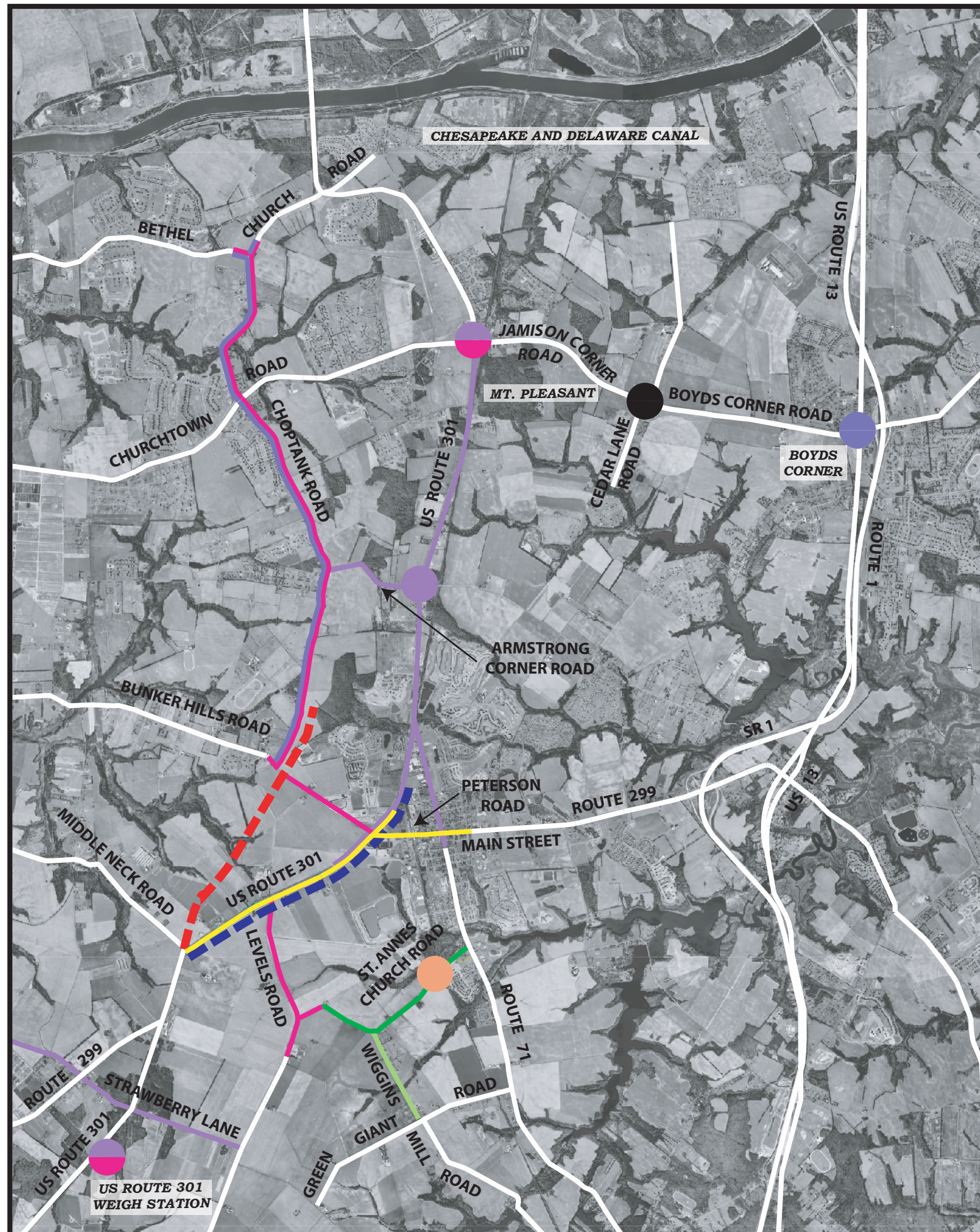
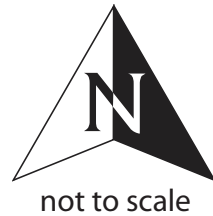


WESTTOWN

CIRCULATION CONCEPT PLAN

Figure 3

Westtown Master Plan, Summer 2004



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Legend

- Year 2005 Construction
- Year 2006 Construction
- Year 2007 Construction
- Year 2008 Construction
- Year 2009 Construction
- Year 2010 Construction
- Railroad Bridge
- — Potential US 301 expressway alignments in the vicinity of Westtown
- — Undetermined Timeline

Note: The US Route 301 project development study is currently examining several alternatives, including both upgrades to existing facilities and new alignments. For more information see: www.deldot.gov/static/projects/US301/index.html

Figure 4

Southern New Castle County
Roadway Projects

consider the traffic impacts of a future US 301 bypass along the Ridge Alignment with a likely interchange at Levels Road. The origin-destination study will aid in determining the expected usage of a limited access roadway from the existing US 301 to Route 1. This preliminary data was used by McCormick Taylor to determine the amount of traffic that could be expected to use the potential limited access roadway.

Other projects in the southern New Castle County Area are listed below.

1. Intersections Projects

- Jamison Corner Road & Cedar Lane Road – realignment of offset intersection
- Boyds Corner and Mt. Pleasant Intersections (US 13 & Route 896, and US 301 & Route 896) – operational improvements including additional NB & SB through lanes and additional left turn on EB Boyds Corner Road
- Armstrong Corner Road & US 301 – new traffic signal installation to be installed in advance of Choptank Road Detour

2. Roadway Projects

- Choptank Road from Bunker Hill Road to Bethel Church Road – 5 mile reconstruction including three roundabouts
- Armstrong Corner Road between US 301 and Choptank Road – mill and overlay to sustain detour traffic from Choptank Road reconstruction
- Route 299 Streetscaping from Wood Street to Catherine Street

3. Pave and Rehabilitation Projects

- US 301 from Bunker Hill Road to Mt. Pleasant Road
- Route 71 from Cedar Lane to Route 299
- Strawberry Lane from Maryland State Line to Levels Road

4. Other Projects

- The US 301 Truck Weigh Station – construction of weigh station near the MD line for eastbound lanes
- St. Annes Church Road Bridge (over Norfolk Southern) – construction of a new bridge along with horizontal and vertical realignments

II. EXISTING CONDITIONS

A. Land Use

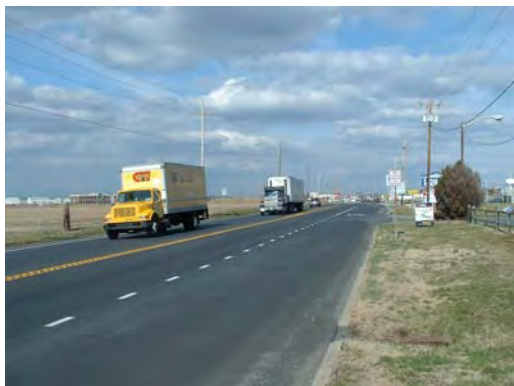


Looking north at St. Annes Church Road, east of Wiggins Mill Road

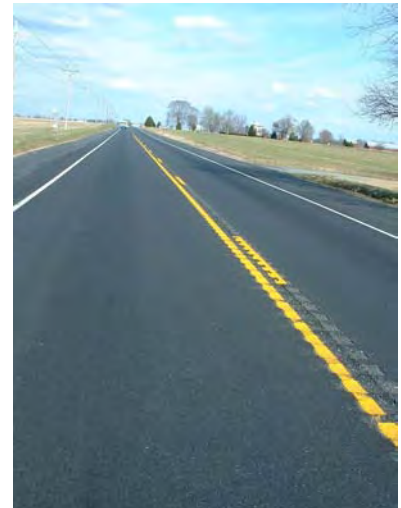
The land use in the study area is predominantly agricultural, as can be seen in the aerial photograph (**Figure 2**). Some of the non-agricultural uses include an area of commercial and office development at the intersection of US 301 & Bunker Hill Road/Main Street, industrial development along Industrial Boulevard, a few residential properties, and two commercial establishments on US 301 south of Levels Road.

B. Roadway Conditions

US Route 301 currently has one 12' travel lane in each direction with 8' shoulders. The section of roadway north of the intersection with Bunker Hill Road is divided by a concrete median of varying width. Left turn lanes currently exist for the two development entrances north of the intersection with Bunker Hill Road. Left and right turn lanes are present for all approaches at the intersection of US Route 301 & Bunker Hill Road. South of Bunker Hill Road, DelDOT has installed centerline rumble strips to reduce the possibility of head-on accidents.



US 301, looking north towards Bunker Hill Road



US 301, looking north, north of Levels Road

Main Street currently consists of a varying typical section from Peterson Road to US Route 301 due to the closely spaced intersections along the roadway. The roadway has one travel lane in each direction. Main Street within the study area (approximately 1900 feet) has three intersections – the Middletown Commons and Market Place shopping centers, Industrial Drive and Peterson Road.



Main Street, looking west from US 301



Bunker Hill Road, looking east towards US 301

Bunker Hill Road has one 10' travel lane in each direction and no shoulders. In addition to its intersection with US 301, three additional intersections exist along Bunker Hill Road within the study area. These intersections are Sandhill Road, Sleepy Hollow Road and Choptank Road. Each intersection is currently a t-intersection with stop control on the minor street approach. A separate DelDOT project will make improvements to the Bunker Hill Road/Choptank Road intersection, converting it to a roundabout and adding a fourth approach for access to the proposed high school.

Levels Road has one 11' travel lane in each direction and no shoulders within the study area and intersects with US 301 at a skewed angle. There is one culvert located on Levels Road that has substandard width for existing traffic and encroaches on the clear zone. The existing intersection geometry of Levels Road & St. Annes Church Road can be confusing to motorists and has more conflict points than necessary for a 3-way intersection.



Culvert on Levels Road, looking northeast



Intersection of Levels Road and St. Annes Church Road, looking east on St. Annes Church Road

St. Annes Church Road has one 10' travel lane in each direction and no paved shoulders or pavement markings. The intersection of St. Annes Church Road & Wiggins Mill Road is a "T" intersection with no clearly identified through movement. Currently there are two substandard curves along St. Annes Church Road located approximately 1200 feet east of the intersection with Levels Road and St. Annes Church Road. There is one railroad bridge along St. Annes Church Road (west of Route 71) that currently has several substandard features (lane width, lack of shoulders, horizontal curvature and grade). DelDOT is currently working with Norfolk Southern regarding improvements to the bridge. The intersection of St. Annes Church Road & Route 71 has a southbound right turn lane and a northbound bypass lane along Route 71 and a stop controlled eastbound approach along St. Annes Church Road.

Wiggins Mill Road has one 10' travel lane in each direction and no shoulders. Pavement markings only appear near the intersection of Green Giant Road. The intersection with Green Giant Road is four-way stop controlled. There is a substandard one-lane culvert located on the roadway with parapet walls in the clear zone. The culvert also has weight restrictions and is in need of repair.



Culvert on Wiggins Mill Road, looking north

C. Traffic Conditions

1. Traffic Patterns & Volumes

US 301 serves the dual purposes of a regional transportation corridor and local access roadway. Regionally, US 301 serves as a southwest-northeast connection from the southern Baltimore, Maryland area and Washington D.C. to Wilmington, Delaware; Philadelphia, Pennsylvania; and New Jersey. Although the travel time on this route is generally longer than that on Interstate 95, the toll charges are significantly less. This contributes to the high truck percentage through the study area (varying from 15 to 24 percent depending on the location and time of day). Through its entire length in Maryland, US 301 is a four-lane roadway (two lanes in each direction), with no signalized intersections from the Chesapeake Bay to the Delaware state line. When traveling northeast from the Washington D.C. area on US 301, the intersection with Bunker Hill Road / Main Street is the first traffic signal encountered in over 70 miles.

Local access on US 301 is relatively minimal from the Maryland/Delaware state line to Bunker Hill Road / Main Street. Near this intersection, commercial, business, and industrial land uses and access to US 301 have increased significantly in recent years. There are several unsignalized access points with full or partial access in this portion of the study area.

Main Street (Route 299) is the primary east-west roadway in the area, which connects US 301 to Route 1 east of Middletown. It also serves regional traffic, and is the main east-west local access street through downtown Middletown. Annual Average Daily Traffic (AADT) volumes for US 301, Main Street, and each of the other state roadways within the study area are shown in **Table 1**.

Table 1 – Annual Average Daily Traffic

Roadway	2003 AADT
US 301	14,400
Main Street (Route 299)	10,100
Bunker Hill (Route 15)	1,400
Levels Road	1,500
St. Annes Church Road	400
Wiggins Mill Road	400
Route 71 (Broad Street)	7,500
Middle Neck Road	500

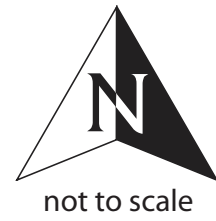
Source: 2003 DelDOT Traffic Summary

For roadway design purposes, peak hour turning movement counts are required. **Table 2** lists the intersections for which peak hour turning movement count data was gathered, when the data was gathered, and the source of the data.

Figure 5 shows the location and year of each intersection turning movement count. To obtain 2004 base conditions, volumes gathered by McCormick Taylor were seasonally adjusted based on DelDOT adjustment factors, while volumes collected by others (previously seasonally adjusted) were projected to 2004 using the growth rates provided by DelDOT (**Appendix A**). Additionally, some adjustments were made to the data due to volume imbalances, based on knowledge of the area, distance between intersections, number of mid-block access points, etc. See **Figures 6 & 7** for 2004 AM and PM peak hour turning movement volumes.

Table 2 – Traffic Count Information

Intersection	Date	Count Times	Source
US 301 & Peterson Road	10/27/2004	AM – 7:00 to 9:00 PM – 3:30 to 6:30	McCormick Taylor
US 301 & Sandhill Road	10/27/2004	AM – 7:00 to 9:00 PM – 3:30 to 6:30	McCormick Taylor
US 301 & Food Lion Access	11/22/2004	AM – 7:00 to 9:00 PM – 3:30 to 6:30	McCormick Taylor
US 301 & Bunker Hill/Main Street	10/27/2004	AM – 7:00 to 9:00 PM – 3:30 to 6:30	McCormick Taylor
US 301 & Wawa Access	10/27/2004	AM – 7:00 to 9:00 PM – 3:30 to 6:30	McCormick Taylor
US 301 & Lowes Access	10/27/2004	AM – 7:00 to 9:00 PM – 3:30 to 6:30	McCormick Taylor
US 301 & Levels Road	12/04/2002	AM – 6:00 – 9:00 PM – 3:30 – 6:00	Karins & Associates
US 301 & Truck Plaza	12/03/2002	AM – 6:00 – 9:00 PM – 3:30 – 6:00	Karins & Associates
US 301 & Middle Neck Road	10/27/2004	AM – 7:00 to 9:00 PM – 3:30 to 6:30	McCormick Taylor
Bunker Hill Road & Sandhill Road	10/27/2004	AM – 7:00 to 9:00 PM – 3:30 to 6:30	McCormick Taylor
Bunker Hill Road & Choptank Road	6/7/2000	AM–7:00 to 12:00 PM–12:00 to 7:00	McCormick Taylor
Main Street & Shopping Center Access	11/22/2004	AM – 7:00 to 9:00 PM – 3:30 to 6:30	McCormick Taylor
Main Street & Industrial Drive	10/27/2004	AM – 7:00 to 9:00 PM – 3:30 to 6:30	McCormick Taylor
Levels Road & Charter School	10/27/2004	AM – 7:00 to 9:00 PM – 3:30 to 6:30	McCormick Taylor
St. Annes Church Road & Wiggins Mill	10/27/2004	AM – 7:00 to 9:00 PM – 3:30 to 6:30	McCormick Taylor
St. Annes Church & Levels	6/11/2002	AM – 6:30 – 9:00 PM – 4:00 – 6:30	Ramesh C. Batta
St. Annes Church Road & Route 71	10/27/2004	AM – 7:00 to 9:00 PM – 3:30 to 6:30	McCormick Taylor
Wiggins Mill Road & Green Giant Road	6/11/2002	AM – 6:30 – 9:00 PM – 4:00 – 6:30	Ramesh C. Batta



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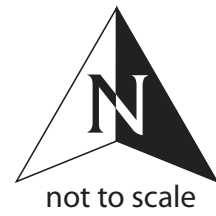
CIRCULATION CONCEPT PLAN

Legend

- Existing Roads Within Study Area
- 2000 Data
- 2002 Data
- 2004 Data

Figure 5

Traffic Count Locations and Year



WESTOWN

CIRCULATION CONCEPT PLAN

Legend

— Existing Roads

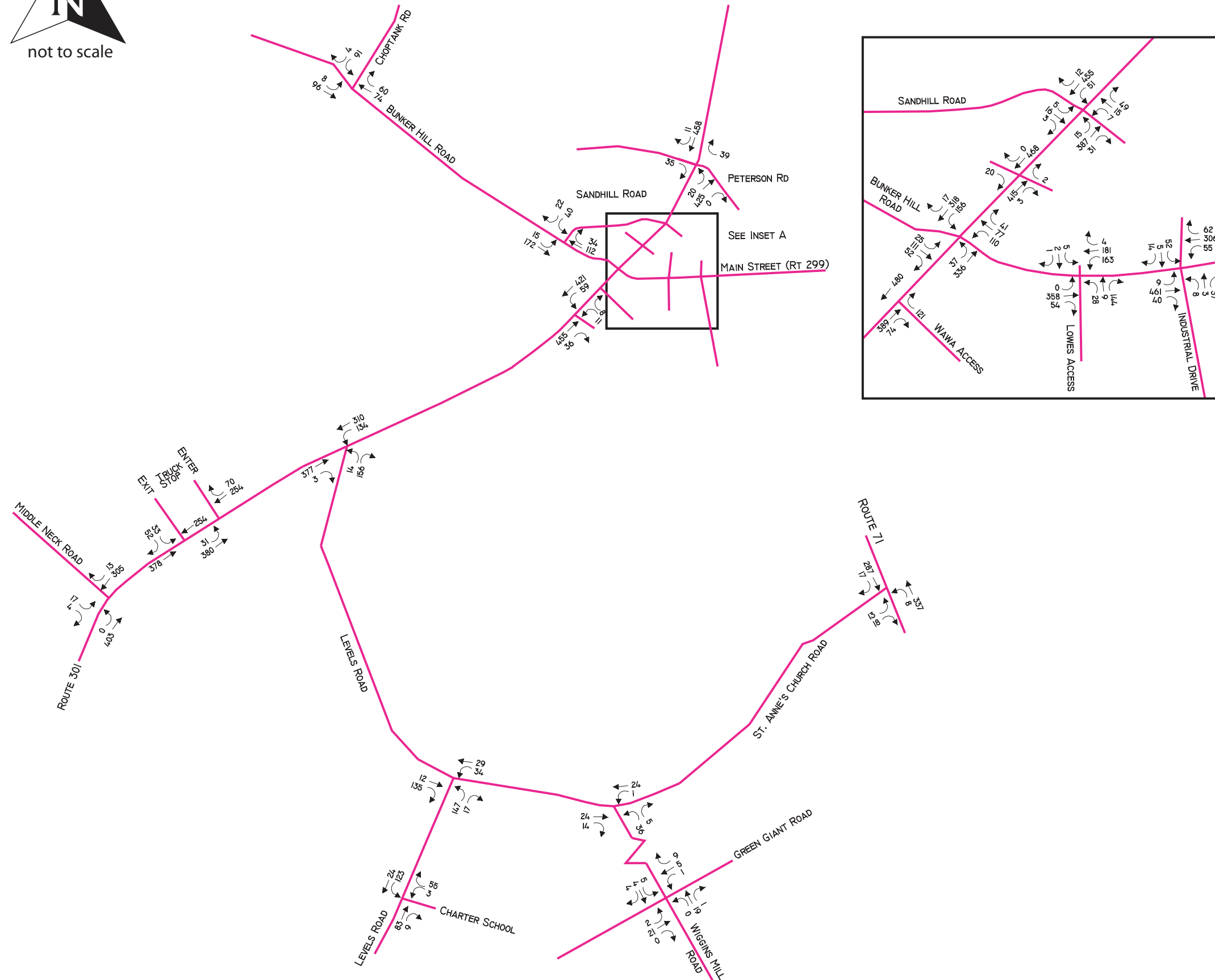
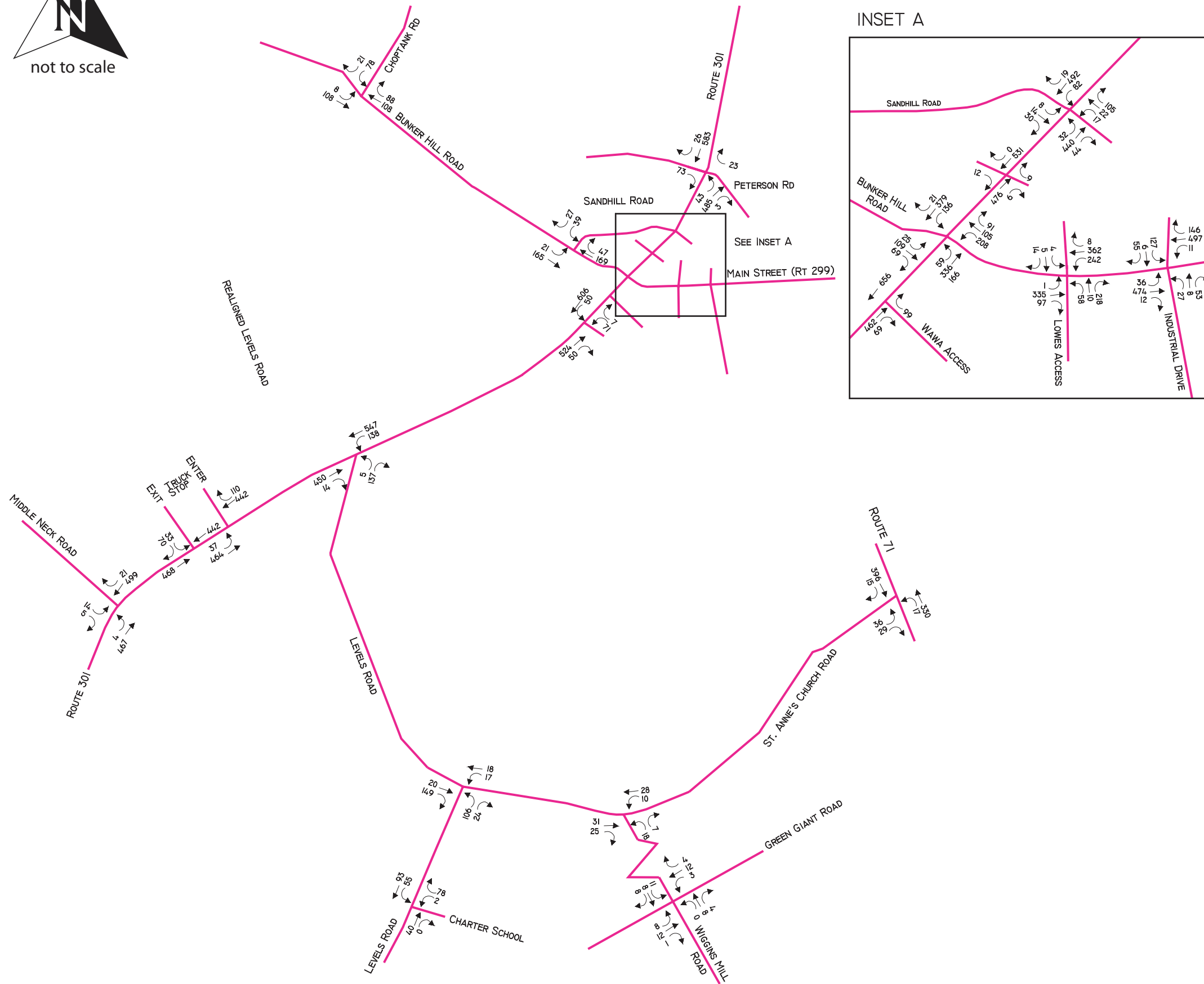
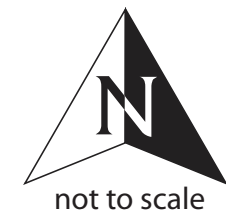
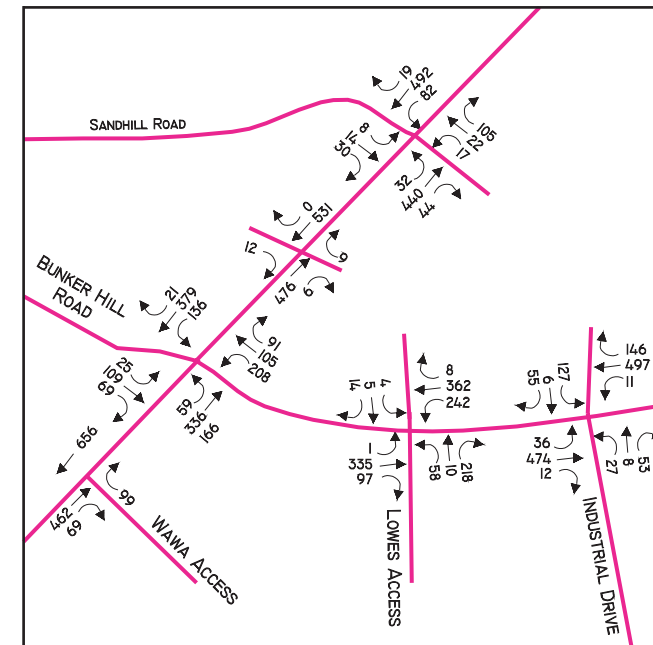


Figure 6

2004 Existing Volumes
AM Peak Hour Volumes



INSET A



WESTTOWN

CIRCULATION CONCEPT PLAN

Legend

— Existing Roads

Figure 7

2004 Existing Volumes
PM Peak Hour Volumes

2. *Level of Service (LOS) Analysis*

This Circulation Concept Plan Report was prepared in a manner generally consistent with DelDOT's Rules and Regulations for Subdivision Streets. It includes all of the information and analysis normally included in a traffic impact study. Traffic analysis was conducted based on the methodology established in the *2000 Highway Capacity Manual* that describes the operation of an intersection controlled by a traffic signal or a stop sign. SYNCHRO Version 6 is a complete software package for modeling traffic operations that was used to analyze the intersections in the study area.

It should be noted that DelDOT, in cooperation with local governments, frequently does not consider delay at unsignalized intersections as a measure of whether the transportation system can handle the traffic created by proposed developments. The best example of this is guidance in New Castle County's Unified Development Code. The LOS information provided for unsignalized intersections is for comparison purposes only; however, it did help the project team in assessing whether new signals at intersections were warranted.

