



US 301 PROJECT
Maryland / Delaware Line to SR1
South of the C&D Canal
New Castle County, Delaware

US 301 SPUR ROAD 2012 MONITORING REPORT



April 2013



**DELAWARE
DEPARTMENT OF
TRANSPORTATION**

WILMAPCO



EXECUTIVE SUMMARY

The US 301 Spur Road, the subject of this traffic monitoring report, is part of Delaware Department of Transportation's (DelDOT's) US 301 Project (see Figure 1). In November 2007, after nearly four decades of study, a preferred alternative was selected, as described in the US 301 Final Environmental Impact Statement. The Federal Highway Administration subsequently approved the Record of Decision on April 30, 2008 which authorized DelDOT to begin final design on the preferred alternative, known as the "Green North + Spur" alternative. In January 2010, the 145th General Assembly of Delaware passed House Resolution No. 35 directing DelDOT to "*sit down over the next 6 weeks to develop and negotiate to final resolution a bill to amend the existing epilogue language, with such bill mandating certain trigger mechanisms for the Spur Road.*" As a result of that coordination the US 301 Spur Road Monitoring Program was developed to monitor growth in traffic and land use development, and to evaluate the operational characteristics of key roads and intersections. This monitoring program will provide decision makers with data to make an informed decision on the appropriate timing for the construction of the US 301 Spur Road.

The monitoring program consists of the annual collection and analysis of daily traffic volumes on select roadways, peak period intersection volumes, vehicular delay at unsignalized intersections, crash data, and land use development data. Each year, the data will be analyzed and compared with data and results from prior years. This report represents a summary of the third year of the monitoring program based on data collected in 2012. This report compares the newly collected data with the data collected and summarized in 2010 and 2011, the first two years of the monitoring program. The key findings and data in the report are summarized below:

Land Development:

- There were approximately 18,000 new housing units in various stages of planning in the study area at the end of 2012. This represents an increase of 2,350 units (15%) compared to 2011. New Castle County has approved approximately 9,900 of the 18,000 housing units, of which approximately 1,590 units (16%) were constructed by the end of 2012. The 9,900 units approved by New Castle County in 2012 represented an increase of 50 units (1%) and 1,590 units constructed in 2012 represents an increase of 330 units (35%), compared to 2011. It should be noted that the number of units constructed in 2011 was updated in this report due as a result of some inconsistencies that were recently found in the data provided by WILMAPCO in 2011. The remaining 7,200 of the 18,000 new housing units, including approximately 230 units in Cecil County, MD, are part of developments which are still in the earlier planning stages (pending approval). This represents an increase of 2,200 units compared to 2011, attributable partly to an increase in the number of new applications submitted as well as a shift in the number of units that had previously been planned but were subsequently approved and completed. Lastly, approximately 990 more housing units were proposed in developments in New Castle County for which approval had expired by the end of 2012. This represents an increase of 100 expired housing units, compared to 2011
- Of the developments described above, there are sixteen (16) residential developments in various stages of completion within the Town of Middletown. Seven of these developments were essentially complete by the end of 2007, with an eighth (Middletown Village) essentially completed by the end of 2010 and ninth (Willow Grove Mill) essentially completed by the end of 2012. There were 124 new housing units completed between 2011 and 2012. The 16



developments total 7,728 housing units, including approximately 4,100 single-family detached homes, 500 duplexes, 1,900 townhouses, and 1,200 apartments / condos.

- A total of 2,179 of the proposed 7,728 housing units within the Town of Middletown were constructed by the end of 2007, 2,951 were constructed by the end of 2010, 3,008 had been constructed by the end of 2011 and 3,132 of the proposed 7,728 housing units were constructed by the end of 2012. This represents an increase of 953 housing units over the five year period between 2007 and 2012, and includes 124 new units completed between 2011 and 2012.
- The ongoing commercial development within the study area consists of various uses, including office space, retail, and light industrial development (including warehouse space). The commercial developments were divided into Approved and Pending (Exploratory) categories. By the end of 2012, developers had submitted plans that are currently either approved or pending for over 12.3 million square feet of non-residential space in southern New Castle County, which included a new 1.25 million SF Amazon.com distribution center. The distribution center was approved on January 9, 2012 and became operational on October 10, 2012. This represents an increase of 4.2 million square feet (52%) of approved or pending commercial development, compared to 2011. Physically, 12.3 million SF non-residential space represent approximately 8.8 million SF of approved development (compared to 5.8 million SF in 2011) with another 2.5 million SF in pending approval (compared to 2.3 million in 2011). Of the 8.8 million SF of approved development, at least 4.0 million SF (45%) has been constructed by the end of 2012.

Traffic:

- Roadway volumes at seven (7) locations are being monitored and recorded annually.
- Five (5) signalized intersections along the existing US301 Corridor between the Summit Bridge and SR 299 are counted and analyzed annually to monitor the change (degradation or improvement) in operation of each intersection. The following trends were observed in 2010, 2011, and 2012:
 - US 301 at Old Summit Bridge Road: The intersection operated at LOS A during both the AM and the PM peak hours for 2010, 2011, and 2012.
 - US 301 at SR 896: The intersection operated at LOS C during both the AM and the PM peak hours for 2010, 2011, and 2012.
 - US 301 at Armstrong Corner Road / Marl Pit Road: The intersection operated at LOS C during both the AM and PM peak hours in 2010 and 2012; however, the intersection operated at LOS D during both the AM and PM peak hours in 2011. The increase in delay in 2011 may have been attributable to a temporary closure of Cedar Lane Road (for bridge maintenance and repair) at the time the intersection turning movement count was taken.
 - US 301 at SR 71: The intersection operated at LOS C during the AM peak hour and LOS D during the PM peak hour for 2010, 2011, and 2012.
 - US 301 at SR 299: The intersection operated at LOS D during both the AM and PM peak hours for 2010, 2011, and 2012.
- Three (3) unsignalized intersections are counted and analyzed annually to monitor the change (degradation or improvement) in operation of each intersection and the following trends were observed in 2010, 2011, and 2012:



- There were relatively minimal changes in delay at the intersection of US 301 and Old School House Road.
- Delay increased significantly (by 21 seconds per vehicle) to nearly a minute of delay per vehicle at the intersection of US 301 and Keenan Auto Body in 2011. In 2012, the delay decreased back down to the 2010 level (37 seconds per vehicle).
- Delay increased slightly at the intersection of Choptank Road and Clayton Manor Drive (by 4 seconds per vehicle); however, the average delay per vehicle remains fairly low at 14 seconds per vehicle.

Highway Safety:

- Average Accident Rates were calculated for eight (8) roadway segments in the vicinity of the US301 Corridor to provide a relative measure of comparison to the Statewide and New Castle County average crash rates. DeIDOT Safety Section provided the Statewide and New Castle County Average Crash Rates for 2010 and 2011. It should be noted that the Statewide and New Castle County Average Crash Rates for 2010 and 2011 were updated due to a new crash reporting methodology adopted by DeIDOT Safety Section in 2012. The change in crash reporting methodology retroactively changed the crash rates for 2010 and 2011. According to the comparison, six (6) of the eight roadway segments being monitored had higher crash rates than the Statewide and New Castle County Average Rate in 2010. In 2011, just two (2) of the eight roadway segments being monitored had higher crash rates than the Statewide and New Castle County Average Rates.
- It should be noted that the DeIDOT Safety Section was not able to provide 2012 Statewide and New Castle County Crash Rates. This information will be updated in future reports when the data becomes available.
- In general, the number of crashes has decreased between 2010 and 2012 at most of the locations being monitored. The exceptions were the curve between Summit Bridge and Bethel Church Road, where the number of crashes increased from 2 to 4, and Choptank Road between Bethel Church Road and Bunker Hill Road, where the number of crashes increased from 8 to 10.
- Roadway segments in the project area that are reported by DeIDOT's Hazard Elimination Program (HEP) and High Risk rural Roads Program (HRRRP) will be monitored each year during construction of the mainline US 301 Project..

Incident Management:

- DeIDOT has been tracking the number of significant incidents that occur each year on several key roads in the Middletown region south of the C&D Canal, and on SR 1 between the Roth Bridge and I-95. Specifically, the monitoring program identifies any incidents that resulted in detours that could have been accommodated more safely and efficiently on the Spur Road rather than on the local road network.
- Since 2004, there have been 68 incidents that have resulted in 190 or more hours of detours that could have utilized the Spur Road as an alternate detour route.



Construction Projects:

- DeIDOT and the Town of Middletown will likely have several other active maintenance and construction projects occurring at various times during the duration of the US 301 Spur Monitoring Program that could affect the traffic data being collected. DeIDOT identified five (5) active construction projects in the US 301 project area in 2012. Although the SR 1 / I-95 Interchange project is not located in the vicinity of the US301 project area, it should be mentioned due to its significant traffic impacts to SR 1 in New Castle County. As part of the monitoring program, DeIDOT will continue to monitor all active roadway construction projects in the US 301 project area from south of Middletown to approximately the Chesapeake and Delaware Canal.



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MONITORING PROGRAM

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INTRODUCTION

The US301 Spur Road, the subject of this traffic monitoring report, is part of Delaware Department of Transportation's (DeIDOT's) US 301 Project (see Figure 1). US 301 is a 1,100 mile interstate route stretching between Sarasota, Florida and New Castle County, Delaware. The tolls and congestion on I-95 combined with the comparatively low traffic volumes on US 301, have made US 301 an attractive alternative route for vehicles, including trucks, traveling between Washington D.C. and Wilmington, Delaware. DeIDOT has been studying the US 301 corridor since the 1960's. The need for improved capacity and safety has been heightened over the past two decades by the rapid pace of development throughout the Middletown-Odessa-Townsend (MOT) area and the resulting transformation of southern New Castle County from rural farmland to growing suburbia.

In November 2007, after nearly four decades of study, a preferred alternative was selected, as described in the US 301 Final Environmental Impact Statement. The Federal Highway Administration subsequently approved the Record of Decision on April 30, 2008 which authorized DeIDOT to begin final design on the preferred alternative, known as the "Green North + Spur" alternative. In January 2010, the 145th General Assembly of Delaware passed House Resolution No. 35 directing DeIDOT to *"sit down over the next 6 weeks to develop and negotiate to final resolution a bill to amend the existing epilogue language, with such bill mandating certain trigger mechanisms for the Spur Road."* As a result of that coordination the US 301 Spur Road Monitoring Program was developed to monitor growth in traffic and land use development, and to evaluate the operational characteristics of key roads and intersections. This monitoring program will provide decision makers with data to make an informed decision on the appropriate timing for the construction of the US 301 Spur Road.

This report represents a summary of the third year of the monitoring program based on data collected in 2012. This report compares the newly collected data with the data collected and summarized in 2010 and 2011, the first two years of the monitoring program. The 2012 report also serves as a basis for comparison with data collected in future years.

US 301 Project History

In the mid-1960's, recognition of the regional significance of the US 301 corridor led DeIDOT to investigate opportunities to improve mobility in the corridor. An earlier study resulted in the location selection and subsequent construction of the existing Summit Bridge by the US Army Corps of Engineers (ACOE) in the 1950's. Since that time, southern New Castle County has been transformed from a rural and largely agricultural area to a suburban residential area for commuters employed in Newark, Wilmington, Philadelphia, and throughout the I-95 corridor in Delaware, northern Maryland, southern Pennsylvania, and Southern New Jersey. The Levels, southwest of Middletown, once known as Delaware's most productive agricultural area, is currently evolving into the Westown community of Middletown, and job growth is expanding with a full range of commercial and professional employers supporting the influx of new residents in southern New Castle County. As southern New Castle County continued to develop, the solution to improving mobility in the growing region remained elusive.



In 2004, a new phase of the US 301 project planning effort was initiated, which was focused on addressing the safety and mobility needs of the region with consideration of the findings of a prior study conducted in 2000, the *Greater Route 301 Major Investment Study*. A traffic survey conducted in October 2004 showed that approximately sixty-five percent (65%) of all northbound traffic originating south of the C&D Canal is destined for the northeast to Wilmington, Philadelphia, New Jersey, and points beyond. Thirty-Five percent (35%) of the traffic has destinations to the north towards Newark and Pennsylvania. However, the traffic survey, which asked motorists to document their actual travel routes, showed that despite the majority of northbound destinations being to the northeast, approximately sixty percent (60%) of motorists currently continue north on US 301/SR 896 and then east on I-95, rather than using a more direct east-west route south of the canal.

With careful consideration of the local and regional travel patterns, projected land use growth of the region, a wide range of other social and environmental resources, and significant public input (5 rounds of public workshops and more than 100 community meetings with concerned parties), DelDOT performed a detailed evaluation of several alternatives, including a no-build option and a variety of capacity improvement options. Those efforts resulted in the publication of a Draft Environmental Impact Statement (DEIS) and a recommended alternative in November 2006. One year later, in November 2007, after nearly four decades of study, a preferred alternative was selected, as described in the *US 301 Project Development Final Environmental Impact Statement* (FEIS). The Federal Highway Administration subsequently approved the Record of Decision on April 30, 2008 which authorized DelDOT to begin final design on the preferred alternative, known as the “Green North + Spur” alternative.

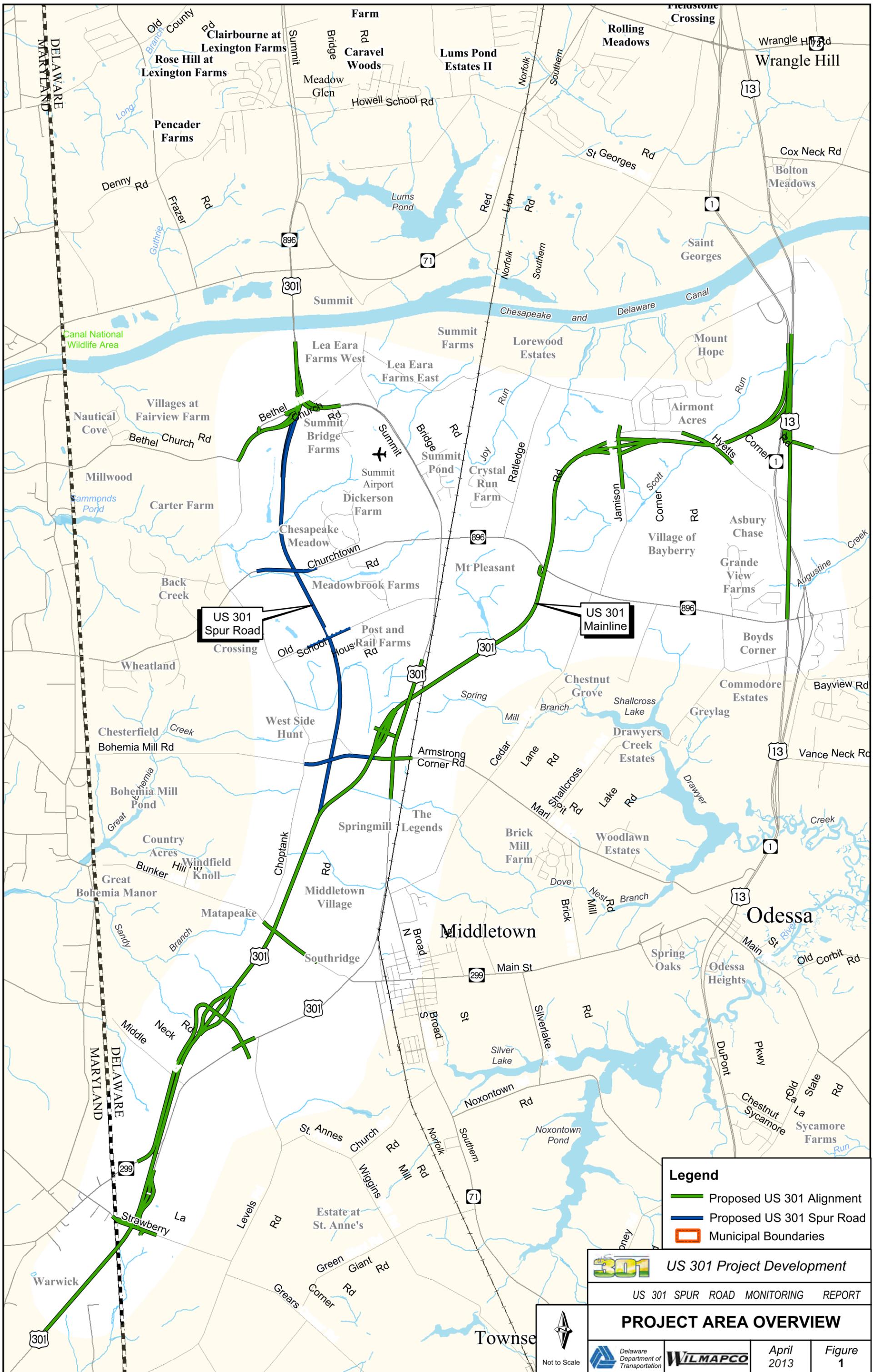
Monitoring Program

In January 2010, the 145th General Assembly of Delaware passed House Resolution No. 35 directing DelDOT to “sit down over the next 6 weeks to develop and negotiate to final resolution a bill to amend the existing epilogue language, with such bill mandating certain trigger mechanisms for the Spur Road.” As a result of that coordination the US 301 Spur Road Monitoring Program was developed to monitor growth in traffic and land use development, and to evaluate the operational characteristics of key roads and intersections. This monitoring program will provide decision makers with data to make an informed decision on the appropriate timing for the construction of the US 301 Spur Road.

The US 301 Spur Road Monitoring Program consists of three (3) primary components: an Annual Monitoring Program, Public Involvement and the publication of an Annual Summary Report.

Annual Monitoring Program

The US 301 Monitoring Program was created to monitor transportation and land use growth patterns before, during and after construction of the US 301 Mainline Project, as applicable. The monitoring program consists of the annual collection and analysis of daily traffic volumes on select roadways, peak period intersection volumes, vehicular delay at unsignalized intersections, crash data, and land use development data. Each year, the data will be analyzed and compared with data and results from prior years.



US 301
Spur Road

US 301
Mainline

- Legend**
- Proposed US 301 Alignment
 - Proposed US 301 Spur Road
 - Municipal Boundaries

301 US 301 Project Development

US 301 SPUR ROAD MONITORING REPORT

PROJECT AREA OVERVIEW



April 2013

Figure 1





Public Involvement

Public involvement has been and continues to be an important part of the US 301 Project. For the US 301 Spur Road Monitoring Program, the annual report will be made publicly available each year, and the updates on the Monitoring Program will be presented annually at a WILMAPCO public meeting. Public Involvement will also be solicited at key decision making points, such as the Secretary of Transportation's decision to recommend that construction of the US 301 Spur Road should begin.

The US 301 Spur Road Monitoring Program was presented at the FY2012 – FY2015 Transportation Improvement Program (TIP) Public Workshop on February 28, 2011 at WILMAPCO, attended by DelDOT staff. The Spur Monitoring Program information was summarized on a large display board that provided an overview of the program including the goals and purpose, and details on the initial data collected on Land Development, Safety, and Traffic.

The most recent US 301 Public Workshop was held on September 6, 2011 to present updates to the US 301 Project, including the US 301 Spur Road. Information on the workshop can be found on the project web site: www.us301.deldot.gov.

A WILMAPCO Public Workshop was not held in February 2012 nor 2013; therefore, there was not an efficient opportunity to present the key findings of the Spur Road Monitoring Program in 2011 or 2012, with the exception of the planned development in the Middletown area, which has continued to increase each year since the monitoring program began. It should be noted that there was very little change in the data and findings between 2010 and 2012. Determination of public involvement in the future years of the monitoring program will be made on a year to year basis, based upon the magnitude of changes found in each area of the monitoring program. This year's report, as well as the reports from previous years are available on the DelDOT web site.

Annual Report

This report contains a summary of the most recent data collected and analyzed as part of the US 301 Spur Road Monitoring Program. These reports will continue to be developed on an annual basis before, during and after the construction of the US 301 mainline. DelDOT will present these reports to the General Assembly in April of each year. The reports will provide decision makers, including the Secretary of Transportation, data to make an informed decision on the appropriate timing for the construction of the Spur Road.



MONITORING PROGRAM

Land Development

The explosive growth in housing and retail in southern New Castle County over the past 10 to 15 years has led to increasing congestion on the local road network, including US 301, SR 299, and SR 896. A number of new residential and retail developments have been completed and many others are in varying stages of construction or planning. As these other planned developments come on line, additional demands will be placed on the transportation infrastructure in the Middletown area.

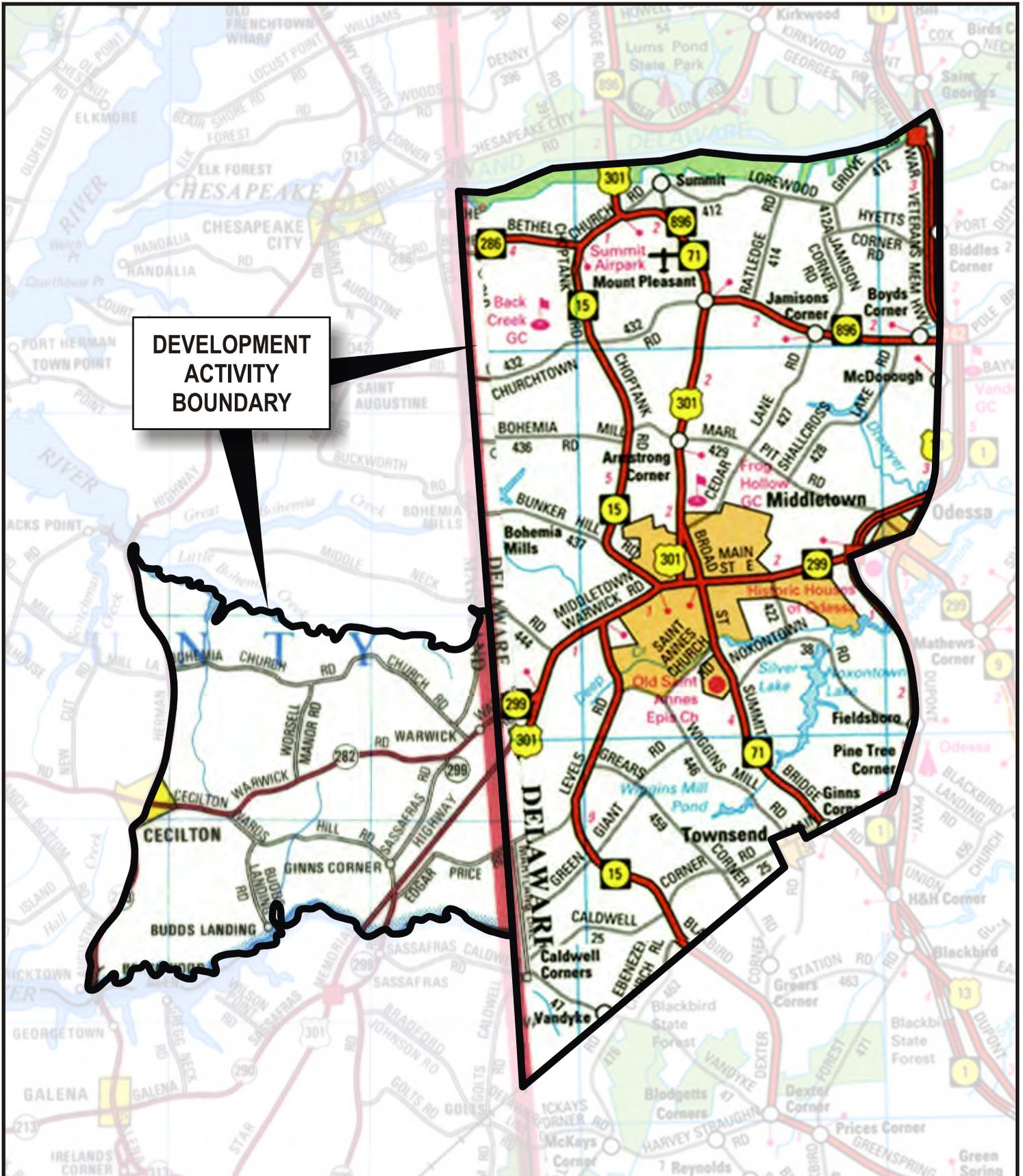
The Town of Middletown approved the final plans for a proposed Amazon.com distribution center on January 9, 2012. The 1.25 million SF distribution center was constructed within the parcel immediately south of the intersection of US 301 and Merrimac Avenue and a fourth leg was added to the intersection to provide access. The new distribution center became operational on October 10, 2012. It is anticipated that the new distribution center will add more than 850 full-time jobs as well as 2,000 seasonal jobs for up to three months twice a year at its full capacity.

