



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

US 301 SPUR ROAD 2013 MONITORING REPORT



April 2014



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 fourth year of the monitoring program based on data collected in 2013. This report compares the newly collected data with the data collected and summarized in 2010, 2011, 2012 and 2013, the first four 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 2013. This represents an increase of 205 units (1%) compared to 2012. New Castle County has approved approximately 9,650 of the 18,000 housing units, of which approximately 1,865 units (19%) were constructed by the end of 2013. In 2012, New Castle County had approved 9,450 units (2% less than 2013), of which 1,530 units were constructed (18% less than 2013). The remaining 8,340 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). The number of new housing units in the early planning stages remained same as 2012, partly attributable to low 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 1,165 more housing units were proposed in developments in New Castle County for which approval had expired by the end of 2013. No additional housing units have expired since the end of 2012.
- 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 89 new housing units completed between 2012 and 2013. 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. 3,132 of the proposed 7,728 housing units were constructed by the end of 2012 and 3,221 of the proposed 7,728 housing units were constructed by the end of 2013. This represents an increase of 1,042 housing units over the six (6) year period between 2007 and 2013, and includes 89 new units completed between 2012 and 2013.

- It should be noted that 2013 non-residential development data for New Castle County was unavailable at this time. This information will be updated in future reports when the data becomes available.

Traffic:

- Roadway volumes at seven (7) locations are being monitored and recorded annually.
- Five (5) signalized intersections along the existing US 301 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, 2012 and 2013:
 - US 301 at Old Summit Bridge Road: The intersection operated at LOS A during both the AM and the PM peak hours in 2010, 2011, 2012 and 2013.
 - US 301 at SR 896: The intersection operated at LOS C during both the AM and the PM peak hours in 2010, 2011, 2012 and 2013.
 - 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, 2012, and 2013; 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 in 2010, 2011, 2012 and 2013.
 - US 301 at SR 299: The intersection operated at LOS D during both the AM and PM peak hours in 2010, 2011, 2012 and 2013.
- 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, 2012 and 2013:
 - In 2013, the average control delay was 32 seconds per vehicle (LOS D) at the intersection of US 301 and Old School House Road, 17 seconds per vehicle (LOS C) at the intersection of US 301 at Keenan Auto Body and 5 seconds per vehicle (LOS A) at the intersection of Choptank Road and Clayton Manor Drive.
 - 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) in 2012. The delay decreased again in 2013 to approximately 17 seconds per vehicle.



- The delay decreased at the intersection of Choptank Road and Clayton Manor Drive in 2013 (by 6 seconds) compared to 2010 data. The delay also decreased at the intersection of US 301 and Old School House Road in 2013 (by 8 seconds per vehicle), compared to 2010 data.

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. According to the comparison, three (3) of the eight roadway segments being monitored had higher crash rates than the Statewide and New Castle County Average Rate in 2013.
- In general, the number of crashes decreased between 2010 and 2012 at most of the locations being monitored. Only two locations experienced an increase of crashes between 2010 and 2012. However, the number of crashes increased between 2012 and 2013 for five of the roadway segments being monitored. This included US 301 between Summit Bridge and SR 896 (Boyds Corner Road), where the number of crashes increased from 21 to 23, US 301 between SR 896 (Boyds Corner Road) and Peterson Road, where the number of crashes increased from 42 to 50, US 301 between Levels Road and the DE / MD state line, where the number of crashes increased from 10 to 11, Choptank Road between Bethel Church Road and Bunker Hill Road, where the number of crashes increased from 10 to 12, and SR 1 between Roth Bridge and US 13/ SR 1 Split (Tybouts Corner), where the number of crashes increased from 47 to 71
- 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 76 incidents that have resulted in 200 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 2013. Although the SR 1 / I-95 Interchange project is not located in the vicinity of the US 301 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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INTRODUCTION

The US301 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). 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. DelDOT 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 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.

This report represents a summary of the fourth year of the monitoring program based on data collected in 2013. This report compares the newly collected data with the data collected and summarized in 2010, 2011 and 2012, the first three years of the monitoring program. The 2013 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 DelDOT 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.



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 on the US 301 project website at www.us301.deldot.gov. 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.