Table 3 details the existing LOS for each intersection as well as the corresponding intersection delay. These results are based on existing field conditions, without any improvements. For unsignalized intersections, LOS is reported for the worst approach only. Level of service definitions and detailed information regarding all approaches and all study area intersections is available in **Appendix B**. Existing level of service analysis reflected that the signalized intersection of US 301 & Bunker Hill operates at LOS C during its PM peak period. This was also reflected in our observations during traffic data collection. Worse operations are known to occur at this intersection during other times of the year (particularly summer weekends). However, for this study, it was decided that the "design volumes" would be based on the annual average peak, rather than a worst case summer peak. It is standard practice to utilize design volumes less than the maximum expected volumes, so that the roadway improvements will not be "over-designed" to accommodate the traffic present during only a small percentage of the time.

Some stop controlled approaches that were observed to have less than desirable levels of service or delays included the eastbound and westbound approaches of Sandhill Road on either side of US 301, the Lowes access & US 301, and the northbound approaches at both Industrial Drive and Middletown Commons, the Shopping Center along Main Street. Crossing US 301 to the Market Place (Food Lion) shopping center (WB) and the Bunker Hill Center (EB) is difficult to motorists. Gaps are infrequent and oftentimes, traffic on the side street backs up. At the Lowes access & US 301, many trucks and other vehicles make lefts out of the shopping center, even though they are currently prohibited. Along Main Street, gaps are infrequent and conflicts are high, causing motorists to have difficulty in turning onto Main Street both from Industrial Drive and the shopping center accesses. This was observed the day of traffic data collection and was reflected in the subsequent traffic analysis.

Table 3 – 2004 Existing Level of Service

INTERSECTION	Control Type	AM Peak		PM Peak	
		LOS	MOE	LOS	MOE
US 301 & Peterson Road/Doc Levinson Road	unsignalized	B	12.3	B	14.6
US 301 & Bunker Hill Road	signalized	B	0.45	C	0.51
US 301 & Sandhill Road/Market Place	unsignalized	D	31.5	F	60.3
US 301 & Wawa Entrance	unsignalized	B	13.3	B	13.9
US 301 & Lowes Entrance	unsignalized	C	21.2	F	163.5
US 301 & Levels Road	unsignalized	C	16.6	C	16.6
US 301 & Truck Stop Exit	unsignalized	B	12.9	C	16.5
US 301 & Middle Neck Road	unsignalized	B	14.9	C	19.4
Bunker Hill Road & Choptank Road	unsignalized	B	10.8	B	11.3
Bunker Hill Road & Sandhill Road	unsignalized	B	11.0	B	11.8
Main Street & Middletown Commons	unsignalized	D	31.9	E	38.6
Main Street & Industrial Drive	unsignalized	D	34.0	F	280.8
St. Annes Church Road & Levels Road	unsignalized	A	9.5	A	9.2
Charter School & Levels Road	unsignalized	A	9.3	A	9.0
St. Annes Church Road & Wiggins Mill Road	unsignalized	A	8.9	A	9.1
St. Annes Church Road & Route 71	unsignalized	B	12.6	C	17.0
Green Giant Road & Wiggins Mill Road	unsignalized	A	7.3	A	7.1

NOTE: For unsignalized analyses, the measure of effectiveness (MOE) shown in the table is the delay on the worst approach at the intersection; for signalized intersections, the MOE shown in the table is the X-critical value, a composite volume-to-capacity ratio.

3. Accident Analysis

Accident data was collected for the study area for the period from May 2001 to April 2004. During that period, 92 accidents were reported in the study area. Fifty-two accidents were reported along US 301 (56% of total accidents), 19 were reported along Main Street (21%) and 9 accidents were reported along Bunker Hill Road (10%). The remainder of the accidents were reported on Levels Road (6 accidents), St. Annes Church Road (3 accidents) and Wiggins Mill Road (3 accidents). Along US 301, 22 out of 52 accidents were reported within approximately 630 feet (0.12 mile) of the intersection of US 301 & Bunker Hill Road. Most of the accidents along US 301 were rear-end or angle accidents.

Three fatal accidents were reported between 2002 and 2004 (one each year). Two occurred along US 301 between Middle Neck Road and Levels Road and one at the intersection of US 301 & Levels Road. In 2004, the rear-end fatal accident occurred south of the intersection of US 301 & Levels Road as a vehicle was attempting to make a left into 301 Plaza from northbound US 301. The accident occurred during the daylight hours and no adverse weather conditions were reported at the time of the

accident. In 2003, the accident occurred just south of intersection of US 301 & Levels Road and involved a tractor-trailer and a passenger vehicle driving left of center. The accident that occurred in 2002 also involved a tractor-trailer and a passenger vehicle that traveled left of center along northbound US 301. Substance abuse was involved. This accident also occurred close to the intersection of US 301 & Levels Road.

Accident rates were calculated for the sections of Main Street, Bunker Hill Road and US 301 within the study area. These were compared to the statewide and New Castle County accident rates for the corresponding roadway classification. All three roadways had accident rates below the average state and county rates for their corresponding roadway designation.

Table 4 – Accident Rates

Roadway	RATE	Statewide Rate	New Castle County Rate
US 301	1.26 acc/mvmt	1.77 acc/mvmt	2.06 acc/mvmt
Bunker Hill	1.04 acc/mvmt	2.04 acc/mvmt	2.36 acc/mvmt
Main Street	3.21 acc/mvmt	3.97 acc/mvmt	4.58 acc/mvmt

NOTE: acc/mvmt = accidents per million vehicle miles traveled

Appendix C contains detailed summary information regarding the accidents along US 301, Bunker Hill Road and Main Street as well as a bar graph indicating where the most accidents occurred along US 301.

4. Existing Pedestrian, Bike and Transit Facilities

Please see **SECTION V**, Multi-Modal Considerations for a description of existing pedestrian, bike and transit facilities located within the study area.

III. Proposed Development

The Town of Middletown and each of the owners/developers in the study area were consulted on their development plans, including the location, size and type. Continuing coordination throughout the process was intended to accurately reflect realistic proposals. **Table 5** and **Figure 8** describe the proposed developments at the time this analysis was conducted. As noted in **Figure 8**, some development plans are finalized and in construction (e.g. Estates at St. Annes), while others are merely conceptual at this time.

A 2006 interim analysis was conducted in order to determine what improvements are needed in the short-term. Again, the Town of Middletown, each of the developers/owners and the consultants met regarding the development plans for 2006. A consensus was reached as to what was reasonable to assume would be constructed by 2006. The project team agreed upon these 2006 development assumptions in order to evaluate interim intersection and roadway improvements that would be needed prior to the full implementation of roadway improvements needed by 2011.

Developments expected to be operational/occupied by 2006 include the following:

- Middletown - Levels Business Park: 13 acres
- Southridge: 50 restricted age homes, 50 town homes and 9,000 sq. ft. of retail
- Auto Mall Facility: 48,000 sq. ft. of auto mall space
- Kohl Property: 210,000 sq.ft. of Walmart and misc. retail
- Westown Village: 50 single family detached homes
- Estates at St. Annes: 200 single family homes

Locations of these partial developments can be determined by referencing **Table 5** and **Figure 8** as described above.

Table 5 – Proposed Developments

#	DEVELOPMENT	DESCRIPTION	SIZE
1	Educational Campus	High School, Middle School, Elementary School and Daycare	Approximately 2850 students
2	Middletown-Levels Business Park	Manufacturing/Industrial Park	100 acres
3 & 4	Southridge	Active Adult Community, Townhouses, and retail	622 dwelling units, 310,000 SF of retail
5	Bunker Hill Center	Mixed use office park with some commercial	10,600 SF of Manufacturing 245,400 SF of Office 71 room Hotel 11,400 SF of restaurant
6	Auto Mall Facility	Auto Mall, Home Depot, misc. retail and Industrial property	210,000 SF Auto Mall 398,000 SF of retail (including Home Depot) 54 acre industrial property
7	Kohl Commercial Property	Wal-Mart, misc. retail, office space and hotels	460,000 SF of retail (including Wal-Mart) 250,000 SF of office 550 rooms of hotel
8	Kohl Industrial Center	Light Industrial	500 employees
9	Cochran Farm Property	Retail/commercial, possible relocation of liquor store, office space	relocation of existing 10,000 SF liquor store 10,000 SF of general retail 25,000 SF of office space (farm house property)
10	Westown Development	Single Family Homes, Age Restricted Community, Town homes, Offices, future retail area/town center	1000 single family detached homes 260 units of duplex restricted age community 540 town homes 30,000 SF of office space 30,000 SF of town center retail
11	Estates at St. Annes	Single Family Homes and Golf Course	1000 single family detached homes, 18 hole golf course
12	Town Park	Town Park	100 acres
13	Ramunno Property	Expansion of Food Lion Shopping Center	240,000 SF of retail
14	Future Recreational Space	Possible ball fields for adjacent educational campus	100 acres
15	Future Goldey Beacom Campus	Full college campus	500 students by 2011
16	Commercial	Commercial including Pharmacy and Ice Cream Parlor	40,500 SF of retail
17	Remaining Middletown Commons	Misc. Retail	29,600 SF of retail



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IV. Future Conditions

A. Traffic Projections

1. Trip Generation

Trips were determined for each development by using the *ITE Trip Generation* report (7th Edition). Future 2011 traffic volumes were then calculated by projecting 2004 traffic volumes to the year 2011 using the growth rates provided by DelDOT (**Appendix A**) and adding development-specific trips. Trips were generated for each development described previously in the **Proposed Development** section and distributed throughout the study network. Pass-by trips, internal trips, study area trips and external trips were determined before distributing the trips throughout the network. These terms are described below:

Pass-by trips: Trips that are not new to the study area. These are existing trips that are accessing a new development and then continuing along their original path. Although these trips do not add traffic to the system, they are reflected by an increase in turn movements and a decrease in through movements at site access points.

Internal Trips: Internal trips are trips that occur entirely within a new development (the motorists' origin and destination both occur within the same development). These trips are not included in the overall trips generated for the project area and do not show up as new trips. Developments that have internal trips are developments that have a combination of residences, retail and/or offices all within the same parcel of land.

Study area trips: Study area trips are applicable to a master plan type of study such as this Westown Circulation Concept Plan. For example, if a trip originates from Estates at St. Annes (residential) and heads for Walmart (retail) along US 301 or the offices in Bunker Hill Center, this is considered a study area trip. These trips originate and find their final destination all within the study area.

External trips: Defined as trips that are generated outside the project area and bring "new" traffic to the study area.

Appendix D contains detailed summaries regarding the number of pass-by trips, internal trips, study area trips and external trips that were calculated for future AM and PM 2011 conditions

2. Trip Distribution and Assignment

Trip Distribution assumptions were based on existing and expected traffic patterns specific to each section of the study area. These assumptions were coordinated with DelDOT and are shown in **Appendix D**. Specific trip assignments to the roadway network were based on reasonable assumptions and engineering judgment. Travel time, travel distance, and expected delays were considered in the allocation of traffic to specific roadway paths. The utilization of the proposed internal development roadway system was also considered.

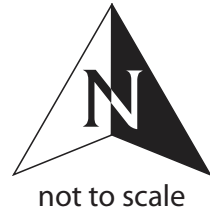
Interim year 2006 and design year 2011 morning and afternoon peak hour traffic projections are shown in **Figures 9 - 14**.

As described in the **Introduction**, the larger Route 301 Project Development study is currently considering two alternatives near the Westown study area, an on-alignment upgrade (without bypass), and an off-alignment new facility (with bypass). Because both options are still under study, the analysis completed for the Westown Circulation Concept Plan considered the traffic impacts of both options for the design year of 2011. Compared to the “without bypass” option, the “with bypass” option generally led to a reduction of traffic on existing study area roads with the exception of Levels Road, which increased in traffic due to its potential connection with an interchange on the US 301 bypass as part of this scenario. **Table 6** shows daily traffic comparisons for each scenario.

Table 6 – Projected Annual Average Daily Traffic

Roadway	2003*	2006	2011 Without Bypass	2011 With Bypass
US 301	14,400	16,200	39,900	28,400
Main Street (Route 299)	10,100	11,700	17,500	15,600
Bunker Hill Road	1,400	4,300	12,400	12,400
Levels Road	1,500	5,100	10,500	10,500
St. Annes Church Road	400	2,000	7,900	7,900
Wiggins Mill Road	400	1,000	3,200	3,200
Route 71	7,500	8,500	15,700	15,700
Middle Neck Road	500	500	1,100	1,100

*Source: 2003 DelDOT Traffic Summary



WESTTOWN

CIRCULATION CONCEPT PLAN

Legend

 Existing Roads

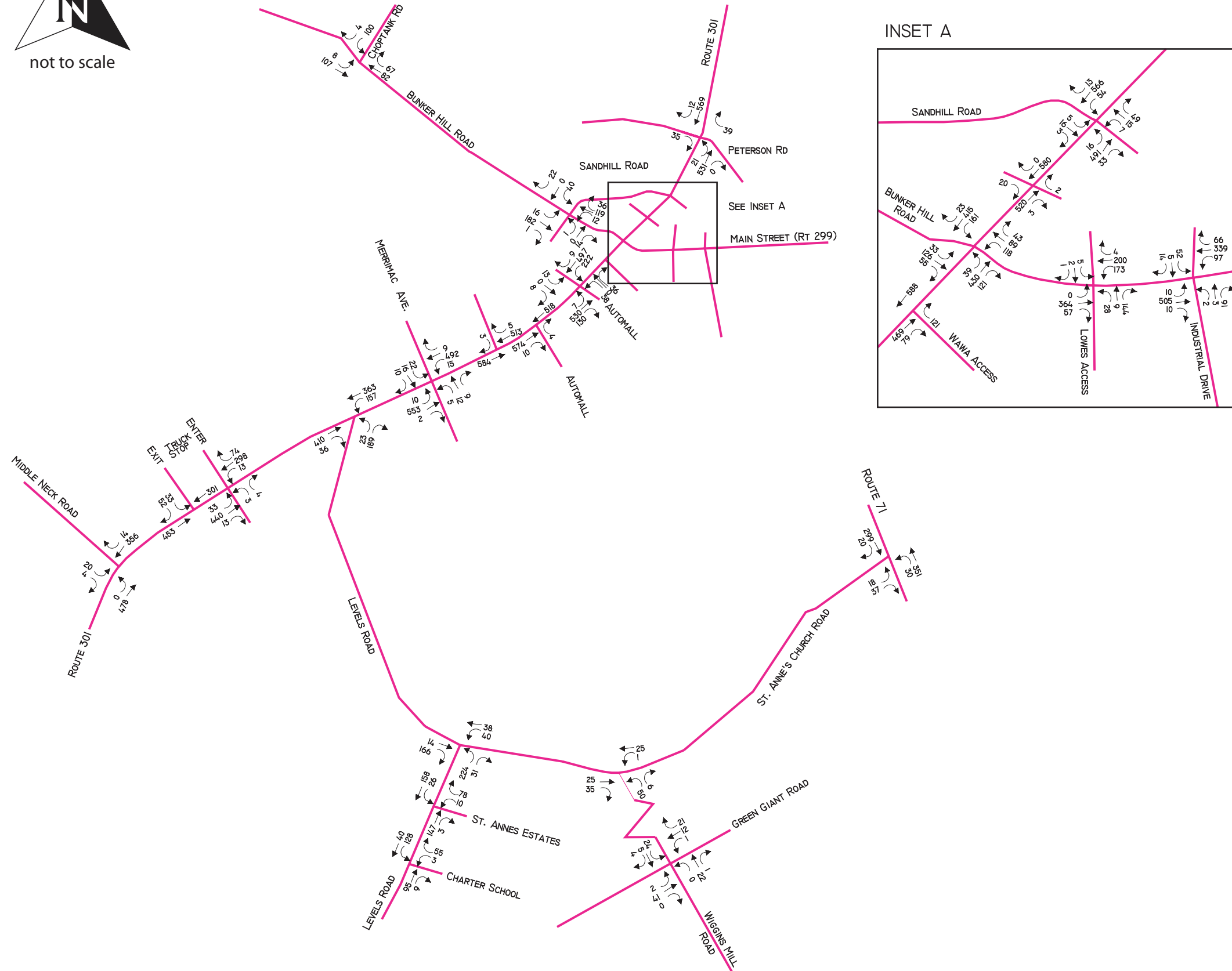
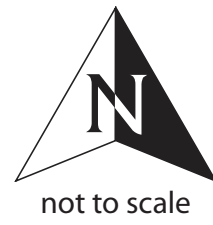


Figure 9

2006 AM Peak Hour Volumes

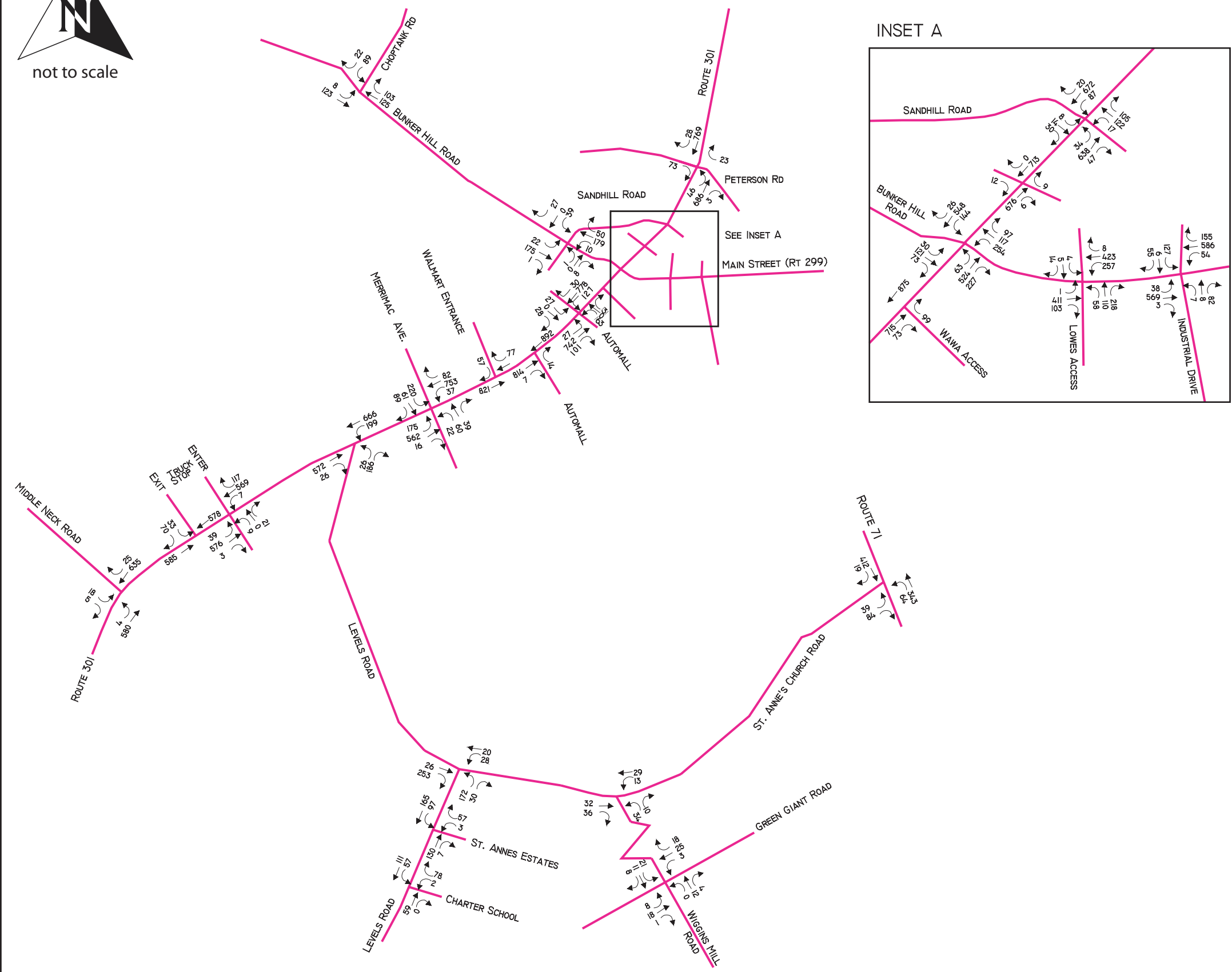


WESTTOWN

CIRCULATION CONCEPT PLAN

Legend

— Existing Roads



INSET A

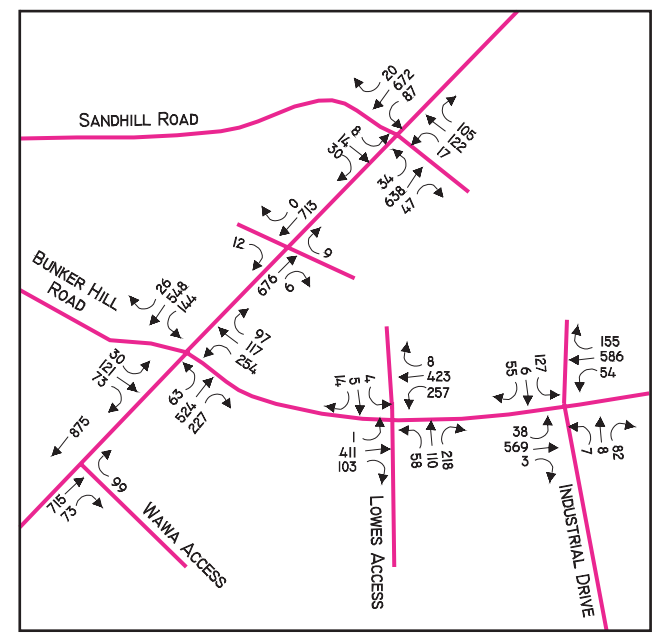
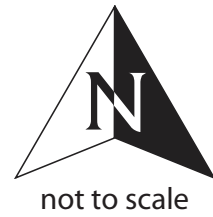


Figure 10

2006 PM Peak Hour Volumes

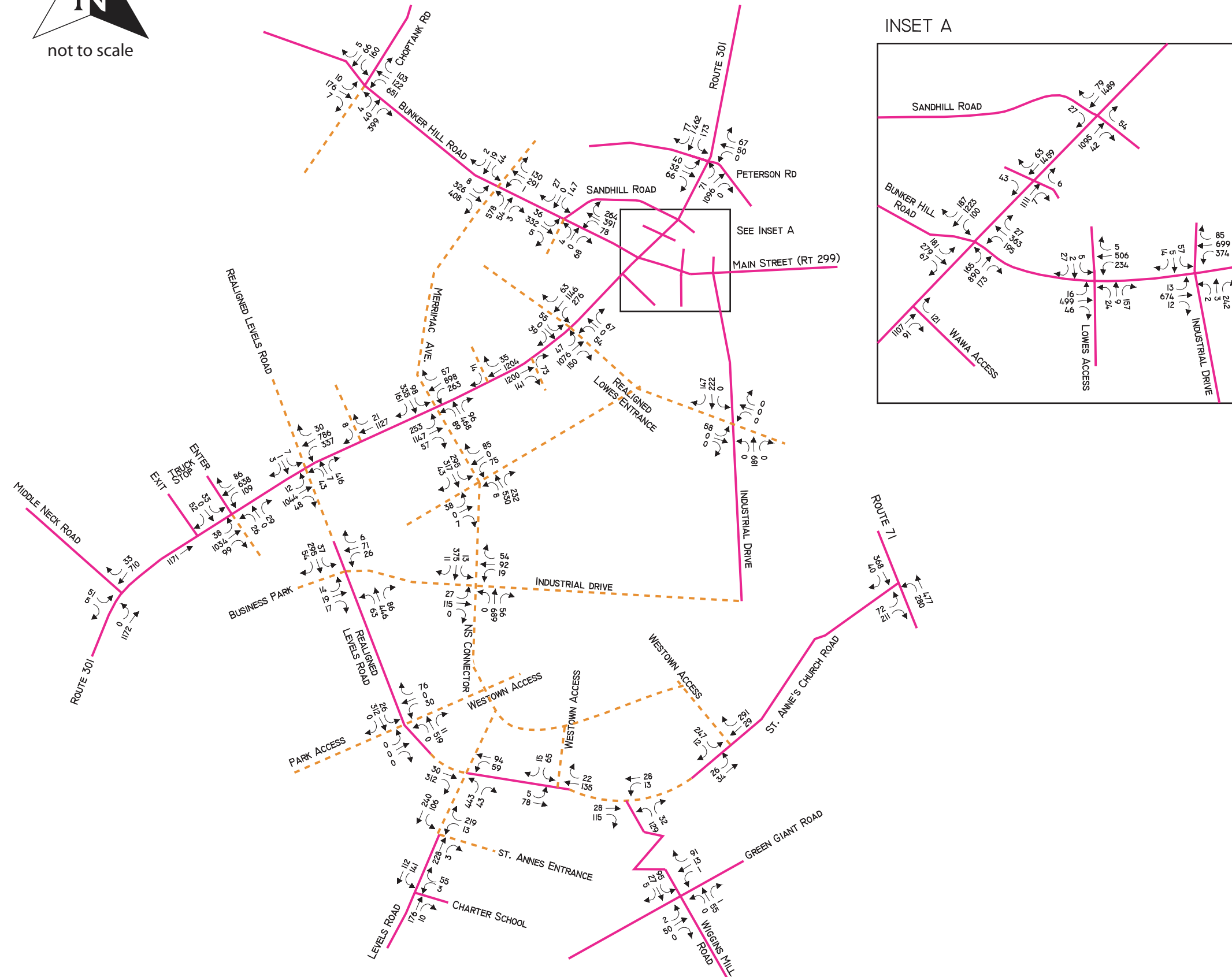


WESTOWN

CIRCULATION CONCEPT PLAN

Legend

- Existing Roads
- - - Proposed Roads



INSET A

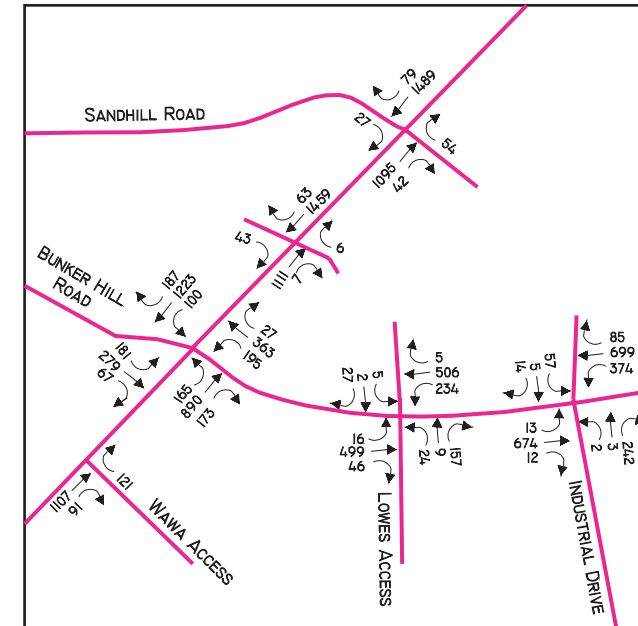
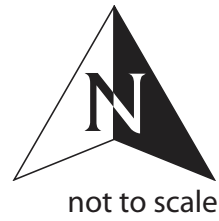