Development activity in New Castle County is monitored by the New Castle County Department of Land Use, the Wilmington Area Planning Council (WILMAPCO), and DeIDOT. Development activity in Middletown is monitored by the Town of Middletown, WILMAPCO, and DeIDOT. WILMAPCO is also tasked with developing short and long-term land-use projections for New Castle County. These projections are constrained on a statewide and countywide basis by the population and employment forecasts provided by the Delaware Population Consortium. WILMAPCO is responsible for projecting how much of that growth will occur in different parts of the county. The primary geographic unit for these projections is the Traffic Analysis Zone (TAZ).

DeIDOT and WILMAPCO have committed to tracking the land development activities in a portion of southern New Castle County and an adjoining portion of Cecil County, Maryland as part of this Monitoring Report. The specific area where development will be tracked annually is depicted in Figure 2. This area represents a total of 34 TAZs in Southern New Castle County and two (2) TAZs in Cecil County, Maryland. Development activity will be monitored in these areas for the length of the project to determine when the surrounding roadway infrastructure may need to be improved based on past, present and near-term development trends.

Summary of Development Activity in Southern New Castle (DE) and Cecil (MD) Counties

WILMAPCO took the lead in coordinating with the various jurisdictions and compiling the land use data for this report. In 2012, a total of sixty-two (62) ongoing commercial and residential developments were in various stages of the planning or building process within the study areas of southern New Castle and Cecil Counties. Fifty (50) of these developments are located in southern New Castle County and twelve (12) developments are located in Cecil County, Maryland. For each development, a description of the development proposal, the current status of the development in the planning process, and what portions (if any) were constructed by the end of 2012 were provided. A full list of the developments can be found in Appendix A. The residential developments range from small subdivision developments with less than 10 homes to major developments with over 1,800 household units planned. The proposed commercial developments range from smaller properties with 5,000 to 25,000 SF to the major commercial centers, such as the 1.7 million SF Scott Run Business Park and



**DEVELOPMENT
ACTIVITY
BOUNDARY**



US 301 Project Development

US 301 SPUR ROAD 2011 MONITORING REPORT

MAJOR DEVELOPMENT LOCATION MAP



SCALE IN MILES



As Shown



Delaware
Department of
Transportation

April 2013

Figure
2

1.25 million SF Amazon.com distribution center. A number of proposals call for mixed-use development, combining residential and commercial activities at one site.

Residential Development Summary

The ongoing residential development within the study area consists of a variety of housing types, including single-family detached dwellings, townhomes, and apartments. The various residential developments were classified in differing stages of completion: Built, Approved but unbuilt, or Pending (includes Exploratory and Expired Proposals). Figure 3 depicts the number of housing units built, approved but unbuilt, and pending at the end of 2010, 2011 and 2012.

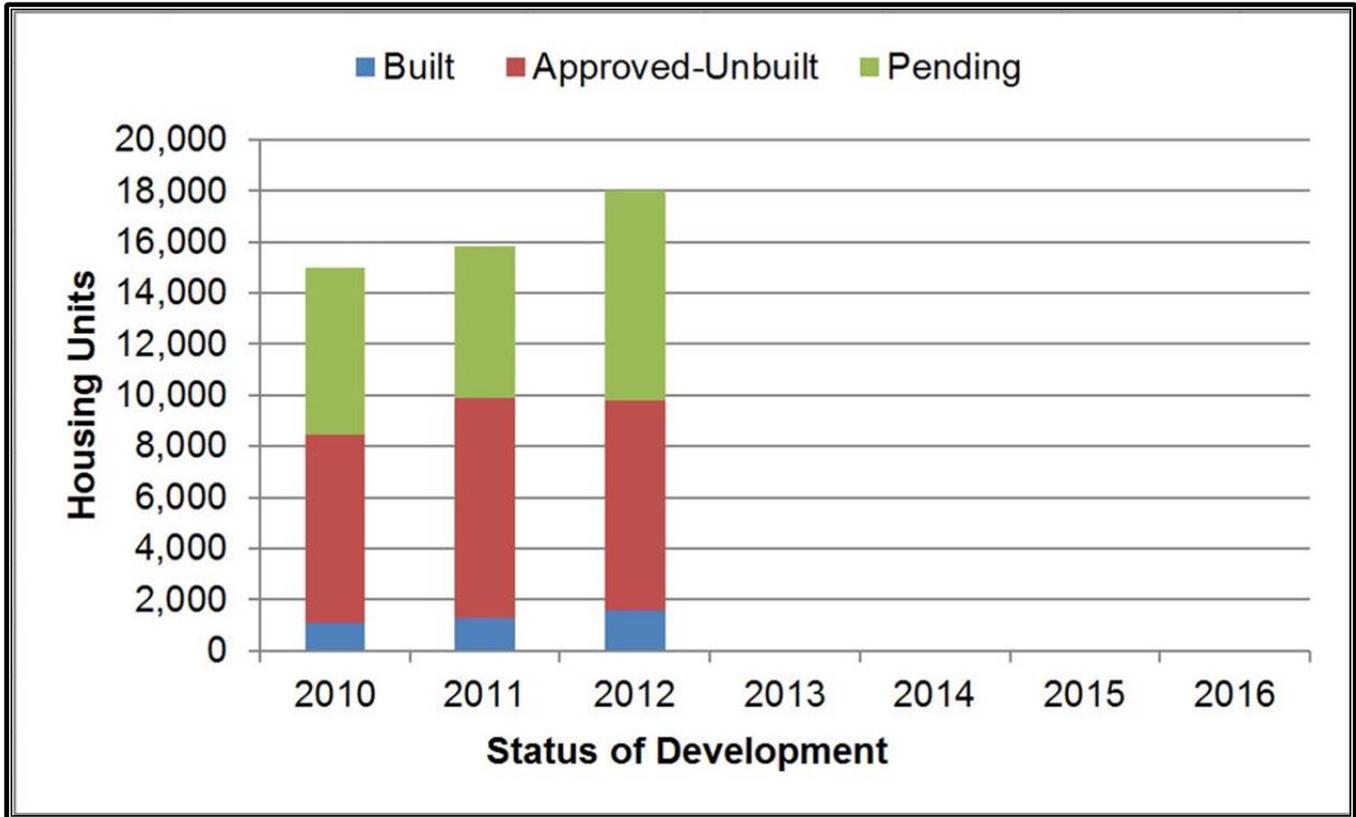


Figure 3: Residential Development in Study Area

As shown in Figure 3, there were approximately 18,000 new housing units in various stages of planning in the study area at the end of 2012. This represents an increase of 2,350 units (15%) compared to 2011. New Castle County has approved approximately 9,900 of the 18,000 housing units, of which approximately 1,590 units (16%) were constructed by the end of 2012. The 9,900 units approved by New Castle County in 2012 represented an increase of 50 units (1%) and 1,590 units constructed in 2012 represents an increase of 330 units (35%), compared to 2011. It should be noted that the number of units constructed in 2011 was updated in this report due as a result of some inconsistencies that were recently found in the data provided by WILMAPCP in 2011. The remaining 7,200 of the 18,000 new housing units, including approximately 230 units in Cecil County, MD, are part of developments which are still in the earlier planning stages (pending approval). This represents an increase of 2,200 units compared to 2011, attributable partly to an increase in the number of new applications submitted as well as a shift in the number of units that had previously been planned but were



subsequently approved and completed. Lastly, approximately 990 more housing units were proposed in developments in New Castle County for which approval had expired by the end of 2012. This represents an increase of 100 expired housing units, compared to 2011.

Snapshot - Residential Construction in the Town of Middletown: Of the developments described above, there are sixteen (16) residential developments in various stages of completion within the Town of Middletown. Seven of these developments were essentially completed by the end of 2007, with an eighth (Middletown Village) essentially completed by the end of 2010 and ninth (Willow Grove Mill) essentially completed by the end of 2012. There were 124 new housing units completed between 2011 and 2012. The 16 developments include a total of 7,728 housing units, including approximately 4,100 single-family detached homes, 500 duplexes, 1,900 townhouses, and 1,200 apartments / condos. WILMAPCO was able to provide data on the number of units built within each of these residential developments between 2007 and 2012:

- By the end of 2007, a total of 2,179 (28%) of the proposed 7,728 housing units within the Town of Middletown had been constructed.
- By the end of 2010, a total of 2,951 (38%) of the proposed 7,728 housing units within the Town of Middletown had been constructed.
- By the end of 2011, a total of 3,008 (39%) of the proposed 7,728 housing units within the Town of Middletown had been constructed.
- By the end of 2012, a total of 3,132 (41%) of the proposed 7,728 housing units within the Town of Middletown had been constructed.
- This represents an increase of 953 housing units over the five (5) year period between 2007 and 2012 and includes 124 new units completed between 2011 and 2012.

Appendix B lists respectively the number of apartments, duplexes, townhouses, and single family homes that have been built and remain to be built in the Town of Middletown.

Commercial (Non-Residential) Development

The ongoing commercial development within the study area consists of various uses, including office space, retail, and light industrial development (including warehouse space). The commercial developments were divided into Approved and Pending (Exploratory) categories. By the end of 2012, developers had submitted plans that are currently either approved or pending for over 12.3 million square feet of non-residential space in southern New Castle County, which included a new 1.25 million SF Amazon.com distribution center. The distribution center was approved on January 9, 2012 and became operational on October 10, 2012. This represents an increase of 4.2 million square feet (52%) of approved or pending commercial development, compared to 2011. Physically, 12.3 million SF non-residential space represent approximately 8.8 million SF of approved development (compared to 5.8 million SF in 2011) with another 2.5 million SF in pending approval (compared to 2.3 million in 2011). Of the 8.8 million SF of approved development, at least 4.0 million SF (45%) has been constructed by the end of 2012.

Currently, no non-residential developments are proposed in the two (2) TAZs in Cecil County that are included in the study area. Figure 4 depicts and approved and pending commercial development in the study area.

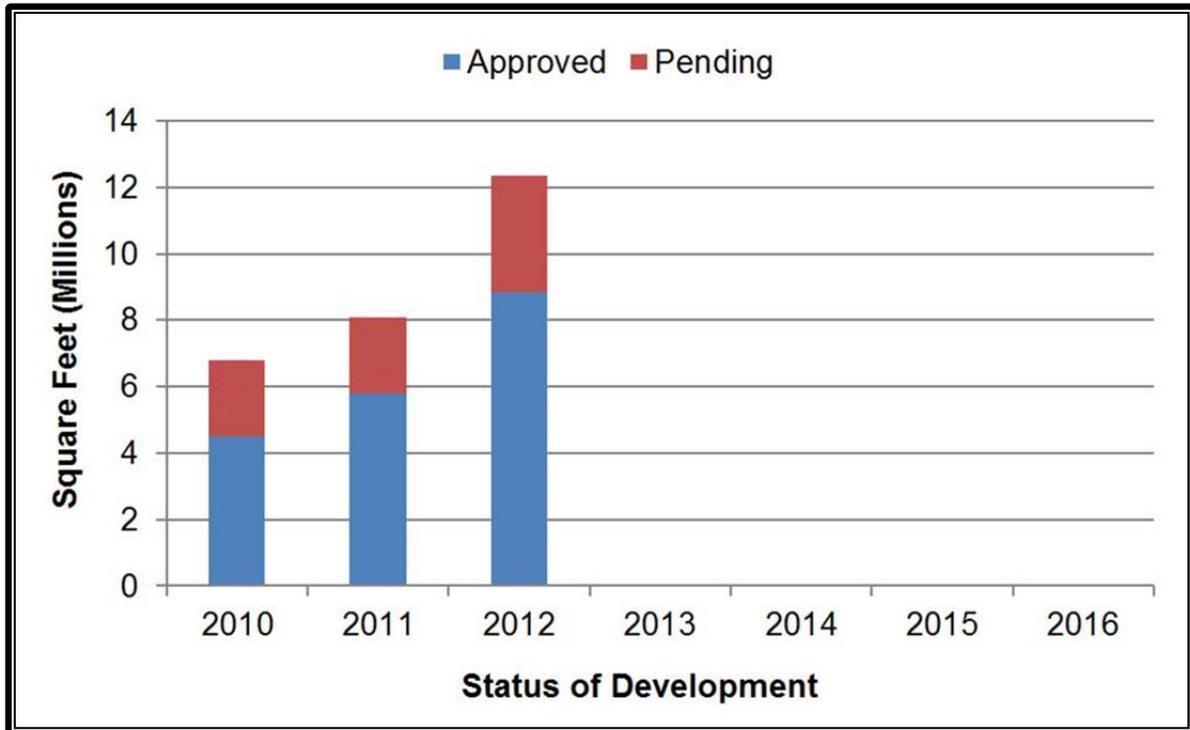


Figure 4: Non-Residential Development in Study Area

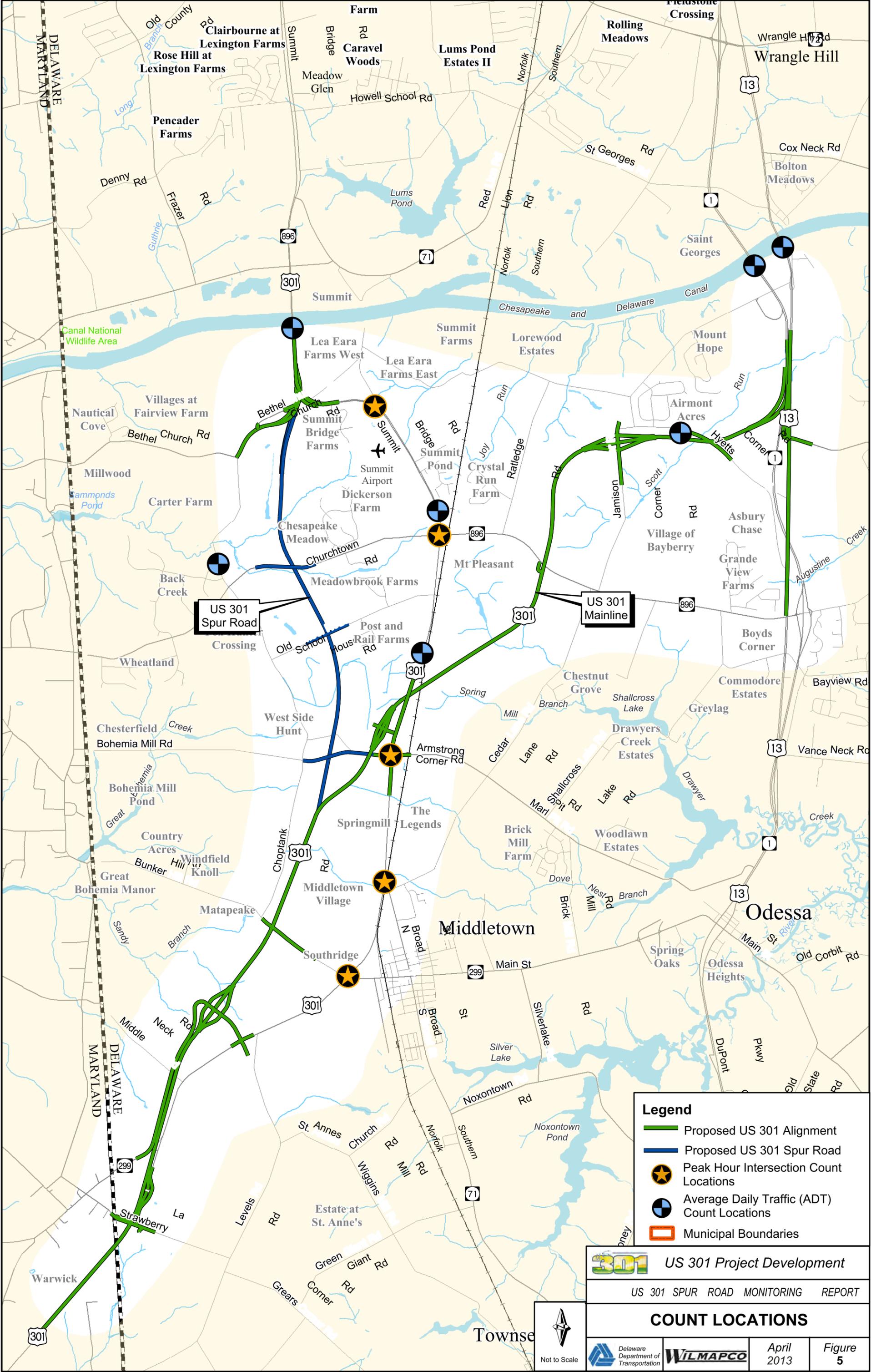
Traffic

Traffic is an important part of the US 301 Spur Road Monitoring Program. The US 301 project team will gather a variety of traffic data annually on key roads within the project corridor to determine the current level of traffic on these roads and to track growth trends throughout the region. Specifically, the following traffic data is being collected each year: mainline roadway volume counts, intersection turning movement counts, and vehicular delays at unsignalized intersections. The data collected in 2010 serves as the base year data for the US 301 Spur Road Monitoring Program. Intersection turning movement counts and mainline volume counts are being performed at each location shown in Figure 5 every year during the construction of the new US 301 alignment from the MD/DE state line to SR 1. This annual traffic monitoring will show how traffic volumes change over time as new development continues to occur.

Roadway Volumes

Mainline volume counts were collected along six (6) key roadways within the US 301 project area during October 2010, 2011, and 2012 (see Figure 5). Automatic traffic recording equipment, commonly called “tube counters”, were used to record the volume and classification of vehicles that pass over the equipment in each direction. This data is used to determine the Average Daily Traffic (ADT) and percentage of trucks travelling on each roadway segment (see Tables 1 and 2). Daily traffic volumes have increased modestly at all locations studied between 2010 and 2012. The two locations with the largest increase were Choptank Road, north of Churchtown Road (a 21% increase) and on US 13 at St. Georges Bridge (a 15% increase).

It should be noted that SR 9 was closed at Reedy Point Bridge between October 8, 2012 and October 26, 2012 due to bridge repair work. Bridge closure detoured vehicles to St.



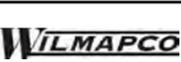
Legend

-  Proposed US 301 Alignment
-  Proposed US 301 Spur Road
-  Peak Hour Intersection Count Locations
-  Average Daily Traffic (ADT) Count Locations
-  Municipal Boundaries

US 301 Project Development

US 301 SPUR ROAD MONITORING REPORT

COUNT LOCATIONS



 April 2013 Figure 5

Not to Scale



Georges Bridge and resulted in higher daily traffic volume and truck volumes for US 13 at St. Georges Bridge.

US 301 Spur Road 2012 Monitoring Report		April 2013					
Table 1: Average Daily Traffic for Select Roadway Segments along US 301							
Roadway Link	2010 ADT*	2011 ADT	2012 ADT	2013 ADT	2014 ADT	2015 ADT	2016 ADT
Summit Bridge (US 301)	27,660	32,360	29,260				
Choptank Rd, North of Churchtown Rd	3,990	4,090	4,810				
SR 1 at Roth Bridge	73,690	78,740	74,900				
US 13 at St. Georges Bridge	10,600	9,070	12,190				
US 301/SR 896, North of Mt. Pleasant	23,450	23,810	24,750				
US 301, between Armstrong Corner Rd and Mt. Pleasant	21,830	22,460	22,710				
US 301 Bypass	-	-	-				

*Data was collected for a seven (7) day period in October / November 2010, 2011, and 2012. Seasonal Adjustments were not made to these volumes because: a) October/November volumes are typically representative of the annual average volumes, and b) because volumes will be collected during the same months in subsequent years.