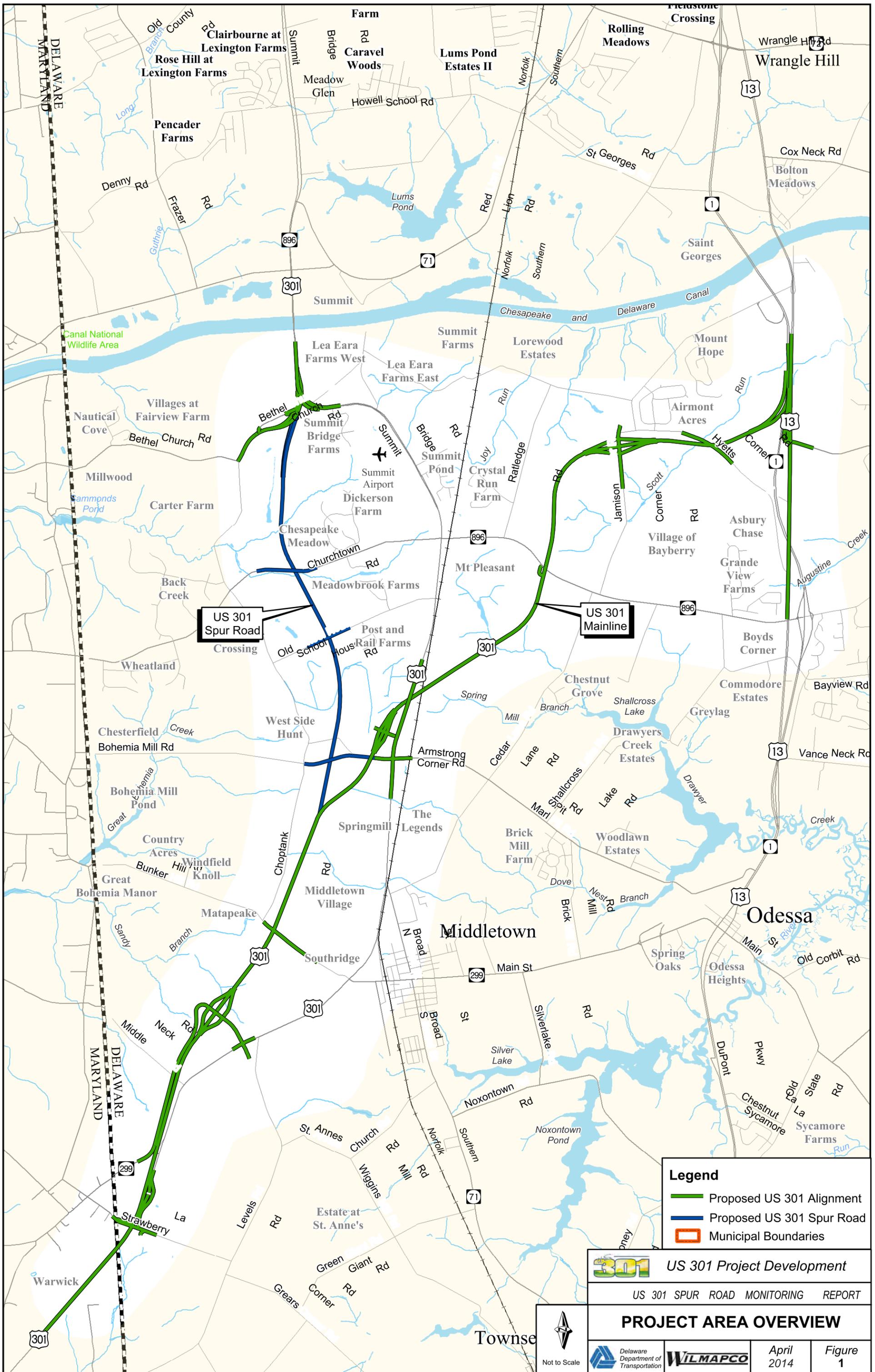
The US 301 Spur Road Monitoring Program was presented at the FY2012 – FY2015 Transportation Improvement Program (TIP) Public Workshop on February 28, 2011 at WILMAPCO, attended by DeIDOT staff. The Spur Monitoring Program information was summarized on a large display board that provided an overview of 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 subsequent WILMAPCO Public Workshop was not held in February 2012, 2013 nor 2014; therefore, there was not an efficient opportunity to present the key findings of the monitoring in those years. It should be noted that there was very little change in the data and findings between 2010 and 2013. 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.

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. DeIDOT 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.



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 2014

Figure 1





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.

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).