Figure 11

2011 Full Development without Bypass
AM Peak Hour Volumes



WESTTOWN

CIRCULATION CONCEPT PLAN

Legend

- Existing Roads
- - - Proposed Roads

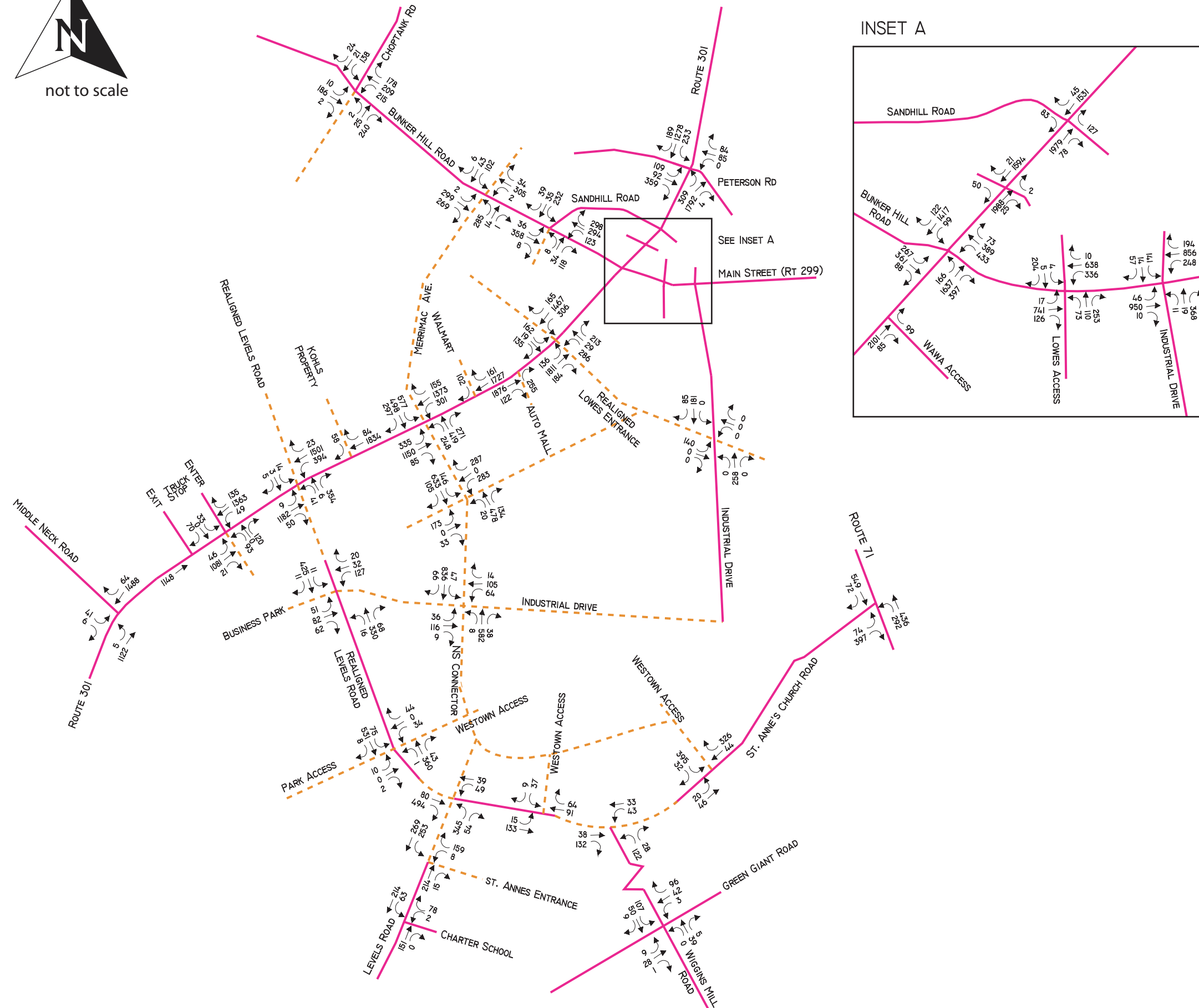
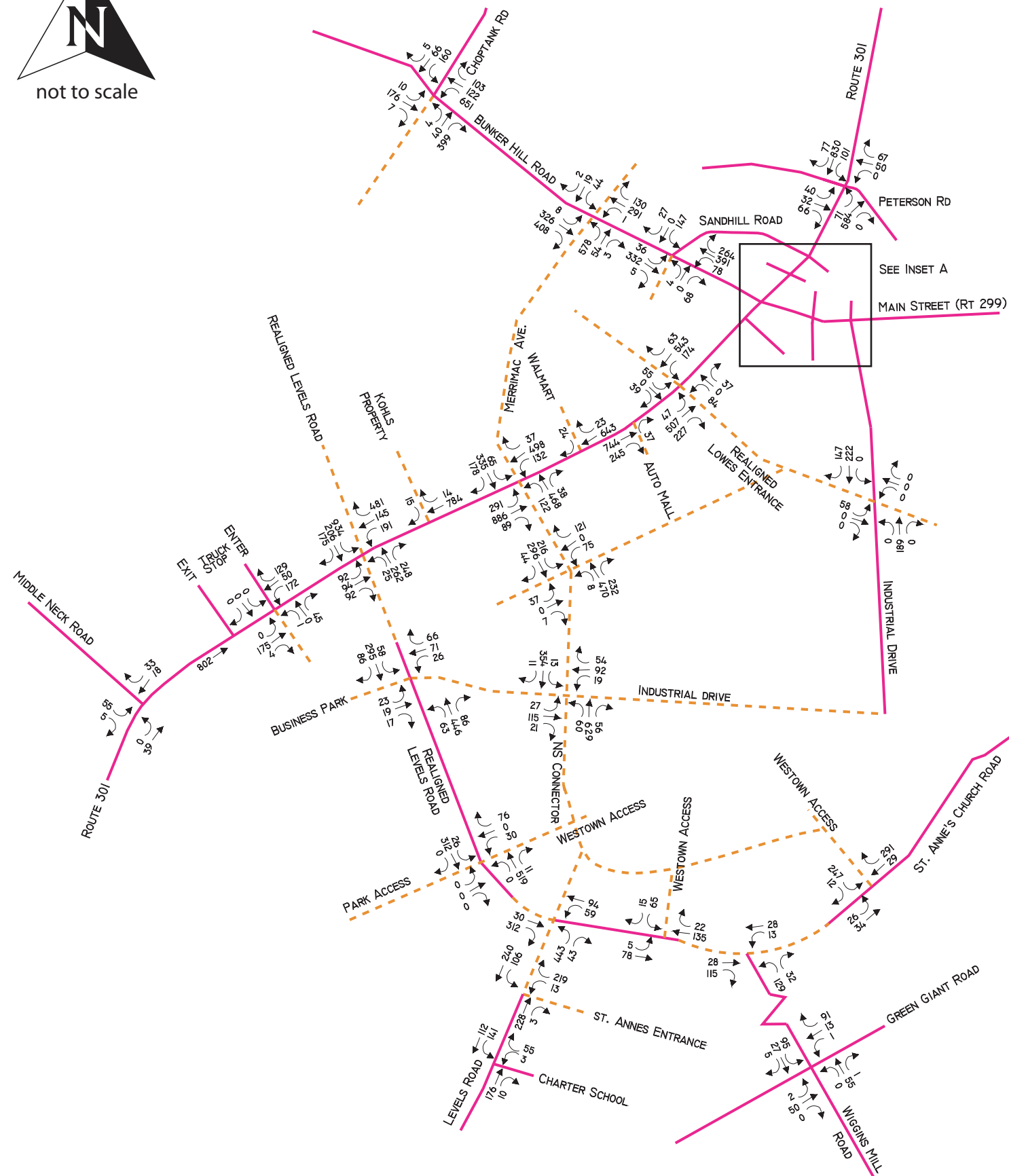
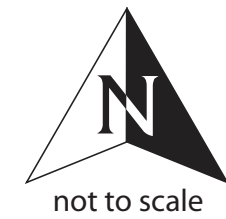
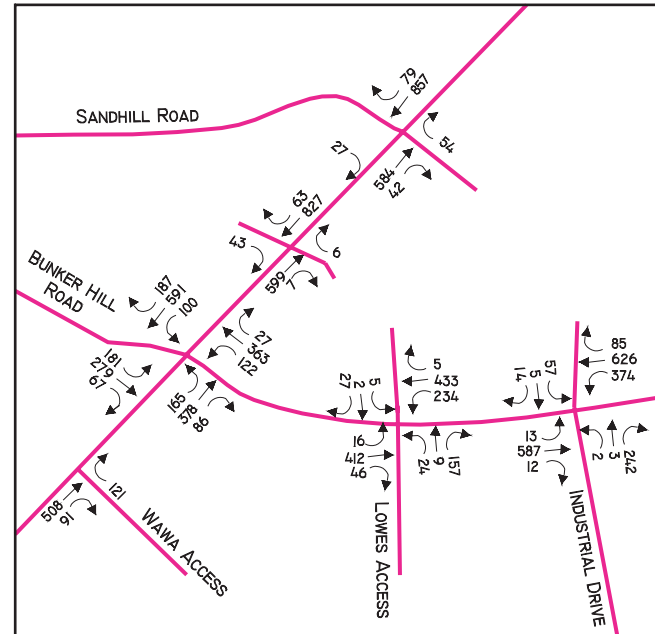


Figure 12

2011 Full Development without Bypass
PM Peak Hour Volumes



INSET A



WESTTOWN

CIRCULATION CONCEPT PLAN

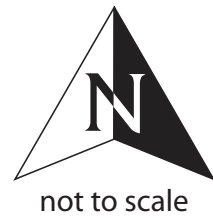
Legend

Existing Roads

Proposed Roads

Figure 13

2011 Full Development with 301 Bypass
AM Peak Hour Volumes



WESTOWN

CIRCULATION CONCEPT PLAN

Legend

- Existing Roads
- - - Proposed Roads

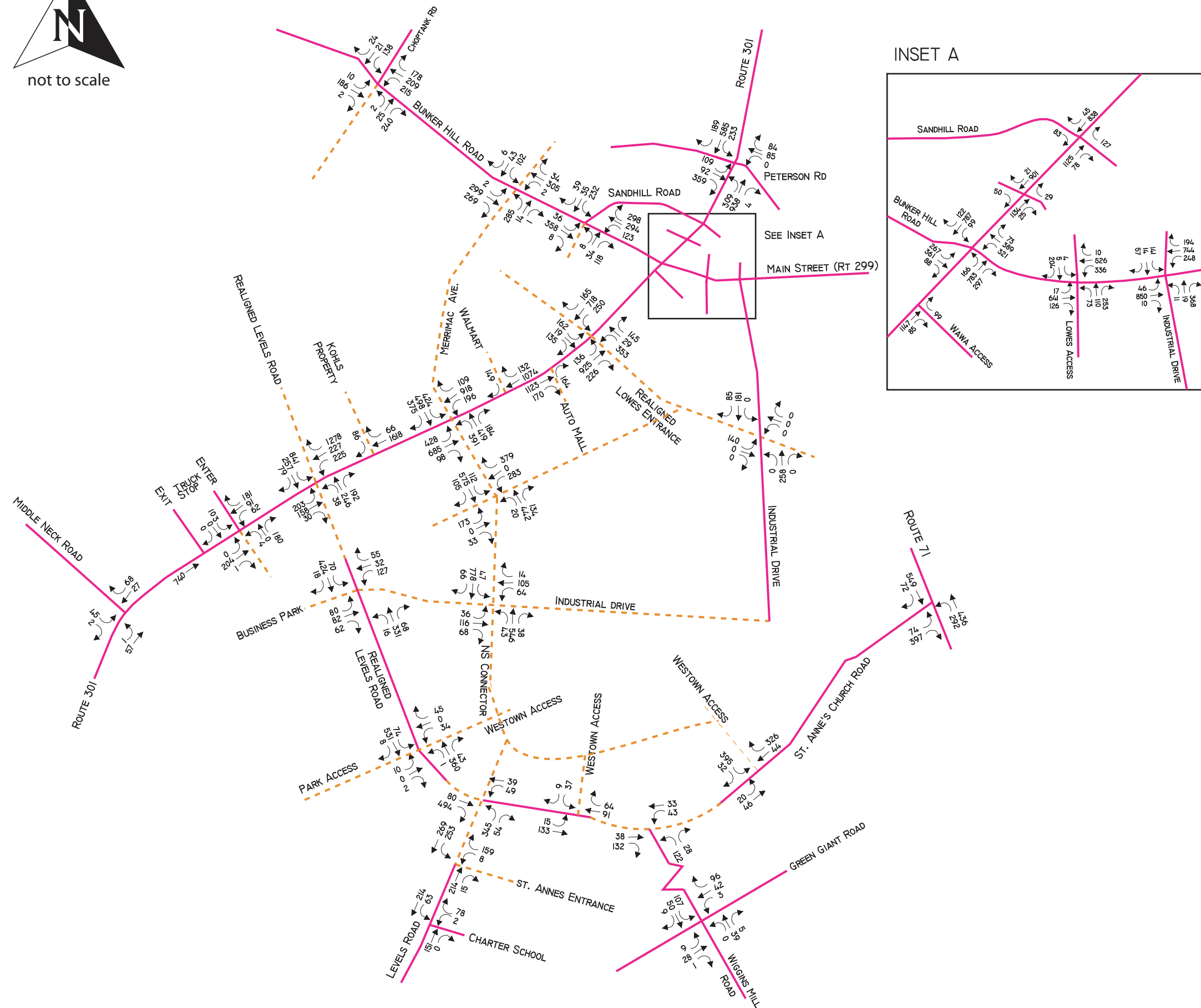


Figure 14

2011 Full Development with 301 Bypass
PM Peak Hour Volumes

B. Improvement Alternatives

1. Traffic Analysis of Improvement Alternatives

The traffic analysis focused on PM conditions (discussed in this section) because traffic volumes were consistently higher for PM conditions than AM conditions. AM results are included in **Appendix B. Table 7** contains a summary of Level of Service (LOS) and intersection delay for all cases. Intersections recommended for signalization in the 2011 cases are detailed below. When unsignalized, as shown in the 2004 LOS table, the LOS for the worst approach is reported. More detailed delay and LOS information is available in **Appendix B**.

After projecting design year traffic volumes, the expected level of service of study area intersections were examined, and potential improvements were developed. Improvement options included additional lanes at existing intersections (including through or turn lanes), signalization, and the incorporation of internal development connector roadways. This last option would ease the circulation between the developments and reduce the traffic impact on existing roadways.

The project team agreed that LOS E would be the worst acceptable level of service for study area intersections. If LOS E could not be achieved (i.e., an intersection operated at LOS F), then either additional roadway improvements would be required, or the proposed development would need to be scaled back. Although typically DelDOT attempts to achieve LOS D or better when working with local governments, LOS E was used for this study for the following reasons:

- LOS E is the “borderline” level of service where operations are still generally under capacity. By maintaining LOS E and keeping the volume-to-capacity ratio under 1.0, significant degradation of operations can be avoided. Although queues may become lengthy, queues will not extend through adjacent intersections, and generally vehicles will not need to wait through more than one signal cycle to proceed.
- LOS E is frequently desirable in towns because additional congestion may support “town transportation conditions” which often desire slower speeds and increased pedestrian, bicycle and transit usage.
- The US 301 Project Development study will likely recommend longer term improvements that could support and complement improvements recommended by this master plan and could therefore further improve traffic operations in and around the study area.

To help circulate traffic between developments in the Westown area, and to reduce traffic on existing state roads to the extent possible, several internal development connector roads had been anticipated by the Master Plan. As the traffic analysis for this study progressed, the need for these roadway connections became more apparent, and their characteristics (i.e., location, number of lanes, etc.) became more defined. Three important connections include:

Table 7 – Future Level of Service

Intersection	2006			2011				
	Control Type	LOS	MOE	Control Type	Without Bypass		With Bypass	
					LOS	MOE	LOS	MOE
US 301 & Peterson Drive	unsignalized	C	18.6	signalized	D	0.94	C	0.68
US 301 & Bunker Hill Road	signalized	C	0.67	signalized	D	0.93	C	0.57
US 301 & Sandhill Road/Market Place	unsignalized	F	*	unsignalized	C	16.0	B	14.2
US 301 & Realigned Lowes Entrance	signalized	A	0.65	signalized	E	0.96	D	0.63
US 301 & Levels Road	unsignalized	D	31.7	signalized	C	0.80	C	0.71
US 301 & 301 Plaza	unsignalized	C	22.1	signalized	B	0.58	B	0.38
US 301 & Merrimac Avenue	signalized	C	0.83	signalized	E	0.91	D	0.82
US 301 & Middle Neck Road	unsignalized	D	28.2	unsignalized	F	1154.7	F	99.1
Bunker Hill Road & Choptank Road	roundabout	-	0.21	roundabout	-	0.56	-	0.56
Bunker Hill Road & Sandhill Road	unsignalized	B	12.1	unsignalized	F	184.9	F	184.9
Bunker Hill Road & Merrimac Avenue	-	-	-	signalized	B	0.56	B	0.57
Main Street & Middletown Commons	unsignalized	F	*	unsignalized	F	*	F	*
Main Street & Industrial Drive	unsignalized	F	*	signalized	C	0.89	D	0.90
St. Annes Church Road & Levels Road	unsignalized	A	9.5	roundabout	-	0.54	-	0.54
Charter School & Levels Road	unsignalized	A	9.1	unsignalized	A	9.7	A	9.7
St. Annes Church Road & Wiggins Mill Rd.	unsignalized	A	9.1	roundabout	-	0.16	-	0.16
St. Annes Church Road & Route 71	unsignalized	C	17.5	signalized	B	0.71	B	0.71
Green Giant Road & Wiggins Mill Road	unsignalized	A	7.4	unsignalized	A	9.0	A	9.0

* Highway Capacity Software does not generate a result due to excessive delay

NOTE: For unsignalized analyses, the measure of effectiveness (MOE) shown in the table is the delay on the worst approach at the intersection. For signalized intersections, the MOE shown in the table is the x-critical value, a composite volume-to-capacity ratio. For unsignalized intersections, the MOE shown in the table is the volume-to-capacity ratio on the worst approach at the intersection. For roundabouts, the 2000 Highway Capacity Manual does not calculate a letter grade level of service.

Westown Circulation Concept Plan

- Merrimac Avenue (North/South Connector) – This roadway is planned to begin at Bunker Hill Road between US 301 and Choptank Road and to proceed south through the Southridge, Kohl, and Auto Mall developments into the Westown development, where various spurs will connect with Levels Road and St. Annes Church Road.
- Industrial Drive Extension – Industrial Drive currently ends at the Middletown waste water treatment plant. The master plan and this analysis show this roadway being extended to Levels Road.
- East/West Connector, South of Lowes – This roadway is planned to connect US 301 to Industrial Boulevard, between the existing Lowes and the proposed Auto Mall.

2006 traffic analysis indicated that intersection improvements will be needed to accommodate the development that is expected to be operational in the interim year. This includes the addition of turning lanes throughout the study area intersections as well as signalization at US 301 & Lowes, US 301 & Merrimac Avenue, and Main Street & Industrial Drive.

By 2011, significant capacity improvements will be required on US 301. This includes dualization within the study limits (two through lanes in each direction), turn lanes at intersections (including dual left turn lanes at some locations) and an additional through lane on Bunker Hill Road/Main Street at US 301. Assumed new signal locations include: US 301 & Peterson Drive, US 301 & Realigned Lowes Access, US 301 & Levels Road, US 301 & Merrimac Avenue and US 301 & 301 Plaza. Each of these intersections are expected to meet 2 or more signal warrants by 2011 (**Appendix E**). With the recommended geometric and signalization improvements, these intersections are expected to operate at LOS E or better based on traffic conditions that do not consider a Route 301 Bypass. The intersections that are expected to operate at LOS E are US 301 & Realigned Lowes Access and US 301 & Merrimac Avenue. While the overall level of service at these intersections is LOS E, most of the through movements on US 301 are expected to operate at LOS D or better (see **Appendix B** for more details).

Analysis reflects that traffic conditions are expected to improve within the study area if the Route 301 Bypass alternative is built. All signalized intersections within the study area are expected to operate at LOS D or better in 2011 with the bypass alternative scenario.

Three areas that require further discussion with the town, DelDOT and local property owners are discussed below:

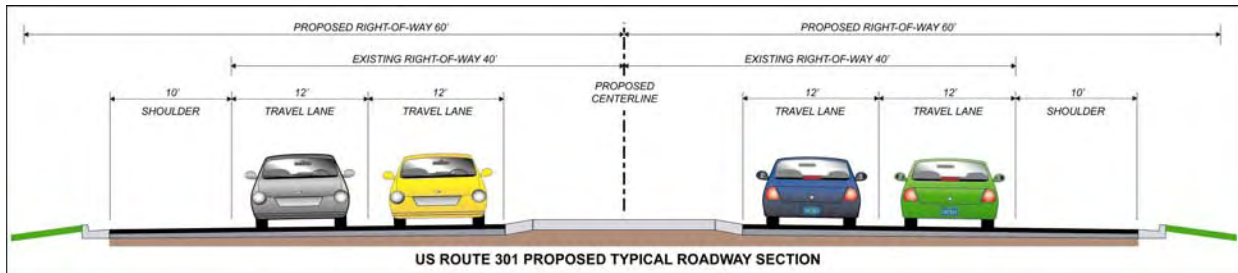
US 301 & Peterson Road: Both 2011 analysis cases assumed that the US 301 & Sandhill Road intersection would be restricted to right-in/right-out, and that all other movements would be shifted to US 301 & Peterson Road. This modification was due to capacity and safety concerns, and the fact that the intersection is too close to Bunker Hill Road to be signalized. In the proposed condition, traffic will use Peterson Road to enter and exit the shopping center from the rear. To accommodate this shift, a signal would be installed at Peterson Road, along with roadway improvements to make this a complete intersection. Future lanes include exclusive left turn lanes in all directions. Along northbound US 301 at Peterson Road, this case assumes one through lane and one exclusive right turn lane (operating as a lane drop) in addition to the northbound left. Depending on geometric design issues and right-of-way, two northbound through lanes may proceed through the intersection, merging to one lane north of Peterson Road. Southbound US 301 would include two through lanes with the outside lane as a shared through/right.

Main Street (Route 299) & Shopping Center (Lowes/Middletown Commons): Future 2011 scenarios do not show this intersection as having a traffic signal; however, some traffic mitigation must be discussed and determined at this location. Because of the close proximity of this intersection to Main Street & Industrial Drive (approximately 530 feet), it was determined that only one of these intersections should be signalized. Since Main Street & Industrial Drive is an intersection of two streets (rather than a street and a driveway) and currently meets the 2004 peak hour warrant for signalization, it is more critical to install a signal at this location. One option to be discussed is installing a connector street from Middletown Commons near the Lowes to Industrial Drive. It is likely that roadway improvements will be necessary at Industrial Drive to accommodate the increase in traffic; however, this is a reasonable alternative to having two signals less than 600 feet apart.

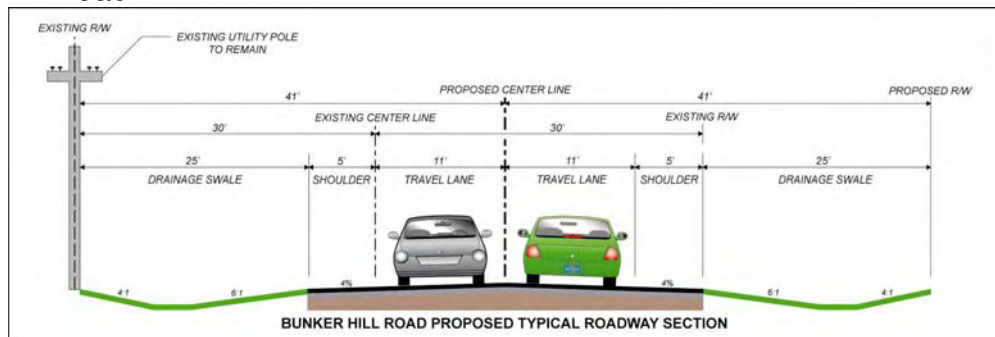
US 301 & 301 Plaza (Truck Stop): The 301 Plaza currently operates with a separate entrance and exit on US 301. Directly across from the existing entrance is the access point for the Middletown-Levels Business Park, which will require signalization. The current exit from the 301 Plaza may face capacity and safety issues if allowed to remain in the future, particularly for left-turning truck traffic. Signalizing the exit is not desired, due to the proximity to the signal at the 301 Plaza entrance/Middletown-Levels Business Park. For this analysis, it was assumed that the 301 Plaza exit would be relocated to the same location (signalized) as the 301 Plaza entrance. This will require further discussions with the property owner with respect to the reconfiguration of the 301 Plaza to allow for the required traffic flow (particularly trucks) within their site.

2. Proposed Roadway Alignments

US Route 301: It was determined that US 301 will need to be dualized (two through lanes in each direction) from just south of 301 Plaza to Peterson Road in order to accommodate the traffic expected by 2011. Travel lanes will be 12 foot wide with 10 foot shoulders on the outside edge and 4 foot shoulders at the median. Both open vs. closed drainage systems are still under consideration. Sidewalks will be constructed along US Route 301 along the entire length of the project. Double left turn lanes and a right turn lane will be required at several locations. New traffic signals are anticipated at US 301 intersections with Realigned Lowes entrance, Merrimac Avenue, Realigned Levels Road and 301 Plaza. The design speed for US 301 is 60 mph with a posted speed between 45 and 55 mph. **Figures 15 & 16** show the geometry for intersections along US 301.