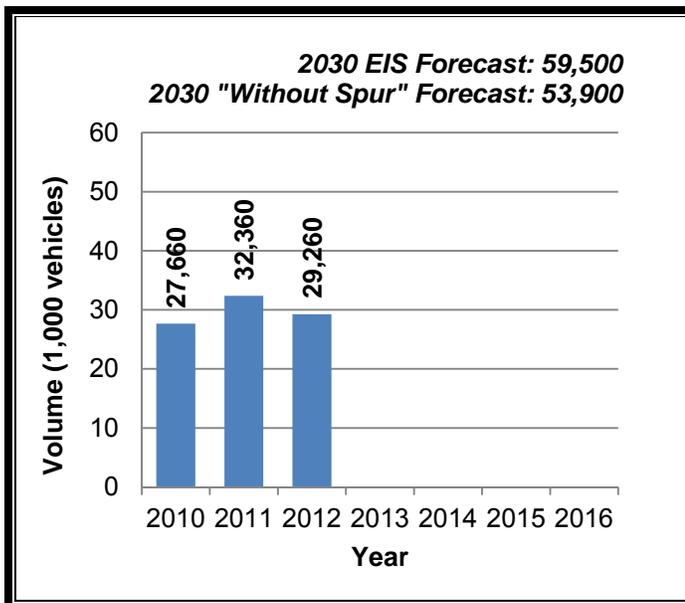


Figure 6: Average Daily Traffic (ADT) for Summit Bridge (US 301)

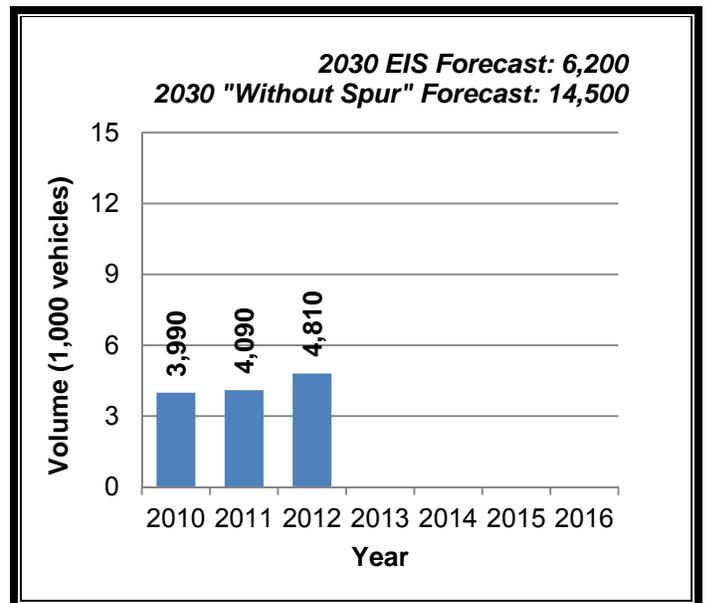


Figure 7: Average Daily Traffic (ADT) for Choptank Rd, North of Churchtown Rd

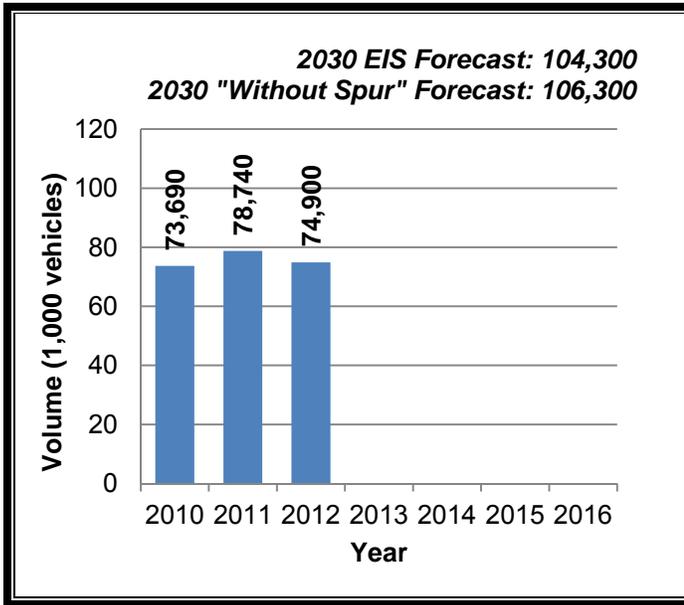


Figure 8: Average Daily Traffic (ADT) for Roth Bridge (SR 1)

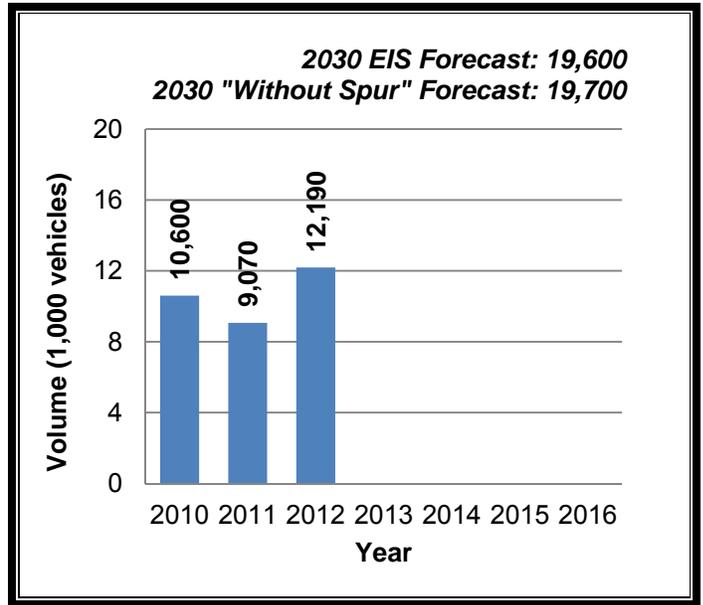


Figure 9: Average Daily Traffic (ADT) for St. George's Bridge (US 13)

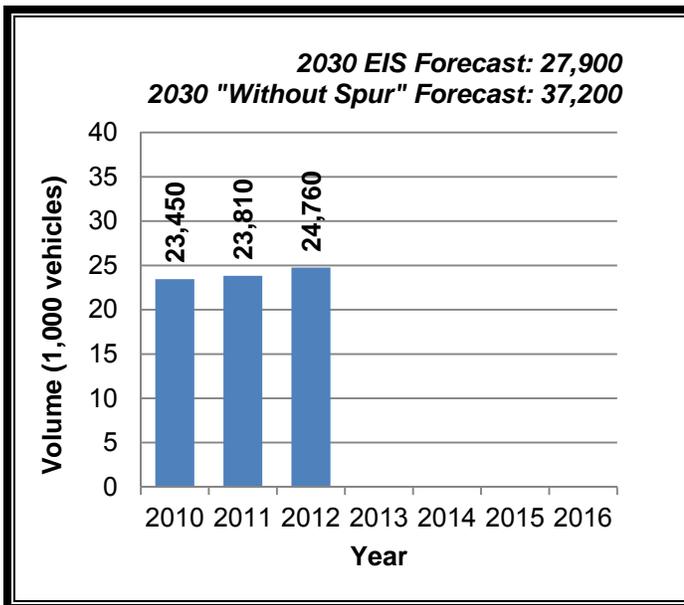


Figure 10: Average Daily Traffic (ADT) for Existing US 301 North of Mt. Pleasant

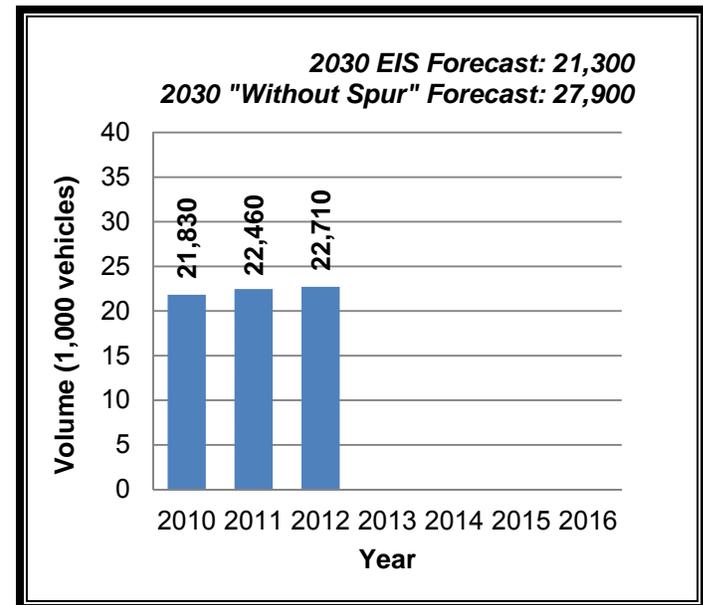


Figure 11: Average Daily Traffic (ADT) for Existing US 301, between Armstrong Corner Rd and Mt. Pleasant



US 301 Spur Road 2012 Monitoring Report														April 2013	
Table 2: Average Daily Truck Volume and Average Daily Truck Percentage* on Select Roadway Segments along US 301															
Roadway Link	2010		2011		2012		2013		2014		2015		2016		
	Volume	% Trucks													
US 301 at Summit Bridge	2,210	8	3,100	10	2,370	8									
Choptank Rd, North of Churchtown Rd	490	12	560	14	370	8									
SR 1 at Roth Bridge	7,860	11	9,020	11	7,840	11									
US 13 at St. Georges Bridge	570	5	440	5	1,165	10									
US 301 / SR 896, North of Mt. Pleasant	1,970	8	1,840	8	2,300	9									
US 301, between Armstrong Corner Rd and Mt. Pleasant	2,910	13	3,000	13	3,075	14									
US 301 Bypass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

*Trucks include FHWA Class 5-13, representing all trucks larger than and including two-axle single unit trucks, such as UPS delivery trucks and DART Paratransit buses.

Signalized Intersections

Peak period turning movement counts are being collected on an annual basis at five (5) key signalized intersections in the project area. These five (5) locations, which are all located along the existing US 301 Corridor between Middletown (SR 299) and the Summit Bridge, will be analyzed annually to monitor the change (degradation or improvement) in operation of each intersection. The five (5) locations, summarized in Figure 5, and Table 3, are the signalized intersections of existing US 301 / SR 896 at Old Summit Bridge Road, Boyds Corner Road, Armstrong Corner Road, North Broad Street, and Bunker Hill Road. Peak hour turning movement counts were performed at these intersections during October 2012. This data was used to create a model of the corridor using Synchro (Version 8), a macroscopic traffic analysis software application used to evaluate the operational performance characteristics of signalized and unsignalized intersections. The results of these analyses are summarized in Table 3 and Figures 12 and 13.

For this monitoring report, the operational performance of signalized intersections is presented in terms of average delay per vehicle and a corresponding letter grade, typically referred to as "Level of Service" (LOS). Level of Service "A" (delay ≤ 10 sec/vehicle) represents the best possible operating conditions, whereas LOS "F" (delay > 80 sec/veh) represents congested conditions corresponding with traffic that has reached or exceeded available



intersection capacity, resulting in relatively high average delay per vehicle and higher likelihood that vehicles will take more than one signal cycle to clear the intersection.

The results of the 2010, 2011, and 2012 intersection capacity analyses are summarized in Table 3 and the following trends were observed between 2010 and 2012:

- US 301 at Old Summit Bridge Road: The intersection operated at LOS A during both the AM and the PM peak hours for 2010, 2011, and 2012. No significant changes were observed.
- US 301 at SR 896: The intersection operated at LOS C during both the AM and the PM peak hours for 2010, 2011, and 2012. No significant changes were observed.
- US 301 at Armstrong Corner Road / Marl Pit Road: The intersection operated at LOS C during both the AM and the PM peak hours in 2010 and 2012; however, the intersection operated at LOS D during both the AM and the PM peak hours in 2011. The increase in delay in 2011 may have been attributable to the Cedar Lane Road closure in effect when the intersection turning movement count was performed in 2011. The closure was needed to repair the Cedar Lane Bridge, which is located on Cedar Lane Road south of SR 896 and increased traffic traveling through the intersection of US 301 and Armstrong Corner Road / Marl Pit Road.
- US 301 at SR 71: The intersection operated at LOS C during the AM peak hour and LOS D during the PM peak hour for 2010, 2011, and 2012. No significant changes were observed.
- US 301 at SR 299: The intersection operated at LOS D during both the AM and the PM peak hours for 2010, 2011, and 2012. No significant changes were observed.

US 301 Spur Road 2012 Monitoring Report														April 2013	
Table 3: Peak Hour LOS at Selected Signalized Intersections along US 301															
Site	2010		2011		2012		2013		2014		2015		2016		
	AM	PM													
US 301 at Old Summit Bridge Rd	A	A	A	A	A	A									
US 301 at SR 896	C	C	C	C	C	C									
US 301 at Armstrong Corner Rd	C	C	D	D	C	C									
Existing US 301 at SR 71	C	D	C	D	C	D									
Existing US 301 at SR 299	D	D	D	D	D	D									

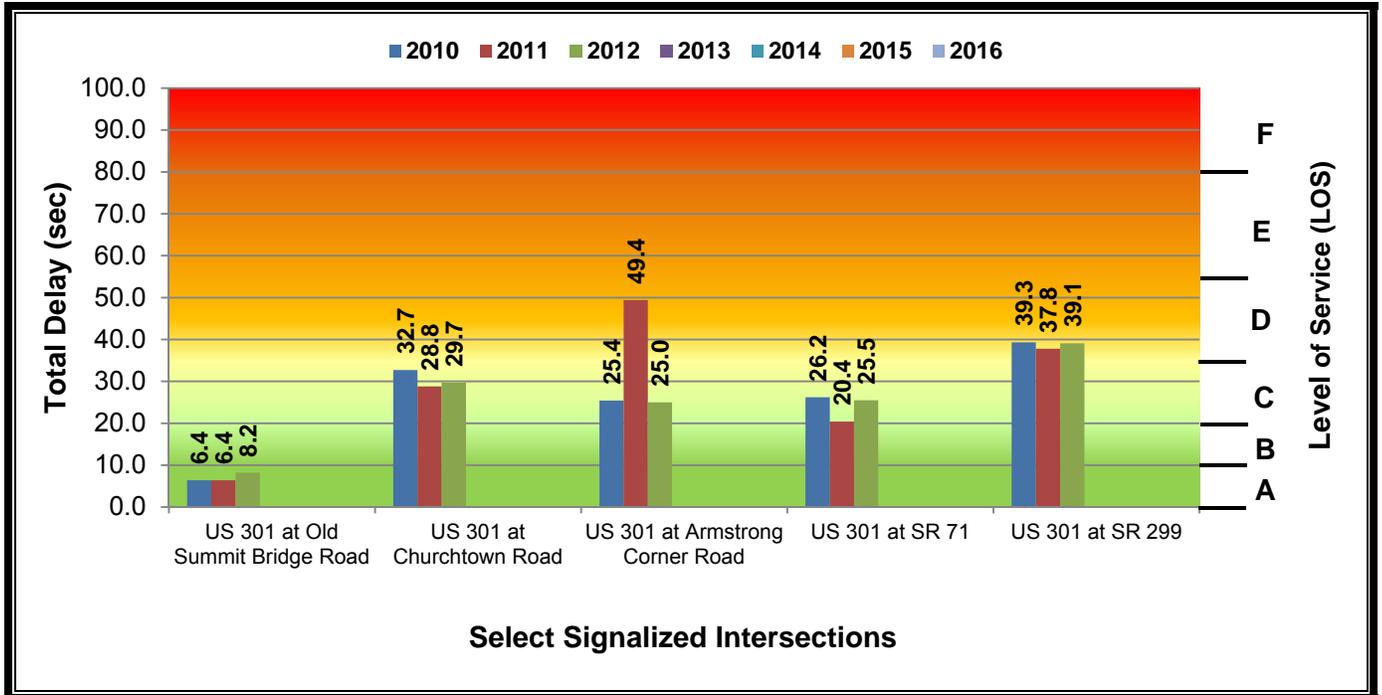


Figure 12: Total Delay and Corresponding Level of Service (LOS) at Select Signalized Intersections along US 301 during the AM Peak Hour

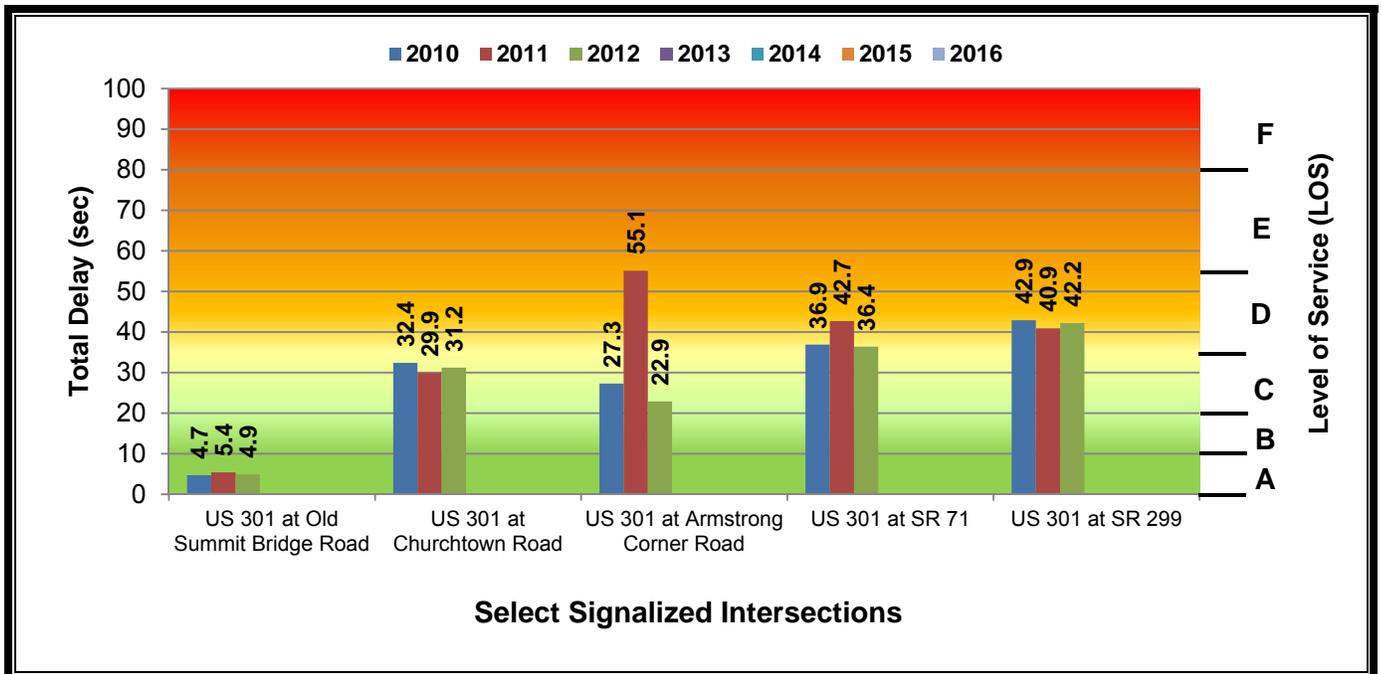


Figure 13: Total Delay and Corresponding Level of Service (LOS) at Select Signalized Intersections along US 301 during the PM Peak Hour



Unsignalized Intersections

Delay studies were performed at the following three (3) unsignalized intersections along the existing US 301 and Choptank Road corridor:

- US 301 at Old School House Road
- US 301 at Keenan Auto Body
- Choptank Road at Clayton Manor Drive

The locations were selected to represent the typical operation of unsignalized access points along the US 301 and Choptank Road corridors, both of which are likely to be impacted by construction of the Spur Road. Similar to the signalized intersections, the operational performance of unsignalized intersections is presented in terms of average delay per vehicle and a corresponding Level of Service (LOS). For unsignalized intersections, the Level of Service thresholds are somewhat lower than the thresholds for signalized intersections, with LOS F representing conditions where vehicles experience 50 or more seconds of delay.

The number of vehicles stopping at the stop sign and the length of each stop was recorded at each of the three study intersections during the PM peak hour. The PM peak hour was selected since it represents the period that vehicles typically experience the highest level of delay making turns from minor street approaches onto US 301 and Choptank Road. The average delay per stopped vehicle was determined for each location (see Figure 14). In 2012, the average control delay was 38 seconds per vehicle (LOS E) at the intersection of US 301 and Old School House Road, 37 seconds per vehicle (LOS E) at the intersection of US 301 at Keenan Auto Body and 14 seconds per vehicle (LOS B) at the intersection of Choptank Road and Clayton Manor Drive. A comparison of the 2010, 2011, and 2012 studies is shown in Figure 14.

It should be noted that the delay at the intersection of Keenan Autobody increased significantly in 2011 (by 21 seconds per vehicle) to nearly a minute of delay per vehicle. This increase in delay may have been attributable to the Cedar Lane Road closure which was necessary to repair the bridge just north of the Marl Pit Road intersection. Following the completion of the bridge work, the delay decreased back to the 2010 level (37 seconds per vehicle). The delay increased slightly at the intersection of Choptank Road and Clayton Manor Drive (by 4 seconds per vehicle); however, the average delay per vehicle remained low at 14 seconds per vehicle. Lastly, the change in delay at the intersection of US 301 and Old School House Road was minimal compared to 2010 and 2011 data.

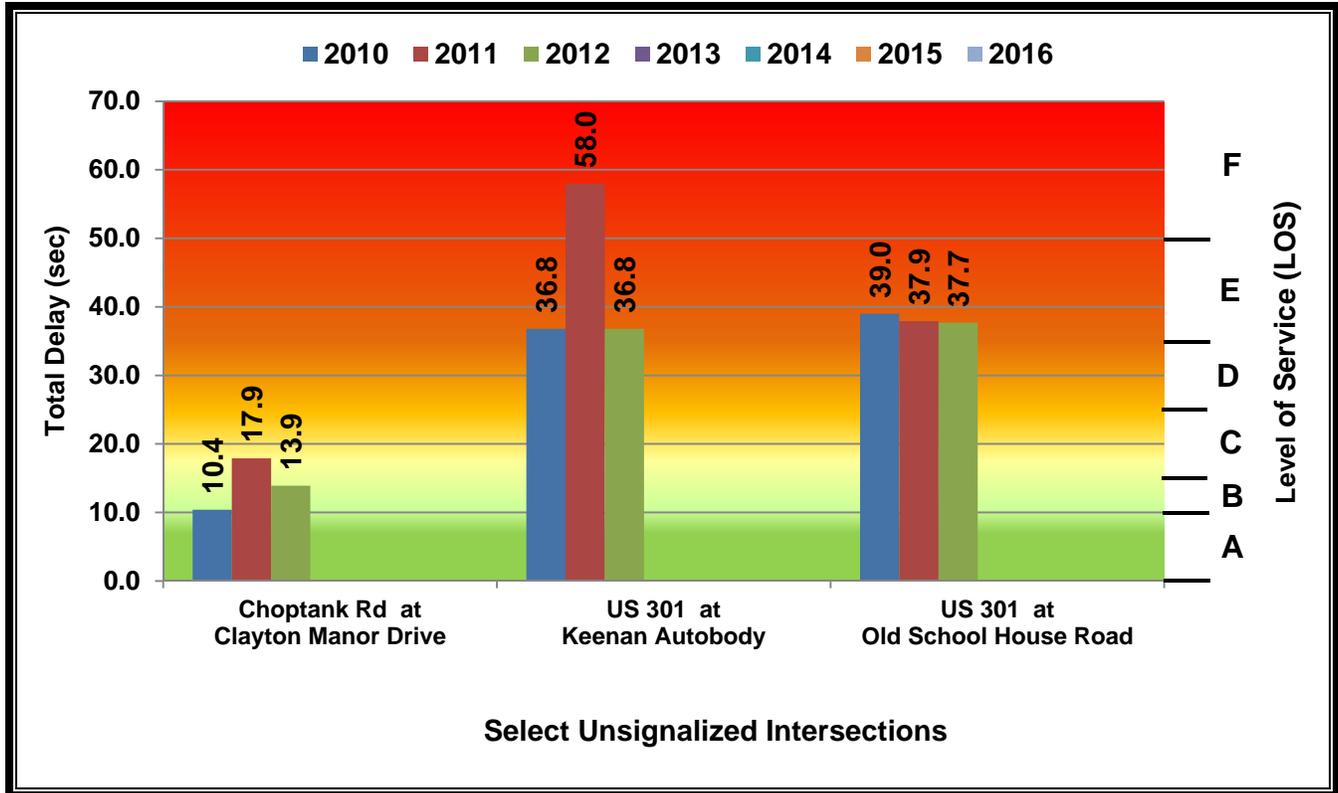


Figure 14: Total Delay and Corresponding Level of Service (LOS) at Select Unsignalized Intersections along US 301 during the PM Peak Hour

Highway Safety

The goal of this annual monitoring report with respect to safety is to monitor the number of crashes occurring on local roads throughout the US 301 Project Area. The number of crashes will be documented each year to determine if any road segments experience a significant increase in crashes.