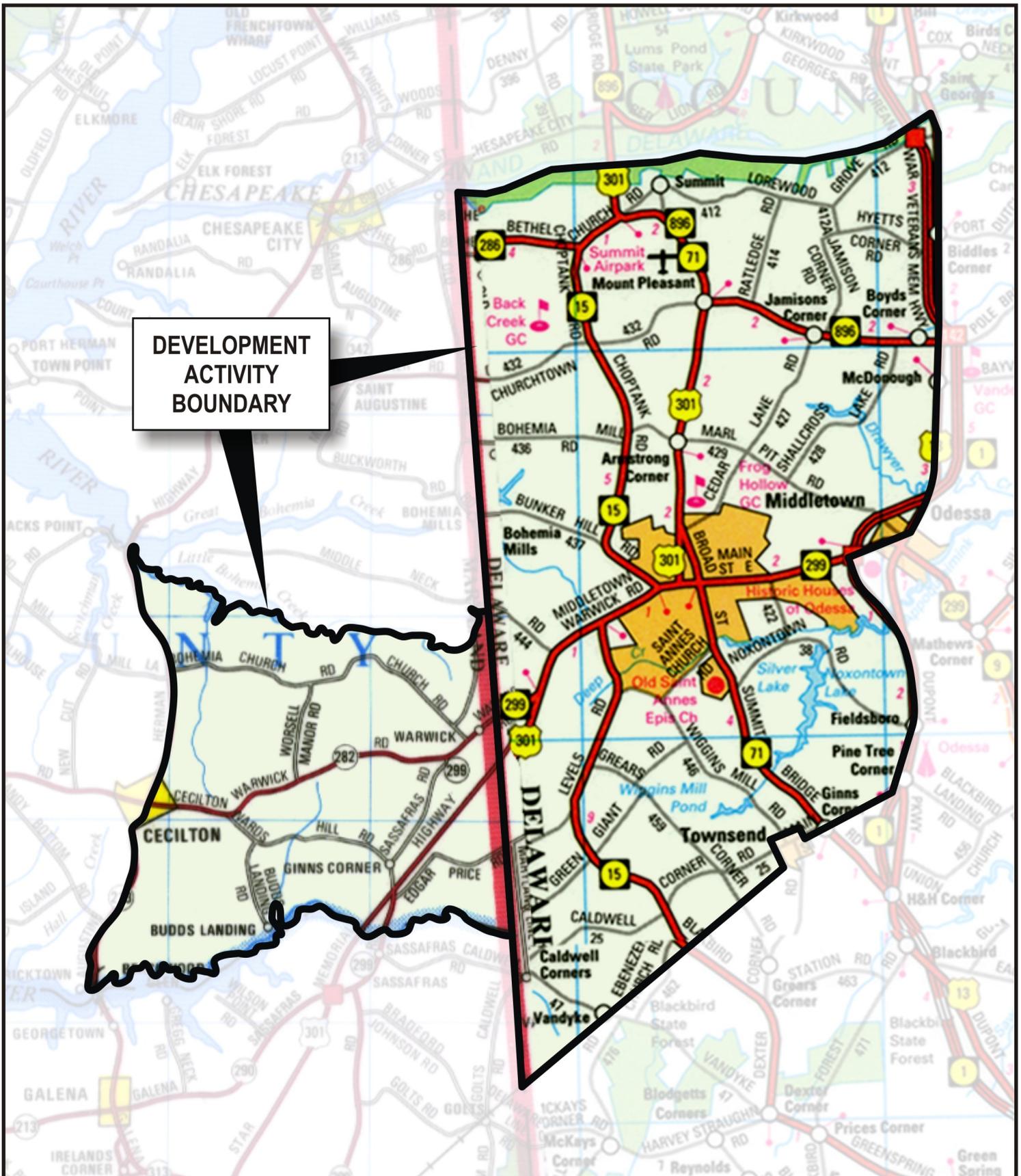
DeIDOT and WILMAPCO have committed to tracking the land development activities in a portion of southern New Castle County and an adjoining portion of Cecil County, Maryland as part of this Monitoring Report. The specific area where development will be tracked annually is depicted in Figure 2. This area 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 2013, a total of sixty-nine (69) 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-seven (57) 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 2013 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 recently completed 1.25 million SF Amazon.com Fulfillment 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



**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 2014

Figure
2

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, 2012 and 2013.