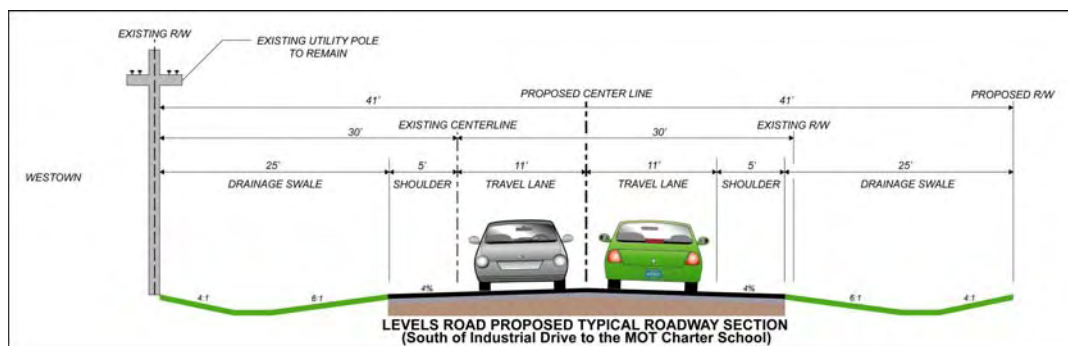


Bunker Hill Road: Bunker Hill Road will be reconstructed to contain one 11 foot lane and 5 foot shoulder in each direction from Choptank Road to US 301. The center line will be shifted south to avoid right-of-way impacts to the properties on the north side of the road. The 5 foot shoulders will provide adequate space for bicycle travel. The proposed developments will construct sidewalks along the roadway leading to the proposed high school. The section of roadway from just north of Merrimac Avenue to US 301 will be a curbed section with a closed drainage system while the remainder of the roadway will be open drainage. The intersection of Bunker Hill Road & Merrimac Avenue may be signalized with an eastbound right turn lane entering Merrimac Avenue from Bunker Hill Road and a northbound left turn lane exiting Merrimac Avenue onto westbound Bunker Hill Road. The design speed will be 40 mph with a posted speed of 35 mph. **Figures 15 & 17** show the intersection geometry for intersections along Bunker Hill Road.



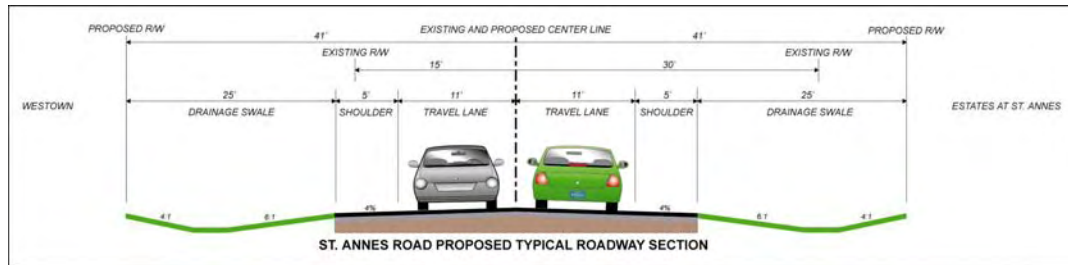
Main Street: Main Street will be reconstructed to contain 11 foot lanes from US Route 301 to Peterson Road. The intersection of Main Street & Industrial Drive may be signalized. Right and left turn lanes will be added at the shopping center intersection as well as at Industrial Drive. The design speed will be 40 mph with a posted speed of 35 mph. The roadway will likely be designed with a closed drainage system. **Figure 15** shows the intersection geometry for intersections along Main Street.

Levels Road: Levels Road will be reconstructed to contain 12 foot lanes and 8 foot shoulders between US 301 and the southern limits of the Kohl Property (south of Industrial Drive extension). Between this point and the MOT Charter School, the road will be reconstructed to have 11 foot lanes and 5 foot shoulders. Both the 8 foot and 5 foot shoulders should provide adequate space for bicycle travel. The intersection of Levels Road & US 301 will be shifted approximately 850 feet to the west which will eliminate the skew angle of the existing intersection. The remainder of Levels Road will be shifted to the west to avoid impacts to the utility poles currently located on the east side of the road. Delmarva Power will be removing its transmission line on the west side of Levels Road. The roadway will be realigned to create a more desirable intersection with St. Annes Church Road and will require a new bridge over Deep Branch Creek. The new intersection with St. Annes Church Road will be a roundabout with geometry that will be serviceable for Town of Middletown emergency equipment, school buses and trucks. The drainage system along Levels Road will be open with the exception of a closed drainage system at the roundabout. On street parking opportunities in the vicinity of the St. Annes intersection will be evaluated as the Westown Development design advances. The design speed will be 40 mph with a posted speed limit of 35 mph. **Figure 16** shows the intersection geometry at US 301 & Levels Road.

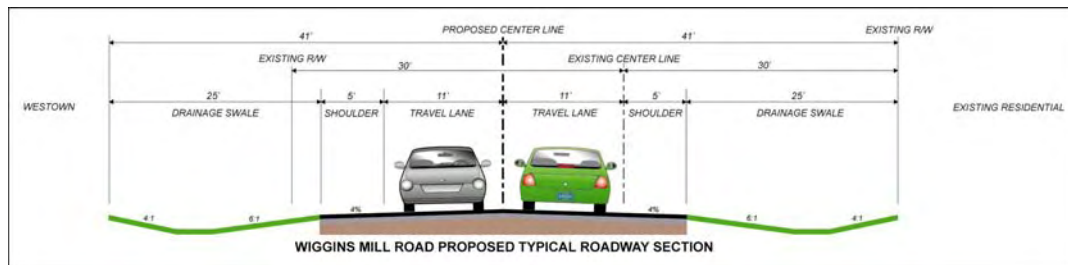


St. Annes Church Road: St. Annes Church Road will be reconstructed to contain one 11 foot travel lane in each direction and 5 foot shoulders. The limits of this improvement will begin at Levels Road and continue to Route 71, excluding the railroad bridge and its approaches. The roadway will be realigned to eliminate the substandard curves and also to improve the intersections with Levels Road and Wiggins Mill Road. These intersections will be designed as roundabouts with geometry serviceable for Town of Middletown emergency equipment, school buses and trucks. The design speed will be 40 mph with a posted speed of 35 mph. An

open drainage system is planned along St. Annes Church Road except at the roundabouts where a closed drainage system will exist. A right turn lane will be added along eastbound St. Annes Church Road and a left turn lane will also be added from northbound Route 71 onto St. Annes Church Road. **Figure 15** shows the geometry of St. Annes Church Road & Wiggins Mill Road while **Figure 17** shows the geometry at Route 71 & St. Annes Church Road.



Wiggins Mill Road: Wiggins Mill Road will be shifted to the west to avoid impacts to the residential properties on the east side. The reconstructed road will consist of one 11 foot travel lane and 5 foot shoulders in each direction from Green Giant Road to St. Annes Church Road. The intersection with St. Annes Church Road will be redesigned as a roundabout with geometry serviceable for Town of Middletown emergency equipment, school buses and trucks. The one-lane bridge located on Wiggins Mill Road will be reconstructed to accommodate two lanes (one lane and one shoulder in each direction). The design speed will be 40 mph with a posted speed limit of 35 mph. Open drainage is currently proposed but a closed system south of the bridge is being considered. **Figure 15** shows the intersection geometry of the roundabout at Wiggins Mill Road & St. Annes Church Road.



Merrimac Avenue: An additional north/south roadway will be constructed within the study area to promote inter-development connectivity. This roadway has been tentatively named Merrimac Avenue and will help move traffic from the south end of the project area, through the proposed developments, to Bunker Hill Road. Currently, the minimum cross-section of the roadway is proposed to contain 11 foot lanes and 5 foot shoulders but will be further discussed as design of the developments progresses. This roadway will be built in sections by developers/property owners as the surrounding area develops. **Figures 16 & 17** show the intersection geometry for US 301 & Merrimac Avenue as well as Bunker Hill Road & Merrimac Avenue.

Industrial Drive: Industrial Drive will be paved from its current terminus near the wastewater treatment plant to Levels Road. Currently, alignment is planned within the Auto Mall Development. The roadway will be constructed to contain one 12 foot travel lane and 8 foot shoulder in each direction. The intersection of Main Street & Industrial Drive may be signalized with separate northbound left, through and right lanes. This roadway will be built in sections by developers/property owners as the surrounding area develops. **Figure 15** shows the intersection geometry proposed for Main Street & Industrial Drive.

WESTTOWN

CIRCULATION CONCEPT PLAN

Legend

- Existing Right-of-Way/Property Line
- Existing Signalized Intersection
- Potential Future Signalized Intersection
- Roadway To Be Removed

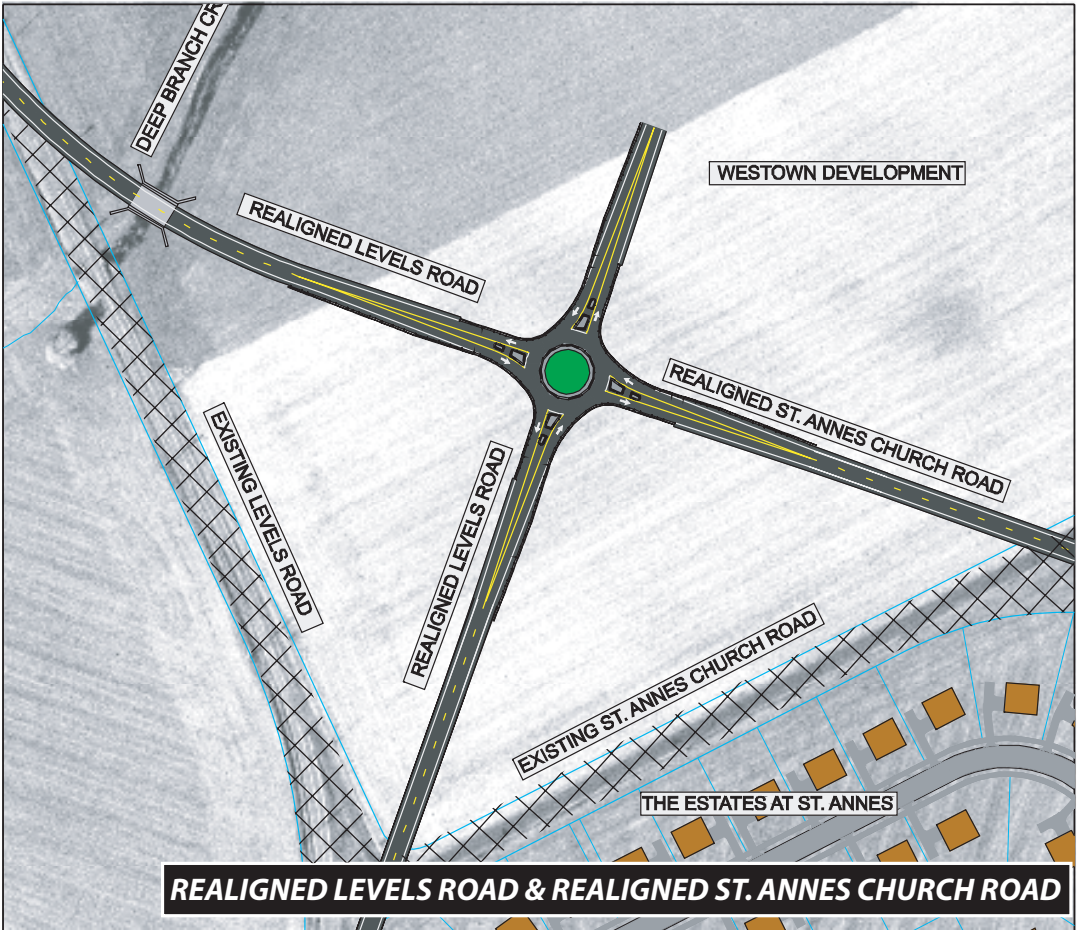
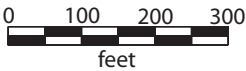


Figure 15

Intersection Geometry (1 of 3)

WESTTOWN

CIRCULATION CONCEPT PLAN

Legend

- Existing Right-of-Way/Property Line
- Existing Signalized Intersection
- Potential Future Signalized Intersection
- Roadway To Be Removed

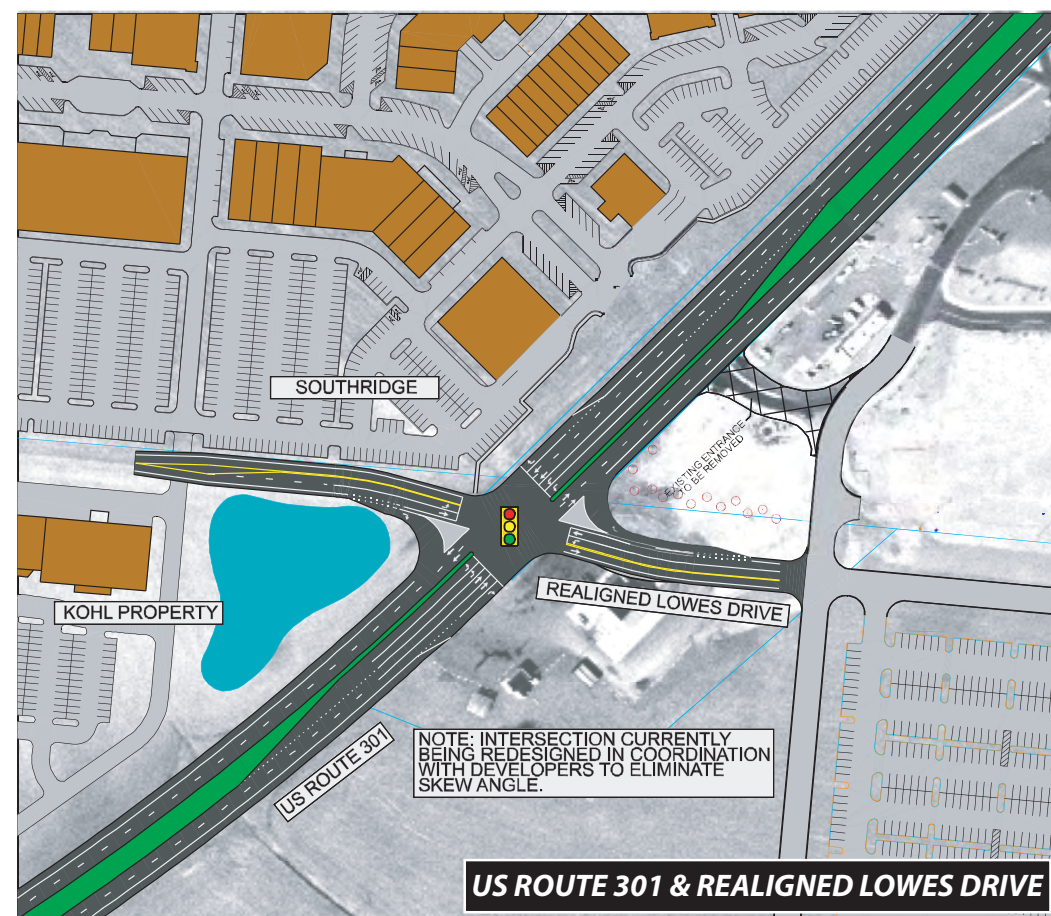
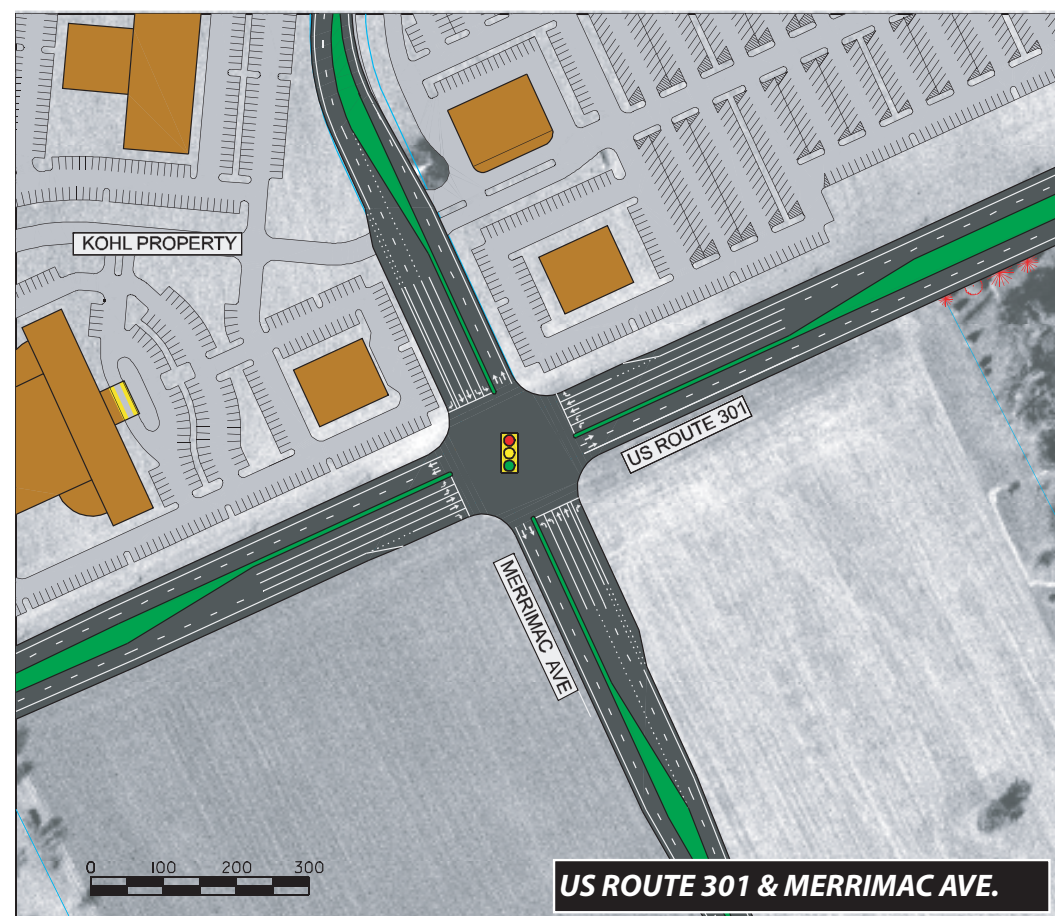
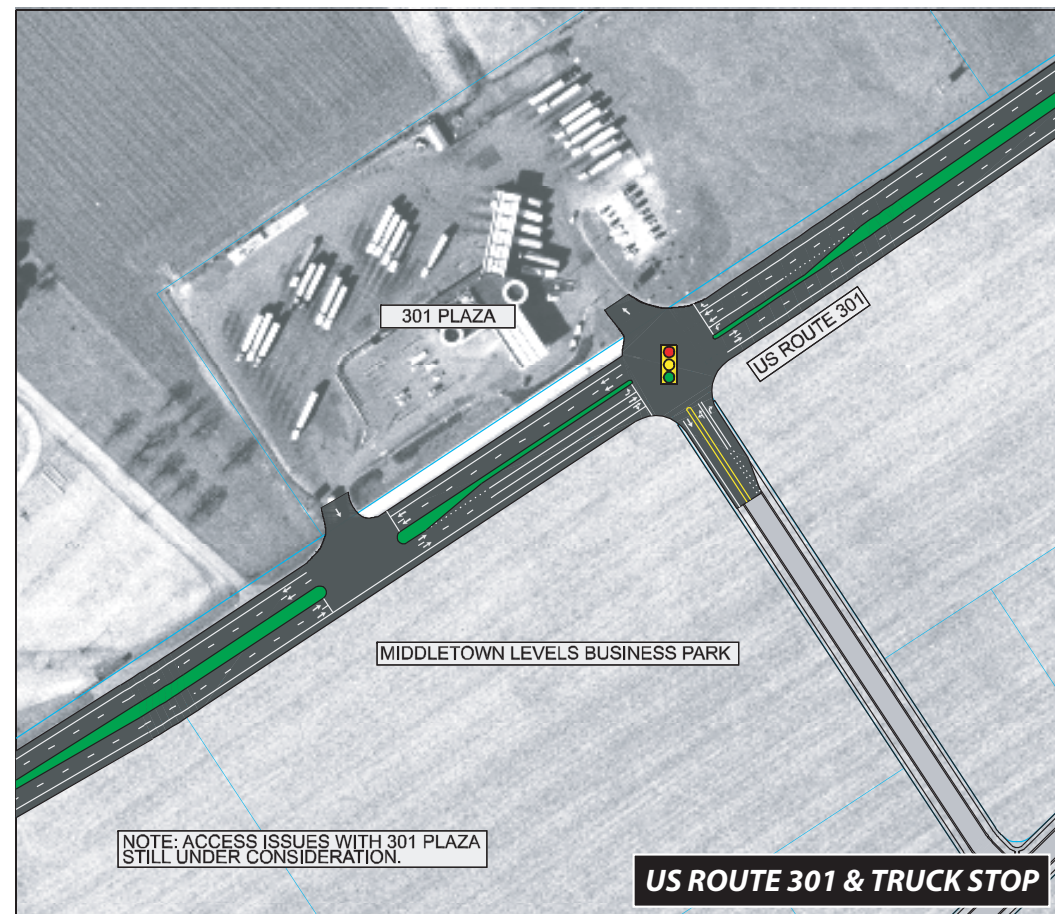
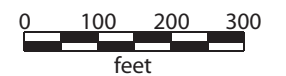
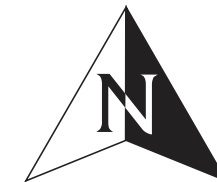


Figure 16

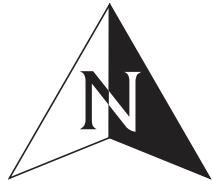
Intersection Geometry (2 of 3)

WESTTOWN

CIRCULATION CONCEPT PLAN

Legend

- Existing Right-of-Way/Property Line
- Existing Signalized Intersection
- Potential Future Signalized Intersection
- Roadway To Be Removed



0 100 200 300
feet

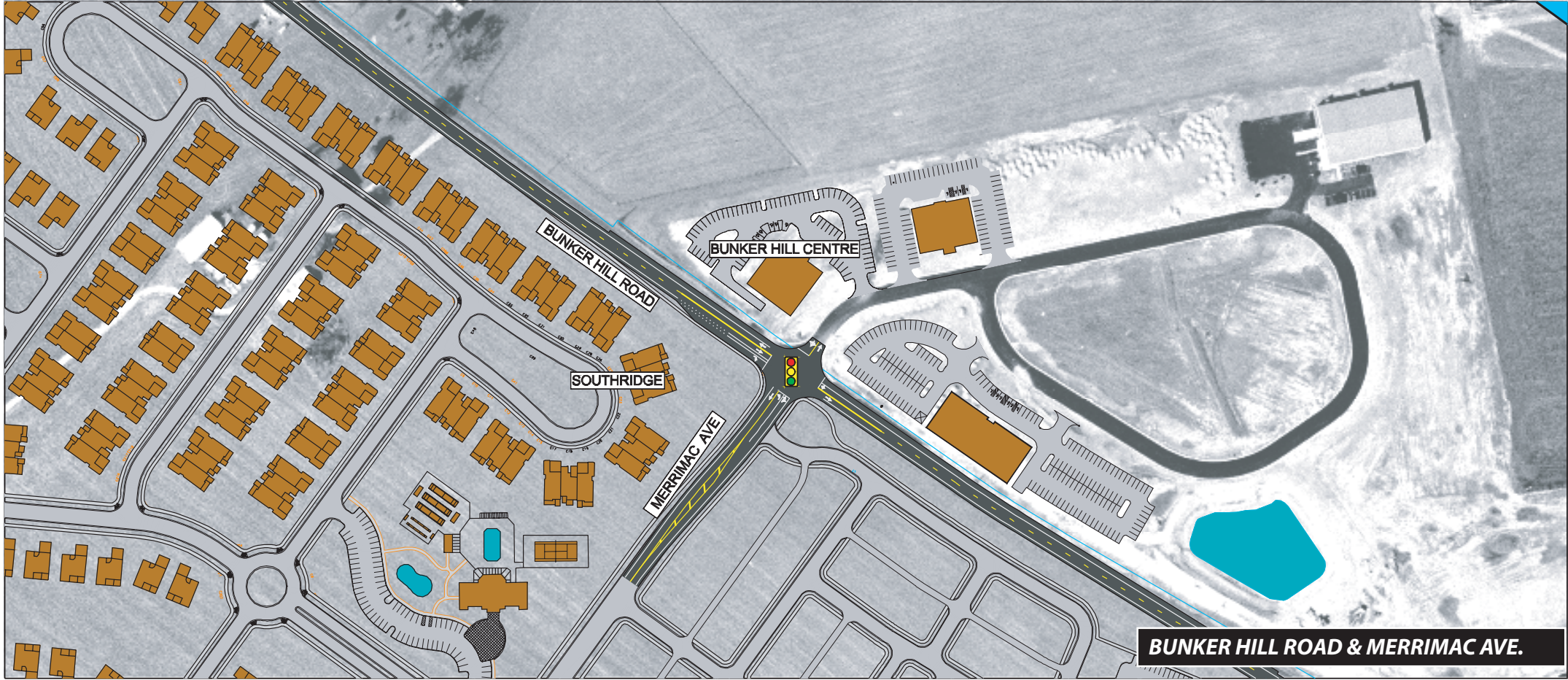


Figure 17

Intersection Geometry (3 of 3)

V. Multi-Modal Considerations

A. Pedestrian and Bicycle Accommodations

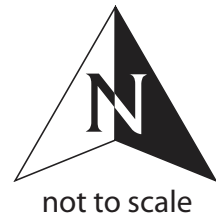
1. *Existing Conditions*

The New Castle County State Bike map states that most roads within the study area have good or average bicycling conditions. However, although they are listed as such, conditions are not ideal as indicated by the high number of trucks as well as the inconsistent shoulder width throughout the study area. There are no continuous sidewalks within the project area. The only significant existing pedestrian/bicycle generators are the modest amount of residential land use along Wiggins Mill Road and near the M.O.T. Charter School. It is anticipated that future development will necessitate desirable accommodations for pedestrians and bicyclists. Within the study area, Delaware Bicycle Route 1 runs along Choptank Road to Bunker Hill Road (Route 15), onto Main Street (Route 299) and south along Broad Street (Route 71).

2. *Proposed Accommodations*

Internal sidewalk networks will be installed within the residential developments of Southridge, Westown and Estates at St. Annes. Consideration should be given to pedestrian interconnections between adjacent developments. In addition, sidewalks are proposed along the length of widened US 301, as well as installation of a possible pedestrian crossing across US 301 at one or more signalized intersections.





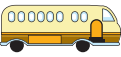

Five-foot bike lanes will be installed in each direction along all major crossroads of US 301 – Bunker Hill Road, Realigned Levels Road and Merrimac Avenue. Bicycle lanes will be maintained through turn lanes at intersections. Because bicycle traffic is not encouraged on US 301, separate bike lanes along US 301 are not proposed at intersections. However, a separate multi-use path is under consideration. It is also recommended that consideration be given to relocating Delaware Bike Route 1 from Main Street & Route 71 to Merrimac Avenue once the full connection from Bunker Hill Road to St. Annes Church Road is complete. Cycling conditions along this roadway will likely be superior to those that presently exist along Main Street and Route 71. **Figure 18** shows a diagram of the potential locations of all multi-modal considerations.