The number of reported crashes occurring within each key roadway segment in 2010, 2011, and 2012 is shown in Table 4 and on Figure 15. Crash data for prior years, while available, was not included in this summary for two reasons: First, there was a considerable amount of roadway construction activity ongoing during 2007 and 2008 throughout the project area that would likely skew the crash data for those years, including long-term lane reductions and temporary closures of US 301, construction along Choptank Road, etc. Second, data will be collected each year for several years into the future, providing a basis for comparison of several years' worth of crash data, including the identification of crash trends over time.

Average Accident Rates have been calculated for each road segment to provide a relative measure of comparison of each roadway segment, factoring in traffic volumes, with other similar roads throughout Delaware and New Castle County (see Table 4). The calculated Average Accident Rates were compared to the Statewide and New Castle County crash rates for similar roadway segments of the same functional classifications. DeIDOT Safety Section provided the Statewide and New Castle County Average Crash Rates for 2010 and 2011. It should be noted that the Statewide and New Castle County Average Crash Rates for 2010 and 2011 were updated due to a new crash reporting methodology adopted by DeIDOT Safety Section in 2012. The change in



crash reporting methodology retroactively changed the crash rates for 2010 and 2011. According to the comparison, six (6) of the eight roadway segments being monitored had higher crash rates than the Statewide and New Castle County Average Rate in 2010. In 2011, just two (2) of the eight roadway segments being monitored had higher crash rates than the Statewide and New Castle County Average Rates.

It should be noted that DeIDOT Safety Section was not able to provide 2012 Statewide and New Castle County Crash Rates; therefore, those columns were left blank. They will be updated in future reports when the data becomes available.

In general, the number of crashes has decreased between 2010 and 2012 at most of the locations being monitored. The exceptions were the curve between Summit Bridge and Bethel Church Road, where the number of crashes increased from 2 to 4, Choptank Road between Bethel Church Road and Bunker Hill Road, where the number of crashes increased from 8 to 10.

Additional detail for these crashes, including the specific location, type and severity of each crash are summarized in Appendix C.

US 301 Spur Road 2012 Monitoring Report														April 2013			
Table 4: Average Accident Rate for Road Type (AART) (Accidents/ Million Vehicle Miles Traveled)																	
Site	2010				2011				2012				2013				
	Number of Crashes	Crash Rate	Delaware Crash Rate	NCC Crash Rate	Number of Crashes	Crash Rate	Delaware Crash Rate	NCC Crash Rate	Number of Crashes	Crash Rate	Delaware Crash Rate	NCC Crash Rate	Number of Crashes	Crash Rate	Delaware Crash Rate	NCC Crash Rate	
US 301 between Summit Bridge and SR 896 (Boyds Corner Rd)	32	1.44	0.75	0.55	21	0.93	0.74	0.53	21	0.95							
The "curve" between Summit Bridge and Bethel Church Rd	2				5				4								
The intersection of US 301 and Bethel Church Rd	3				3				3								
US 301 between SR 896 and Peterson Rd	50	1.78	1.27	1.35	27	0.94	1.40	1.42	42	1.40							
US 301 between Peterson Rd and Levels Rd	22	3.06	3.43	3.78	16	2.18	3.41	3.81	22	2.86							
US 301 between Levels Rd and DE / MD State Line	19	1.42	1.27	1.35	13	0.95	1.40	1.42	10	0.65							
Bethel Church Rd between US 301 and Choptank Rd	6	6.05	2.10	2.91	2	1.30	2.08	2.80	3	2.02							
Choptank Rd between Bethel Church Rd and Bunker Hill Rd	8	3.32	2.10	2.91	5	0.86	2.08	2.80	10	1.76							
Bunker Hill Rd between Choptank Rd and US 301	5	8.83	2.10	2.91	7	12.97	2.08	2.80	4	4.07							
SR 1 between Roth Bridge and US 13 / SR 1 Split (Tybouts Corner)	53	0.41	1.09	1.09	69	0.52	1.12	1.12	47	0.34							

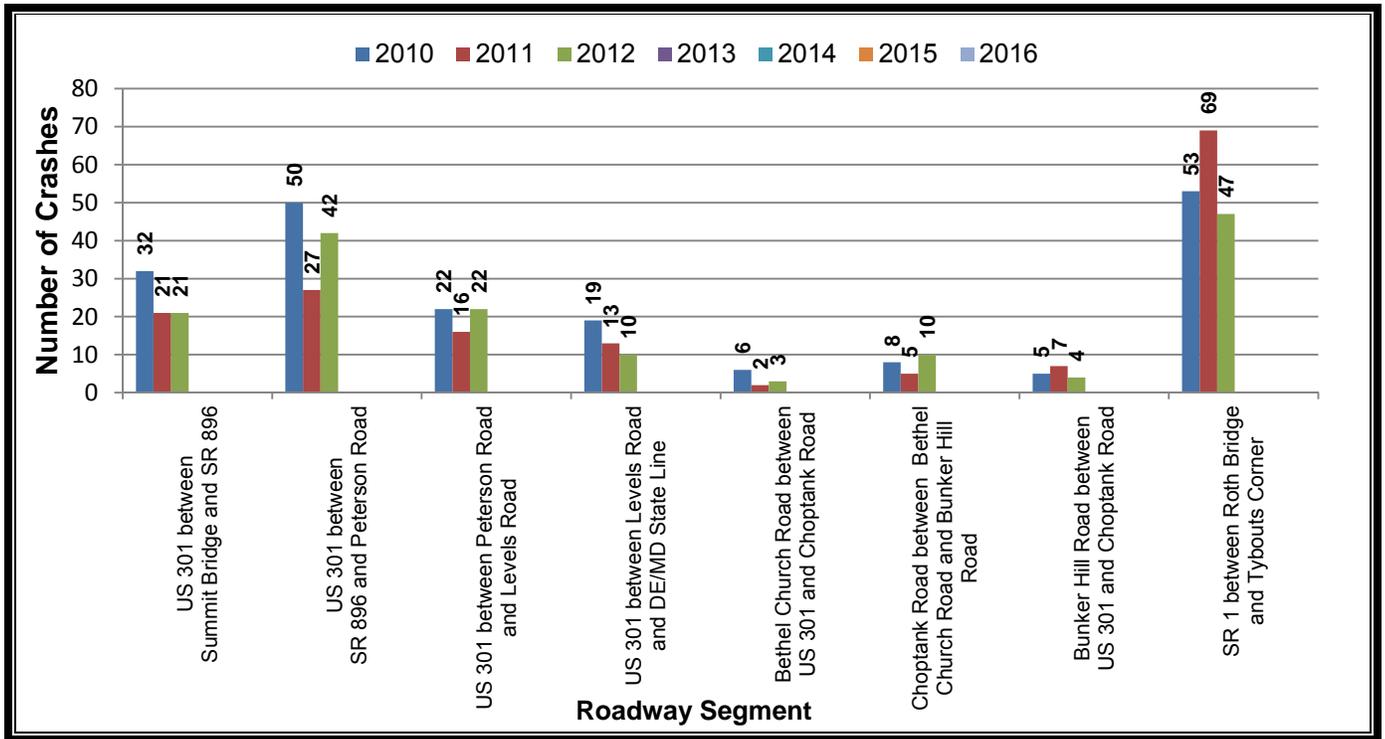


Figure 15: Comparison of Crashes for Select Roadways in the US 301 Corridor



Hazard Elimination Program

Roadway segments in the project area that are reported within DeIDOT’s Hazard Elimination Program (HEP) and High Risk Rural Roads Program (HRRRP) will be identified each year during the construction of US 301. These programs seek improvements focused on reducing the number of crashes at each location. A list of the HEP and HRRRP locations between 2007 and 2012 can be found in Tables 5 and 6.

US 301 Spur Road 2012 Monitoring Report			April 2013
Table 5: Hazard Elimination Program Locations – From 2006 to 2012			
Site	Start Milepost	End Milepost	Year Studied
US 13	0.19 miles South of Greylag Road	0.24 miles North of Boyds Corner Road	2006
US 301/SR 896 Summit Bridge Rd	0.44 miles North of Beaston Rd	0.56 miles South of Bethel Church Rd	2007
SR 299/Main Street	0.25 miles West of Brick Mill Road	0.24 miles East of Brick Mill Road	2007
SR 299/Main Street	0.35 miles East of Brick Mill Road	0.23 miles West of Brick Mill Road	2009
SR 1	1.36 miles South of SR 299	0.97 miles south of SR 299	2009
SR 299/Main Street	US 301	0.11 miles East of Silver Lake Road	2010
US 301/SR 896 Summit Bridge Rd	0.21 miles North of Springmill Drive	0.25 miles North of Marl Pit Road	2011
SR 299	0.1 mile west of Park Alley	Northbound US 13	2012
US 301 / SR 896	Churchtown Road	0.29 mile north of Churchtown Road	2012

US 301 Spur Road 2012 Monitoring Report			April 2013
Table 6: High Risk Rural Roads Program Locations – from 2007 to 2012			
Site	Start Milepost	End Milepost	Year Studied
Churchtown Rd	0.11 miles East of Dickerson Lane	0.33 miles West of SR 896/ Summit Bridge Rd	2009
Cedar Lane Road	0.33 mile south of SR 896	0.04 mile south of SR 896	2012

Incident Management

One of the regional benefits identified with the Spur Road is that it will provide an alternative north-south route for traffic should there be an incident that occurs on the following road segments:



- Existing US 301 between SR 299 and Bethel Church Road
- SR 896 (Boyds Corner Road) between US 301 and US 13
- Bethel Church Road between US 301 and Choptank Road
- SR 1 between Roth Bridge and I-95

For this monitoring program, DeIDOT is tracking the number of significant incidents that occur each year on these roads which result in detours that could have been accommodated more safely and efficiently on the Spur Road rather than on the local road network. Since 2004, there have been 68 incidents, including 12 in 2012, that have resulted in 190 or more hours of detour-related delay. These incidents occurred in locations that could have utilized the Spur Road as an alternate detour route if it existed, thereby reducing impacts to the local roadway network. Additional detail for each of these incidents that has occurred since 2004 are summarized in Appendix D.

Construction Projects

DeIDOT and the Town of Middletown will likely have several other active maintenance and construction projects occurring at various times during the duration of the US 301 Spur Monitoring Program that could affect the traffic data being collected. DeIDOT identified five (5) active construction projects in the US 301 project area in 2012, as shown in Table 7. Although the SR 1 / I-95 Interchange project is not located in the vicinity of the US301 project area, it should be mentioned due to its significant traffic impacts to SR 1 in New Castle County. As part of the program, DeIDOT will continue to monitor all active roadway construction projects in the US 301 project area from south of Middletown to approximately the Chesapeake and Delaware Canal.

US 301 Spur Road 2011 Monitoring Report			April 2013
Table 7: Construction Activity in the US 301 Project Area in 2012			
Contract Number	Project Title	Start/End	Project Description
T200712003	Jamisons Corner Road, SR 896 (Boyds Corner Road) to Hyetts Corner Road	11-10-2011 / 8-25-2012	Reconstruct Jamisons Corner Road to improve to current standards
T201007101	N412A, Hyetts Corner Road to Lorewood Grove Road	6-18-2012 / 1-11-2013	Reconstruct Road 412A to improve to current standards and construct roundabouts at the intersections with Lorewood Grove Road and Hyetts Corner Road
T201009004	SR 1 / I-95 Interchange, Christiana Mall Road Bridge	September 2011 / October 2013	Construct high speed connecting ramps from both Northbound SR1 to Northbound I-95 and from Southbound I-95 to Southbound SR 1
Army Corp of Engineers	Summit Bridge Construction	4-26-2011 / TBD	Bridge repair work requiring daytime intermittent lane closures.
Army Corp of Engineers	Reedy Point Bridge Construction	March 2012 / TBD	Bridge repair work requiring 3-week lane closures periods.



Appendix A

Proposed Development for Southern New Castle County

Subdivision	Plan Status	Total Units to be Built	SQ_FT_NRES	Units Built 2010	Units Built 2011	Units Built 2012	UnBuilt 2010	UnBuilt 2011	UnBuilt 2012
449 ARMSTRONG CORNER	Expired	0	24,000	0	0	0	0	0	0
ASBURY CHASE II	Approved	47	0	0	31	47	47	16	0
BAYBERRY NORTH	Approved	951	0	0	13	71	951	938	880
BAYBERRY SOUTH	Approved	1,190	0	4	0	0	1,186	1,186	1,186
BAYBERRY TOWN CENTER	Pending	0	559,204	0	0	0	0	0	0
BIGGS FARM	Approved	20	0	0	0	0	20	20	20
BOHEMIA MILL POND	Approved	50	0	28	28	28	22	22	22
Boyd's Corner Farm	Pending	116	146,800	0	0	0	116	116	116
CANALVIEW AT CROSSLAND (South)	Approved	432	0	31	86	140	401	346	287
CARTER FARM	Pending	578	0	0	0	0	578	578	578
CEDAR LANE	Approved	78	0	0	0	0	77	77	77
Christiana Care	Approved	0	64,000	0	0	0	0	0	0
CHURCHTOWN MANOR	Pending	273	0	0	0	0	273	273	273
COUNTRY ACRES II	Approved	6	0	0	0	0	6	6	0
COUNTRY CLUB ESTS	Expired	407	0	0	0	0	407	407	407
DEATS FARM	Pending	1,381	0	0	0	0	1,381	1,381	1,381
ESTATES AT RIDGEFIELD	Expired	16	0	0	0	0	16	16	16
ESTATES AT ST ANNES	Approved	466	0	164	175	217	302	291	249
Gander Hill	Approved	80	0	32	33	33	48	47	47
HUBERS CROSSING	Pending	0	119,385	0	0	0	0	0	0
HYETTS CORNER	Approved	143	0	34	40	56	109	103	87
Isaacs Subdivision	Exploratory	87	0	0	0	0	87	87	87
LOREWOOD ESTATES	Approved	10	0	6	6	6	4	4	4
Merrimack Commons	Approved	78	0	0	0	0	78	78	78
OASIS AT CYPRESS RIDGE	Expired	29	0	0	0	0	29	29	29
PARKSIDE	Approved	492	0	166	176	179	326	316	313
PLEASANTON	Expired	434	0	0	0	0	434	434	434
Promedade at Middletown	Approved	273	145,000	0	0	0	273	273	273
ROTHWELL VILLAGE	Approved	150	0	0	0	0	150	150	150
SCOTT RUN BUSINESS PK	Approved	0	1,700,000	0	0	0	0	0	0
SHANNON COVE	Approved	409	0	99	108	132	311	301	277
SPRING ARBOR AT South Ridge	Approved	317	0	111	122	154	206	195	163
SUMMIT CROSSING PH 2	Approved	0	5,500	0	0	0	0	0	0
The Highlands	Approved	1,242	0	0	0	0	1,242	1,242	1,242
The Highlands @ Backcreek	Approved	42	0	0	0	0	42	42	42
THE PARKWAY AT SOUTH RIDGE	Approved	446	0	33	39	39	413	407	407
Townsend Acres	Approved	49	0	0	0	0	49	49	49
TOWNSEND VILLAGE	Approved	242	0	95	99	111	147	143	131
TOWNSEND VILLAGE	Approved	336	0	174	182	185	162	154	151
TSAGANOS	Approved	0	16,960	0	0	0	0	0	0
VILLAGE OF SCOTT RUN	Pending	271	0	0	0	0	271	271	271
Westown (Levels)	Approved	1,800	0	0	0	0	1,800	1,800	1,800
Westown Commercial (Amazon)	Approved	0	1,250,000	0	0	0	0	0	0
Whitehall Phase A	Pending	1,361	79,300	0	0	0	0	1,361	1,361
Whitehall Phase B	Pending	529	0	0	0	0	0	529	529
Whitehall Phase C	Pending	1,853	0	0	0	0	0	1,853	1,853
WILLOW GROVE MILL Phase II	Approved	192	58,700	105	118	192	87	74	0
WINCHELSEA	Pending	513	0	0	0	0	513	513	513
Windsor Commons at Hyetts Corner	Approved	316	0	0	0	0	149	149	149
WOODGRIFF FARMS	Expired	4	0	0	4	0	4	0	0
Browning Creek (Cecil)	Expired	47	0.00	0	0	0	47	47	47
John Harrison (Cecil)	Expired	4	0	0	0	0	4	4	4
John Curtis (Cecil)	Approved	3	0.00	0	0	0	3	3	3
Worsell Manor (Cecil)	Pending	41	0.00	0	0	0	41	41	41
Blossom View (Cecil)	approved	29	0.00	0	0	0	29	29	29
Bayside Development (Cecil)	Pending	18	0.00	0	0	0	18	18	18
Horse Trails at Worsell Manor (Cecil)	Expired	27	0.00	0	0	0	27	27	27
Sycamore Lane Nursery (Cecil)	Pending	90	0.00	0	0	0	90	90	90
Frisby Meadows (Cecil)	Pending	75	0.00	0	0	0	75	75	75
Glenn Maple (Cecil)	Approved	7	0.00	0	0	0	7	7	7
Butlers Crossing (Cecil)	Pending	7	0.00	0	0	0	7	7	7
Spirit Airpark (Cecil)	Expired	20	0.00	0	0	0	20	20	20
		18,077	4,168,849	1,082	1,260	1,590	13,085	16,645	16,300



Appendix B
Residential Construction in the Town of Middletown



Appendix C
US 301 Corridor Crash Reports

	Date	Time	Milepoint	Type	Severity	Direction
1	1/17/2012	13:25	2.14	Rear-end	PDO	NB/NB
2	2/1/2012	19:35	2.3	Rear-end	PDO	SB/SB
3	2/6/2012	15:53	0.71	Rear-end	PDO	NB/NB/NB
4	3/4/2012	22:15	2.57	Rear-end	PDO	SB/SB
5	4/8/2012	17:04	2.55	Sideswipe-same	PDO	NB/NB
6	4/12/2012	18:18	1.94	Other	Fatality	SB/NB
7	4/27/2012	23:37	0	Rear-end	PDO	NB/NB
8	5/7/2012	7:19	2.13	Rear-end	PDO	NB/NB
9	5/24/2012	11:55	0.71	Rear-end	PDO	NB/NB
10	5/25/2012	14:38	3.44	Rear-end	PDO	SB/SB
11	6/19/2012	16:48	1.98	Rear-end	Injury	SB/SB/SB
12	6/24/2012	23:20	1.56	Rear-end	PDO	SB/SB
13	7/2/2012	18:49	0.72	Left-turn	PDO	WB/NB/SBLT
14	8/23/2012	21:20	3.75	Sideswipe-same	PDO	SB/SB
15	9/15/2012	20:44	0.3	Rear-end	Injury	NB/NB
16	9/15/2012	21:11	1.78	ROR-HFO	PDO	SB
17	9/29/2012	9:35	Unknown	Left-turn	PDO	NB/SBLT
18	10/12/2012	20:24	0.45	Left-turn	PDO	NB/NB/SBLT
19	11/18/2012	21:39	3.83	Angle	PDO	SB/EBLT
20	12/8/2012	7:28	2.04	ROR-HFO	PDO	SB
21	12/10/2012	6:41	0.04	Rear-end	PDO	SB/SB
2012 Total Number of Crashes					21	

HFO: Hit-fixed-object

ROR: Run-off the Road

PDO: Property Damage Only

US 301 between Summit Bridge and SR896

A total of twenty-one (21) crashes were reported in 2012, and the following trends were identified:

- One (5 percent) of the twenty-one reported crashes resulted in a fatality. The crash occurred on the curve between Summit Bridge and Bethel Church Road.
- Two (9 percent) of the twenty-one reported crashes resulted in personal injury.
- Eighteen (86 percent) of the twenty-one crashes resulted in property damage only.
- Twelve (57 percent) of the reported crashes were rear-end crashes.
- Three (14 percent) of the reported crashes were left-turn crashes.
- Two (9.5 percent) of the reported crashes were run-off-the-road crashes.
- Two (9.5 percent) of the reported crashes were sideswipe-same direction crashes.
- One (5 percent) of the reported crashes was an angle crash.
- One (5 percent) of the reported crashes is classified as other. The crash involved a northbound and southbound vehicle. The vehicle traveling northbound lost control in the curve and crossed the median hitting the vehicle traveling southbound. The crash resulted in a fatality and was attributable to aggressive driving.