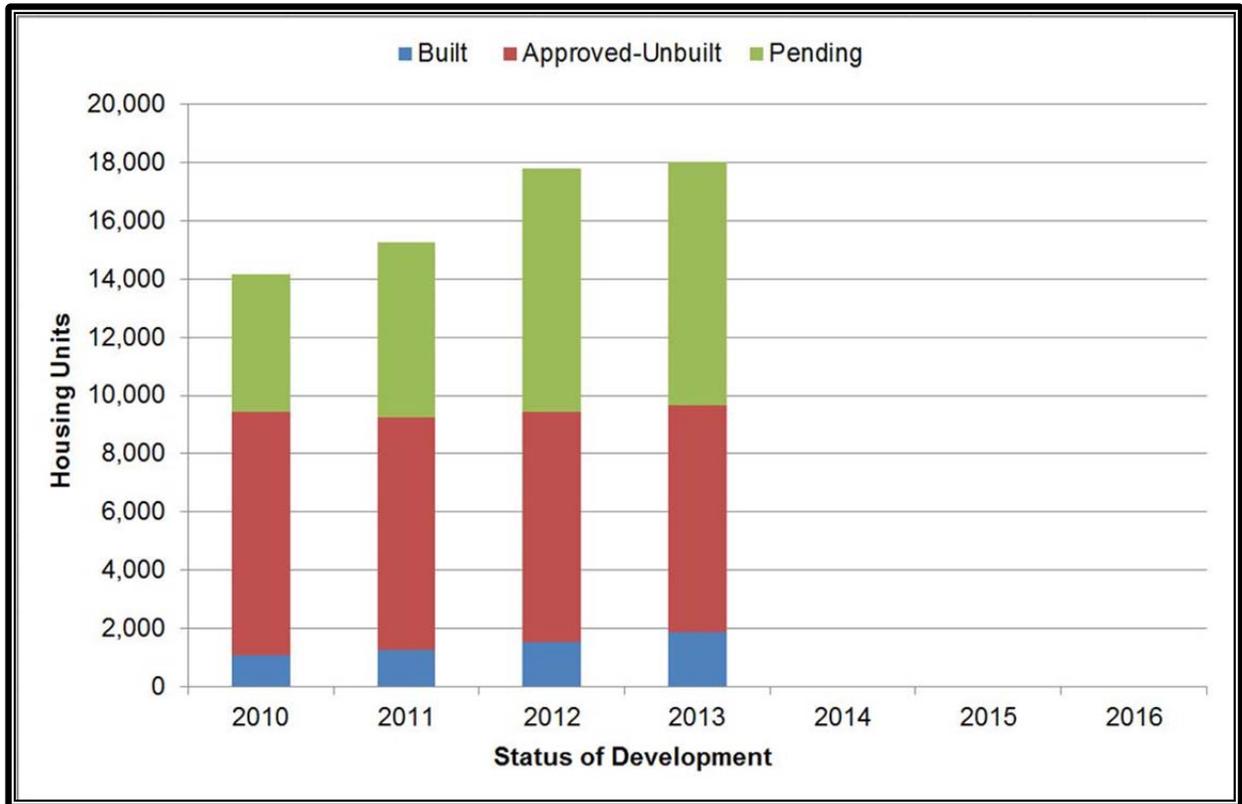


Figure 3: Residential Development in Study Area

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 2013. This represents an increase of 205 units (1%) compared to 2012. New Castle County has approved approximately 9,650 of the 18,000 housing units, of which approximately 1,865 units (19%) were constructed by the end of 2013. In 2012, New Castle County had approved 9,450 units (2% less than 2013), of which 1,530 units were constructed (18% less than 2013). The remaining 8,340 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). The number of new housing units in the early planning stages remained same as 2012, partly attributable to the low 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 1,165 more house units were proposed in developments in New Castle County for which approval had expired by the end of 2013. No additional housing units have expired since the end of 2012.

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 89 new housing units completed between 2012 and 2013. 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 2009, a total of 2,735 (35%) 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.
- By the end of 2013, a total of 3,221 (42%) of the proposed 7,728 housing units within the Town of Middletown had been constructed.
- This represents an increase of 1,042 housing units over the six (6) year period between 2007 and 2013 and includes 89 new units completed between 2012 and 2013.

Appendix B respectively lists 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.

Currently, no non-residential developments are proposed in the two (2) TAZs in Cecil County that are included in the study area. In addition, 2013 non-residential development data for New Castle County was unavailable; therefore, 2013 data was left blank in Figure 4. It will be updated in future when the data becomes available.