WESTTOWN

CIRCULATION CONCEPT PLAN

Legend

-  Possible location of commuter rail station
-  Sidewalks on both sides of US 301; possibly multi-use path on one side of US 301
-  5' bike lane in each direction on crossroads
-  Possible pedestrian crossing
-  Potential bus pull-off in this vicinity
-  Potential future alignment of Bicycle Route 1

GENERAL NOTES

- Location of pedestrian crossings and additional bus pull-offs still being considered
- Possible expansion of Bus Route 301 and/or new routes through Middletown (Results of study pending)
- Internal sidewalks to provide pedestrian interconnections

Figure 18

Multimodal Considerations

B. Transit

1. Existing Conditions

DART Intercounty Bus Route 301 currently runs services in the Town of Middletown via a shuttle service which stops at the intersection of Main Street & Catherine Street. Shuttle service departs Middletown 10 times between 6:20 AM and 6:03 PM and arrives 10 times between 6:34 AM to 6:10 PM. There are no local bus routes within Middletown nor is there any rail service in the area. Below is the schedule for arrivals and departures of IC Bus Route 301.

Table 8 – DART Route 301 - Wilmington to Dover - Monday thru Friday

Effective: May 23, 2005

Delaware Ave. @ Adams St.	6:05a	7:35a	7:56a	8:36a	1:45p	4:05p	4:40p	4:46p	5:15p	6:31p
11th St. @ King St.	6:08a	7:38a	7:59a	8:39a	1:48p	4:08p	4:43p	4:49p	5:18p	6:34p
Amtrak Station	6:15a	7:47a	8:06a	8:46a	1:55p	4:15p	4:50p	4:56p	5:25p	6:41p
Christiana Mall	6:30a	8:02a	8:21a	9:01a	2:10p	4:35p	–	5:16p	5:45p	6:56p
Boyd's Corner P&R	–	–	–	–	2:26p	4:51p	–	5:32p	6:01p	7:12p
Odessa P&R	6:49a	–	8:40a	9:20a	2:31p	5:01p	–	5:42p	6:06p	7:17p
Smyrna P&R	–	–	–	–	2:46p	5:16p	5:30p	5:57p	6:21p	7:32p
Smyrna/Mt. Vernon	7:04a	–	8:55a	9:35a	2:49p	5:19p	–	6:00p	6:24p	7:35p
Bishop's Corner	7:11a	–	9:02a	9:42a	2:56p	5:26p	–	6:07p	6:31p	7:42p
US 13/Denneys Rd.	7:14a	–	9:05a	9:45a	2:59p	5:29p	–	6:10p	6:34p	7:45p
Scarborough P&R	–	–	–	–	3:04p	5:34p	5:45p	6:15p	6:39p	7:50p
Dover Mall	7:17a	–	9:08a	9:48a	–	–	–	–	–	–
Del State Univ	7:22a	8:45a	9:13a	9:53a	3:08p	5:38p	–	6:19p	6:43p	7:54p
Wesley College	7:26a	8:49a	9:17a	9:57a	3:12p	5:42p	5:51p	6:23p	6:47p	7:58p
Water St	7:29a	8:52a	9:20a	10:00a	3:15p	5:45p	5:54p	6:26p	6:50p	8:01p
DelDot Admin	7:35a	8:59a	9:26a	10:06a	3:21p	5:51p	6:00p	6:32p	6:56p	8:07p

Middletown Shuttle Schedule to Middletown

ODESSA P & R	6:30a	6:54a	7:24a	8:51a	12:49p	2:31p	2:53p	5:01p	5:42p	6:06p
MAIN ST-RT 299 & CATHERINE ST	6:34a	6:58a	7:28a	8:55a	12:53p	2:35p	2:57p	5:05p	5:46p	6:10p

Middletown Shuttle Schedule from Middletown

MAIN ST-RT 299 & CATHERINE ST	6:20a	6:42a	7:17a	8:44a	12:42p	2:25p	2:46p	4:54p	5:35p	5:59p
ODESSA P & R	6:24a	6:46a	7:21a	8:48a	12:46p	2:29p	2:50p	4:58p	5:39p	6:03p

Source: Delaware Transit Corporation

Note: Not all bus stops along the route in Wilmington are listed.

Westtown Circulation Concept Plan

Table 9 – DART Route 301 – Dover to Wilmington - Monday thru Friday

Effective: May 23, 2005

DelDot Admin	5:35a	–	6:13a	6:37a	8:00a	11:49a	2:00p	4:40p	6:15p	6:45p	7:10p
Water St	5:41a	–	6:19a	6:43a	8:06a	11:56a	2:06p	4:48p	6:23p	6:51p	7:16p
Wesley College	5:43a	–	6:22a	6:45a	8:10a	11:58a	2:08p	4:50p	6:25p	*6:53p	7:18p
Del State Univ	–	–	–	–	8:17a	12:12p	2:15p	5:00p	6:32p	7:00p	7:25p
Dover Mall	–	–	–	–	–	12:16p	2:19p	–	6:36p	*7:04p	7:29p
Scarborough P&R	5:51a	–	6:30a	6:54a	8:21a	12:19p	2:23p	–	–	–	–
US 13/Denneys Rd.	5:54a	–	–	6:57a	8:24a	12:22p	2:26p	–	6:43p	7:11p	7:36p
Bishops Corner	5:57a	–	–	7:00a	8:27a	12:25p	2:29p	–	6:46p	7:14p	7:39p
Smyrna/MT. Vernon	6:04a	–	–	7:06a	8:33a	12:31p	2:35p	5:13p	6:53p	7:21p	7:46p
Smyrna P&R	6:09a	–	6:47a	7:09a	8:36a	12:34p	2:38p	–	–	–	–
Odessa P&R	6:24a	6:30a	–	7:24a	8:51a	12:49p	2:53p	–	7:11p	7:39p	8:01p
Boyd's Corner P&R	–	6:37a	–	7:31a	8:58a	12:56p	3:00p	–	–	–	–
Christiana Mall	6:45a	6:53a	–	7:47a	9:14a	1:12p	3:16p	5:45p	7:32p	8:00p	8:22p
Amtrak	7:01a	7:09a	7:28a	8:03a	9:30a	1:28p	3:32p	6:01p	7:48p	8:16p	8:38p
10th @ Market St.	7:07a	7:15a	7:34a	8:09a	9:36a	1:34p	3:38p	6:07p	7:54p	8:22p	8:44p
Delaware Ave. @ Adams St.	7:13a	7:21a	7:40a	8:15a	9:42a	1:40p	3:44p	6:13p	8:00p	8:28p	8:50p

Middletown Shuttle Schedule to Middletown

ODESSA P & R	6:30a	6:54a	7:24a	8:51a	12:49p	2:31p	2:53p	5:01p	5:42p	6:06p
MAIN ST-RT 299 & CATHERINE ST	6:34a	6:58a	7:28a	8:55a	12:53p	2:35p	2:57p	5:05p	5:46p	6:10p

Middletown Shuttle Schedule from Middletown

MAIN ST-RT 299 & CATHERINE ST	6:20a	6:42a	7:17a	8:44a	12:42p	2:25p	2:46p	4:54p	5:35p	5:59p
ODESSA P & R	6:24a	6:46a	7:21a	8:48a	12:46p	2:29p	2:50p	4:58p	5:39p	6:03p

Source: Delaware Transit Corporation

Note: Not all bus stops along the route in Wilmington are listed.

2. Proposed Accommodations

Delaware Transit Corporation (DTC) is currently assessing Intercounty Bus Route 301 for expansion in 2007 through a survey that will help DTC determine the present usage as well as the need for additional bus service needed to service the Town. This will include potential locations for additional bus stops. It is expected that the Villagebrook development will be a new stop as well as a stop to service motorists wishing to go to the Route 1 Park and Rides. In response to the additional development proposed for the Middletown area, DART will consider a new circulation route, possibly utilizing the new connector internal access roads. Existing Bus Route 304 will also be considered for further expansion. New DART pull-offs will be placed strategically throughout the study area, particularly where areas of high demand will occur. Possible DART Bus pull-offs could be located in the Walmart shopping center and along Industrial Drive.

The Downstate Rail Study is studying the possibility of a commuter train to be operational by 2010 or 2012. Ridership is expected to be between 800-1400 people a day with trains running approximately 4 trips per peak hour. Although there are no set locations for the train station in the study area, a potential commuter rail station along Industrial Boulevard was discussed in the Middletown Infrastructure Agreement and is subject to future study. Also discussed was a possible rail station location along US 301, north of Peterson Road. This was discussed during a December 2004 meeting with the project team and Delaware Transit Corporation.

VI. Implementation Plan

Transportation improvements discussed throughout this report will be implemented as development occurs throughout the study area. In general, improvements to existing state roadways will be designed, bid and constructed in a manner consistent with DelDOT standards. Internal roadway connections will be built in logical sections by each developer as the surrounding area develops. **Table 10** and **Figure 19** contain a complete list of proposed projects and roadway improvements.

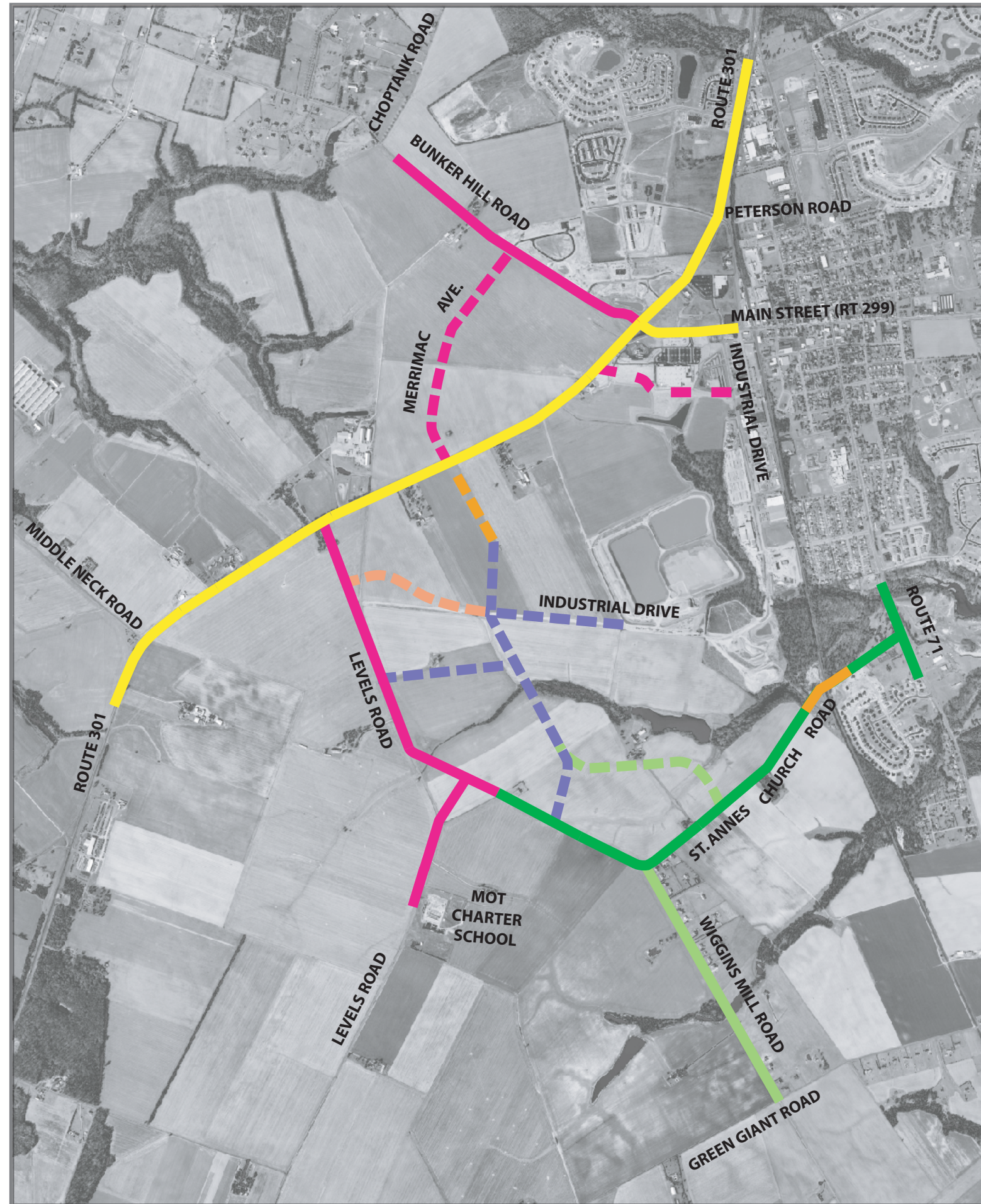
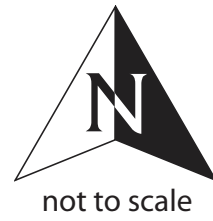
For short-term improvements, it will be the responsibility of each developer to design intersection improvements that meet the needs for interim conditions but also take into account the “ultimate” 2011 roadway alignments that will eventually be in place.

Developers will implement multimodal improvements that are not included in state projects as each development progresses.

Table 10 – Conceptual Cost Estimates for State Roadway Projects

Road	Limits	Completed In	Construction Cost Estimate (May 24, 2005)
Bunker Hill Road	US 301 to Choptank Road	2006	\$2,096,000
Levels Road	US 301 to MOT Charter School	2006	\$3,315,000
US 301 Dualization	Peterson Road to Middle Neck Road	2008	\$24,293,000
St. Annes Church Road	Levels Road to Route 71	2009	\$2,875,000
St. Annes Church Road	Railroad Bridge	to be determined	\$4,000,000
Wiggins Mill Road	Green Giant Road to St. Annes Church Road	2010	\$1,766,000

Note: Details of the cost estimates are included in **Appendix F**.



WESTTOWN

CIRCULATION CONCEPT PLAN

Legend

Completed By

- 2006
- 2007
- 2008
- 2009
- 2010
- To be determined
- To be constructed by developer
- To be constructed by State

Figure 19

Proposed Roadway Projects

VII. Public Involvement Summary

A public workshop was held between 4-7 PM on February 8, 2005 at the Middletown-Odesa-Townsend Fire House. The project team, including representatives from the Town of Middletown, DelDOT and McCormick Taylor, presented information regarding the Westown Master Plan endeavor. Information presented included land use development data for the proposed 2011 target year along with the corresponding levels of service. Traffic simulation models were displayed for existing 2004 conditions, interim 2006 conditions and the projected 2011 conditions, both with and without a potential limited access Route 301. These simulations helped workshop attendees visualize what the proposed development and subsequent traffic will look like. Conceptual roadway design plans were presented for US 301, Bunker Hill Road, Main Street, Levels Road, St. Annes Church Road, and Wiggins Mill Road as well as a video and board explaining roundabouts. Representatives from the consultant firm working on the US 301 Limited Access study were present to answer detailed questions regarding the concurrent project, and DelDOT and Middletown representatives were there to answer questions regarding general DelDOT and Middletown land use development procedures.

A questionnaire and comment form was distributed to all those who attended the public workshop. A sign-in sheet indicated that at least 219 people attended the workshop; however, it is expected that some people bypassed the sign-in or did not get a chance to register. The questionnaire and comment form, along with a compilation of comments received during and after the workshop, can be found in **Appendix G**.

Future public involvement will include additional public workshops as well as continued coordination with property owners, developers, DelDOT and the Town of Middletown. Communication with the public will be shared via a newsletter and a project website (www.westownproject.com).

VIII. Conclusion

The Westown Master Plan developed an overall blue print for development growth within the study area, and a general plan for the location and types of infrastructure improvements that would be required to support that development. This report documents a more detailed analysis of the transportation systems within the study area, and defines specific roadway, pedestrian, bicycle, and transit improvements to be implemented either by individual developers or through state sponsored projects.

Transportation improvements to be implemented by individual property owners will be completed as land parcels are developed. These improvements include internal development connector roadways, sidewalks, bicycle accommodations (shoulders and multi-use paths), and transit amenities (pull-outs and shelters). Three internal development connector roadways are proposed: Merrimac Avenue, the extension of Industrial Drive, and a connector through the Automall between US 301 and Industrial Drive. Specific details on the remaining improvements will be finalized as development plans solidify.

Transportation improvements to be implemented through state sponsored projects include the addition of shoulders; roadway shifts and realignments; the addition of capacity including additional through lanes, turn lanes, and signalization; drainage improvements; and bicycle/pedestrian improvements. The primary capacity improvements will be along the US 301 corridor, which is proposed to be dualized (two through lanes in each direction, with a median and double left-turn lanes where required). These improvements are proposed to be implemented through five separate construction contracts – one for each state roadway within the study area: US 301, Bunker Hill Road, Levels Road, St. Annes Church Road, and Wiggins Mill Road.



East Middletown

Master Transportation Plan

A Message from the Town Council and DeIDOT



Middletown has grown at a dramatic rate during the last five years and a large part of the land the Town has annexed has already been developed or is currently in the process of being developed. During this time, Middletown’s population has grown from 6,000 to 12,000, and population growth is forecast to continue well into the future with as many as 33,000 people expected to be living in the Town by the year 2030.

It is clear that without positive actions, new commercial and residential development will overwhelm the existing transportation infrastructure’s ability to accommodate the ever increasing number of vehicle trips in the eastern part of Middletown. We need to establish a better link between our land use and transportation planning efforts.

To meet these challenges the Town has recently partnered with the Delaware Department of Transportation (DeIDOT) to create a master transportation plan for the eastern portion of Middletown. The goal of this plan is to create a transportation plan that addresses and anticipates existing and future growth while also seeking to preserve the unique character of the Town.

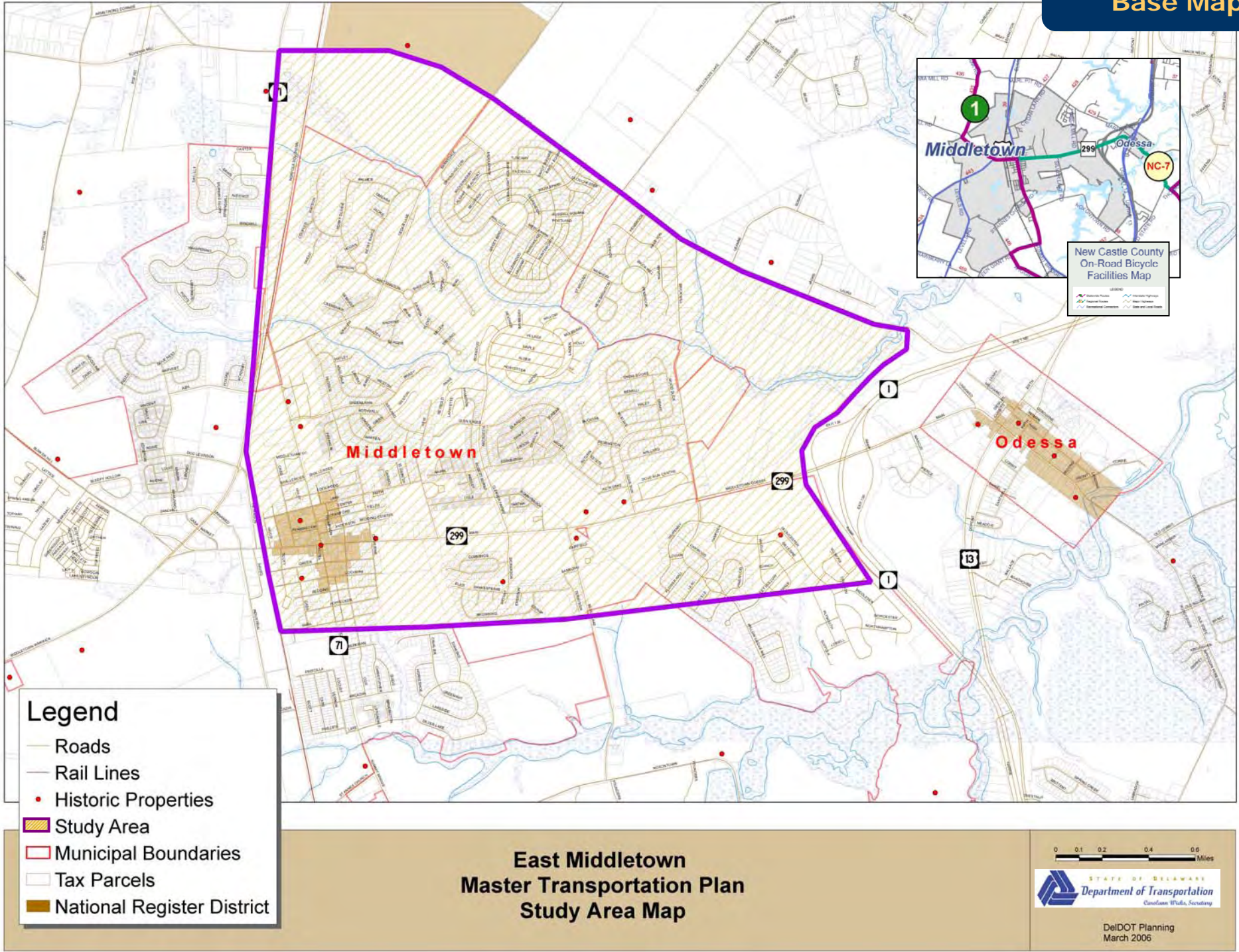
The development and implementation of this Plan is reflective of Middletown’s 2005 Comprehensive Plan which recommends that the Town “Plan for the mitigation of congestion along the US 301 corridor and SR 299.”

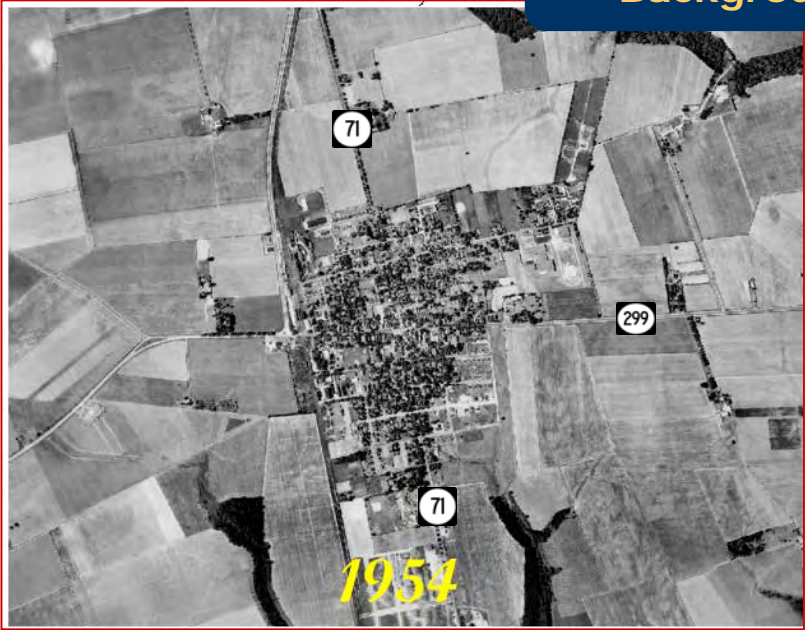
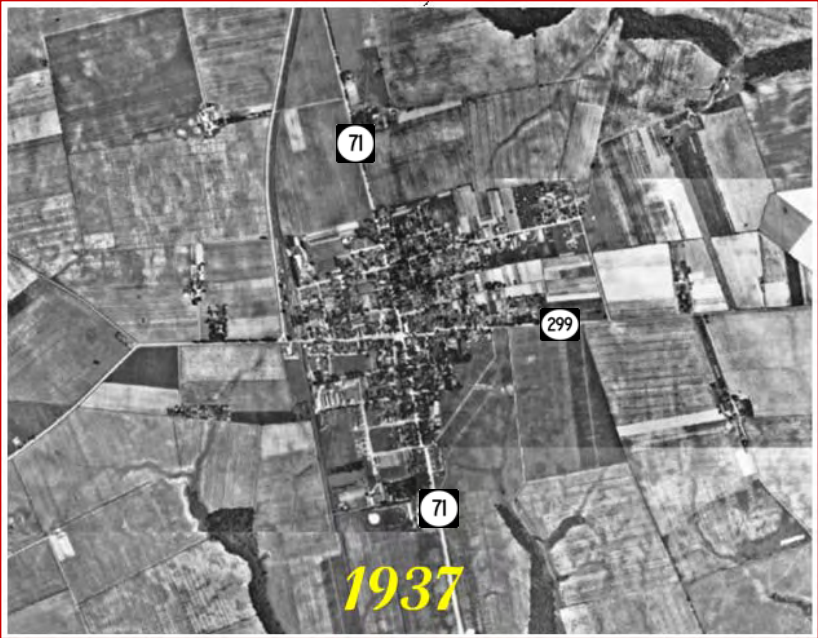
Implementing this ambitious plan will not be an easy task. However, with the help and advice of the Town’s residents we will be well positioned to bring forth a comprehensive transportation plan that provides solutions to both the existing and future transportation needs of the Town of Middletown.

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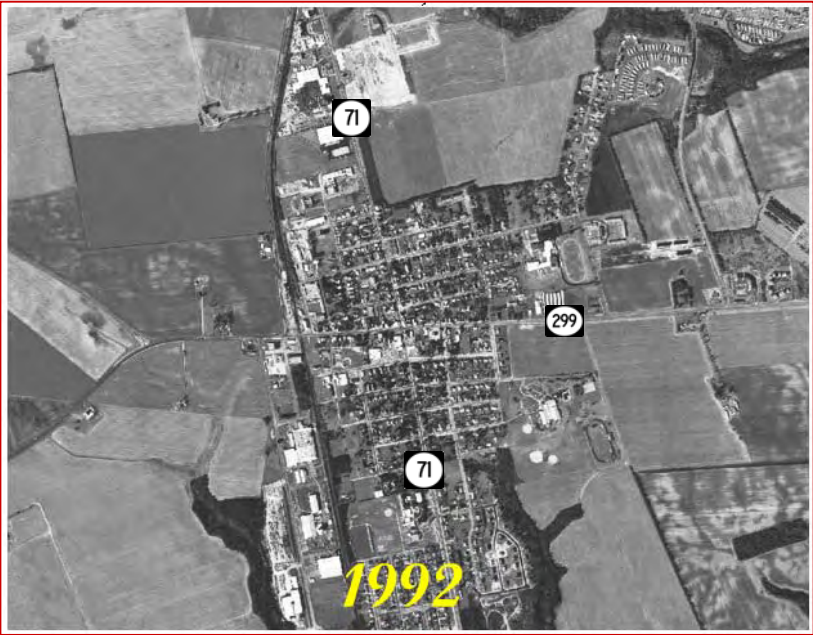
Appendix	
Scenario Comparison.....	A
W. Lake Street Extension....	B
Cleaver Farm Rd Ext.....	C
E. SR 299 Connector.....	D







Middletown Through Time





The eastern part of Middletown has seen the construction of several new housing and commercial developments in the last few years. Some of these developments are still under construction. There are also a number of developments that have already been approved but not yet built and some that have been proposed but not yet approved.