	Date	Time	Milepoint	Type	Severity	Direction
1	1/27/2012	19:14	1.96	Rear-end	PDO	SB/NBUT
2	2/1/2012	15:24	1.01	Rear-end	Injury	SB/SB
3	2/1/2012	15:24	1.01	Rear-end	Injury	SB/SB
4	2/1/2012	15:51	1.33	Rear-end	PDO	SB/SB
5	2/10/2012	18:22	1.20	Rear-end	PDO	SB/SB
6	2/14/2012	21:06	1.84	Hit-deer	PDO	SB
7	2/14/2012	7:15	1.00	Rear-end	Injury	SB/SB/SB
8	3/16/2012	18:29	3.97	Rear-end	PDO	SB/SB
9	3/20/2012	15:55	2.35	ROR-HFO	PDO	SB/SB
10	3/21/2012	16:09	3.58	Rear-end	Injury	NB/NB
11	3/23/2012	16:27	1.70	Rear-end	Injury	SB/SB
12	3/26/2012	10:24	3.22	ROR-HFO	PDO	NB
13	4/19/2012	15:31	2.52	Rear-end	PDO	SB/SB/SB
14	5/1/2012	15:45	3.87	Angle	PDO	SB/EB
15	5/11/2012	21:20	3.87	Angle	Injury	SB/EB
16	5/11/2012	16:25	2.46	Rear-end	Injury	SB/SB
17	5/26/2012	23:19	3.60	Sideswipe-same	Injury	NB/NB
18	5/29/2012	14:50	3.87	Angle	PDO	SB/EBLT
19	6/1/2012	16:28	1.08	Rear-end	PDO	SB/SB
20	6/7/2012	17:24	2.14	Angle	PDO	NW/WB
21	6/13/2012	17:54	1.09	Rear-end	PDO	SB/SB
22	6/26/2012	15:43	2.91	Sideswipe-same	PDO	NB/NB
23	7/9/2012	13:36	1.59	Rear-end	Injury	NB/NB
24	7/31/2012	16:42	2.36	Rear-end	PDO	SB/SB
25	8/10/2012	17:36	2.34	Rear-end	PDO	SB/SB
26	8/26/2012	11:16	2.14	Rear-end	PDO	SB/SB/SB/SB
27	8/27/2012	1:18	4.31	ROR-HFO	PDO	SB
28	9/4/2012	10:36	2.23	Rear-end	PDO	SB/SB
29	9/9/2012	2:11	1.38	Rear-end	PDO	SB/SB
30	9/11/2012	7:11	2.32	Rear-end	PDO	SB/SB
31	9/15/2012	12:48	0.98	Rear-end	Injury	SB/SB
32	9/18/2012	7:20	0.99	Other	PDO	NB/SBUT
33	10/20/2012	9:30	3.87	Angle	Injury	SB/EBLT
34	10/21/2012	1:11	3.18	Rear-end (DUI)	PDO	SB/SB
35	10/27/2012	7:29	2.14	Left-turn	PDO	NB/SBLT
36	11/12/2012	16:06	4.22	Rear-end	Injury	NB/NB/NB
37	12/1/2012	5:52	2.71	Pedestrian	Fatality	NB/SB
38	12/4/2012	17:42	3.44	Rear-end	PDO	SB/SB
39	12/14/2012	16:11	3.90	Left-turn	Injury	EB/WBLT
40	12/21/2012	11:29	2.26	Other	Injury	NB/NBUT
41	12/22/2012	3:35	0.98	Angle	Injury	NB/WB
42	12/22/2012	0:44	Unknown	ROR-HFO	PDO	NB
2012 Total Number of Crashes					42	

HFO: Hit-fixed-object

ROR: Run-off the Road

PDO: Property Damage Only

US 301 between SR896 and Peterson Road

A total of forty-two (42) crashes were reported in 2012, and the following trends were identified:

- One (2.5 percent) of the forty-two reported crashes resulted in a fatality. The crash involved a pedestrian.
- Fifteen (35.5 percent) of the forty-two reported crashes resulted in personal injury.
- Twenty-six (62 percent) of the forty-two reported crashes resulted in property damage only.
- Twenty-four (57 percent) of the reported crashes were rear-end crashes.
- Six (14 percent) of the reported crashes were angle crashes. Four (4) of the crashes occurred at the Ash Boulevard intersection. One (1) of the crashes occurred at the SR 71 intersection and one (1) crash occurred at the Armstrong Corner Road intersection.
- Four (10 percent) of the reported crashes were run-off-the-road crashes. Two (2) of the crashes occurred on northbound US 301 and two (2) crashes occurred on southbound US 301.
- Two (5 percent) of the reported crashes were classified as other.
- Two (5 percent) of the reported crashes were left-turn crashes. Both of the left-turn crashes occurred at the Armstrong Corner Road intersection.
- Two (5 percent) of the reported crashes were sideswipe-same direction crashes.
- One (2 percent) of the reported crashes involved a motor vehicle and a pedestrian. The crash resulted in a fatality and occurred on southbound US 301 north of Armstrong Road. The crash was attributable to a pedestrian under the influence of alcohol.
- One (2 percent) of the reported crashed involved a motor vehicle and a deer.

	Date	Time	Milepoint	Type	Severity	Direction
1	1/18/2012	18:41	2.85	Rear-end	PDO	SB/SB
2	3/5/2012	5:58	3.10	Rear-end	PDO	SB/SB/SB
3	3/29/2012	10:22	3.13	Rear-end	PDO	
4	5/13/2012	15:15	0.48	Rear-end	PDO	WBRT/WBRT
5	5/27/2012	17:40	0.48	Angle	Injury	EBLT/SB
6	6/6/2012	10:24	2.52	Sideswipe-same	PDO	SB/SB
7	6/12/2012	16:41	3.13	Rear-end	PDO	NB/NB
8	6/21/2012	22:04	3.13	Rear-end	PDO	SB/SB
9	6/28/2012	21:32	3.33	Left-turn	Injury	SB/NBLT
10	7/18/2012	19:45	2.88	Left-turn	PDO	EBLT/WBLT
11	9/26/2012	19:07	3.08	ROR-HFO (DUI)	Injury	NB
12	10/1/2012	8:15	3.15	Sideswipe-same	Injury	NB/WBRT
13	10/19/2012	16:25	3.20	Left-turn	PDO	SB/NBLT
14	10/21/2012	11:21	0.48	Sideswipe-same	PDO	NBRT/NBRT
15	11/1/2012	13:04	0.00	Rear-end	PDO	WBLT/WBLT
16	11/15/2012	10:05	0.00	Angle	PDO	EB/NBRT
17	11/18/2012	17:06	3.48	Sideswipe-same	PDO	NB/NB
18	11/24/2012	22:05	2.61	Head-on	Injury	SB/EBLT
19	11/25/2012	18:24	2.68	Rear-end	PDO	NB/NB
20	11/26/2012	18:20	0.48	Rear-end	PDO	WBRT/WBRT
21	12/6/2012	20:21	2.38	Sideswipe-same	PDO	NB/NB/NB
22	12/7/2012	18:15	0.48	Rear-end	Injury	NB/NB
2012 Total Number of Crashes					22	

HFO: Hit-fixed-object

ROR: Run-off the Road

PDO: Property Damage Only

US 301 between Peterson Road and Levels Road

A total of twenty-two (22) crashes were reported in 2012, and the following trends were identified:

- Six (27 percent) of the reported sixteen crashes resulted in personal injury.
- Sixteen (73 percent) of the reported crashes resulted in property damage only.
- Ten (46 percent) of the reported crashes were rear-end crashes.
- Five (23 percent) of the reported crashes were sideswipe-same direction crashes.
- Three (14 percent) of the reported crashes were left-turn crashes.
- Two (9 percent) of the reported crashes were angle crashes.
- One (4 percent) of the reported crashes was a head-on crash.
- One (4 percent) of the reported crashes was a run-off-the-road crash. The crash involved a northbound vehicle and was attributable to a motorists driving under the influence of alcohol.

	Date	Time	Milepoint	Type	Severity	Direction
1	1/14/2012	15:45	1.51	Angle	Injury	NB/WBLT
2	10/6/2012	11:35	0	Angle	Injury	SB/EBLT
3	11/24/2012	13:00	0.24	Debris in roadway	PDO	SB/SB
4	7/1/2012	23:03	1.19	Hit-deer	PDO	SB
5	10/26/2012	18:14	2.04	Other	PDO	NB/WBRT
6	2/16/2012	7:32	0.84	Rear-end	Injury	SBLT/SB
7	3/23/2012	19:44	1.01	Rear-end	Injury	SBLT/SB
8	10/26/2012	14:52	0.87	ROR-HFO	PDO	NB(NCV SBLT)
9	12/18/2012	23:50	2.04	ROR-HFO	PDO	SB
10	3/25/2012	2:01	0.25	Sideswipe-same	Injury	SBLT/SB
2012 Total Number of Crashes					10	

HFO: Hit-fixed-object

ROR: Run-off the Road

PDO: Property Damage Only

US 301 between Levels Road and DE / MD State Line

A total of ten (10) crashes were reported in 2012, and the following trends were identified:

- Five (50 percent) of the ten reported crashes resulted in personal injury.
- Five (50 percent) of the ten reported crashes resulted in property damage only.
- Two (20 percent) of the reported crashes were angle crashes.
- Two (20 percent) of the reported crashes were run-off-the-road crashes. One (1) of the reported crashes involved a northbound vehicle and one (1) of the crashes involved a southbound vehicle.
- Two (20 percent) of the reported crashes were rear-end crashes.
- One (10 percent) of the reported crashes was a sideswipe-same direction crash.
- One (10 percent) of the reported crashes involved a motor vehicle and a deer.
- One (10 percent) of the reported crashes involved debris in the roadway and a motor vehicle.
- One (10 percent) of the reported crashes was classified as other.

Crash Reports Summary

**Bethel Church Road between
US301 and Choptank Road**

4/8/2013

	Date	Time	Milepoint	Type	Severity	Direction
1	5/31/2012	21:15	2.43	Hit-deer	PDO	WB
2	6/11/2012	1:15	2.53	ROR-HFO	PDO	WB
3	8/30/2012	13:04	2.24	ROR-HFO	Injury	EB
2012 Total Number of Crashes					3	

HFO: Hit-fixed-object

ROR: Run-off the Road

PDO: Property Damage Only

Bethel Church Road between US 301 and Choptank Road

A total of three (3) crashes were reported in 2012, and the following trends were identified:

- One (33 percent) of the reported crashes resulted in personal injury.
- Two (67 percent) of the reported crashes resulted in property damage only.
- Two (67 percent) of the reported crashes were run-off-the-road (ROR) crashes. One (1) crash involved an eastbound vehicle and one (1) crash involved a westbound vehicle.
- One (33 percent) of the reported crashes involved a motor vehicle and a deer.

	Date	Time	Milepoint	Type	Severity	Direction
1	1/27/2012	9:31	0.11	ROR-HFO	PDO	SB
2	3/6/2012	21:15	3.94	ROR-HFO	PDO	SB
3	3/28/2012	14:48	2.32	Sideswipe-opposite-direction	PDO	NB/SB
4	7/5/2012	12:08	3.47	Angle	PDO	SB/EB
5	8/15/2012	1:34	Unknown	ROR-HFO (DUI)	Injury	SB
6	10/6/2012	19:58	4.72	Hit-deer	PDO	EB/NB/SB
7	10/9/2012	8:00	1.68	Angle	PDO	WB/SB
8	11/16/2012	17:48	2.37	Hit-deer	Injury	EB/NB
9	11/30/2012	10:24	3.47	Angle	PDO	SB/EB
10	12/25/2012	0:06	2.93	ROR-HFO	PDO	SB
2012 Total Number of Crashes					10	

HFO: Hit-fixed-object

ROR: Run-off the Road

PDO: Property Damage Only

Choptank Rd between Bethel Church Road and Bunker Hill Road

A total of ten (10) crashes were reported in 2012, and the following trends were identified:

- Two (20 percent) of the ten reported crashes resulted in personal injury.
- Eight (80 percent) of the ten reported crashes resulted in property damage only.
- Three (30 percent) of the reported crashes were angle crashes. All (3) of the crashes occurred at the Churchtown Road intersection.
- Four (40 percent) of the reported crashes were run-off-the-road (ROR) type crashes. All (4) of the ROR crashes involved southbound vehicles. One (1) of the crashes was attributable to a motorist driving under the influence of alcohol.
- Two (20 percent) of the reported crashes involved a motor vehicle and a deer.
- One (10 percent) of the reported crashes was a sideswipe-opposite direction crash.

Crash Reports Summary

**Bunker Hill Road between
Choptank Road and US301**

4/8/2013

	Date	Time	Milepoint	Type	Severity	Direction
1	1/23/2012	7:25	2.08	Rear-end	PDO	WB/WB
2	2/17/2012	10:00	0.00	Angle	PDO	EB/SB
3	3/29/2012	10:22	3.13	Rear-end	PDO	EBRT/EBRT
4	4/17/2012	6:00	2.54	Angle	PDO	WB/SB
2012 Total Number of Crashes					4	

HFO: Hit-fixed-object

ROR: Run-off the Road

PDO: Property Damage Only

Bunker Hill Road between Choptank Road and US 301

A total of Four (4) crashes were reported in 2012, and the following trends were identified:

- All (4) of the reported crashes resulted in property damage only.
- Two (50 percent) of the reported crashes were angle crashes.
- Two (50 percent) of the reported crashes were run-off-the-road (ROR) type crashes.

	Date	Time	Milepoint	Type	Severity	Direction
1	1/5/2012	19:26	4.99	ROR-HFO	PDO	SB
2	1/21/2012	5:31	5.29	Sideswipe-same	PDO	NB/NB
3	2/6/2012	11:14	5.08	Rear-end	PDO	SB/SB
4	2/18/2012	3:22	5.57	Rear-end	Injury	SB/SB
5	2/27/2012	11:22	3.77	ROR-HFO	PDO	SB
6	3/19/2012	21:20	1.13	ROR-HFO	PDO	NB
7	3/23/2012	17:21	5.08	ROR-HFO	Injury	SB
8	4/11/2012	22:22	4.05	Debris in roadway	PDO	SB
9	4/18/2012	18:25	4.97	ROR-HFO	Injury	SB
10	4/18/2012	19:14	4.22	Sideswipe-same	PDO	SB/SB
11	4/29/2012	20:38	4.86	Debris in roadway	PDO	SB
12	5/6/2012	10:33	3.34	Sideswipe-same	Injury	SB/SB/SB
13	5/19/2012	2:56	2.93	Sideswipe-same	PDO	NB/NB
14	5/23/2012	23:44	4.80	Rear-end	PDO	NB/NB
15	5/25/2012	6:16	4.03	ROR-HFO	Injury	NB
16	6/1/2012	12:25	3.69	ROR-HFO	Injury	SB
17	6/3/2012	16:07	1.61	Sideswipe-same	PDO	NB/NB
18	6/7/2012	15:37	3.91	ROR-HFO	PDO	SB
19	6/16/2012	10:22	5.50	Sideswipe-same	PDO	NB/NB
20	6/18/2012	0:48	2.34	Rear-end	PDO	NB/NB
21	6/18/2012	0:14	4.51	ROR-HFO	PDO	NB
22	6/20/2012	8:35	3.95	Debris in roadway	PDO	NB
23	6/21/2012	13:15	5.03	Sideswipe-same	Injury	SB/SB/SB
24	6/26/2012	16:25	3.41	ROR-HFO	PDO	SB
25	6/29/2012	5:31	3.59	ROR-HFO	PDO	SB
26	7/1/2012	18:48	2.31	ROR-HFO	Injury	NB
27	7/3/2012	8:06	3.07	Sideswipe-same	PDO	NB/NB
28	7/4/2012	21:11	2.52	Sideswipe-same	PDO	NB/NB
29	7/12/2012	3:30	3.89	ROR-HFO	Injury	NB
30	7/24/2012	18:14	6.98	ROR-HFO	PDO	SB
31	7/26/2012	15:49	7.88	Rear-end	Injury	SB/SB
32	7/29/2012	3:31	3.92	Rear-end (DUI)	Injury	SB/SB
33	8/8/2012	21:05	2.89	Debris in roadway	PDO	NB
34	8/8/2012	21:31	5.05	Sideswipe-same (DUI)	Injury	SB/SB
35	8/23/2012	9:11	3.60	Debris in roadway	PDO	SB/SB
36	8/25/2012	14:00	4.65	Sideswipe-same	PDO	NB/NB
37	9/8/2012	17:51	3.63	ROR-HFO	PDO	SB
38	9/12/2012	21:30	5.30	Hit-deer	PDO	NB
39	9/24/2012	15:02	1.84	Rear-end	PDO	NB/NB
40	9/25/2012	15:49	6.05	Debris in roadway	PDO	SB/SB
41	9/27/2012	22:48	7.88	Sideswipe-same	PDO	SB/SB
42	10/15/2012	21:12	0.00	Rear-end	PDO	NB/NB
43	10/18/2012	19:05	6.58	Hit-deer	PDO	SB
44	10/30/2012	6:40	7.02	ROR-HFO	Injury	SB
45	11/19/2012	18:46	5.28	Hit-deer	PDO	NB
46	12/23/2012	6:23	4.09	ROR-HFO	PDO	NB

Crash Reports Summary

**SR1 between Roth Bridge
and Tybouts Corner**

4/8/2013

	Date	Time	Milepoint	Type	Severity	Direction
47	12/25/2012	19:10	4.88	Hit-pedestrian	Injury	NB
2012 Total Number of Crashes					47	

HFO: Hit-fixed-object

ROR: Run-off the Road

PDO: Property Damage Only

SR1 between Roth Bridge and Tybouts Corner

A total of forty-seven (47) crashes were reported in 2012, and the following trends were identified:

- Fourteen (30 percent) of the forty-seven reported crashes resulted in personal injury.
- Thirty-three (70 percent) of the forty-seven reported crashes resulted in property damage only.
- Seventeen (36 percent) of the reported crashes were run-off-the-road (ROR) type crashes. Six (6) crashes involved northbound vehicles and eleven (11) crashes involved southbound vehicles.
- Twelve (26 percent) of the reported crashes were sideswipe-same direction crashes. Seven (7) crashes involved northbound vehicles and five (5) crashes involved southbound vehicles.
- One (1) of run-off-the-road crashes involving a southbound vehicle was attributable to a motorists driving under the influence of alcohol.
- Eight (17 percent) of the reported crashes were rear-end crashes.
- Six (13 percent) of the reported crashes involved debris in the roadway and a motor vehicle.
- Three (6 percent) of the reported crashes involved a motor vehicle and a deer.
- One (2 percent) of the reported crashes involved a motor vehicle and a pedestrian.

	Date	Time	Milepoint	Type	Severity	Direction
1	4/12/2012	18:18	1.94	Other	Fatality	SB/NB
2	6/19/2012	16:48	1.98	Rear-end	Injury	SB/SB/SB
3	6/24/2012	23:20	1.56	Rear-end	PDO	SB/SB
4	12/8/2012	7:28	2.04	ROR-HFO	PDO	SB
2012 Total Number of Crashes					4	

HFO: Hit-fixed-object

ROR: Run-off the Road

PDO: Property Damage Only

US 301 between Summit Bridge and Bethel Church Road

A total of four (4) crashes were reported in 2012, and the following trends were identified:

- One (25 percent) of the four reported crashes resulted in a fatality.
- One (25 percent) of the four reported crashes resulted in personal injury.
- Two (50 percent) of the four reported crashes resulted in property damage only.
- Two (50 percent) of the crashes were rear-end crashes.
- One (25 percent) crash was a run-off-the-road type crash. The crash involved a southbound vehicle.
- One (25 percent) of the reported crashes is classified as other. The crash involved a northbound and southbound vehicle. The vehicle traveling northbound lost control in the curve and crossed the median hitting the vehicle traveling southbound. The crash resulted in a fatality and was attributable to aggressive driving.

Crash Reports Summary

**US301 @
Bethel Church Road**

4/8/2013

	Date	Time	Milepoint	Type	Severity	Direction
1	1/17/2012	13:25	2.14	Rear-end	PDO	NB/NB
2	5/7/2012	7:19	2.13	Rear-end	PDO	NB/NB
3	10/13/2012	7:17	2.55	Rear-end	PDO	NB/NB
2012 Total Number of Crashes					3	

HFO: Hit-fixed-object

ROR: Run-off the Road

PDO: Property Damage Only

US 301 at Bethel Church Road

A total of three (3) crashes were reported in 2012, and the following trends were identified:

- All of the reported crashes resulted in property damage only.
- All of the reported crashes were rear-end crashes. All of the crashes involved northbound vehicles.



Appendix D

**Significant Incidents on SR 1 and
Other Roadways in the Middletown Region**

**Significant Incidents on SR 1 that Could have Utilized the Spur Road
to Accommodate Detoured Traffic – 2004 through present**

Date	Location	Event	Duration	Roads used for Detour
5/14/2004	SR 1 at SR 273	Property Damage Crash - SB SR 1 Left Lane Closed	1.5 Hours	Unknown
9/24/2004	SR 1 South of SR 273	Personal Injury Crash - SB SR 1 Closed	1 Hours	Unknown
4/3/2005	SR 1 at SR 72	Personal Injury Crash - Right and Center Lane Closed on SB SR 1	0.5 Hour	Unknown
4/14/2005	SR 1 South of US 40	Dump Truck Rolled Over – SB SR 1 Closed	3 Hours	Unknown
5/16/2005	NB SR 1 at Christiana Mall Ramp	Vehicle Fire - NB SR 1 Closed	1 Hour	Unknown
7/1/2005	SB SR 1 South of SR 273	Possible Fatal Crash / Entrapment - SB SR 1 Closed	2 Hours	Unknown
8/7/2006	SB SR 1 at Christiana Mall Ramp	Tractor Trailer Rolled Over - SB SR 1 Closed	7.5 Hours	Unknown
11/30/2006	NB SR 1 at Tybouts Corner	Personal Injury Crash - NB SR 1 Closed	1 Hour	Unknown
1/31/2007	SB SR 1 North of School House Road	Property Damage Crash – SB Left and Center Lane and NB Left Lane on SR 1 Closed	1.5 Hours	Unknown
2/14/2007	NB SR 1 South of SR 72	Tractor Trailer Rolled Over - NB SR 1 Closed at SR 896	6.5 Hours	Unknown
3/7/2007	NB SR 1 at Christiana Mall	Multiple (6) Vehicle Personal Injury Crash - NB SR 1 Closed	1.5 Hours	US 13, SR 72, SR 273 and I-95
5/14/2007	SB SR 1 on Roth Bridge	Personal Injury Crash - SB SR 1 Closed	1 Hour	Unknown
6/27/2007	SB SR 1 North of Roth Bridge	Tractor Trailer Rolled Over – SB SR 1 Closed	3 Hours	US 13 and SR 72
9/2/2007	NB SR 1 near Hyetts Corner Road	Personal Injury Crash - NB SR 1 Closed	2 Hours	Unknown
9/7/2007	SR 1 at SR 72	Vehicle Fire & Clean-up – SR 1 Closed at SR 72	3 Hours	SR 72
11/29/2007	SB SR 1 North of Roth Bridge	Fluid Spilled on Road - SB SR 1 Right Lane and Shoulder Closed	1 Hour	Unknown
1/29/2008	SB SR 1, South of SR 273	Property Damage Crash/ Rollover – SB SR 1 Left Lane Closed	1.5 Hours	Unknown
2/10/2008	SB SR 1 at Christiana Mall Ramp	Personal Injury Crash - Left Lanes Closed on NB & SB SR 1 s/o I-95	3 Hours	Unknown
2/12/2008	SR 1 near I-95	DSP Fatal Accident Reconstruction – Partial Closure	9.5 Hours	Unknown
2/12/2008	SR 1 between US 40 and SR 273	DSP Fatal Accident Reconstruction - Partial Closure	12 Hours	Unknown
4/2/2008	SR 1 at SR 273	Possible Fatal Crash involving 3 vehicles - NB SR 1 and SB SR 1 Ramp to SR 273 Closed	3 Hours	US 13
6/17/2008	NB SR 1 at SR 273	Possible Fatal Crash / damaged bridge – NB SR 1 Closed	3 Hours	Unknown
3/30/2009	NB SR 1 North of SR 72	Personal Injury Crash involving 4 vehicles – Partial closure	2 Hours	US 13
4/5/2009	SB SR 1 Ramp at Lorewood Grove Road	Tractor Trailer Rolled Over - SB SR 1 Closed	9 Hours	SR 9, US13 and SR 72