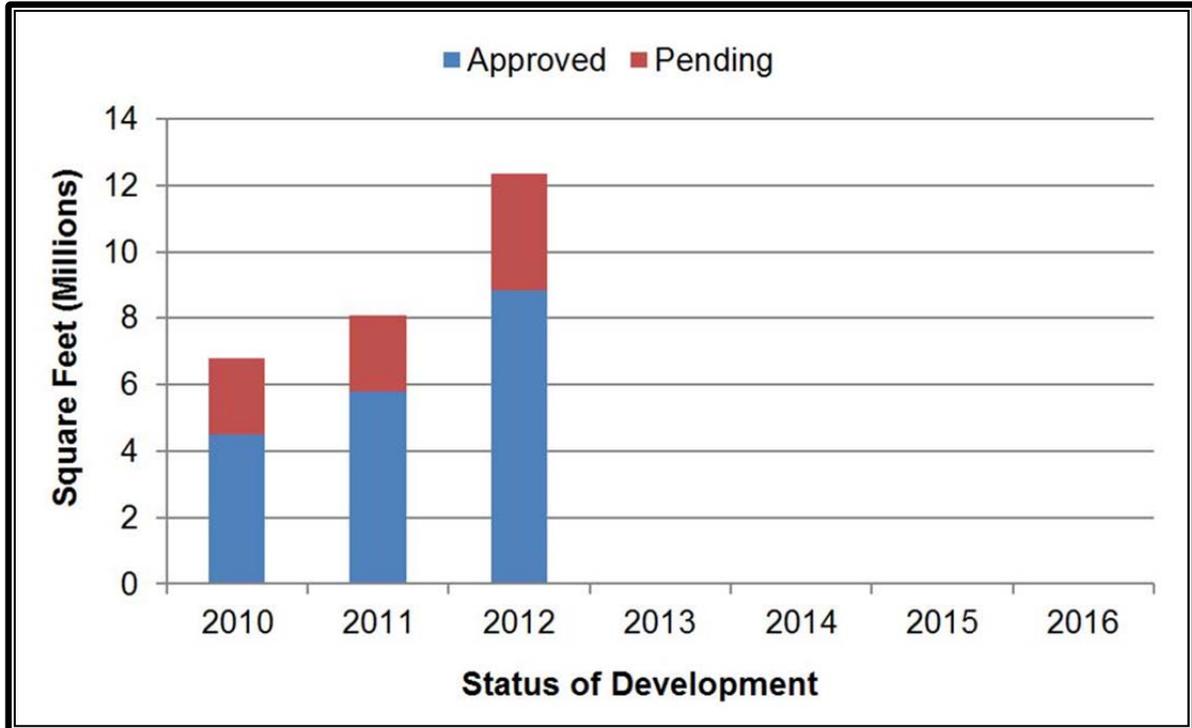


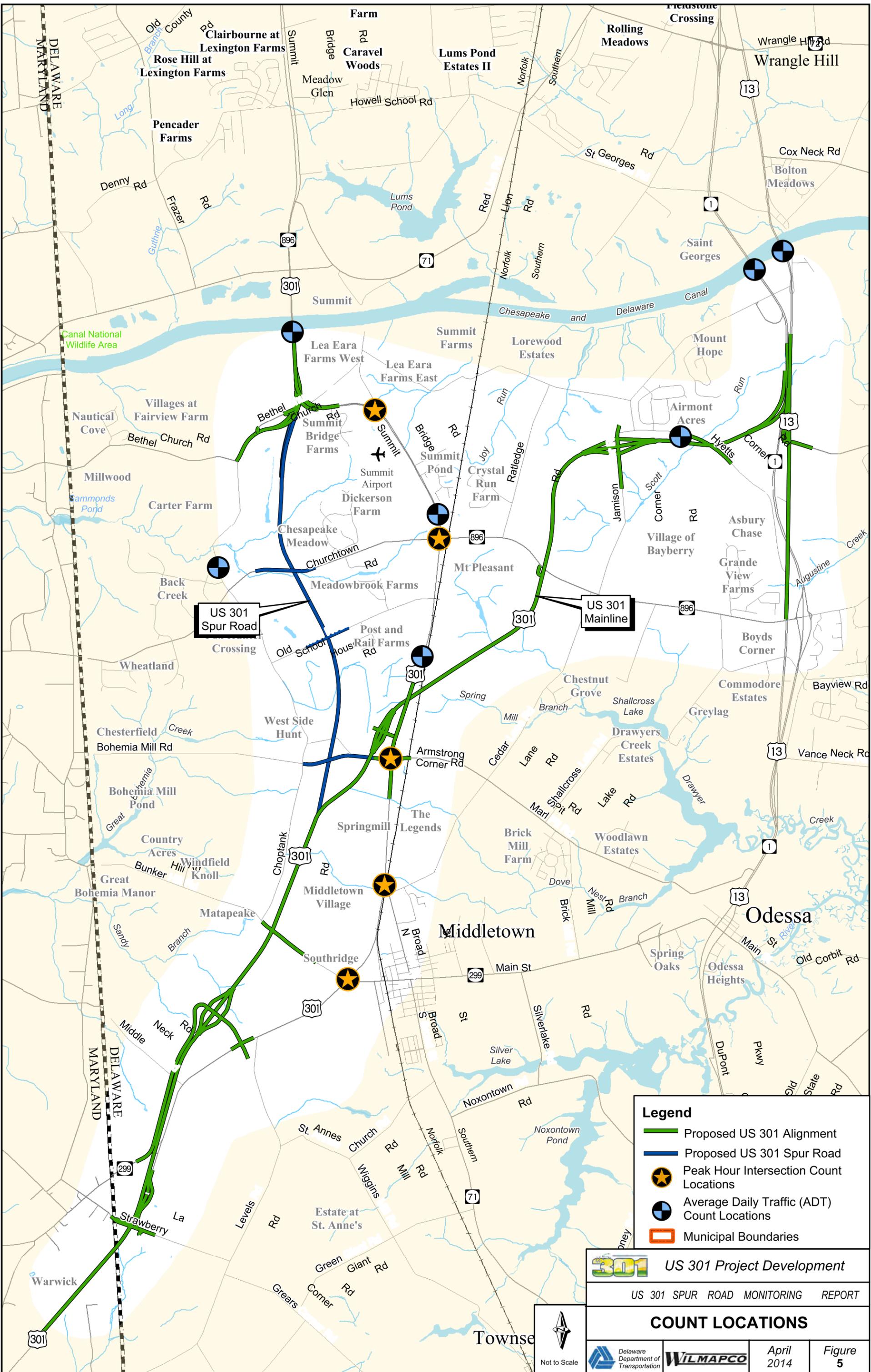
Figure 4: Non-Residential Development in Study Area

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, 2012, and 2013 (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 2013. The two locations with the largest increase were Choptank Road, north of Churchtown Road (a 24% increase) and on US 13 at St. Georges Bridge (a 16% increase).



Legend

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

301 US 301 Project Development

US 301 SPUR ROAD MONITORING REPORT

COUNT LOCATIONS

		April 2014	Figure 5
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Not to Scale



**US 301 Spur Road
2013 Monitoring Report**