While growth in east Middletown has provided additional housing choices and needed services it has also brought pressure on the transportation system.

More than three thousand dwelling units and over one million square feet of commercial space are either under construction or due to be under construction in the near future (Table 1).

To meet the challenges associated with future growth it is first necessary to understand how that growth would impact the current transportation system if no improvements were made. DeIDOT has performed traffic analyses for the list of developments listed in Table 1 to better understand how these additional vehicle trips will impact travel in east Middletown.

As changes in land use are approved without sufficient infrastructure the end result is a transportation system unable to keep pace with new commercial and residential development.

The implementation of new transportation projects contained in the East Middletown Transportation Plan will help to provide solutions for traffic congestion throughout the study area and provide a roadmap of shared implementation.



TABLE 1

Active Developments East of Broad Street Approved but not Completely Built		
Greenlawn Office / Retail	308,000 square feet	
The Legends	577 dwelling units	
Parkside	500 dwelling units	
Estates at Dove Run	298 dwelling units	
Dove Run Centre	259,673 square feet	
Middletown Crossing Shop.Ctr.	372,350 square feet	
Willow Grove Mill Residential	863 dwelling units	

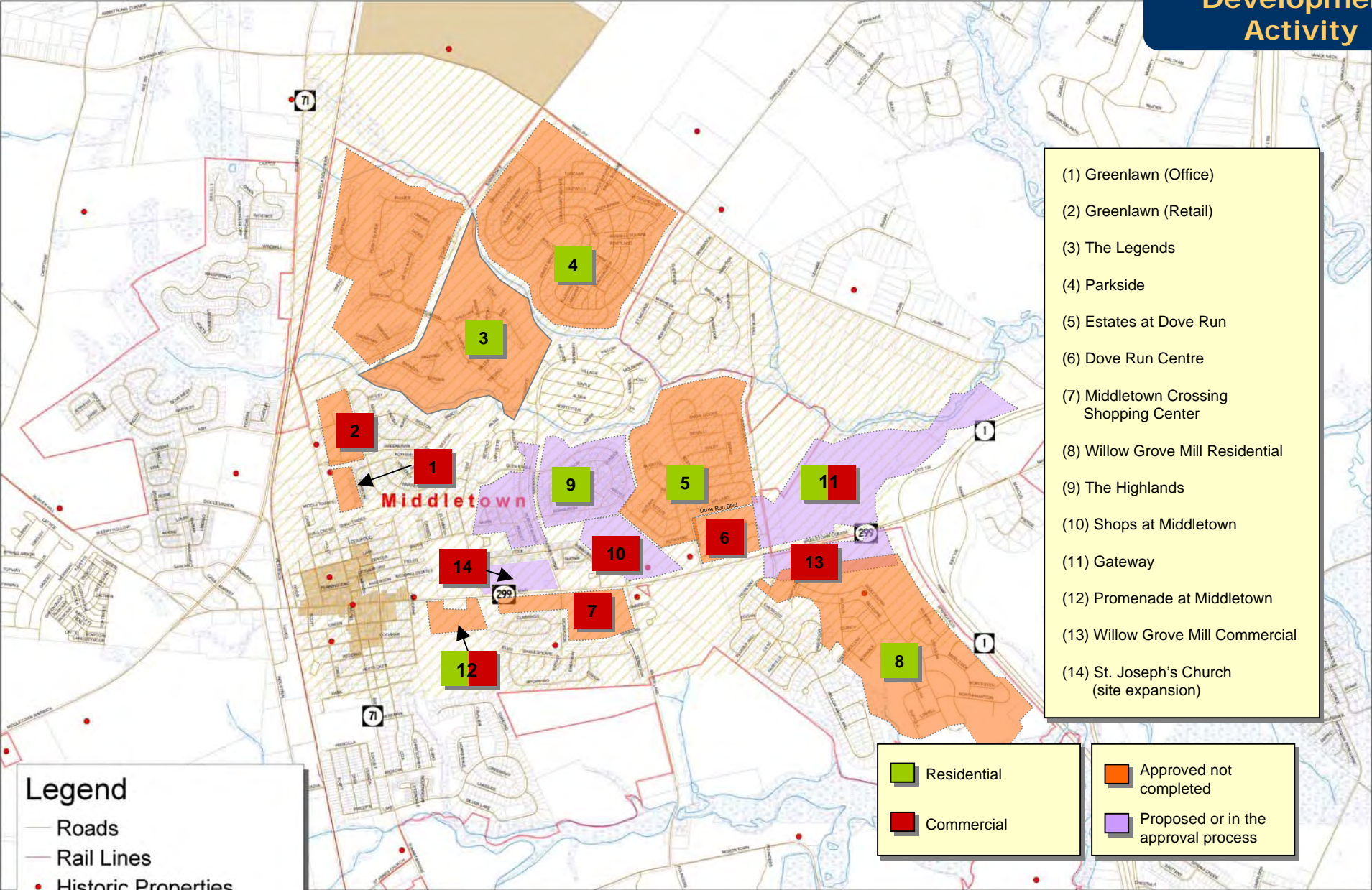
Total Dwelling Units	2,238	dwelling units
Total Commercial Square Footage	940,023	square feet
Total New AM Peak Hour Trips	3,031	vehicles
Total New PM Peak Hour Trips	3,831	vehicles

Active Developments East of Broad Street Proposed or In Approval Process		
The Highlands	1,246	dwelling units
Shops at Middletown	322,813	square feet
Gateway - residential	800	dwelling units
Gateway - commercial	240,000	square feet
Promenade at Middletown - residential	312	dwelling units
Promenade at Middletown - commercial	136,106	square feet
Willow Grove Mill Comm.	289,520	square feet

Total Dwelling Units	2,358	dwelling units
Total Commercial Square Footage	988,439	square feet
Total New AM Peak Hour Trips	3,344	vehicles
Total New PM Peak Hour Trips	5,062	vehicles

Grand Total Dwelling Units	4,596	dwelling units
Grand Total Commercial Square Footage	1,928,462	square feet
Grand Total New AM Peak Hour Trips	6,375	vehicles
Grand Total New PM Peak Hour Trips	8,893	vehicles





East Middletown
Master Transportation Plan
Study Area Map
Current Development Activity (East of SR 71)*

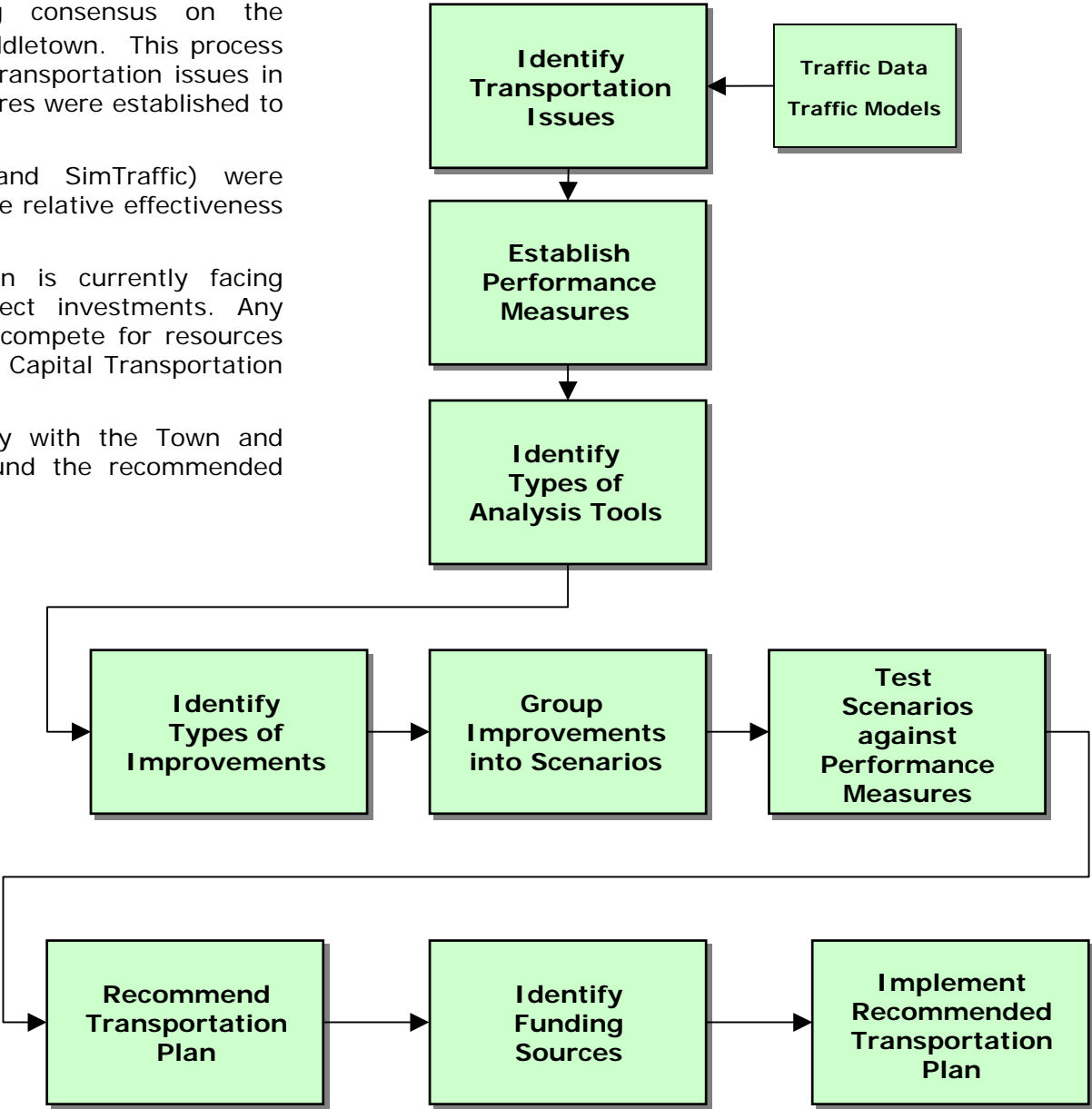
*As of March 6, 2006

A process was developed for reaching consensus on the recommended transportation plan for east Middletown. This process included identifying both existing and future transportation issues in the study area. A series of performance measures were established to compare alternative improvement scenarios.

Traffic analysis software tools (Synchro and SimTraffic) were employed to provide a means to distinguish the relative effectiveness of each proposed scenario.

The Delaware Department of Transportation is currently facing budgetary constraints for new capital project investments. Any recommended projects would be required to compete for resources among other state projects within the DelDOT Capital Transportation Program (CTP).

Therefore, DelDOT will need to work closely with the Town and developers to identify innovative ways to fund the recommended improvements.



Problem Identification

The first part in the creation of any transportation plan is to identify the issues and problems that are occurring within a study area.

The identification and quantification of existing and potential future transportation related problems in east Middletown were identified through a variety of sources including:

- Discussions with Town Officials
- Field investigations
- Traffic Modeling
- Preliminary operational analysis
- Accident record review

The above information was used to determine what standards would be used to measure the effectiveness of the alternative scenarios

Evaluating the effectiveness of the improvements included in a transportation plan requires the use of performance measures and criteria. Individual transportation projects were weighed against the measures and criteria found in Table 2 (below).

Volume to capacity ratio is a way of assessing whether any given intersection has enough through and turning lanes to accommodate the number of existing or projected vehicles expected to traverse an intersection. Since the study area is an urbanized area the team adopted a volume to capacity ratio of 1.00 for each of the future transportation scenarios.

Vehicle delay at intersections is measured using a Level of Service (LOS) index that ranges from LOS A (the least amount of delay) to LOS F (the greatest amount of delay). A target LOS E was used for each intersection to determine whether the proposed improvements provided an acceptable Level of Service. A local government, as part of its adopted comprehensive plan, may determine that acceptance of LOS D, E, or F for some portion of the day is necessary, efficient, and appropriate for the pattern of development they seek to create.

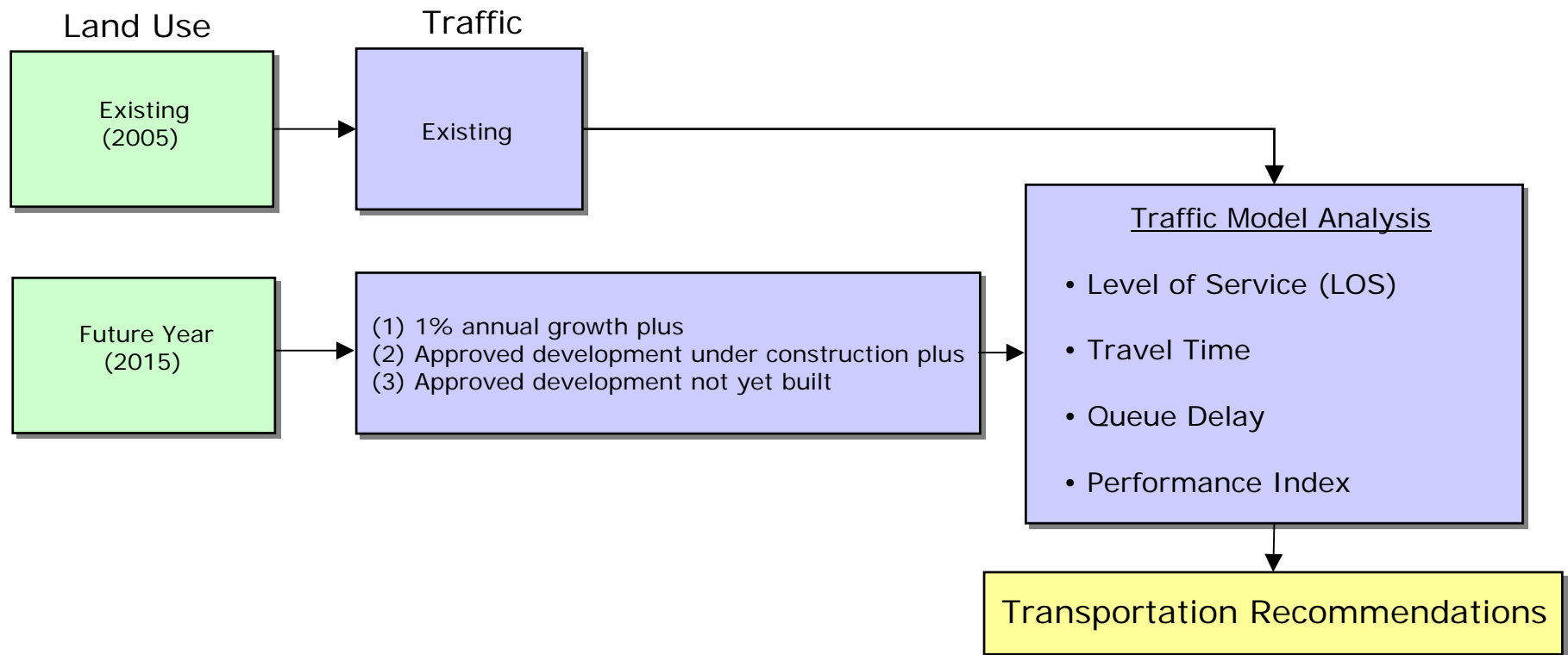
Vehicle queues (“backups”) are another way of determining how well a given intersection is operating. Vehicles in a left-turn lane, for example, should not block an adjacent through lane (spillover).

Table 2
Performance measures and criteria.

Performance Measure	Concerns addressed	Desired Performance Level
Volume-to-capacity Ratio	Motorist operations	0.90 (peak 15 minute period for 5-year condition); 1.00 (peak hourly period for 10-year condition)
Average Vehicle Delay	Motorist operations	55 seconds or less per vehicle (to achieve level of service (LOS) D or better)
Vehicle Queues	Motorist operations and safety	Should not spill back into through lanes
Performance Index	Motorist operations	Aggregate score based on delay, stops, and queuing
Average Accident Rate (AAR)	Safety	AAR less than other similarly classified roads in New Castle County

The year 2005 was selected as the base year and the year 2015 as the build-out year. The year 2005 constituted the existing conditions, or base year, against from which future alternative improvement scenarios would be compared. The year 2015 was designated as the “horizon” year in which the study area may experience a full build-out of available residential and commercial land.

Peak hour automobile trips were generated for the year 2015 based on developments that are already approved and under construction and those approved but not yet built. A one percent annual growth rate was also applied to estimated traffic inside the study area so as to account for additional growth outside of the study area.



Study Area
Intersections

The map below depicts the various intersections that were modeled and tested under each of the scenarios listed on page 17.



Intersections

- (1) SR 299 and Industrial Drive
- (2) SR 299 and Cass St
- (3) SR 299 and SR 71
- (4) SR 299 and Cox St
- (5) SR 299 and Catherine St
- (6) SR 299 and Promenade*
- (7) SR 299 and New St
- (8) SR 299 and Cleaver Farm Rd
- (9) SR 299 and Silver Lake Rd
- (10) SR 299 and Dove Run Blvd
- (11) SR 299 and Brick Mill Rd
- (12) SR 71 and Green St
- (13) SR 71 and Lake St
- (14) SR 71 and Greenlawn Blvd
- (15) SR 71 and Cedar Lane Rd
- (16) SR 71 and US 301
- (17) SR 71/US301 and Marl Pit Rd
- (18) Marl Pit Rd and Cedar Lane Rd
- (19) Marl Pit Rd and Shallcross Lake Rd
- (20) Marl Pit Rd and Brick Mill Rd
- (21) Brick Mill Rd and Dove Run Blvd
- (22) SR 299 and Gloucester Blvd**

*Not yet under construction
**Proposed new public road

LEGEND

■ ■ ■ Proposed new public road

As growth has continued in the east Middletown area so have the number of vehicle accidents. Along SR 299 (Main Street), for example, total vehicle accidents have increased by +960% since 1981.

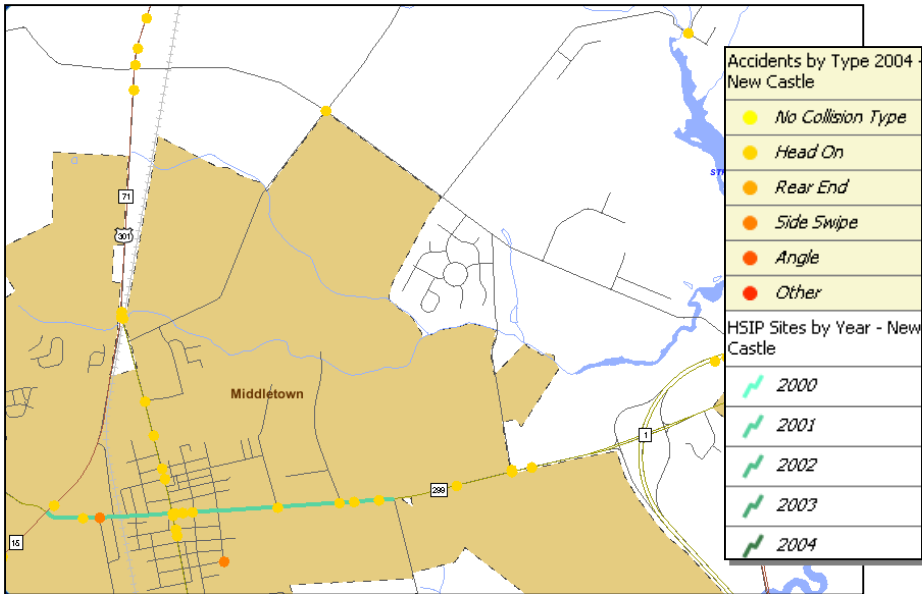
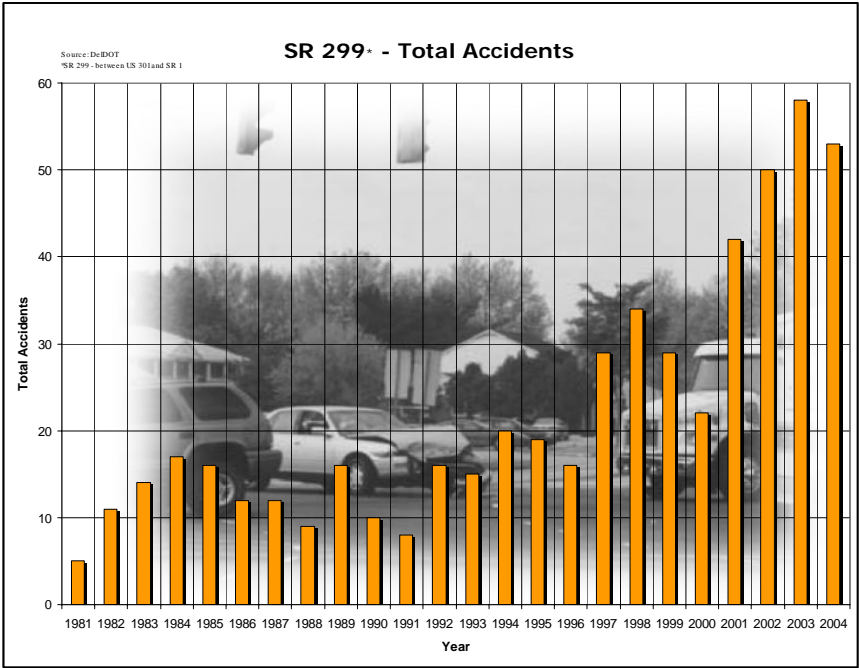
SR 299 is classified as a two-lane urban minor arterial road. Accident data collected by DeIDOT indicate that SR 299 has an average accident rate (AAR) score of 2.75 per million million miles of travel. The State-wide average for similarly classified roads (i.e. US 13 and SR 71) is 4.23.

DeIDOT’s Highway Safety Improvement Program (HSIP) helps to reduce the number and severity of accidents throughout the State by targeting funding to roads or intersections that have a history of high accident rates. For an intersection or location to be added to the HSIP project list it must have had a minimum of fifteen accidents within a three year period and a minimum critical accident ratio* of 1.0.

The program has a number of tools that can be used to reduce accidents and improve safety including intersection improvements, rumble strips, bicycle and pedestrian improvements, and pavement resurfacing.

The Brick Mill Rd / SR 299 intersection has been identified in the DeIDOT 2006 HSIP program.













Currently there is no funding for this project in the DeIDOT Capital Transportation Program (CTP). There are, however, several ongoing Traffic Impact Studies and recommendations within this document that will address possible improvements to this intersection.



*Critical Accident Rates (CAR) are a statistical test of significance of the calculated accident rate for each section of roadway. CAR values vary in relation to Average Annual Daily Traffic

Year 2005 & Year 2015 Development (w/no improvements)

Table 4.
Existing & Year 2015 Intersection Analysis

# Intersection	Type Existing	Peak Hour	Existing Conditions			No Improvements 2015 plus development		
			Avg. Delay	Max V/C Ratio	Level of Service	Avg. Delay	Max V/C Ratio	Level of Service
1 SR 299 and Industrial Dr		AM PM	12.0 17.2	0.43 0.45	B C	13.4 23.3	0.60 0.77	B C
3 SR 299 and SR 71		AM PM	29.5 31.9	0.51 0.59	C C	82.9 154.1	1.05 1.28	F F
5 SR 299 and Catherine St		AM PM	14.1 17.1	0.56 0.8	B B	32.3 176.4	0.96 1.40	C F
8 SR 299 and Cleaver Farm Rd		AM PM	27.2 27.8	0.47 0.64	C C	119.8 99.1	1.19 1.18	F F
9 SR 299 and Silver Lake Rd		AM PM	38.5 51.2	0.68 0.80	D D	160.9 169.7	1.42 1.33	F F
11 SR 299 and Brick Mill Rd		AM PM	29.4 40.0	0.68 0.78	C D	140.9 237.2	1.37 1.62	F F
13 SR 71 and Lake St		AM PM	5.20 5.00	0.37 0.40	A A	7.80 7.70	0.57 0.65	A A
14 SR 71 and Greenlawn Dr		AM PM	10.2 12.0	0.48 0.57	B B	12.9 13.6	0.58 0.64	B B
16 SR 71 and US 301 (South)		AM PM	7.40 12.6	0.42 0.49	A B	7.7 14.9	0.53 0.48	A B
17 SR 71 and US 301 (North)		AM PM	19.6 19.3	0.83 0.82	B B	39.0 23.9	0.96 0.85	D C
18 SR 71 and Marl Pit Rd		AM PM	11.9 14.6	0.62 0.69	B B	42.3 17.1	0.97 0.75	D B
21 Brick Mill Rd at Brick Mill E. School		AM PM	12.5 11.2	0.19 0.28	B B	19.6 11.8	0.26 0.35	B B

Existing conditions and the year 2015 traffic projections (with no transportation improvements) were compared utilizing the following performance measures:

- Average Delay (seconds)
- Maximum Volume to Capacity
- Level of Service (LOS)

Results:

Numerous intersections will exceed the target LOS E and V/C Ratio criteria by the year 2015 if no improvement projects are implemented.

Signalized Intersections Level of Service (LOS)

	LOS A-C (<35 seconds)
	LOS D (36 - 55 seconds)
	LOS E (56 - 80 seconds)
	LOS F (>80 seconds)

Year 2005 & Year 2015 Development (SR 299 Travel Time)

Traffic analysis has shown that the following intersections will not meet the established performance measure of LOS D by the year 2015 if no improvements are implemented:

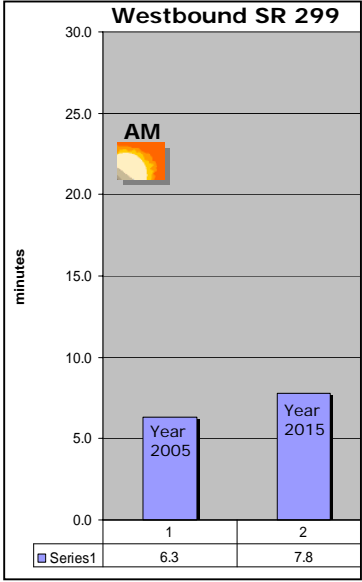
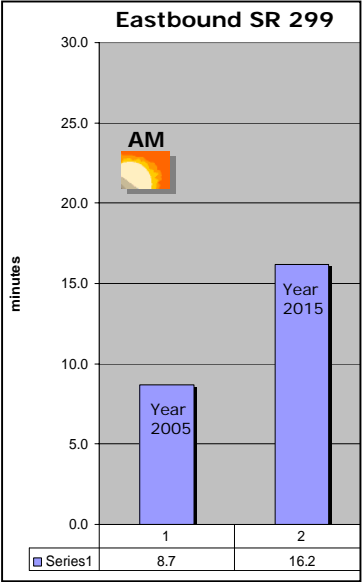
- SR 299 & SR 71
- SR 299 & Catherine St (PM)
- SR 299 & Promenade Entrance
- SR 299 & Cleaver Farm Rd
- SR 299 & Silver Lake Rd
- SR 299 & Brick Mill Rd

Another way to look at how one of the major corridors within the study area might be impacted by future development is to look at predicted* changes in travel time associated with future growth.