**Significant Incidents on SR 1 that Could have Utilized the Spur Road
to Accommodate Detoured Traffic – 2004 through present (Continued)**

Date	Location	Event	Duration	Roads used for Detour
6/29/2009	SR 1 at SR 273	Truck Rolled Over - SB SR 1 Closed	2.5 Hours	Unknown
8/2/2009	SR 1 at SR 273	Personal Injury Crash - SB SR 1 Closed at SR 273	2.5 Hours	Unknown
8/6/2009	SR 1 on Roth Bridge	Fatal Crash/ Vehicle Fire – SB SR 1 Closed	Unknown	Unknown
4/5/2010	SB SR 1, South of SR 71	Personal Injury Crash - SB SR 1 Closed	Unknown	Unknown
4/5/2010	NB SR 1 at Christiana Mall	Personal Injury Crash – Partial Closure on NB SR 1	Unknown	Unknown
5/27/2010	NB SR 1, North of US 40	Personal Injury Crash – NB SR 1 at US 40 Closed	Unknown	Unknown
3/17/2011	NB SR 1 at Biddles Toll Plaza	EZ Pass Lane Closure	7.5 Hours	US 13 / Others
4/8/2011	NB SR 1 at Christiana Mall Ramp	Jack-Knifed Tractor-Trailer	1 Hour	SR 273
6/2/2011	SB SR 1 at Biddles Toll Plaza	EZ Pass Lane Closure	7.5 Hours	US 13 / Others
7/17/2011	SR 1 near Christiana Mall	Fatal Crash in the work zone - Both NB & SB SR 1 Closed	3 Hours	SR 273
9/29/2011	NB SR 1 near SR 72 Ramps	Truck Fire - NB SR 1 Closed	1.5 Hours	Unknown
10/27/2011	SB SR 1 over Drawyers Creek Overpass	Personal Injury / Possible Fatal Crash – NB & SB SR 1 Closed	3 Hours	Unknown
10/27/2011	NB SR 1 at Christiana Mall Ramp	Personal Injury Crash – NB SR 1 On-Ramp to I-95 Closed	12.5 Hours	SR 273
12/12/2011	NB SR 1 at Tybouts Corner	Vehicle Crash – NB SR 1 Closed	1 Hour	US 13
11/8/2011	NB SR 1 on Roth Bridge	Vehicle Crash – NB SR 1 Closed	1.5 Hours	US 13 / Others
1/15/2012	SB SR 1 at SR 273	Vehicle Crash – SB SR 1 Closed	1.0 Hour	SR 273 / US 40
4/11/2012	NB SR 1 South of I-95 Ramps	Vehicle Crash – NB SR 1 Closed	2 Hours	SR 273
4/16/2012	SR 1 between SR 273 and AAA Blvd	Maintenance of Traffic	3 Hours	I-95 / SR 273
4/18/2012	SB SR 1 North of SR 72	Vehicle Crash – SB SR 1 Closed	1.5 Hours	US 13 / SR 72
4/30/2012	SB SR 1 at SR 7	Vehicle Crash – SB SR 1 Closed	3 Hours	I-95 / SR 273
6/15/2012	NB SR 1 near SR 71	Maintenance of Traffic – Partial Closure on NB SR 1	3.5 Hours	US 13 / SR 273
9/28/2012	NB SR 1 near SR 273	Vehicle Crash – NB SR Closed	1 Hour	SR 72/ SR 7 / US 13
11/8/2012	SB SR 1 At Christiana Mall Exit	Vehicle Crash – SB SR 1 Closed	1 Hour	SR 273 / US 13
11/9/2012	NB SR 1 At Christiana Mall Exit	Vehicle Crash – NB SR 1 Closed	1 Hour	SR 273 / I–95
12/8/2012	SB SR 1 near Exit 148	Vehicle Crash – SB SR 1 Closed	0.5 Hours	US 13
12/27/2012	NB SR 1 at Roth Bridge	Unknown	0.5 Hours	US 13
Total			141.5 Hours	

**Significant Incidents in the Middletown Region that Could have Utilized
the Spur Road to Accommodate Detoured Traffic – 2004 through present**

Date	Location	Event	Duration	Roads used for Detour
11/29/2004	Bethel Church Rdload	Personal Injury Crash - SB US 301 Left Lane and Left-turn Lane Closed	1 Hour	Right lane and shoulder on US 301
9/3/2005	US 301 at SR 71	Property Damage Crash - US 301 SB and SR 71 NB Left-turn Lane Closed	1 Hour	Access to Middletown Village back on to US 301
1/30/2006	SB US 301 at Bethel Church Road	Property Damage Crash & Fuel Spill - SB US 301 Closed	7 Hours	Bethel Church Road, Choptank Road and Churchtown Road
8/24/2006	US 301 North of Churchtown Road	Property Damage Crash – US 301 Closed	1 Hour	Unknown
12/25/2006	SB US 301 South of Summit Bridge	Personal Injury Crash - SB US 301 Closed	1 Hour	Shoulder Lane on SB US 301
7/26/2007	US 301 South of Summit Bridge	Fatal Crash – US 301 Closed	3 Hours	SR 1 and US 13
10/20/2007	Bethel Church Road	Fatal Crash – Bethel Church Road Closed at US 301	3.5 Hours	Unknown
11/2/2007	US 301 at Bethel Church Road	Damaged Pole - Bethel Church Road Closed	7 Hours	Unknown
1/5/2008	US 301 at Bethel Church Road	Damaged Pole - Bethel Church Road Closed	5 Hours	Unknown
5/30/2008	SB US 301 at SR 71	Personal Injury Crash - SB US 301 Closed	1 Hour	SR 71
6/16/2008	SR 896 East of Jamisons Corner Road	Barn Fire – SR 896 Closed	3.5 Hours	Unknown
9/30/2008	Old School House Road and US 301	Personal Injury Crash – Old School House Road Closed at US 301	1.5 Hours	Unknown
12/1/2009	US 301 and Churchtown Road	Personal Injury Crash – Details Unknown	1 Hour	Unknown
12/3/2009	US 301 at SR 71	Roadway Flooding - Details Unknown	Unknown	Unknown
12/11/2009	SB US 301 near Summit Bridge	Fatal Crash - Full Closure	3 Hours	Unknown
12/28/2009	US 301 North of SR 299	Property Damage Crash – US 301 Closed between SR 299 & SR 71	5 Hours	Unknown
9/26/2011	SR 299 near Cleaver Farms Road	Vehicle Crash – SR 299 Closed (Direction Unknown)	2.5 Hours	Unknown
11/9/2012	Marl Pit Road / Cedar Lane Road	Lane Closure – Direction & cause unknown	1.0 Hour	US 301 / US 13 / SR 896
Total			49 Hours	



Appendix E
Peak Hour Traffic Volumes,
SYNCHRO Capacity Reports and
Delay Study Results

Rummel, Klepper & Kahl, LLP

Consulting Engineers
81 W Mosher St
Baltimore MD 21217

File Name : US301-SR896
Site Code : 00000000
Start Date : 10/4/2012
Page No : 4

Start Time	US 301 Southbound					US 301 Northbound					Boyd's Corner Rd (SR896) Westbound					Churchtown Rd Eastbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 06:30 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	72	104	3	0	179	2	171	42	0	215	30	8	74	0	112	10	43	2	0	55	561
07:15 AM	66	88	6	0	160	0	214	51	0	265	24	17	92	0	133	13	31	3	0	47	605
07:30 AM	56	124	2	0	182	1	186	34	0	221	23	7	89	0	119	11	23	2	0	36	558
07:45 AM	56	134	5	0	195	0	185	41	0	226	28	4	78	0	110	7	33	8	0	48	579
Total Volume	250	450	16	0	716	3	756	168	0	927	105	36	333	0	474	41	130	15	0	186	2303
% App. Total	34.9	62.8	2.2	0		0.3	81.6	18.1	0		22.2	7.6	70.3	0		22	69.9	8.1	0		
PHF	.868	.840	.667	.000	.918	.375	.883	.824	.000	.875	.875	.529	.905	.000	.891	.788	.756	.469	.000	.845	.952
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	80	214	24	0	318	3	151	39	0	193	69	22	47	0	138	8	12	7	0	27	676
05:15 PM	78	206	16	0	300	4	147	27	0	178	55	30	46	0	131	13	10	8	0	31	640
05:30 PM	75	199	16	0	290	3	147	28	0	178	82	32	71	0	185	18	11	3	0	32	685
05:45 PM	89	216	11	0	316	4	129	36	0	169	76	27	43	0	146	11	11	7	0	29	660
Total Volume	322	835	67	0	1224	14	574	130	0	718	282	111	207	0	600	50	44	25	0	119	2661
% App. Total	26.3	68.2	5.5	0		1.9	79.9	18.1	0		47	18.5	34.5	0		42	37	21	0		
PHF	.904	.966	.698	.000	.962	.875	.950	.833	.000	.930	.860	.867	.729	.000	.811	.694	.917	.781	.000	.930	.971

Rummel, Klepper & Kahl, LLP

Consulting Engineers
81 W Mosher St
Baltimore MD 21217

File Name : US301-ArmstrongCornerRd
Site Code : 00000000
Start Date : 10/4/2012
Page No : 4

Start Time	US 301 Southbound					US 301 Northbound					Marl Pit Rd Westbound					Armstrong Corner Rd Eastbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 06:30 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 06:45 AM																					
06:45 AM	22	158	4	0	184	5	180	9	0	194	7	8	27	0	42	2	8	15	1	26	446
07:00 AM	19	152	5	0	176	6	210	8	0	224	9	15	35	0	59	3	11	11	0	25	484
07:15 AM	16	127	1	0	144	5	215	10	0	230	14	8	34	0	56	3	10	10	0	23	453
07:30 AM	17	123	0	1	141	7	181	8	0	196	15	11	30	0	56	2	27	6	0	35	428
Total Volume	74	560	10	1	645	23	786	35	0	844	45	42	126	0	213	10	56	42	1	109	1811
% App. Total	11.5	86.8	1.6	0.2		2.7	93.1	4.1	0		21.1	19.7	59.2	0		9.2	51.4	38.5	0.9		
PHF	.841	.886	.500	.250	.876	.821	.914	.875	.000	.917	.750	.700	.900	.000	.903	.833	.519	.700	.250	.779	.935
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	43	251	4	0	298	4	195	16	0	215	9	12	26	2	49	1	9	8	0	18	580
05:15 PM	40	237	1	0	278	6	181	17	0	204	16	12	19	0	47	1	14	8	0	23	552
05:30 PM	35	245	4	0	284	12	169	5	0	186	14	10	12	0	36	1	23	6	0	30	536
05:45 PM	20	275	3	0	298	7	165	10	0	182	12	10	16	0	38	0	8	12	0	20	538
Total Volume	138	1008	12	0	1158	29	710	48	0	787	51	44	73	2	170	3	54	34	0	91	2206
% App. Total	11.9	87	1	0		3.7	90.2	6.1	0		30	25.9	42.9	1.2		3.3	59.3	37.4	0		
PHF	.802	.916	.750	.000	.971	.604	.910	.706	.000	.915	.797	.917	.702	.250	.867	.750	.587	.708	.000	.758	.951

Rummel, Klepper & Kahl, LLP

Consulting Engineers
81 W Mosher St
Baltimore MD 21217

File Name : US301-SR299
Site Code : 00000000
Start Date : 10/4/2012
Page No : 4

Start Time	US 301 Southbound					US 301 Northbound					Bunker Hill Rd (SR299) Westbound					Main St (SR299) Eastbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 06:30 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	24	74	9	0	107	12	87	22	2	123	30	76	23	0	129	15	49	4	0	68	427
07:15 AM	22	68	9	1	100	11	81	23	0	115	31	59	33	0	123	9	44	2	1	56	394
07:30 AM	26	79	8	0	113	4	68	28	0	100	38	40	35	0	113	13	45	2	1	61	387
07:45 AM	23	68	11	0	102	15	78	28	0	121	42	47	25	0	114	6	41	7	0	54	391
Total Volume	95	289	37	1	422	42	314	101	2	459	141	222	116	0	479	43	179	15	2	239	1599
% App. Total	22.5	68.5	8.8	0.2		9.2	68.4	22	0.4		29.4	46.3	24.2	0		18	74.9	6.3	0.8		
PHF	.913	.915	.841	.250	.934	.700	.902	.902	.250	.933	.839	.730	.829	.000	.928	.717	.913	.536	.500	.879	.936
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	40	121	5	0	166	25	158	57	0	240	61	43	11	0	115	19	66	3	0	88	609
05:00 PM	30	126	8	0	164	12	133	64	0	209	84	39	39	0	162	36	50	7	0	93	628
05:15 PM	50	115	9	0	174	15	121	53	1	190	87	70	27	1	185	41	79	1	0	121	670
05:30 PM	59	103	9	0	171	9	153	76	0	238	78	59	29	0	166	17	53	5	0	75	650
Total Volume	179	465	31	0	675	61	565	250	1	877	310	211	106	1	628	113	248	16	0	377	2557
% App. Total	26.5	68.9	4.6	0		7	64.4	28.5	0.1		49.4	33.6	16.9	0.2		30	65.8	4.2	0		
PHF	.758	.923	.861	.000	.970	.610	.894	.822	.250	.914	.891	.754	.679	.250	.849	.689	.785	.571	.000	.779	.954

Lanes, Volumes, Timings
2: US 301 & Bunker Hill Rd

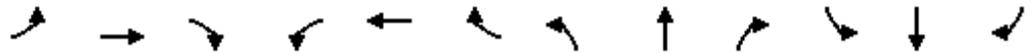
NEMA Compliant Phasing
Timing Plan: ACTRA - AM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	43	179	15	141	222	116	42	314	101	95	289	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	330		210	390		230	480		307	290		300
Storage Lanes	2		1	2		1	1		1	1		1
Taper Length (ft)	100			140			180			85		
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Fr _t			0.850			0.850			0.850			0.850
Fl _t Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3273	3539	1429	3242	3438	1482	1687	3085	1509	1752	3406	1615
Fl _t Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3273	3539	1429	3242	3438	1482	1687	3085	1509	1752	3406	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			138			138			131			95
Link Speed (mph)		35			35			50				50
Link Distance (ft)		1027			832			1861				1623
Travel Time (s)		20.0			16.2			25.4				22.1
Peak Hour Factor	0.88	0.88	0.88	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	7%	2%	13%	8%	5%	9%	7%	17%	7%	3%	6%	0%
Adj. Flow (vph)	49	203	17	152	239	125	45	338	109	102	311	40
Shared Lane Traffic (%)												
Lane Group Flow (vph)	49	203	17	152	239	125	45	338	109	102	311	40
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Prot	NA	Perm	Prot	NA	custom	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	8		7	4		1	6		5	2	
Permitted Phases			8			8			6			2

Lanes, Volumes, Timings
2: US 301 & Bunker Hill Rd

NEMA Compliant Phasing
Timing Plan: ACTRA - AM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	3	8	8	7	4	8	1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	16.0	16.0	5.0	16.0	16.0
Minimum Split (s)	11.0	12.0	12.0	11.0	12.0	12.0	11.0	23.0	23.0	11.0	23.0	23.0
Total Split (s)	40.0	19.0	19.0	40.0	19.0	19.0	16.0	67.0	67.0	24.0	75.0	75.0
Total Split (%)	26.7%	12.7%	12.7%	26.7%	12.7%	12.7%	10.7%	44.7%	44.7%	16.0%	50.0%	50.0%
Maximum Green (s)	35.0	13.0	13.0	35.0	13.0	13.0	11.0	60.0	60.0	19.0	68.0	68.0
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	5.0	5.0	3.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	6.0	5.0	7.0	7.0	5.0	7.0	7.0
Lead/Lag	Lead	Lag	Lag									
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min						
Act Effect Green (s)	7.7	15.2	15.2	12.4	22.1	15.2	9.4	85.4	85.4	14.0	92.2	92.2
Actuated g/C Ratio	0.05	0.10	0.10	0.08	0.15	0.10	0.06	0.57	0.57	0.09	0.61	0.61
v/c Ratio	0.29	0.57	0.06	0.57	0.47	0.46	0.43	0.19	0.12	0.63	0.15	0.04
Control Delay	72.6	70.1	0.5	74.2	61.9	12.3	79.2	17.4	2.1	78.6	14.4	0.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	72.6	70.1	0.5	74.2	61.9	12.3	79.2	17.4	2.1	78.6	14.4	0.9
LOS	E	E	A	E	E	B	E	B	A	E	B	A
Approach Delay		66.2			53.5			19.7			27.6	
Approach LOS		E			D			B			C	

Intersection Summary

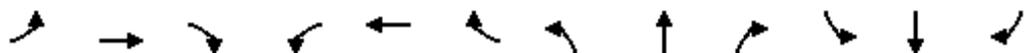
Area Type:	Other
Cycle Length:	150
Actuated Cycle Length:	150
Offset:	76 (51%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle:	60
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.63
Intersection Signal Delay:	39.1
Intersection LOS:	D
Intersection Capacity Utilization:	48.1%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 2: US 301 & Bunker Hill Rd



Lanes, Volumes, Timings
7: US 301 & Armstrong Corner Rd

NEMA Compliant Phasing
Timing Plan: ACTRA - AM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↗	↖	↗	↖	↖	↗
Volume (vph)	10	56	42	45	42	126	23	786	35	74	560	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	250		145	250		60
Storage Lanes	0		0	0		0	1		1	1		1
Taper Length (ft)	25			25			200			200		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.948			0.920				0.850			0.850
Flt Protected		0.995			0.990		0.950			0.950		
Satd. Flow (prot)	0	1532	0	0	1672	0	1805	1743	1615	1480	1638	1154
Flt Permitted		0.917			0.795		0.377			0.175		
Satd. Flow (perm)	0	1412	0	0	1343	0	716	1743	1615	273	1638	1154
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		20			45				73			73
Link Speed (mph)		40			50			50				50
Link Distance (ft)		1915			1875			944				1823
Travel Time (s)		32.6			25.6			12.9				24.9
Peak Hour Factor	0.78	0.78	0.78	0.90	0.90	0.90	0.92	0.92	0.92	0.88	0.88	0.88
Heavy Vehicles (%)	40%	18%	10%	11%	0%	2%	0%	9%	0%	22%	16%	40%
Adj. Flow (vph)	13	72	54	50	47	140	25	854	38	84	636	11
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	139	0	0	237	0	25	854	38	84	636	11
Enter Blocked Intersection	No											
Lane Alignment	Left	Left	Right									
Median Width(ft)		0			0			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		8			4		1	6		5		2
Permitted Phases	8			4			6		6	2		2

Lanes, Volumes, Timings
7: US 301 & Armstrong Corner Rd

NEMA Compliant Phasing
Timing Plan: ACTRA - AM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	8	8		4	4		1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	15.0	15.0	4.0	15.0	15.0
Minimum Split (s)	12.0	12.0		12.0	12.0		11.0	38.0	38.0	11.0	38.0	38.0
Total Split (s)	40.0	40.0		40.0	40.0		25.0	85.0	85.0	25.0	85.0	85.0
Total Split (%)	26.7%	26.7%		26.7%	26.7%		16.7%	56.7%	56.7%	16.7%	56.7%	56.7%
Maximum Green (s)	34.0	34.0		34.0	34.0		20.0	78.0	78.0	18.0	80.0	80.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	5.0	5.0	5.0	3.0	3.0
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0			0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0			6.0		5.0	7.0	7.0	7.0	5.0	5.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	6.0	6.0	6.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Min	C-Min	Min	C-Max	C-Max
Act Effect Green (s)		25.1			25.1		102.0	93.9	93.9	111.9	107.1	107.1
Actuated g/C Ratio		0.17			0.17		0.68	0.63	0.63	0.75	0.71	0.71
v/c Ratio		0.55			0.90		0.05	0.78	0.04	0.29	0.54	0.01
Control Delay		55.8			84.4		2.8	15.8	0.1	10.8	13.0	0.1
Queue Delay		0.0			0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		55.8			84.4		2.8	15.8	0.1	10.8	13.0	0.1
LOS		E			F		A	B	A	B	B	A
Approach Delay		55.8			84.4			14.8			12.6	
Approach LOS		E			F			B			B	

Intersection Summary

Area Type:	Other
Cycle Length:	150
Actuated Cycle Length:	150
Offset:	49 (33%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle:	80
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.90
Intersection Signal Delay:	25.0
Intersection LOS:	C
Intersection Capacity Utilization:	81.2%
ICU Level of Service:	D
Analysis Period (min):	15

Splits and Phases: 7: US 301 & Armstrong Corner Rd



Lanes, Volumes, Timings
8: US 301 & Churchtown Rd/SR 896

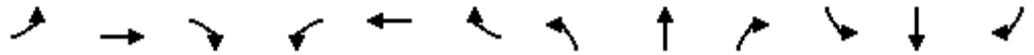
NEMA Compliant Phasing
Timing Plan: ACTRA - AM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	41	130	15	105	36	333	3	756	168	250	450	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	450		466	195		370	400		220
Storage Lanes	1		0	2		1	1		1	2		1
Taper Length (ft)	100			100			60			150		
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt		0.984				0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1792	0	2824	1845	1568	1805	3406	1335	3242	3374	1615
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	1792	0	2824	1845	1568	1805	3406	1335	3242	3374	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3				374			191			109
Link Speed (mph)		45			25			50				50
Link Distance (ft)		1984			1201			1469				1377
Travel Time (s)		30.1			32.8			20.0				18.8
Peak Hour Factor	0.84	0.84	0.84	0.89	0.89	0.89	0.88	0.88	0.88	0.92	0.92	0.92
Heavy Vehicles (%)	2%	4%	7%	24%	3%	3%	0%	6%	21%	8%	7%	0%
Adj. Flow (vph)	49	155	18	118	40	374	3	859	191	272	489	17
Shared Lane Traffic (%)												
Lane Group Flow (vph)	49	173	0	118	40	374	3	859	191	272	489	17
Enter Blocked Intersection	No											
Lane Alignment	Left	Left	Right									
Median Width(ft)		24			24			24				24
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex								
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Split	NA		Split	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	8	8		4	4		1	6		5	2	
Permitted Phases						4			6			2