April 2014

**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	30,250			
Choptank Rd, North of Churchtown Rd	3,990	4,090	4,810	4,940			
SR 1 at Roth Bridge	73,690	78,740	74,900	76,940			
US 13 at St. Georges Bridge	10,600	9,070	12,190	12,270			
US 301/SR 896, North of Mt. Pleasant	23,450	23,810	24,760	24,980			
US 301, between Armstrong Corner Rd and Mt. Pleasant	21,830	22,460	22,710	22,360			
US 301 Bypass	-	-	-	-			

*Data was collected for a seven (7) day period in October / November 2010, 2011, 2012 and 2013. 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.

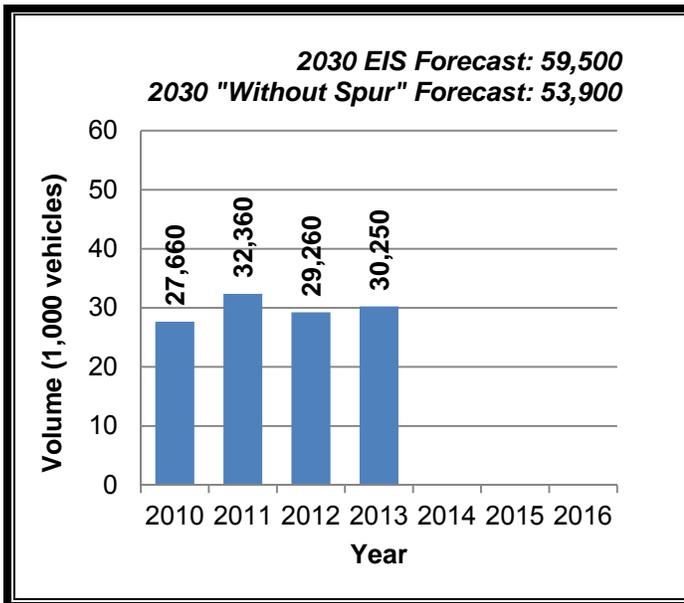


Figure 6: Average Daily Traffic (ADT) for Summit Bridge (US 301)