Travel times along SR 299 (between Brick Mill Rd and Industrial Drive) are predicted to increase dramatically by the year 2015.

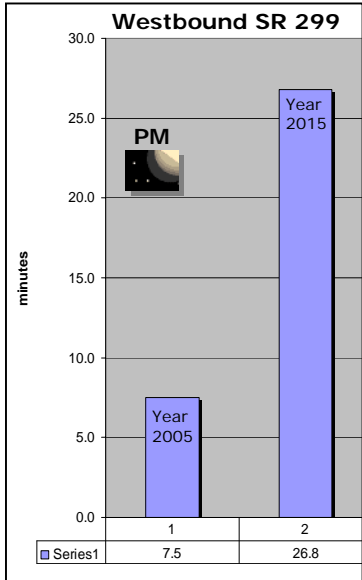
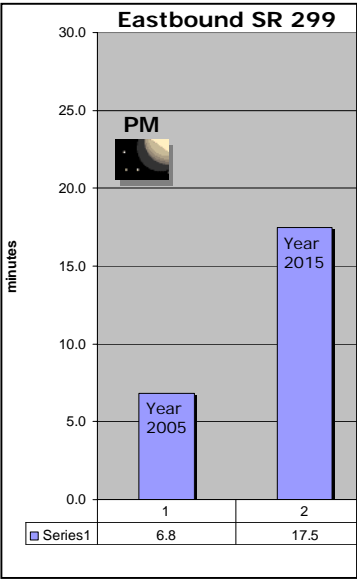
Currently, the average travel time in the AM peak hour from Industrial Blvd to Brick Mill Rd (eastbound) is approximately 9 minutes. By the year 2015 this commuting time will grow to 16 minutes (an increase of +160%). The same trip going westbound will increase by 3 minutes (+33%).

Currently, the average travel time in the PM peak hour from Industrial Blvd to Brick Mill Rd (eastbound) is approximately 7 minutes. By the 2015 this commuting time will also grow to 18 minutes (an increase of +160%). The same trip going westbound will increase by 21 minutes (+237%).



SR 299 Travel Time

SR 299 Travel Time



*Traffic model derived travel times.
Observed travel times (Summer, 2006) were within +/- 10 to 15% of model travel times.



Year 2015 Transportation Improvements

Both ongoing and proposed future development are predicted to create additional intersection delay and increased travel times throughout much of east Middletown's street system.

Improving future travel conditions in the study area required that several different categories of potential projects be examined including:

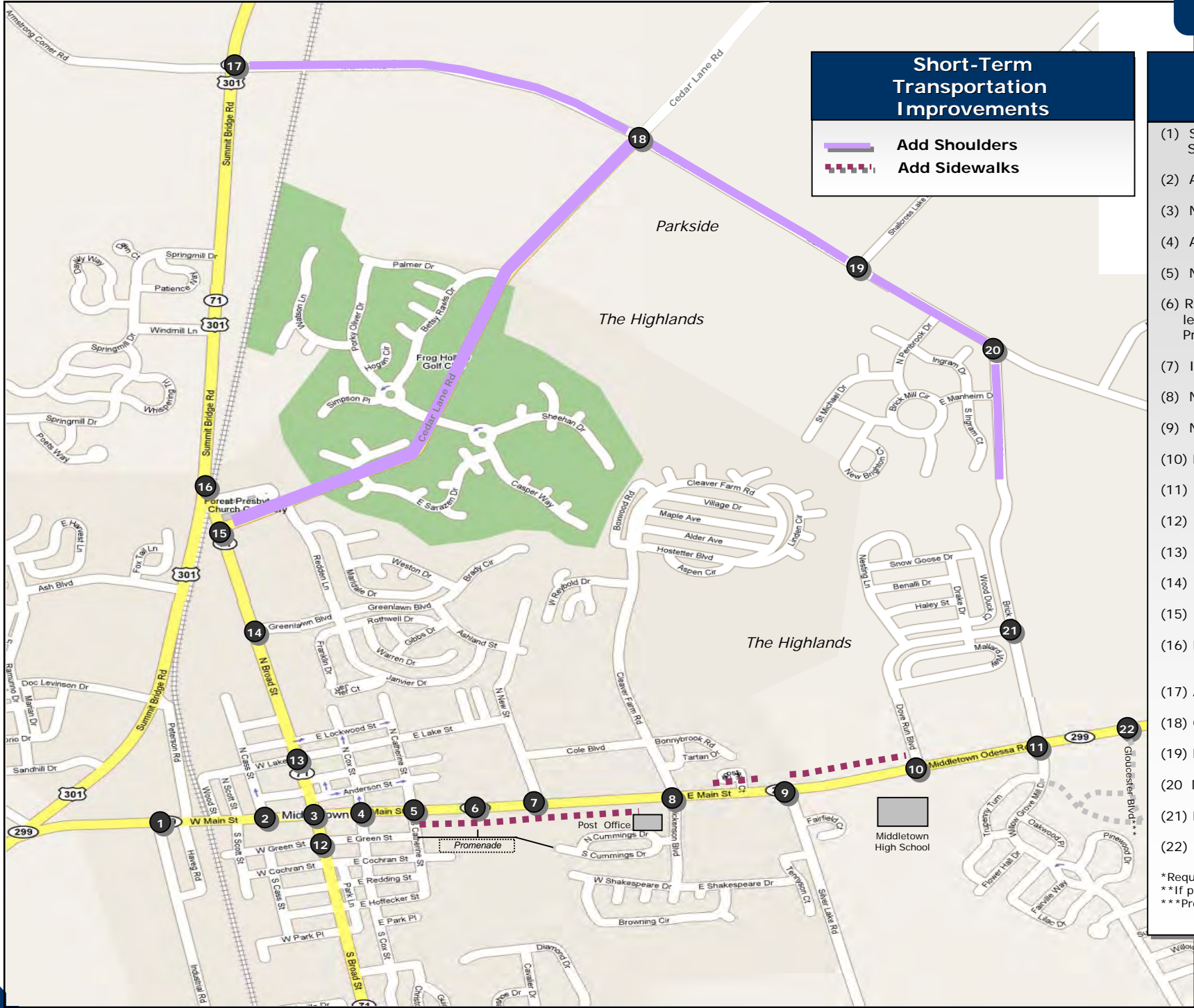
- Intersection Improvements
- New Road Connections
- Expanding Capacity on Existing Facilities
- Bicycle Improvements
- Pedestrian Improvements
- Transit Improvements

Dependent upon funding availability and construction feasibility each of the improvements can be considered either short term or long term. Short term improvements are operational improvements and long term improvements relate to increases in capacity.

The following map (p.15) depicts the recommended operational improvements resulting from modeling and analyses.

The subsequent map (p.16) depicts the proposed new road connections and expanded capacity improvements that were also modeled and analyzed among the various future year scenarios.

Operational Improvements

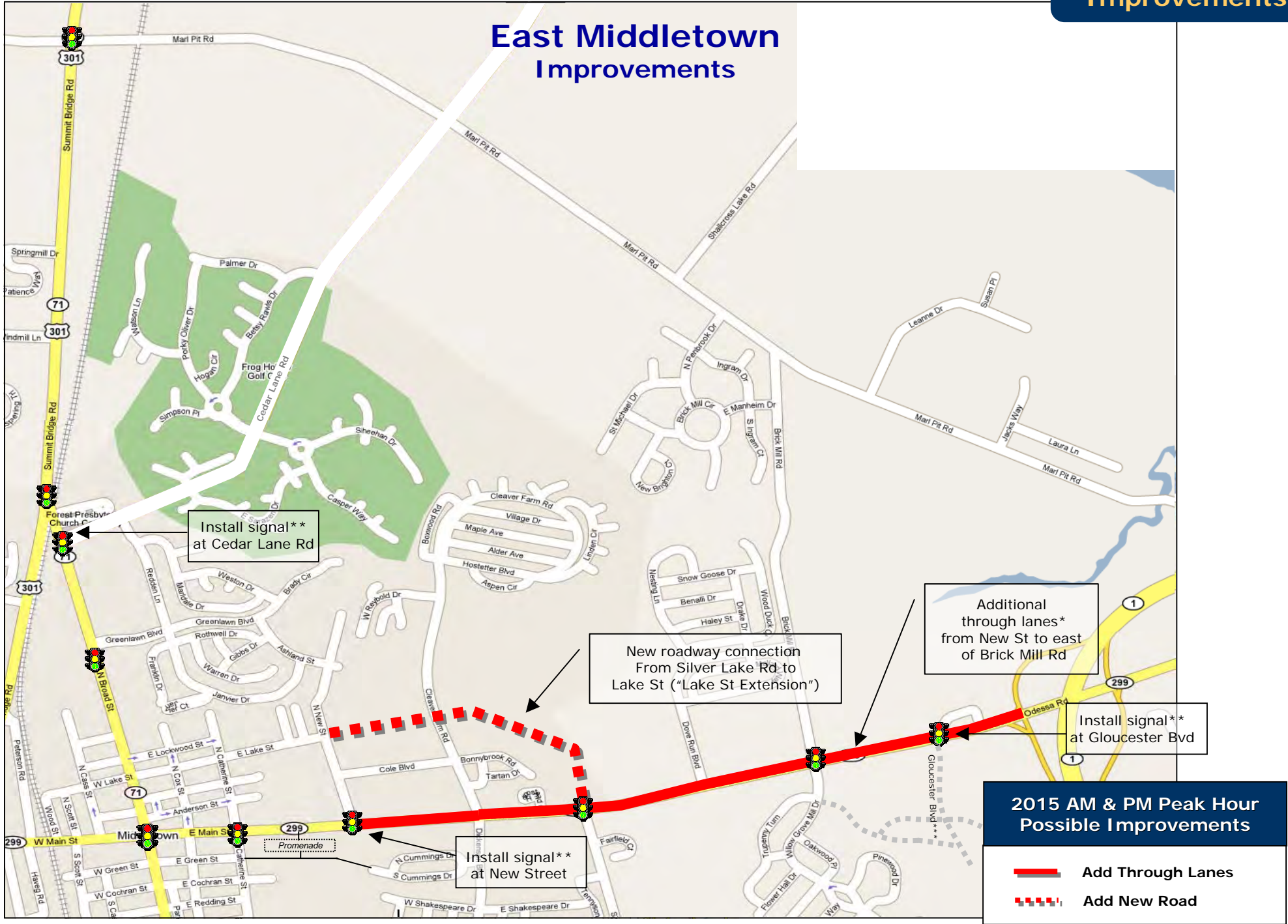


Short-Term Transportation Improvements

— Add Shoulders
- - - Add Sidewalks

- Short-Term Transportation Improvements**
- (1) Signal installation scheduled for Summer/Fall 2006
 - (2) Add WB Right Turn Lane*
 - (3) No Improvements
 - (4) Add EB/WB Right Turn Lanes*
 - (5) No Improvements
 - (6) Right In/Right Out with westbound left turn lane (in association with Promenade development)
 - (7) Install Traffic Signal**
 - (8) No Improvements
 - (9) No Improvements
 - (10) No Improvements
 - (11) Add WB Channelized Right Turn Lane
 - (12) No Improvements
 - (13) No Improvements
 - (14) No Improvements
 - (15) Install Traffic Signal**
 - (16) No Improvements (part of ongoing US 301 Project Development Study)
 - (17) Add EB/WB Left and Right Turn Lanes
 - (18) Construct Roundabout
 - (19) No Improvements
 - (20) No Improvements
 - (21) No Improvements
 - (22) Install Traffic Signal**
- *Requires removal of existing on-street parking
**If proposed signal meets DeIDOT signal warrants
***Proposed new public road

East Middletown Improvements



*The actual location of where the existing two lane section of SR 299 would transition to a new four lane section would be determined in the design phase of the project.

**If recommendation meets DelDOT signal warrants

***Proposed new public road

For the purposes of developing a Plan to address the predicted increases in traffic in the east Middletown area numerous scenarios of potential transportation improvements were prepared and modeled.

The scenarios list (table 3) attempts to group and mix each of the short term and long-term improvements in a manner that would yield the most effective list of potential projects.

Each of these scenarios was tested and compared against the established performance measures listed in table 2. The relative effectiveness of each scenario was measured to arrive at the recommended improvements which taken together constitute the East Middletown Transportation Plan.

Below is a table that lists the various improvements (pages 14 & 15) that were included in each scenario.

After testing each of the scenarios below against the established performance measures on page 7 it was concluded that scenario 7B provided the greatest level of improvement to the transportation system.

The remainder of this report will focus on the benefits of scenario 7B which will now be referred to as the East Middletown Master Transportation Plan or the “Plan”













Table 3
Transportation Scenarios

East Middletown Transportation Plan Land Use & Transportation Improvement Scenarios										
Transportation Scenario	Land Use		Short-Term Improvements	Long-Term	Short-Term	Short-Term	Short-Term	Long-Term	Long-Term	Long-Term
	2005	2015		E. Lake St Extension	E. Lake St Roundabout	New St & Cleaver Farm Rd Roundabouts	New St & Cleaver Farm Rd Signals	SR 299 Widening	W. Lake St Extension	Cleaver Farm Rd Extension
1	●									
2		●								
3		●		●						
4		●		●					●	
5		●		●						●
6		●	●	●						
7A		●	●	●		●		●		
7B		●	●	●			●	●		
8		●	●	●	●					
9		●	●	●	●			●		
10		●	●	●	●			●	●	
11		●	●	●	●			●	●	●

Existing Conditions & Year 2015 Development & E. Middletown Master Transportation Plan

Existing conditions and the year 2015 traffic projections (with short and mid-term improvements) were compared utilizing the following performance measures:





- Average Delay (seconds)
- Max Volume to Capacity
- Level of Service (LOS)

# Intersection	Type Exsiting	Peak Hour	Existing Conditions			No Improvements 2015 plus development			With Improvements 2015 plus development		
			Avg. Delay	Max V/C Ratio	Level of Service	Avg. Delay	Max V/C Ratio	Level of Service	Avg. Delay	Max V/C Ratio	Level of Service
1 SR 299 and Industrial Dr		AM	12.0	0.43	B	13.4	0.60	B	13.2	0.65	B
		PM	17.2	0.45	C	23.3	0.77	C	21.7	0.80	C
3 SR 299 and SR 71		AM	29.5	0.51	C	82.9	1.05	F	67.8	1.01	E
		PM	31.9	0.59	C	154.1	1.28	F	119.4	1.12	F
5 SR 299 and Catherine St		AM	14.1	0.56	B	32.3	0.96	C	15.7	0.73	B
		PM	17.1	0.8	B	176.4	1.40	F	61.0	1.35	E
8 SR 299 and Cleaver Farm Rd		AM	27.2	0.47	C	119.8	1.19	F	46.4	0.83	D
		PM	27.8	0.64	C	99.1	1.18	F	39.3	0.71	D
9 SR 299 and Silver Lake Rd		AM	38.5	0.68	D	160.9	1.42	F	28.0	0.70	C
		PM	51.2	0.80	D	169.7	1.33	F	44.2	0.82	D
11 SR 299 and Brick Mill Rd		AM	29.4	0.68	C	140.9	1.37	F	42.0	0.94	D
		PM	40.0	0.78	D	237.2	1.62	F	73.9	1.0	E
13 SR 71 and Lake St		AM	5.20	0.37	A	7.80	0.57	A	15.60	0.72	B
		PM	5.00	0.40	A	7.70	0.65	A	42.10	0.92	D
14 SR 71 and Greenlawn Dr		AM	10.2	0.48	B	12.9	0.58	B	12.2	0.59	B
		PM	12.0	0.57	B	13.6	0.64	B	17.2	0.62	B
16 SR 71 and US 301 (South)		AM	7.40	0.42	A	7.7	0.53	A	7.7	0.53	A
		PM	12.6	0.49	B	14.9	0.48	B	14.9	0.48	B
17 SR 71 and US 301 (North)		AM	19.6	0.83	B	39.0	0.96	D	39.0	0.96	D
		PM	19.3	0.82	B	23.9	0.85	C	23.9	0.85	C
18 SR 71 and Marl Pit Rd		AM	11.9	0.62	B	42.3	0.97	D	38.4	0.92	D
		PM	14.6	0.69	B	17.1	0.75	B	17.1	0.75	B
21 Brick Mill Rd at Brick Mill E. School		AM	12.5	0.19	B	19.6	0.26	B	20.0	0.26	B
		PM	11.2	0.28	B	11.8	0.35	B	12.3	0.34	B

*The SR 71 / SR 299 intersection does not meet the performance criteria due to historical geometric constraints

Results:

The East Middletown Master Transportation Plan (w/short-term improvements and additional SR299 through lanes) meets* the performance criteria for LOS and V/C ratios established by the planning team.

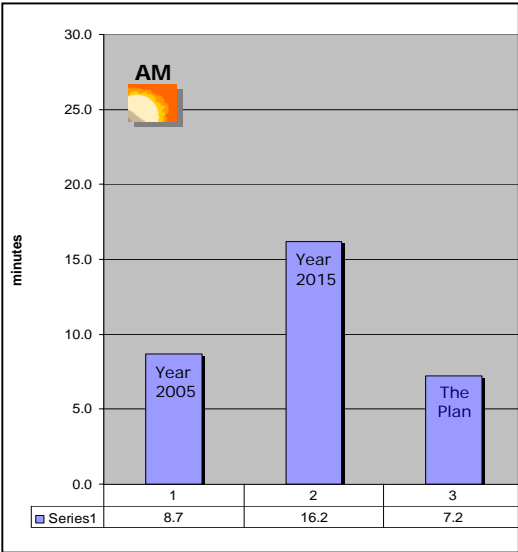
Signalized Intersections Level of Service (LOS)	
	LOS A-C (<35 seconds)
	LOS D (36 - 55 seconds)
	LOS E (56 - 80 seconds)
	LOS F (>80 seconds)

The graph to the right depicts the projected changes in the AM and PM peak hour travel times along SR299 between the year 2005, year 2015 (with no improvements) and the East Middletown Master Transportation Plan.

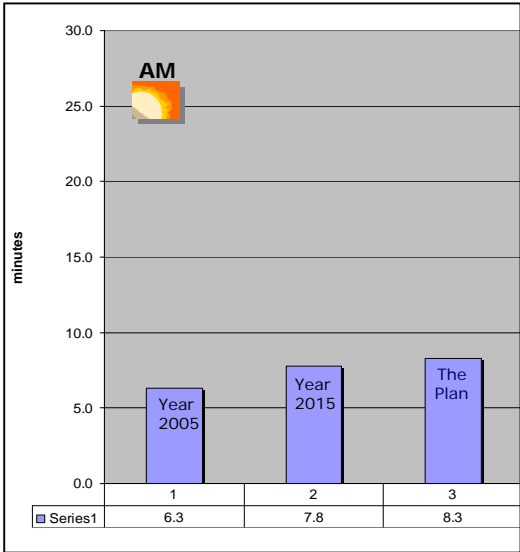
Larger fluctuations in travel time between the scenarios occur on eastbound, SR 299 which also has the largest share of traffic during the morning rush hour compared to westbound traffic.

The Plan proves to be effective at reducing increased travel times associated with projected growth in the year 2015.

Eastbound SR 299

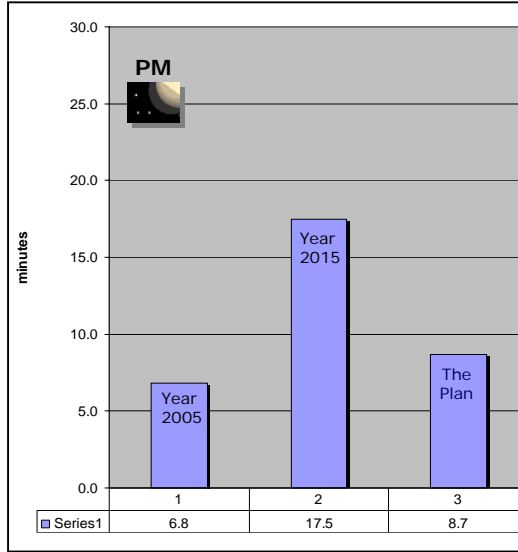


Westbound SR 299



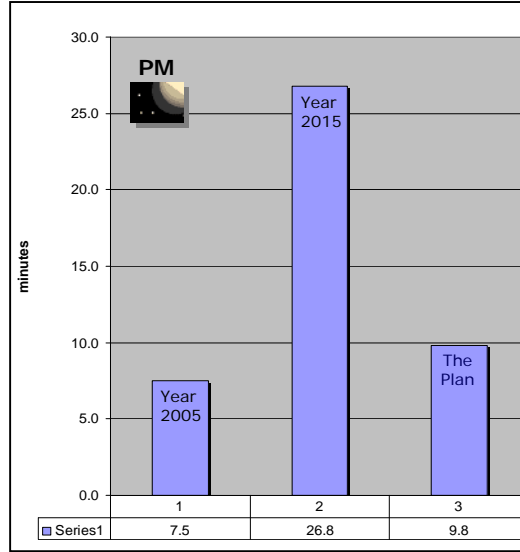
SR 299 Travel Time

Eastbound SR 299



SR 299 Travel Time

Westbound SR 299

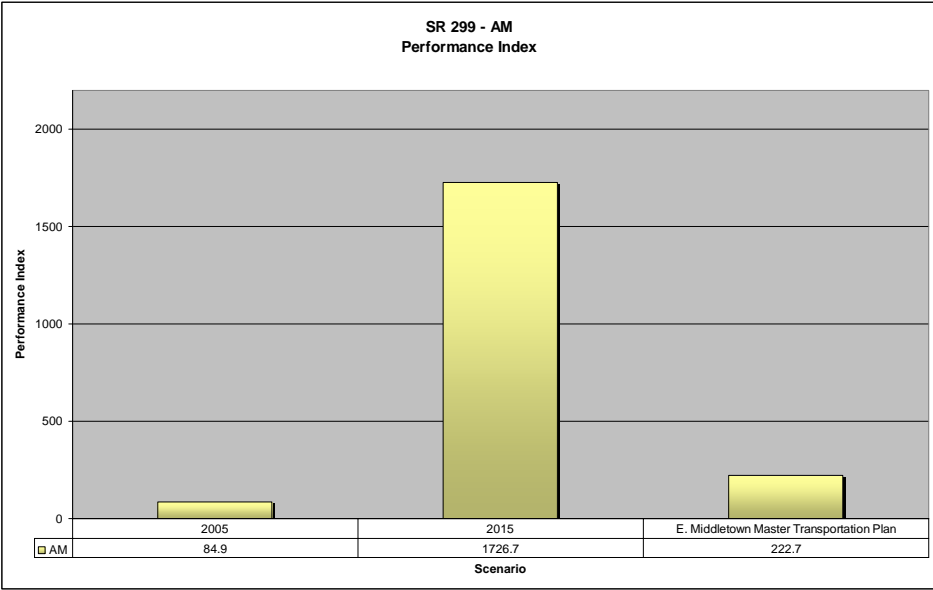


A Performance Index (PI) is a composite score derived from the Synchro traffic model that looks at the amount of delay and the number of stops per vehicle associated with a transportation scenario. A lower PI score indicates a more efficient transportation network or corridor.

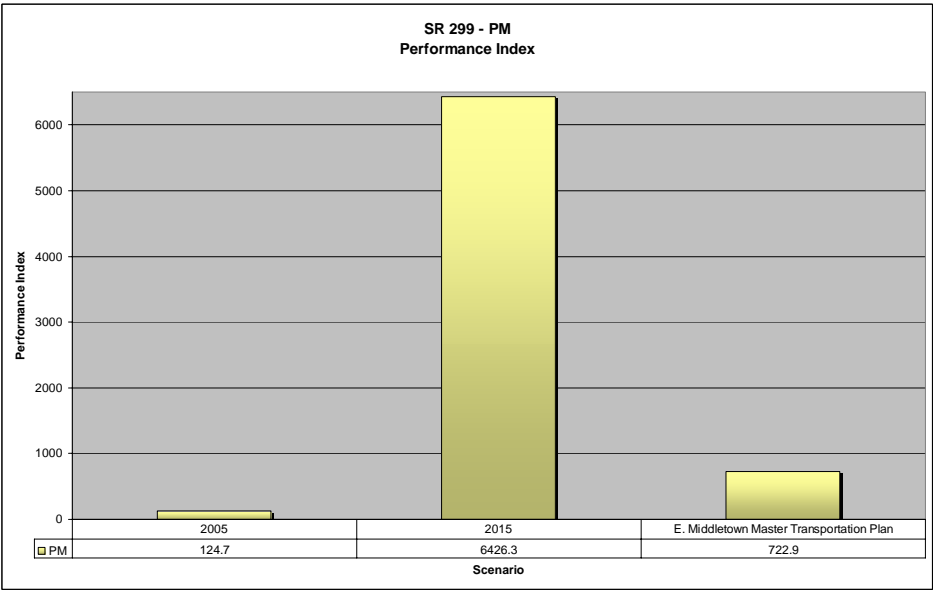
The graph to the right depicts the various SR 299 AM and PM peak hour PI scores for the eleven transportation scenarios.

The East Middletown Master Transportation Plan will clearly result in greater operational efficiency of the SR 299 corridor when compared to the year year 2015 scenario with no transportation improvements.