Lanes, Volumes, Timings
 8: US 301 & Churchtown Rd/SR 896

NEMA Compliant Phasing
 Timing Plan: ACTRA - AM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	8	8		4	4	4	1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	5.0	5.0		10.0	10.0	10.0	5.0	20.0	20.0	5.0	20.0	20.0
Minimum Split (s)	12.0	12.0		17.0	17.0	17.0	12.0	29.0	29.0	12.0	29.0	29.0
Total Split (s)	32.0	32.0		35.0	35.0	35.0	30.0	53.0	53.0	30.0	53.0	53.0
Total Split (%)	21.3%	21.3%		23.3%	23.3%	23.3%	20.0%	35.3%	35.3%	20.0%	35.3%	35.3%
Maximum Green (s)	26.0	26.0		29.0	29.0	29.0	24.0	45.0	45.0	24.0	45.0	45.0
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	5.0	5.0	4.0	5.0	5.0
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	3.0	3.0	2.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0	6.0	8.0	8.0	6.0	8.0	8.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	4.0	4.0		4.0	4.0	4.0	4.0	5.0	5.0	4.0	5.0	5.0
Recall Mode	None	None		None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
Act Effect Green (s)	20.4	20.4		15.7	15.7	15.7	6.9	69.2	69.2	18.7	91.2	91.2
Actuated g/C Ratio	0.14	0.14		0.10	0.10	0.10	0.05	0.46	0.46	0.12	0.61	0.61
v/c Ratio	0.20	0.70		0.40	0.21	0.75	0.04	0.55	0.27	0.67	0.24	0.02
Control Delay	57.6	75.7		65.4	61.5	15.4	96.7	20.3	2.6	70.6	15.4	0.1
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.6	75.7		65.4	61.5	15.4	96.7	20.3	2.6	70.6	15.4	0.1
LOS	E	E		E	E	B	F	C	A	E	B	A
Approach Delay		71.7			29.9			17.3			34.4	
Approach LOS		E			C			B			C	

Intersection Summary

Area Type:	Other
Cycle Length:	150
Actuated Cycle Length:	150
Offset:	85 (57%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle:	75
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.75
Intersection Signal Delay:	29.7
Intersection LOS:	C
Intersection Capacity Utilization:	65.8%
ICU Level of Service:	C
Analysis Period (min):	15

Splits and Phases: 8: US 301 & Churchtown Rd/SR 896



Lanes, Volumes, Timings
 10: US 301 & Old Summit Bridge Road

NEMA Compliant Phasing
 Timing Plan: ACTRA - AM

							
Lane Group	WBL	WBR	NBU	NBT	NBR	SBL	SBT
Lane Configurations							
Volume (vph)	63	17	0	1132	34	29	673
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	100	250		384	445	
Storage Lanes	1	1	1		1	1	
Taper Length (ft)	25		85			85	
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00	0.95
Flt		0.850			0.850		
Flt Protected	0.950					0.950	
Satd. Flow (prot)	1770	1454	1900	3505	1615	1752	3312
Flt Permitted	0.950					0.139	
Satd. Flow (perm)	1770	1454	1900	3505	1615	256	3312
Right Turn on Red		Yes			Yes		
Satd. Flow (RTOR)		30			41		
Link Speed (mph)	35			55			55
Link Distance (ft)	277			1231			2058
Travel Time (s)	5.4			15.3			25.5
Peak Hour Factor	0.57	0.57	0.82	0.82	0.82	0.93	0.93
Heavy Vehicles (%)	2%	0%	0%	3%	0%	3%	9%
Parking (#/hr)		0					
Adj. Flow (vph)	111	30	0	1380	41	31	724
Shared Lane Traffic (%)							
Lane Group Flow (vph)	111	30	0	1380	41	31	724
Enter Blocked Intersection	No						
Lane Alignment	Left	Right	R NA	Left	Right	Left	Left
Median Width(ft)	12			12			12
Link Offset(ft)	0			0			0
Crosswalk Width(ft)	16			16			16
Two way Left Turn Lane							
Headway Factor	1.00	1.14	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	9		9	15	
Number of Detectors	1	1	1	2	1	1	2
Detector Template	Left	Right	Left	Thru	Right	Left	Thru
Leading Detector (ft)	20	20	20	100	20	20	100
Trailing Detector (ft)	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	20	20	6	20	20	6
Detector 1 Type	Cl+Ex						
Detector 1 Channel							
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)				94			94
Detector 2 Size(ft)				6			6
Detector 2 Type				Cl+Ex			Cl+Ex
Detector 2 Channel							
Detector 2 Extend (s)				0.0			0.0
Turn Type	NA	Perm	pm+pt	NA	Perm	pm+pt	NA
Protected Phases	4		1	6		5	2

Lanes, Volumes, Timings
 10: US 301 & Old Summit Bridge Road

NEMA Compliant Phasing
 Timing Plan: ACTRA - AM



Lane Group	WBL	WBR	NBU	NBT	NBR	SBL	SBT
Permitted Phases		4	6		6	2	2
Detector Phase	4	4	1	6	6	5	2
Switch Phase							
Minimum Initial (s)	4.0	4.0	3.0	17.0	17.0	3.0	17.0
Minimum Split (s)	12.0	12.0	11.0	24.0	24.0	11.0	24.0
Total Split (s)	13.0	13.0	12.0	50.0	50.0	12.0	50.0
Total Split (%)	17.3%	17.3%	16.0%	66.7%	66.7%	16.0%	66.7%
Maximum Green (s)	7.0	7.0	7.0	43.0	43.0	7.0	43.0
Yellow Time (s)	4.0	4.0	3.0	5.0	5.0	3.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	7.0	7.0	5.0	7.0
Lead/Lag			Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?							
Vehicle Extension (s)	4.0	4.0	3.0	5.0	5.0	3.0	5.0
Recall Mode	None	None	None	C-Max	C-Max	None	C-Max
Act Effect Green (s)	7.0	7.0		54.5	54.5	59.6	59.0
Actuated g/C Ratio	0.09	0.09		0.73	0.73	0.79	0.79
v/c Ratio	0.67	0.19		0.54	0.03	0.10	0.28
Control Delay	55.0	15.5		7.1	2.1	2.8	3.3
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0
Total Delay	55.0	15.5		7.1	2.1	2.8	3.3
LOS	D	B		A	A	A	A
Approach Delay	46.6			7.0			3.3
Approach LOS	D			A			A

Intersection Summary

Area Type: Other
 Cycle Length: 75
 Actuated Cycle Length: 75
 Offset: 10 (13%), Referenced to phase 2:SBTL and 6:NBTU, Start of Green
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.67
 Intersection Signal Delay: 8.2
 Intersection LOS: A
 Intersection Capacity Utilization 45.6%
 ICU Level of Service A
 Analysis Period (min) 15

Splits and Phases: 10: US 301 & Old Summit Bridge Road



Lanes, Volumes, Timings
30: US 301 & SR 71

NEMA Compliant Phasing
Timing Plan: ACTRA - AM

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	126	338	558	113	179	467
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	315	0		400	250	
Storage Lanes	1	1		1	1	
Taper Length (ft)	25				50	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t		0.850		0.850		
Fl _t Protected	0.950				0.950	
Satd. Flow (prot)	1752	1538	1776	1553	1656	1712
Fl _t Permitted	0.950				0.950	
Satd. Flow (perm)	1752	1538	1776	1553	1656	1712
Right Turn on Red		Yes		No		
Satd. Flow (RTOR)		412				
Link Speed (mph)	35		45			50
Link Distance (ft)	1186		916			549
Travel Time (s)	23.1		13.9			7.5
Peak Hour Factor	0.82	0.82	0.91	0.91	0.89	0.89
Heavy Vehicles (%)	3%	5%	7%	4%	9%	11%
Adj. Flow (vph)	154	412	613	124	201	525
Shared Lane Traffic (%)						
Lane Group Flow (vph)	154	412	613	124	201	525
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors	1	1	2	1	1	2
Detector Template	Left	Right	Thru	Right	Left	Thru
Leading Detector (ft)	20	20	100	20	20	100
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	20	20	6	20	20	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	NA	Free	NA	Prot	Prot	NA
Protected Phases			6	6	5	2
Permitted Phases	7	Free				

Lanes, Volumes, Timings
30: US 301 & SR 71

NEMA Compliant Phasing
Timing Plan: ACTRA - AM



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Detector Phase	7		6	6	5	2
Switch Phase						
Minimum Initial (s)	6.0		15.0	15.0	8.0	15.0
Minimum Split (s)	16.0		30.0	30.0	15.0	30.0
Total Split (s)	30.0		68.0	68.0	52.0	120.0
Total Split (%)	20.0%		45.3%	45.3%	34.7%	80.0%
Maximum Green (s)	21.0		59.0	59.0	46.0	111.0
Yellow Time (s)	5.0		5.0	5.0	4.0	5.0
All-Red Time (s)	4.0		4.0	4.0	2.0	4.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	9.0		9.0	9.0	6.0	9.0
Lead/Lag			Lag	Lag	Lead	
Lead-Lag Optimize?						
Vehicle Extension (s)	4.0		7.0	7.0	4.0	7.0
Recall Mode	None		C-Min	C-Min	None	C-Min
Act Effect Green (s)	18.1	150.0	83.3	83.3	24.6	113.9
Actuated g/C Ratio	0.12	1.00	0.56	0.56	0.16	0.76
v/c Ratio	0.73	0.27	0.62	0.14	0.74	0.40
Control Delay	83.0	0.4	25.8	15.5	89.9	5.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	83.0	0.4	25.8	15.5	89.9	5.6
LOS	F	A	C	B	F	A
Approach Delay	22.9		24.1			28.9
Approach LOS	C		C			C

Intersection Summary

Area Type: Other
 Cycle Length: 150
 Actuated Cycle Length: 150
 Offset: 136 (91%), Referenced to phase 2:SBT and 6:NBT, Start of Green
 Natural Cycle: 70
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.74
 Intersection Signal Delay: 25.5
 Intersection LOS: C
 Intersection Capacity Utilization 66.3%
 ICU Level of Service C
 Analysis Period (min) 15

Splits and Phases: 30: US 301 & SR 71



Lanes, Volumes, Timings
2: US 301 & Bunker Hill Rd/SR 299

NEMA Compliant Phasing
Timing Plan: ACTRA - PM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	248	16	310	211	106	61	565	250	179	465	31
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	330		210	390		230	480		307	290		300
Storage Lanes	2		1	2		1	1		1	1		1
Taper Length (ft)	100			140			180			85		
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Flt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3467	3610	1615	3433	3574	1509	1805	3343	1583	1770	3406	1615
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3467	3610	1615	3433	3574	1509	1805	3343	1583	1770	3406	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			138			138			275			95
Link Speed (mph)		35			35			50			50	
Link Distance (ft)		1051			832			1861			1623	
Travel Time (s)		20.5			16.2			25.4			22.1	
Peak Hour Factor	0.78	0.78	0.78	0.85	0.85	0.85	0.91	0.91	0.91	0.97	0.97	0.97
Heavy Vehicles (%)	1%	0%	0%	2%	1%	7%	0%	8%	2%	2%	6%	0%
Adj. Flow (vph)	145	318	21	365	248	125	67	621	275	185	479	32
Shared Lane Traffic (%)												
Lane Group Flow (vph)	145	318	21	365	248	125	67	621	275	185	479	32
Enter Blocked Intersection	No	No	No	No	No	No						
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex						
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	Perm	Prot	NA	custom	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	8		7	4		1	6		5	2	
Permitted Phases			8			8			6			2

Lanes, Volumes, Timings
2: US 301 & Bunker Hill Rd/SR 299

NEMA Compliant Phasing
Timing Plan: ACTRA - PM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	3	8	8	7	4	8	1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	16.0	16.0	5.0	16.0	16.0
Minimum Split (s)	11.0	12.0	12.0	11.0	12.0	12.0	11.0	23.0	23.0	11.0	23.0	23.0
Total Split (s)	40.0	19.0	19.0	40.0	19.0	19.0	16.0	67.0	67.0	24.0	75.0	75.0
Total Split (%)	26.7%	12.7%	12.7%	26.7%	12.7%	12.7%	10.7%	44.7%	44.7%	16.0%	50.0%	50.0%
Maximum Green (s)	35.0	13.0	13.0	35.0	13.0	13.0	11.0	60.0	60.0	19.0	68.0	68.0
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	5.0	5.0	3.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	6.0	5.0	7.0	7.0	5.0	7.0	7.0
Lead/Lag	Lead	Lag	Lag									
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min						
Act Effect Green (s)	11.6	22.5	22.5	21.3	32.2	22.5	10.9	61.5	61.5	21.7	74.7	74.7
Actuated g/C Ratio	0.08	0.15	0.15	0.14	0.21	0.15	0.07	0.41	0.41	0.14	0.50	0.50
v/c Ratio	0.54	0.59	0.06	0.75	0.32	0.36	0.51	0.45	0.34	0.73	0.28	0.04
Control Delay	73.7	64.0	0.3	71.6	50.4	9.3	79.9	35.2	5.0	73.2	17.8	0.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	73.7	64.0	0.3	71.6	50.4	9.3	79.9	35.2	5.0	73.2	17.8	0.2
LOS	E	E	A	E	D	A	E	D	A	E	B	A
Approach Delay		64.1			53.9			29.7			31.7	
Approach LOS		E			D			C			C	

Intersection Summary

Area Type: Other
 Cycle Length: 150
 Actuated Cycle Length: 150
 Offset: 62 (41%), Referenced to phase 2:SBT and 6:NBT, Start of Green
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.75
 Intersection Signal Delay: 42.2 Intersection LOS: D
 Intersection Capacity Utilization 60.4% ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 2: US 301 & Bunker Hill Rd/SR 299



Lanes, Volumes, Timings
7: US 301 & Armstrong Corner Rd/Marl Pit Road

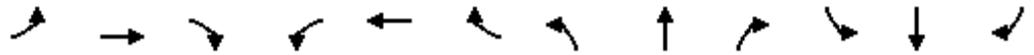
NEMA Compliant Phasing
Timing Plan: ACTRA - PM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↗	↖	↗	↖	↖	↗
Volume (vph)	3	54	34	51	44	73	29	710	48	138	1008	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	250		145	250		60
Storage Lanes	0		0	0		0	1		1	1		1
Taper Length (ft)	25			25			200			200		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.949			0.942				0.850			0.850
Flt Protected		0.998			0.985		0.950			0.950		
Satd. Flow (prot)	0	1691	0	0	1763	0	1805	1792	1615	1687	1743	1615
Flt Permitted		0.990			0.739		0.157			0.223		
Satd. Flow (perm)	0	1678	0	0	1323	0	298	1792	1615	396	1743	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		19			24				73			73
Link Speed (mph)		40			50			50				50
Link Distance (ft)		1915			1875			944				1823
Travel Time (s)		32.6			25.6			12.9				24.9
Peak Hour Factor	0.76	0.76	0.76	0.87	0.87	0.87	0.92	0.92	0.92	0.97	0.97	0.97
Heavy Vehicles (%)	0%	7%	6%	0%	0%	0%	0%	6%	0%	7%	9%	0%
Adj. Flow (vph)	4	71	45	59	51	84	32	772	52	142	1039	12
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	120	0	0	194	0	32	772	52	142	1039	12
Enter Blocked Intersection	No											
Lane Alignment	Left	Left	Right									
Median Width(ft)		0			0			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		8			4		1	6		5	2	
Permitted Phases	8			4			6		6	2		2

Lanes, Volumes, Timings
 7: US 301 & Armstrong Corner Rd/Marl Pit Road

NEMA Compliant Phasing
 Timing Plan: ACTRA - PM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	8	8		4	4		1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	15.0	15.0	4.0	15.0	15.0
Minimum Split (s)	12.0	12.0		12.0	12.0		11.0	38.0	38.0	11.0	38.0	38.0
Total Split (s)	40.0	40.0		40.0	40.0		25.0	85.0	85.0	25.0	85.0	85.0
Total Split (%)	26.7%	26.7%		26.7%	26.7%		16.7%	56.7%	56.7%	16.7%	56.7%	56.7%
Maximum Green (s)	34.0	34.0		34.0	34.0		20.0	78.0	78.0	18.0	78.0	78.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0			0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0			6.0		5.0	7.0	7.0	7.0	7.0	7.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	6.0	6.0	6.0	6.0	6.0
Recall Mode	None	None		None	None		None	C-Min	C-Min	Min	C-Min	C-Min
Act Effect Green (s)		22.7			22.7		103.5	95.3	95.3	114.3	107.4	107.4
Actuated g/C Ratio		0.15			0.15		0.69	0.64	0.64	0.76	0.72	0.72
v/c Ratio		0.45			0.88		0.12	0.68	0.05	0.35	0.83	0.01
Control Delay		52.2			90.1		2.4	6.8	0.1	8.5	23.0	0.0
Queue Delay		0.0			0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		52.2			90.1		2.4	6.8	0.1	8.5	23.0	0.0
LOS		D			F		A	A	A	A	C	A
Approach Delay		52.2			90.1			6.3			21.0	
Approach LOS		D			F			A			C	

Intersection Summary

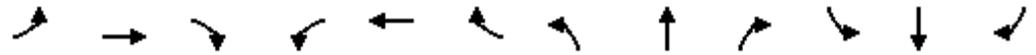
Area Type: Other
 Cycle Length: 150
 Actuated Cycle Length: 150
 Offset: 9 (6%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.88
 Intersection Signal Delay: 22.9
 Intersection LOS: C
 Intersection Capacity Utilization 88.5%
 ICU Level of Service E
 Analysis Period (min) 15

Splits and Phases: 7: US 301 & Armstrong Corner Rd/Marl Pit Road



Lanes, Volumes, Timings
8: US 301 & Churchtown Rd/SR 896

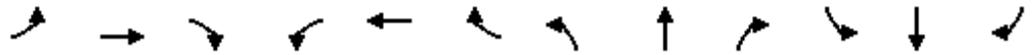
NEMA Compliant Phasing
Timing Plan: ACTRA - PM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	44	25	282	111	207	14	574	130	322	835	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	450		466	195		370	400		220
Storage Lanes	1		0	2		1	1		1	2		1
Taper Length (ft)	100			100			60			150		
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt		0.945				0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1748	0	3072	1863	1583	1687	3505	1335	3273	3374	1553
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1805	1748	0	3072	1863	1583	1687	3505	1335	3273	3374	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		17				256			140			109
Link Speed (mph)		45			25			50				50
Link Distance (ft)		1984			1173			1469				1377
Travel Time (s)		30.1			32.0			20.0				18.8
Peak Hour Factor	0.93	0.93	0.93	0.81	0.81	0.81	0.93	0.93	0.93	0.96	0.96	0.96
Heavy Vehicles (%)	0%	2%	4%	14%	2%	2%	7%	3%	21%	7%	7%	4%
Adj. Flow (vph)	54	47	27	348	137	256	15	617	140	335	870	70
Shared Lane Traffic (%)												
Lane Group Flow (vph)	54	74	0	348	137	256	15	617	140	335	870	70
Enter Blocked Intersection	No											
Lane Alignment	Left	Left	Right									
Median Width(ft)		24			24			24				24
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex								
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Split	NA		Split	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	8	8		4	4		1	6		5	2	
Permitted Phases						4			6			2

Lanes, Volumes, Timings
 8: US 301 & Churchtown Rd/SR 896

NEMA Compliant Phasing
 Timing Plan: ACTRA - PM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	8	8		4	4	4	1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	5.0	5.0		10.0	10.0	10.0	5.0	20.0	20.0	5.0	20.0	20.0
Minimum Split (s)	12.0	12.0		17.0	17.0	17.0	12.0	29.0	29.0	12.0	29.0	29.0
Total Split (s)	32.0	32.0		35.0	35.0	35.0	30.0	53.0	53.0	30.0	53.0	53.0
Total Split (%)	21.3%	21.3%		23.3%	23.3%	23.3%	20.0%	35.3%	35.3%	20.0%	35.3%	35.3%
Maximum Green (s)	26.0	26.0		29.0	29.0	29.0	24.0	45.0	45.0	24.0	45.0	45.0
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	5.0	5.0	4.0	5.0	5.0
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	3.0	3.0	2.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0	6.0	8.0	8.0	6.0	8.0	8.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	4.0	4.0		4.0	4.0	4.0	4.0	5.0	5.0	4.0	5.0	5.0
Recall Mode	None	None		None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
Act Effect Green (s)	11.4	11.4		25.3	25.3	25.3	7.9	65.9	65.9	21.4	87.3	87.3
Actuated g/C Ratio	0.08	0.08		0.17	0.17	0.17	0.05	0.44	0.44	0.14	0.58	0.58
v/c Ratio	0.40	0.50		0.67	0.44	0.53	0.17	0.40	0.21	0.72	0.44	0.07
Control Delay	73.5	62.0		64.9	59.7	10.0	90.7	13.3	1.9	66.7	19.3	1.9
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	73.5	62.0		64.9	59.7	10.0	90.7	13.3	1.9	66.7	19.3	1.9
LOS	E	E		E	E	A	F	B	A	E	B	A
Approach Delay		66.8			44.9			12.7			30.8	
Approach LOS		E			D			B			C	

Intersection Summary

Area Type:	Other
Cycle Length:	150
Actuated Cycle Length:	150
Offset:	44 (29%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle:	70
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.72
Intersection Signal Delay:	31.2
Intersection LOS:	C
Intersection Capacity Utilization:	58.6%
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 8: US 301 & Churchtown Rd/SR 896



Lanes, Volumes, Timings
 10: US 301 & Old Summit Bridge Rd

NEMA Compliant Phasing
 Timing Plan: ACTRA - PM



Lane Group	WBL	WBR	NBU	NBT	NBR	SBL	SBT
Lane Configurations							
Volume (vph)	37	17	0	741	49	81	1122
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	100	250		384	445	
Storage Lanes	1	1	1		1	1	
Taper Length (ft)	25		85			85	
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00	0.95
Flt		0.850			0.850		
Flt Protected	0.950					0.950	
Satd. Flow (prot)	1805	1442	1900	3438	1615	1641	3471
Flt Permitted	0.950					0.291	
Satd. Flow (perm)	1805	1442	1900	3438	1615	503	3471
Right Turn on Red		Yes			Yes		
Satd. Flow (RTOR)		19			56		
Link Speed (mph)	35			55			55
Link Distance (ft)	277			1227			2058
Travel Time (s)	5.4			15.2			25.5
Peak Hour Factor	0.90	0.90	0.88	0.88	0.88	0.89	0.89
Heavy Vehicles (%)	0%	12%	0%	5%	0%	10%	4%
Adj. Flow (vph)	41	19	0	842	56	91	1261
Shared Lane Traffic (%)							
Lane Group Flow (vph)	41	19	0	842	56	91	1261
Enter Blocked Intersection	No						
Lane Alignment	Left	Right	R NA	Left	Right	Left	Left
Median Width(ft)	12			12			12
Link Offset(ft)	0			0			0
Crosswalk Width(ft)	16			16			16
Two way Left Turn Lane							
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	9		9	15	
Number of Detectors	1	1	1	2	1	1	2
Detector Template	Left	Right	Left	Thru	Right	Left	Thru
Leading Detector (ft)	20	20	20	100	20	20	100
Trailing Detector (ft)	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	20	20	6	20	20	6
Detector 1 Type	Cl+Ex						
Detector 1 Channel							
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)				94			94
Detector 2 Size(ft)				6			6
Detector 2 Type				Cl+Ex			Cl+Ex
Detector 2 Channel							
Detector 2 Extend (s)				0.0			0.0
Turn Type	NA	Perm	pm+pt	NA	Perm	pm+pt	NA
Protected Phases	4		1	6		5	2
Permitted Phases		4	6		6	2	2