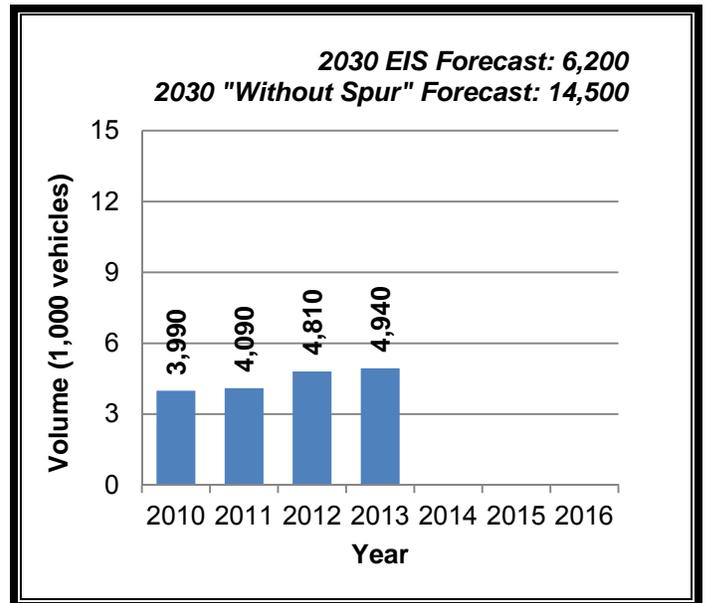


Figure 7: Average Daily Traffic (ADT) for Choptank Rd, North of Churchtown Rd

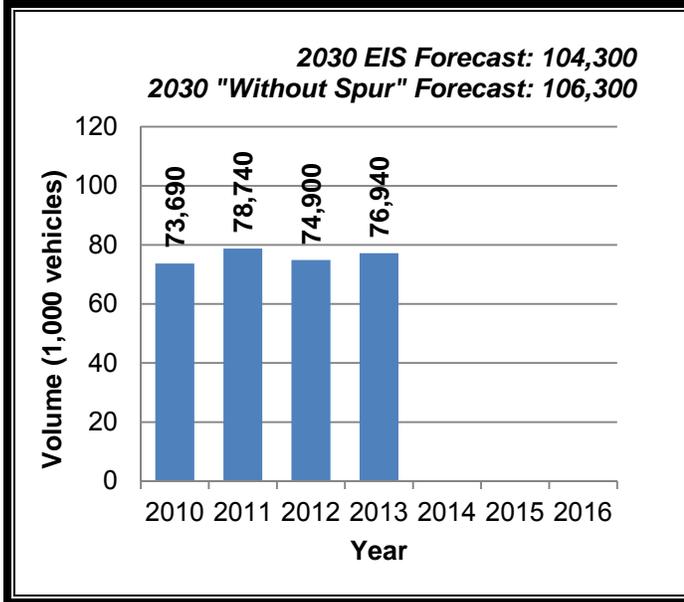


Figure 8: Average Daily Traffic (ADT) for Roth Bridge (SR 1)

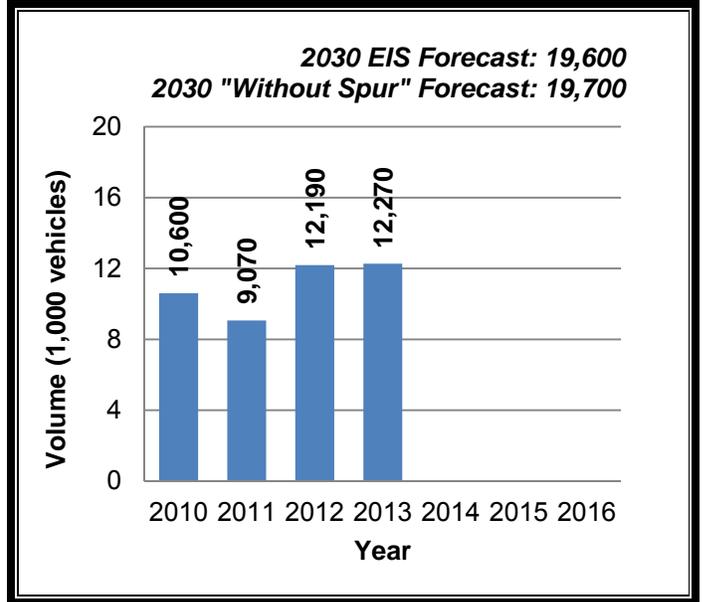


Figure 9: Average Daily Traffic (ADT) for St. George's Bridge (US 13)