AM Peak Hour	Year 2005	Year 2015	E. Middletown Transportation Plan
Total Delay (hr)	68	1656	183
Stops (#)	6109	25499	14179
Average Speed (mph)	20	4	17
Total Travel Time (hr)	154	1867	393
Distance Traveled (mi)	3119	6750	6756
Performance Index	84.9	1726.7	222.7



PM Peak Hour	Year 2005	Year 2015	E. Middletown Transportation Plan
Total Delay (hr)	103	4144	670
Stops (#)	7859	821597	19184
Average Speed (mph)	20	2	9
Total Travel Time (hr)	192	4397	914
Distance Traveled (mi)	3871	8070	7884
Performance Index	124.7	6426.3	722.9

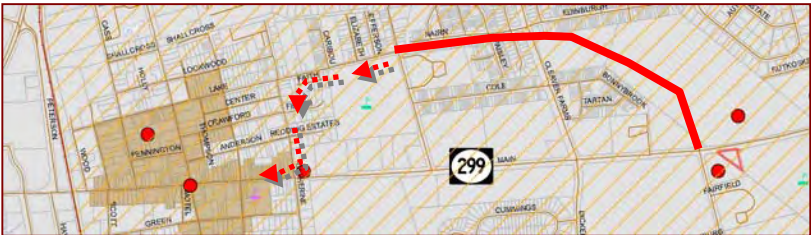


*East of Brickmill Rd to Industrial Blvd

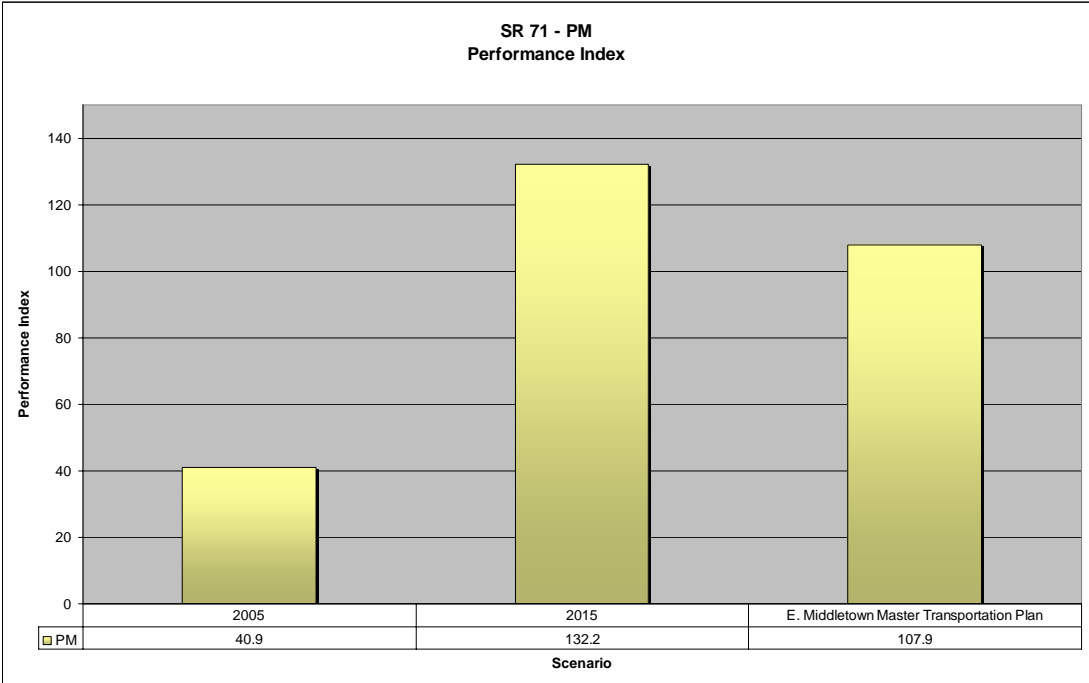
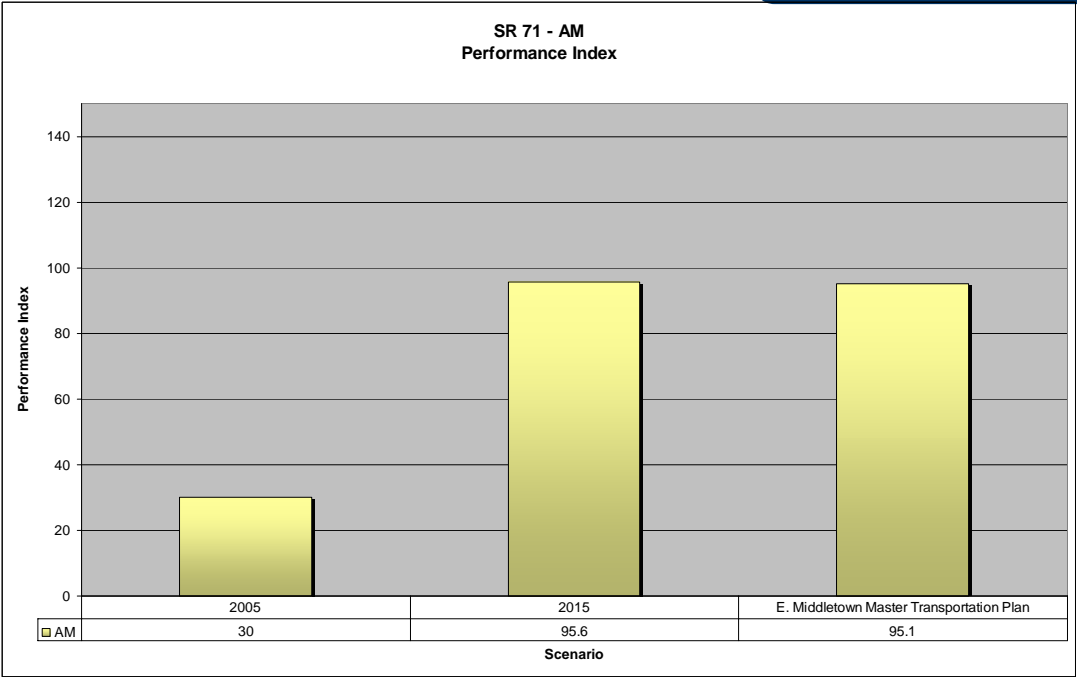
Performance Index (PI) analyses were also performed for the SR 71 corridor from SR 299 to Marl Pit Rd. The graph to the right depicts the year 2015. Year 2015 (with no improvements) and the Plan AM and PM peak hour PI scores. A lower PI score indicates better performance.

The impacts of each of the scenarios on the SR 71 corridor appears to be related to how each of the proposed improvements on SR 299 alter the flow of traffic on SR 71.

The proposed Lake Street extension, for example, would re-direct some of westbound SR 299 traffic onto the extension which would then utilize a portion of southbound SR 71 to return to SR 299.



*East of Brickmill Rd to Industrial Blvd



An estimated 36%* of EB SR299 through traffic could use the proposed Lake St Extension via NB SR 71

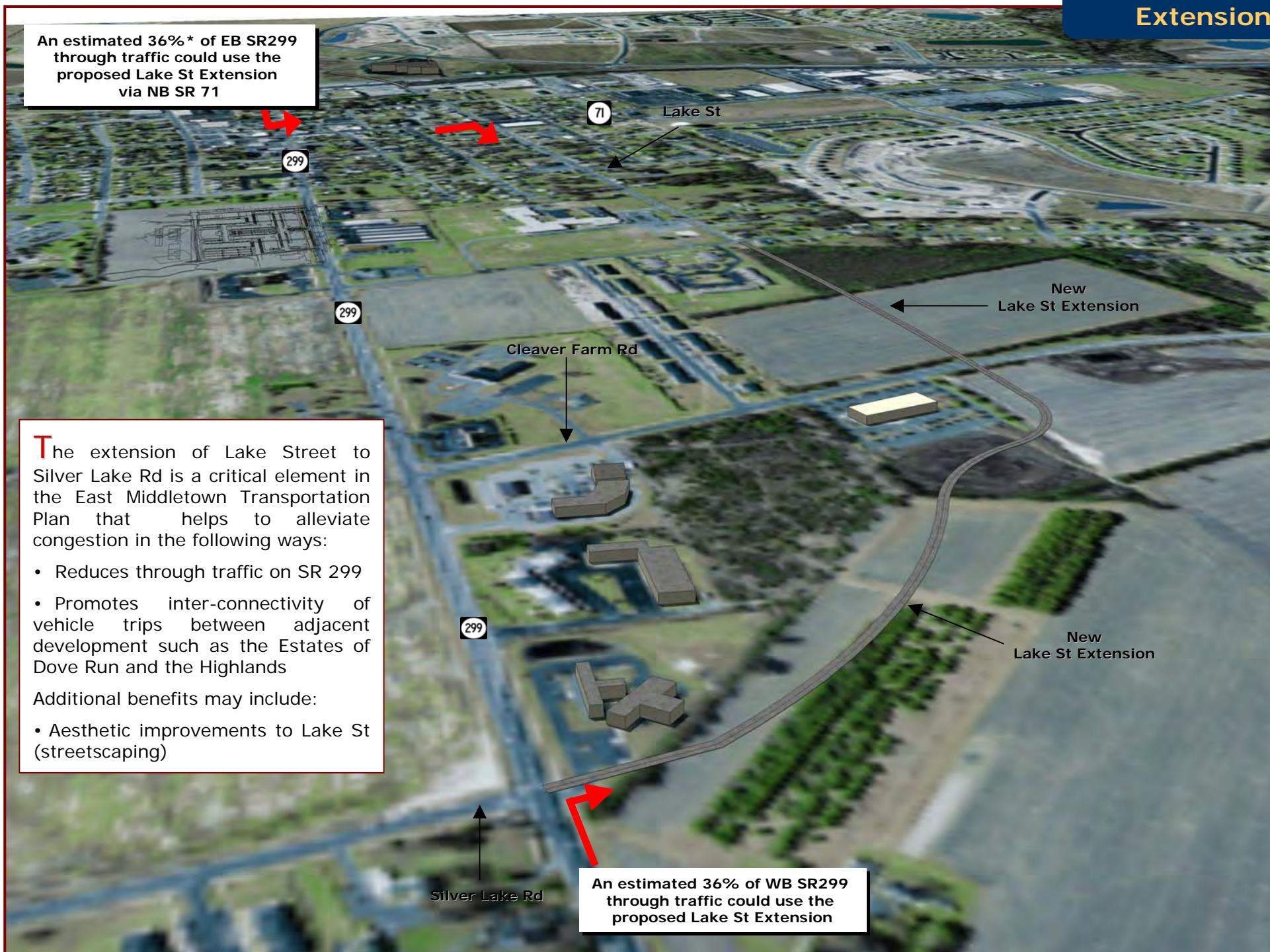
The extension of Lake Street to Silver Lake Rd is a critical element in the East Middletown Transportation Plan that helps to alleviate congestion in the following ways:

- Reduces through traffic on SR 299
- Promotes inter-connectivity of vehicle trips between adjacent development such as the Estates of Dove Run and the Highlands

Additional benefits may include:

- Aesthetic improvements to Lake St (streetscaping)

An estimated 36% of WB SR299 through traffic could use the proposed Lake St Extension



*Source: DelDOT Travel Demand Model

Roundabouts are often an effective alternative for either 4-way stop or signalized intersections.

Research indicates that roundabouts may improve safety by forcing vehicles to decrease their speed as they approach and drive through an intersection. Conflict points at many intersections can also be eliminated or modified with the installation of a roundabout.

Crash frequencies for eleven intersections converted to roundabouts in the United States have shown a reduction of 37 percent for all crashes and 51 percent for injury crashes.*

Traffic flow improvements associated with a roundabout can often result in the need for fewer lanes and less right-of-way when undertaking an intersection improvement project.

The planning team looked at the possibility of constructing roundabouts on SR 299 at New St and Cleaver Farm Rd. Traditional signalized intersections were also tested. While roundabouts at these locations did show some initial promise it was determined that the geometric constraints of these locations would not make the construction of roundabouts feasible at this time.

As capacity improvement projects from the Plan are implemented, however, DelDOT will acquire the needed right-of-way at both the New Street and Cleaver Farm Rd intersections to allow for the possible conversion of these intersections at a future date.

DelDOT is currently looking at several sites around the State (including Cedar Lane Rd and Marl Pit Rd) for the possible conversion into roundabouts. The experience gained from these projects will benefit planners in the future as this Plan is carried forward.

New Street / SR 299**Cleaver Farm / SR 299**

*Roundabouts: An Informational Guide, Federal Highway Administration, 2000

The possible additional of two new through lanes along SR 299 is another vital element of the recommended East Middletown Transportation Plan. In fact, existing average daily traffic (ADT) on the SR 299 corridor already suggests the need for adding additional capacity.

Although the widening of SR 299 would help to alleviate traffic and backups at many of the intersections within the Study Area, it is also recognized that there are physical and historical constraints involved in implementing such a facility through the historical downtown area of Middletown.

For this reason, the Plan recommends that a widening of SR 299 be investigated only for those portions of the corridor where there is sufficient right-of-way and minimal impacts to historic structures or properties. The section of SR 299 from New Street to east of Brickmill Rd best fulfills this goal.



A roundabout has been proposed in the Plan for the Cedar Lane Rd and Marl Pit Rd intersection. The illustrations below depict how the intersection might look if a roundabout were constructed. Further technical analysis will be required to determine if a roundabout is appropriate for this location.



Before



After
(View #1)



After
(View #2)



After
(View #3)



After
(View #4)

East Middletown Master Transportation Plan Improvement List

Improvement	Area or Location	Type	Goal
Intersection	<ul style="list-style-type: none"> • SR 299 and Industrial Blvd 	Install right-turn lane on westbound SR 299 Install left-turn lane on eastbound SR 299	Reduce delay
	<ul style="list-style-type: none"> • SR 299 and Cass St 	Install right-turn lane on westbound SR 299*	Reduce delay
	<ul style="list-style-type: none"> • SR 299 and Cox St 	Install right-turn lanes on east and westbound SR 299*	Reduce delay
	<ul style="list-style-type: none"> • SR 299 and Promenade Entrance 	Westbound left turn (in association with Promenade development)	Reduce delay
	<ul style="list-style-type: none"> • SR 299 and New St 	Install new traffic signal at intersection**	Reduce delay
	<ul style="list-style-type: none"> • SR 299 and Brick Mill Rd 	Install channelized right-turn lane on westbound SR 299 and widen turn radius	Reduce delay
	<ul style="list-style-type: none"> • SR 299 and Gloucester Blvd*** 	Install new traffic signal at intersection*	Reduce delay
	<ul style="list-style-type: none"> • SR 71 and Cedar Lane Rd 	Install new traffic signal at intersection*	Reduce delay & improve safety
	<ul style="list-style-type: none"> • Marl Pit Rd and Cedar Lane Rd 	Install roundabout at intersection (to be determined)	Reduce delay
	<ul style="list-style-type: none"> • SR 71 and Marl Pit Rd 	Install dedicated left-turn lanes on EB & WB approaches. Install dedicated right-turn lanes on NB/EB/WB approaches	Reduce delay
New Roads	<ul style="list-style-type: none"> • Silver Lake Rd to Lake St 	Construct new two-lane roadway to extend Lake St east to Silver Lake Rd (w/ 5ft sidewalks and 4 ft on-road bike lanes)	Reduce delay
	<ul style="list-style-type: none"> • SR 299 from New Street to east of Brick Mill Rd 	Construct two additional through lanes (w/ 5ft sidewalks and 4 ft on-road bike lanes)	Reduce delay

Improvement	Area or Location	Type	Goal
Bicycle	<ul style="list-style-type: none"> Statewide Bicycle Route 1 New Castle County Regional Route 7 	Install bike facilities in accordance with Delaware Bicycle Facility Master Plan as roadway improvements are made	Encourage biking
Transit	<ul style="list-style-type: none"> Along existing bus routes in the Study area At existing bus stops in the east Middletown Study Area 	<p>Increase frequency of bus service consistent with DART Business Plan</p> <p>Install improvements at bus stops (bus stop signs, bus pad, benches, lighting, shelters)</p>	<p>Encourage transit usage</p> <p>Encourage transit usage</p>
Pedestrian	<ul style="list-style-type: none"> Catherine St to East of Post Office Cleaver Farm Rd to Silver Lake Rd Silver Lake Rd to Brick Mill Rd All signalized intersections along SR 299 between Industrial Drive and Brick Mill Rd 	<p>Install sidewalks on south side of SR 299</p> <p>Install sidewalks on north side of SR 299 (where missing)</p> <p>Install sidewalks on north and south side of SR 299 (where missing)</p> <p>Install signalized pedestrian crosswalks</p>	<p>Encourage walking</p> <p>Encourage walking</p> <p>Encourage walking</p> <p>Encourage walking</p> <p>Promote safety</p>
Other	<ul style="list-style-type: none"> Cedar Lane Rd (from SR 71 to Marl Pit Rd) Marl Pit Rd (from SR 71 to Brick Mill Rd) Brick Mill Rd (from Marl Pit Rd to south of Dove Nest Branch) 	<p>Install 8 ft shoulders with 4 ft on-road bike lanes</p> <p>Install 5 ft shoulders with 4 ft on-road bike lanes</p> <p>Install 5 ft shoulders with 4 ft on-road bike lanes</p>	<p>Promote safety</p> <p>Promote safety</p> <p>Promote safety</p>

Costs and Implementation

Preliminary costs for implementing the East Middletown Transportation Plan have not been developed at this time. Some of the costs associated with the construction of the improvements will likely be borne by the private development sector while other improvements will be funded by DelDOT. A recoupment process, similar to that used for Westown, will be utilized.

The purpose of this document is to lay out a Plan that will effectively address both existing and future transportation issues in the community. After the Plan has been reviewed and a consensus formed the Department of Transportation will develop a Program (cost and estimated schedule) for implementing the recommended improvements. The following four categories will be considered in the development of that Program.

- (1) Capital costs (project development, design, and construction)**
- (2) Operating costs**
- (3) Maintenance costs**
- (4) Other cost and/or issues including:**
 - (A) Construction constraints**
 - (B) Environmental Impacts (historic landmarks, wetlands and archeological sites)**
 - (C) Right-of-Way requirements**
 - (D) Americans with Disabilities Act (ADA) compliance**

East Middletown is a growing community that continues to be a desirable destination for families, employees, and businesses to locate. With new growth, however, come new challenges. Significant transportation issues need to be addressed in both the short and long-term if the existing quality of life is to be preserved.

Any transportation improvements will require DelDOT and the Town to work with local citizens and communities to reach an accord on how to best balance the need to reduce congestion, and accommodate all modes of transportation. Proposed improvements should also be sensitive to how each project can enhance impacted neighborhoods not just how well traffic is moving. This can be done through the provision of improvements to those elements that adjoin the roadway such as landscaping, sidewalks, bike lanes, cross-walks and aesthetic improvements.

Many of the residents of east Middletown have expressed their desire not only for relief from growing traffic congestion but also for more travel options such as bicycle and pedestrian improvements. It is imperative that the Town, DelDOT, and the private sector work together to achieve the vision of a community that welcomes growth yet also retains the small town qualities that have made east Middletown such a popular location.

The East Middletown Transportation Plan is a first step towards achieving those goals.



Appendix

AM

SR299

The Recommended Plan



Scenario #	1	2	3	4	5	6	(7-A)	(7-B)	9	10	11
Control Delay / Veh (s/v)	10	41	30	34	39	54	12	15	24	13	25
Queue Delay / Veh (s/v)	0	0	0	0	0	0	0	0	0	0	0
Total Delay / Veh (s/v)	10	41	30	34	39	55	12	15	24	13	26
Total Delay (hr)	40	342	226	250	282	236	84	101	167	92	83
Stops / Veh	0.31	0.71	0.41	0.43	0.40	0.57	0.47	0.40	0.47	0.48	0.62
Stops (#)	4429	21147	10990	11269	10554	8826	11885	10121	11569	11923	7300
Average Speed (mph)	24	11	14	13	12	10	22	21	16	21	15
Total Travel Time (hr)	113	519	394	416	445	341	253	270	333	259	154
Distance Traveled (mi)	2729	5791	5519	5478	5362	3464	5528	5529	5455	5477	2283
Fuel Consumed (gal)	170	615	455	472	486	367	358	357	413	363	199
Fuel Economy (mpg)	16.1	9.4	12.1	11.6	11.0	9.4	15.5	15.5	13.2	15.1	11.5
CO Emissions (kg)	11.86	42.96	31.79	33.00	33.99	25.65	25.00	24.95	28.90	25.38	13.91
NOx Emissions (kg)	2.31	8.36	6.19	6.42	6.61	4.99	4.86	4.86	5.62	4.94	2.71
VOC Emissions (kg)	2.75	9.96	7.37	7.65	7.88	5.95	5.79	5.78	6.70	5.88	3.22
Unserved Vehicles (#)	0	1148	690	858	952	738	45	45	386	0	0
Vehicles in dilemma zone (#)	142	133	111	105	135	155	199	240	116	272	354
Performance Index	52.3	401.0	256.3	281.3	311.4	260.8	117.4	129.2	198.9	125.3	103.7

Note: A lower Performance Index score indicates a better performing scenario

PM

SR299

The Recommended Plan



Scenario #	1	2	3	4	5	6	(7-A)	(7-B)	9	10	11
Control Delay / Veh (s/v)	14	194	47	52	58	50	28	24	38	16	17
Queue Delay / Veh (s/v)	0	2	0	0	6	2	0	0	2	1	1
Total Delay / Veh (s/v)	14	196	47	52	63	52	28	24	40	17	18
Total Delay (hr)	63	2009	424	455	539	459	234	203	352	139	150
Stops / Veh	0.34	22.14	0.58	0.59	0.50	0.43	0.48	0.55	0.52	0.53	0.54
Stops (#)	5626	817028	18865	18521	15236	13715	14409	16455	16479	15653	16484
Average Speed (mph)	25	3	11	10	9	10	15	16	12	19	19
Total Travel Time (hr)	135	2225	626	650	731	659	435	404	551	338	341
Distance Traveled (mi)	3361	7074	6640	6447	6353	6568	6599	6599	6568	6546	6353
Fuel Consumed (gal)	236	6923	690	705	739	683	523	516	625	461	468
Fuel Economy (mpg)	14.2	1.0	9.6	9.1	8.6	9.6	12.6	12.8	10.5	14.2	13.6
CO Emissions (kg)	16.53	483.94	48.26	49.30	51.64	47.77	36.57	36.05	43.66	32.20	32.73
NOx Emissions (kg)	3.22	94.16	9.39	9.59	10.05	9.29	7.12	7.01	8.49	6.26	6.37
VOC Emissions (kg)	3.83	112.16	11.18	11.43	11.97	11.07	8.48	8.35	10.12	7.46	7.59
Unserved Vehicles (#)	14	3952	1513	1759	1974	1616	413	348	957	26	80
Vehicles in dilemma zone (#)	178	292	111	125	165	168	204	153	199	276	350
Performance Index	78.9	4278.2	476.1	506.9	581.5	497.0	274.4	249.1	397.3	182.5	195.7

Note: A lower Performance Index score indicates a better performing scenario

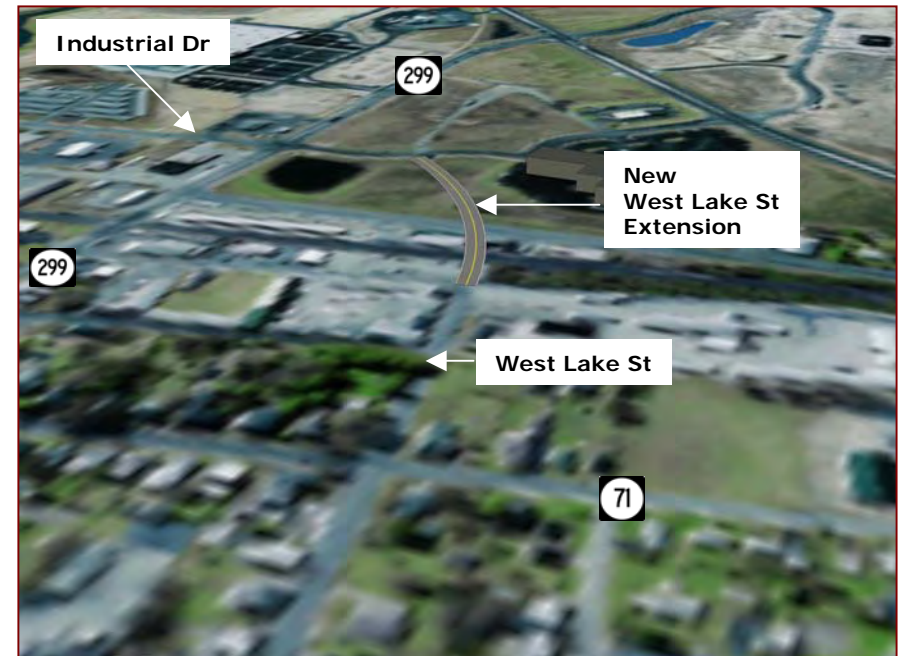
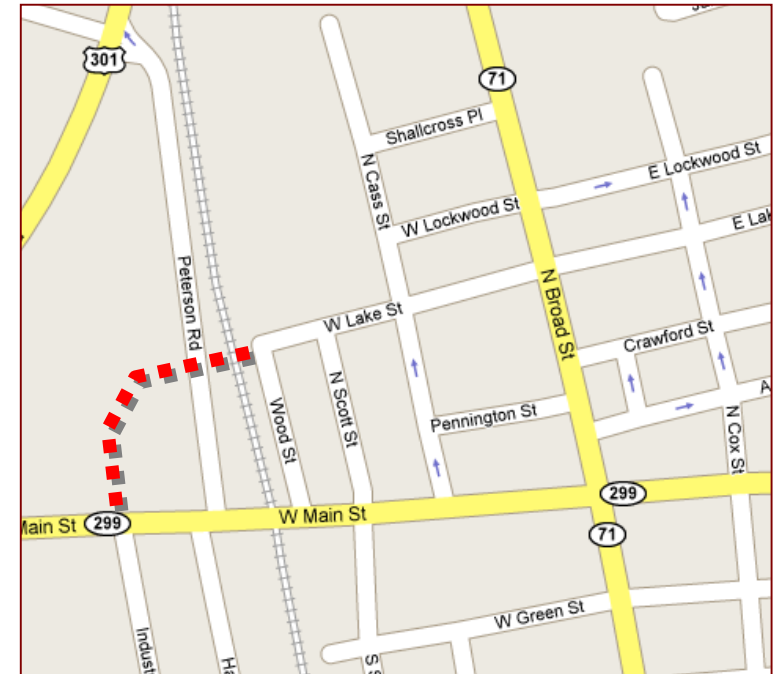
West Lake St Extension

Additional benefits to the proposed Lake Street Extension project may be realized if a new connection is constructed from existing west Lake Street across the rail line connecting into Industrial Drive.

Constructing a new at-grade intersection across the existing rail line would require further investigation into potential legal, design, and environmental justice issues associated with this improvement.

This facility could further enhance the proposed east Lake Street in the following ways:

- Reductions of southbound left-turn vehicles at the SR 71 / Main Street intersection
- Greater utilization of the east Lake Street Extension due to reduced travel times from the eastern part of Middletown to the US 301 corridor.
- Streetscaping opportunities for west Lake Street



Cleaver Farm Rd Extension

To help facilitate traffic north and south traffic patterns in the study area it may be necessary in the future to investigate a possible new north-south connection from Cleaver Farm Rd to Marl Pit Rd.

Any new connection of this sort would require extensive study and analysis of the possible environmental, historical, and community impacts associated with such a project.

In addition, the advantages and disadvantages of where the new facility would tie into Marl Pit Rd would also need to be examined.



The Lake Street Extension project, described earlier in this report, seeks to help facilitate east-west traffic that would normally utilize SR 299 by providing an additional travel option.

Currently, the eastern section of the proposed Lake Street Extension would tie in at Silver Lake Rd at SR 299.

It may be necessary at sometime in the future to investigate the possibility of creating a direct connection from SR 1 to the Lake Street Extension. This connection would most likely enhance the travel time benefits associated with the proposed Lake Street Extension and further reduce congestion on SR 299.

Any new connection of this sort would require extensive study and analysis of the possible environmental, historical, and community impacts associated with such a project.





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