Lanes, Volumes, Timings
 10: US 301 & Old Summit Bridge Rd

NEMA Compliant Phasing
 Timing Plan: ACTRA - PM

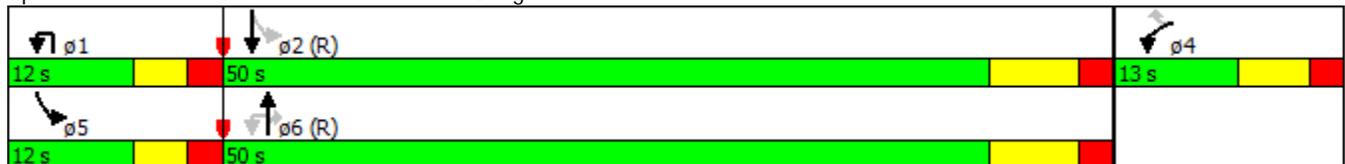


Lane Group	WBL	WBR	NBU	NBT	NBR	SBL	SBT
Detector Phase	4	4	1	6	6	5	2
Switch Phase							
Minimum Initial (s)	4.0	4.0	3.0	17.0	17.0	3.0	17.0
Minimum Split (s)	12.0	12.0	11.0	24.0	24.0	11.0	24.0
Total Split (s)	13.0	13.0	12.0	50.0	50.0	12.0	50.0
Total Split (%)	17.3%	17.3%	16.0%	66.7%	66.7%	16.0%	66.7%
Maximum Green (s)	7.0	7.0	7.0	43.0	43.0	7.0	43.0
Yellow Time (s)	4.0	4.0	3.0	5.0	5.0	3.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	7.0	7.0	5.0	7.0
Lead/Lag			Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?							
Vehicle Extension (s)	4.0	4.0	3.0	5.0	5.0	3.0	5.0
Recall Mode	None	None	None	C-Max	C-Max	None	C-Max
Act Effect Green (s)	6.9	6.9		52.4	52.4	62.2	63.0
Actuated g/C Ratio	0.09	0.09		0.70	0.70	0.83	0.84
v/c Ratio	0.25	0.13		0.35	0.05	0.18	0.43
Control Delay	35.6	16.8		5.7	1.3	2.8	3.5
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0
Total Delay	35.6	16.8		5.7	1.3	2.8	3.5
LOS	D	B		A	A	A	A
Approach Delay	29.7			5.4			3.5
Approach LOS	C			A			A

Intersection Summary

Area Type: Other
 Cycle Length: 75
 Actuated Cycle Length: 75
 Offset: 58 (77%), Referenced to phase 2:SBTL and 6:NBTU, Start of Green
 Natural Cycle: 55
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.43
 Intersection Signal Delay: 4.9
 Intersection Capacity Utilization 52.7%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service A

Splits and Phases: 10: US 301 & Old Summit Bridge Rd



Lanes, Volumes, Timings
30: US 301 & SR 71

NEMA Compliant Phasing
Timing Plan: ACTRA - PM

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	170	238	551	207	428	767
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	315	0		400	250	
Storage Lanes	1	1		1	1	
Taper Length (ft)	25				50	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t		0.850		0.850		
Fl _t Protected	0.950				0.950	
Satd. Flow (prot)	1805	1599	1810	1599	1787	1776
Fl _t Permitted	0.950				0.950	
Satd. Flow (perm)	1805	1599	1810	1599	1787	1776
Right Turn on Red		Yes		No		
Satd. Flow (RTOR)		270				
Link Speed (mph)	35		45			50
Link Distance (ft)	1186		916			549
Travel Time (s)	23.1		13.9			7.5
Peak Hour Factor	0.88	0.88	0.87	0.87	0.95	0.95
Heavy Vehicles (%)	0%	1%	5%	1%	1%	7%
Adj. Flow (vph)	193	270	633	238	451	807
Shared Lane Traffic (%)						
Lane Group Flow (vph)	193	270	633	238	451	807
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors	1	1	2	1	1	2
Detector Template	Left	Right	Thru	Right	Left	Thru
Leading Detector (ft)	20	20	100	20	20	100
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	20	20	6	20	20	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	NA	Free	NA	Prot	Prot	NA
Protected Phases			6	6	5	2
Permitted Phases	7	Free				

Lanes, Volumes, Timings
30: US 301 & SR 71

NEMA Compliant Phasing
Timing Plan: ACTRA - PM

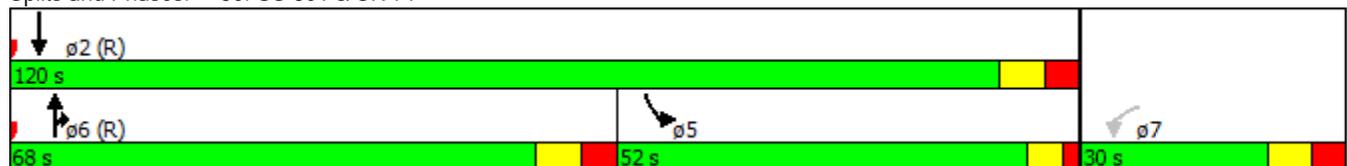


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Detector Phase	7		6	6	5	2
Switch Phase						
Minimum Initial (s)	6.0		15.0	15.0	8.0	15.0
Minimum Split (s)	16.0		30.0	30.0	15.0	30.0
Total Split (s)	30.0		68.0	68.0	52.0	120.0
Total Split (%)	20.0%		45.3%	45.3%	34.7%	80.0%
Maximum Green (s)	21.0		59.0	59.0	46.0	111.0
Yellow Time (s)	5.0		5.0	5.0	4.0	5.0
All-Red Time (s)	4.0		4.0	4.0	2.0	4.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	9.0		9.0	9.0	6.0	9.0
Lead/Lag			Lead	Lead	Lag	
Lead-Lag Optimize?						
Vehicle Extension (s)	4.0		7.0	7.0	4.0	7.0
Recall Mode	None		C-Min	C-Min	None	C-Min
Act Effect Green (s)	20.0	150.0	64.0	64.0	42.0	112.0
Actuated g/C Ratio	0.13	1.00	0.43	0.43	0.28	0.75
v/c Ratio	0.80	0.17	0.82	0.35	0.90	0.61
Control Delay	87.1	0.2	50.4	34.7	70.0	7.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	87.1	0.2	50.4	34.7	70.0	7.0
LOS	F	A	D	C	E	A
Approach Delay	36.4		46.1			29.6
Approach LOS	D		D			C

Intersection Summary

Area Type: Other
 Cycle Length: 150
 Actuated Cycle Length: 150
 Offset: 86 (57%), Referenced to phase 2:SBT and 6:NBT, Start of Green
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.90
 Intersection Signal Delay: 36.4
 Intersection LOS: D
 Intersection Capacity Utilization 82.1%
 ICU Level of Service E
 Analysis Period (min) 15

Splits and Phases: 30: US 301 & SR 71



Intersection Delay Study - Field Sheet

4 30 PM

Request No.:
Job No.:

Location: Choptank Rd at Clayton Manor Dr **Weather:** Clear
Date: 10/10/2012 **Recorder:** JG
Direction: EB **Start Time:** 16:30
(Military)

Location Characteristics:
Number Of Lanes : 1 Turning Lanes 1LT, 1RT
Number Of Pedestrians: 0 Parking N
Traffic Control Devices : Stop Sign Transit Stop (Y/N) N
Type of Delay (Fixed/ Operational): Fixed

Time Interval (hh:mm): 0:01

No	Begin	End	Total Number of Vehicles				Approach Volume:	
			Stopped In Approach At Time:				Number	Number not
			0 SEC+	15 SEC +	30 SEC+	45 SEC+	Stopped	Stopped
1	16:30	16:31	0	0	0	0	0	1
2	16:31	16:32	0	0	0	0	0	0
3	16:32	16:33	0	0	0	0	0	0
4	16:33	16:34	1	0	0	0	1	0
5	16:34	16:35	0	0	0	0	0	0
6	16:35	16:36	0	0	1	1	1	0
7	16:36	16:37	1	0	0	0	0	2
8	16:37	16:38	0	0	1	1	1	0
9	16:38	16:39	0	0	0	0	0	0
10	16:39	16:40	1	2	2	0	2	0
11	16:40	16:41	0	0	0	0	0	1
12	16:41	16:42	0	0	0	0	0	0
13	16:42	16:43	0	0	0	0	0	0
14	16:43	16:44	1	0	0	0	1	0
15	16:44	16:45	0	0	1	1	1	0
SUBTOTAL			4	2	5	3	7	4
TOTAL			14				11	

Comments:
(Cell C50)

Total Delay = Total Number Stopped X Sampling Interval
= 14 X 15 = 210 Veh-Sec/ 3600 = 0.058333 Veh - Hr

Average Delay Per Stopped Vehicle = Total Delay / Number of Stopped Vehicles
= 210 / 7 = 30 Sec

Average Delay Per Approach Vehicle = Total Delay / Approach Volume
= 210 / 11 = 19.09091 Sec

Percent of Vehicles Stopped = Number of Stopped Vehicles / Approach Volume
= 7 / 11 = 0.636364

Intersection Delay Study - Field Sheet

Request No.:		4 45 PM
Job No.:		

Location:	Choptank Rd at Clayton Manor Dr	Weather:	Clear
Date:	10/10/2012	Recorder:	JG
Direction:	EB	Start Time:	16:45
		(Military)	

Location Characteristics:

Number Of Lanes :	1	Turning Lanes	1LT, 1RT
Number Of Pedestrians:	0	Parking	N
Traffic Control Devices :	Stop Sign	Transit Stop (Y/N)	N
Type of Delay (Fixed/ Operational):	Fixed		

Time Interval (hh:mm): 0:01

No	Begin	End	Total Number of Vehicles				Approach Volume:	
			Stopped In Approach At Time:				Number	Number not
			0 SEC+	15 SEC +	30 SEC+	45 SEC+	Stopped	Stopped
1	16:45	16:46	0	1	0	0	1	2
2	16:46	16:47	1	1	1	0	2	0
3	16:47	16:48	1	1	0	0	1	0
4	16:48	16:49	0	0	0	0	0	1
5	16:49	16:50	0	1	0	0	1	0
6	16:50	16:51	0	0	0	0	0	2
7	16:51	16:52	1	0	0	0	1	0
8	16:52	16:53	0	0	0	0	0	1
9	16:53	16:54	1	0	0	1	2	0
10	16:54	16:55	0	0	0	0	0	0
11	16:55	16:56	0	0	0	0	0	0
12	16:56	16:57	0	0	0	0	0	0
13	16:57	16:58	0	0	0	0	0	0
14	16:58	16:59	0	0	0	0	0	0
15	16:59	17:00	0	0	0	0	0	0
SUBTOTAL			4	4	1	1	8	6
TOTAL				10			14	

Comments:
(Cell C50)

Total Delay = Total Number Stopped X Sampling Interval
 = 10 X 15 = 150 Veh-Sec/ 3600 = 0.041667 Veh - Hr

Average Delay Per Stopped Vehicle = Total Delay / Number of Stopped Vehicles
 = 150 / 8 = 18.75 Sec

Average Delay Per Approach Vehicle = Total Delay / Approach Volume
 = 150 / 14 = 10.71429 Sec

Percent of Vehicles Stopped = Number of Stopped Vehicles / Approach Volume
 = 8 / 14 = 0.571429

Intersection Delay Study - Field Sheet

5 00 PM

Request No.:
Job No.:

Location: Choptank Rd at Clayton Manor Dr **Weather:** Clear
Date: 10/10/2012 **Recorder:** JG
Direction: EB **Start Time:** 17:00
(Military)

Location Characteristics:

Number Of Lanes : 1 Turning Lanes 1LT, 1RT
Number Of Pedestrians: 0 Parking N
Traffic Control Devices : Stop Sign Transit Stop (Y/N) N
Type of Delay (Fixed/ Operational): Fixed

Time Interval (hh:mm): 0:01

No	Begin	End	Total Number of Vehicles				Approach Volume:	
			Stopped In Approach At Time:				Number	Number not
			0 SEC+	15 SEC +	30 SEC+	45 SEC+	Stopped	Stopped
1	17:00	17:01	0	0	0	0	0	0
2	17:01	17:02	0	0	0	0	0	1
3	17:02	17:03	0	0	0	0	0	0
4	17:03	17:04	0	1	0	2	3	1
5	17:04	17:05	2	0	0	0	1	0
6	17:05	17:06	0	0	0	0	0	0
7	17:06	17:07	0	0	0	0	0	1
8	17:07	17:08	1	2	0	0	2	0
9	17:08	17:09	3	1	0	0	3	0
10	17:09	17:10	0	0	0	0	0	0
11	17:10	17:11	1	0	0	0	1	1
12	17:11	17:12	0	0	0	0	0	0
13	17:12	17:13	0	0	0	0	0	0
14	17:13	17:14	0	0	1	1	2	0
15	17:14	17:15	0	0	0	1	1	1
SUBTOTAL			7	4	1	4	13	5
TOTAL			16				18	

Comments:
(Cell C50)

Total Delay = Total Number Stopped X Sampling Interval
= 16 X 15 = 240 Veh-Sec / 3600 = 0.066667 Veh - Hr

Average Delay Per Stopped Vehicle = Total Delay / Number of Stopped Vehicles
= 240 / 13 = 18.46154 Sec

Average Delay Per Approach Vehicle = Total Delay / Approach Volume
= 240 / 18 = 13.33333 Sec

Percent of Vehicles Stopped = Number of Stopped Vehicles / Approach Volume
= 13 / 18 = 0.722222

Intersection Delay Study - Field Sheet

Request No.:					5 15 PM		
Job No.:							

Location:	Choptank Rd at Clayton Manor Dr	Weather:	Clear
Date:	10/10/2012	Recorder:	JG
Direction:	EB	Start Time:	17:15
		(Military)	

Location Characteristics:			
Number Of Lanes :	1	Turning Lanes	1LT, 1RT
Number Of Pedestrians:	0	Parking	N
Traffic Control Devices :	Stop Sign	Transit Stop (Y/N)	N
Type of Delay (Fixed/ Operational):	Fixed		

Time Interval (hh:mm):	0:01
-------------------------------	------

No	Begin	End	Total Number of Vehicles				Approach Volume:	
			Stopped In Approach At Time:				Number	Number not
			0 SEC+	15 SEC +	30 SEC+	45 SEC+	Stopped	Stopped
1	17:15	17:16	0	0	0	0	0	0
2	17:16	17:17	0	0	0	0	0	0
3	17:17	17:18	0	0	0	0	0	1
4	17:18	17:19	0	0	0	0	0	1
5	17:19	17:20	0	0	0	0	0	0
6	17:20	17:21	0	0	0	1	1	1
7	17:21	17:22	1	1	1	0	2	0
8	17:22	17:23	0	0	0	0	0	1
9	17:23	17:24	0	1	0	0	1	0
10	17:24	17:25	0	0	0	1	1	0
11	17:25	17:26	3	1	1	0	2	0
12	17:26	17:27	0	0	0	0	0	0
13	17:27	17:28	0	0	0	0	0	1
14	17:28	17:29	1	0	0	0	1	0
15	17:29	17:30	0	0	0	0	0	0
SUBTOTAL			5	3	2	2	8	5
TOTAL				12			13	

Comments:
(Cell C50)

Total Delay = Total Number Stopped X Sampling Interval
 = 12 X 15 = 180 Veh-Sec/ 3600 = 0.05 Veh - Hr

Average Delay Per Stopped Vehicle = Total Delay / Number of Stopped Vehicles
 = 180 / 8 = 22.5 Sec

Average Delay Per Approach Vehicle = Total Delay / Approach Volume
 = 180 / 13 = 13.84615 Sec

Percent of Vehicles Stopped = Number of Stopped Vehicles / Approach Volume
 = 8 / 13 = 0.615385

Intersection Delay Study - Field Sheet

4 30 PM

Request No.:
Job No.:

Location: US 301 at Keenan Auto Body **Weather:** Clear
Date: 10/4/2012 **Recorder:** AG
Direction: WB **Start Time:** 16:30
(Military)

Location Characteristics:

Number Of Lanes : 1 Turning Lanes 1LT, 1RT
Number Of Pedestrians: 0 Parking N
Traffic Control Devices : Stop Sign Transit Stop (Y/N) N
Type of Delay (Fixed/ Operational): Fixed

Time Interval (hh:mm): 0:01

No	Begin	End	Total Number of Vehicles				Approach Volume:	
			Stopped In Approach At Time:				Number	Number not
			0 SEC+	15 SEC +	30 SEC+	45 SEC+	Stopped	Stopped
1	16:30	16:31	0	0	0	0	0	0
2	16:31	16:32	0	0	0	0	0	0
3	16:32	16:33	0	0	0	0	0	0
4	16:33	16:34	0	0	0	0	0	0
5	16:34	16:35	0	0	0	0	0	0
6	16:35	16:36	0	0	0	0	0	0
7	16:36	16:37	0	0	0	0	0	0
8	16:37	16:38	0	0	0	0	0	0
9	16:38	16:39	0	0	0	0	0	0
10	16:39	16:40	0	0	0	0	0	0
11	16:40	16:41	0	0	0	0	0	0
12	16:41	16:42	0	0	0	0	0	0
13	16:42	16:43	0	0	0	0	0	0
14	16:43	16:44	0	0	0	0	0	0
15	16:44	16:45	0	0	0	0	0	0
SUBTOTAL			0	0	0	0	0	0
TOTAL			0				0	

Comments:
(Cell C50)

Total Delay = Total Number Stopped X Sampling Interval
= 0 X 15 = 0 Veh-Sec/ 3600 = 0 Veh - Hr

Average Delay Per Stopped Vehicle = Total Delay / Number of Stopped Vehicles
= 0 / 0 = #DIV/0! Sec

Average Delay Per Approach Vehicle = Total Delay / Approach Volume
= 0 / 0 = #DIV/0! Sec

Percent of Vehicles Stopped = Number of Stopped Vehicles / Approach Volume
= 0 / 0 = #DIV/0!

Intersection Delay Study - Field Sheet

Request No.: 4 45 PM

Job No.:

Location: US 301 at Keenan Auto Body

Weather: Clear

Date: 10/4/2012

Recorder: AG

Direction: WB

Start Time: 16:45
(Military)

Location Characteristics:

Number Of Lanes :	1	Turning Lanes	1LT, 1RT
Number Of Pedestrians:	0	Parking	N
Traffic Control Devices :	Stop Sign	Transit Stop (Y/N)	N
Type of Delay (Fixed/ Operational):	Fixed		

Time Interval (hh:mm): 0:01

No	Begin	End	Total Number of Vehicles				Approach Volume:	
			Stopped In Approach At Time:				Number	Number not
			0 SEC+	15 SEC +	30 SEC+	45 SEC+	Stopped	Stopped
1	16:45	16:46	0	0	0	0	0	0
2	16:46	16:47	0	0	0	0	0	0
3	16:47	16:48	1	0	0	0	1	0
4	16:48	16:49	0	0	0	0	0	0
5	16:49	16:50	0	0	0	0	0	0
6	16:50	16:51	0	0	0	0	0	0
7	16:51	16:52	0	0	0	0	0	0
8	16:52	16:53	0	0	0	0	0	0
9	16:53	16:54	0	0	0	0	0	0
10	16:54	16:55	0	0	0	0	0	0
11	16:55	16:56	0	0	1	1	1	0
12	16:56	16:57	1	1	1	1	0	0
13	16:57	16:58	0	0	0	0	0	0
14	16:58	16:59	0	0	1	1	1	0
15	16:59	17:00	0	0	0	0	0	0
SUBTOTAL			2	1	3	3	3	0
TOTAL			9				3	

Comments:
(Cell C50)

Total Delay = Total Number Stopped X Sampling Interval
 = 9 X 15 = 135 Veh-Sec/ 3600 = 0.0375 Veh - Hr

Average Delay Per Stopped Vehicle = Total Delay / Number of Stopped Vehicles
 = 135 / 3 = 45 Sec

Average Delay Per Approach Vehicle = Total Delay / Approach Volume
 = 135 / 3 = 45 Sec

Percent of Vehicles Stopped = Number of Stopped Vehicles / Approach Volume
 = 3 / 3 = 1

Intersection Delay Study - Field Sheet

Request No.:
Job No.:

5 15 PM

Location: US 301 at Keenan Auto Body
Date: 10/4/2012
Direction: WB

Weather: Clear
Recorder: AG
Start Time: 17:15
 (Military)

Location Characteristics:

Number Of Lanes :	1	Turning Lanes	1LT, 1RT
Number Of Pedestrians:	0	Parking	N
Traffic Control Devices :	Stop Sign	Transit Stop (Y/N)	N
Type of Delay (Fixed/ Operational):	Fixed		

Time Interval (hh:mm): 0:01

No	Begin	End	Total Number of Vehicles				Approach Volume:	
			Stopped In Approach At Time:				Number	Number not
			0 SEC+	15 SEC +	30 SEC+	45 SEC+	Stopped	Stopped
1	17:15	17:16	0	0	0	1	1	0
2	17:16	17:17	1	1	0	0	0	0
3	17:17	17:18	0	0	0	0	0	0
4	17:18	17:19	0	0	0	0	0	0
5	17:19	17:20	0	0	0	0	0	0
6	17:20	17:21	0	0	0	0	0	0
7	17:21	17:22	0	0	0	0	0	0
8	17:22	17:23	0	1	1	1	1	0
9	17:23	17:24	1	0	0	0	0	0
10	17:24	17:25	0	0	0	0	0	0
11	17:25	17:26	0	0	0	0	0	0
12	17:26	17:27	0	0	0	1	1	0
13	17:27	17:28	0	0	0	0	0	0
14	17:28	17:29	0	0	0	0	0	0
15	17:29	17:30	0	0	0	0	0	0
SUBTOTAL			2	2	1	3	3	0
TOTAL			8			3		

Comments:

(Cell C50)

Total Delay = Total Number Stopped X Sampling Interval

= 8 X 15 = 120 Veh-Sec/ 3600 = 0.033333 Veh - Hr

Average Delay Per Stopped Vehicle = Total Delay / Number of Stopped Vehicles

= 120 / 3 = 40 Sec

Average Delay Per Approach Vehicle = Total Delay / Approach Volume

= 120 / 3 = 40 Sec

Percent of Vehicles Stopped = Number of Stopped Vehicles / Approach Volume

= 3 / 3 = 1