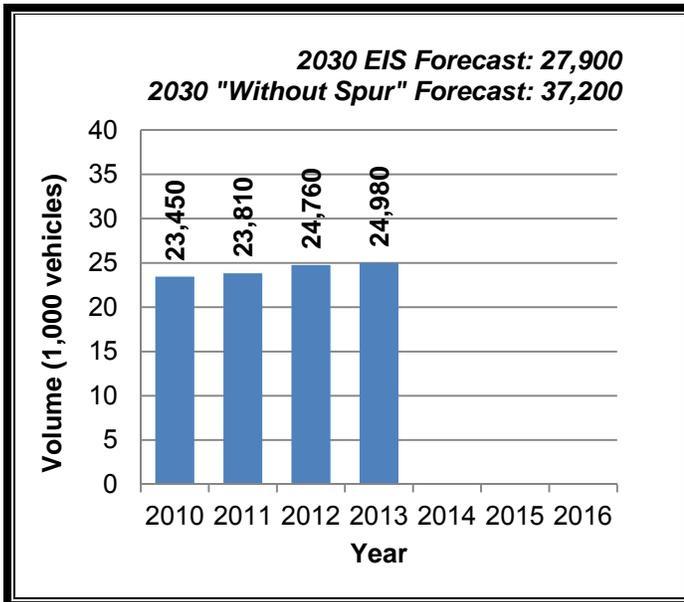


Figure 10: Average Daily Traffic (ADT) for Existing US 301 North of Mt. Pleasant

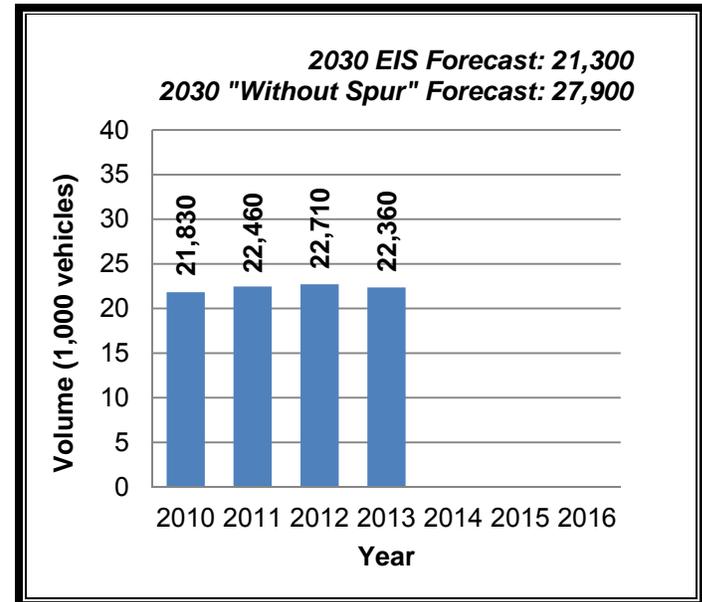


Figure 11: Average Daily Traffic (ADT) for Existing US 301 between Armstrong Corner Rd and Mt. Pleasant



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**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	2,480	8						
Choptank Rd, North of Churchtown Rd	490	12	560	14	370	8	170	3						
SR 1 at Roth Bridge	7,860	11	9,020	11	7,840	11	6,620	9						
US 13 at St. Georges Bridge	570	5	440	5	1,165	10	585	5						
US 301 / SR 896, North of Mt. Pleasant	1,970	8	1,840	8	2,300	9	1,840	7						
US 301, between Armstrong Corner Rd and Mt. Pleasant	2,910	13	3,000	13	3,075	14	2,990	13						
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 2013. 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, 2012, and 2013 intersection capacity analyses are summarized in Table 3 and the following trends were observed between 2010 and 2013:

- US 301 at Old Summit Bridge Road: The intersection operated at LOS A during both the AM and the PM peak hours in 2010, 2011, 2012, and 2013. 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 in 2010, 2011, 2012, and 2013. 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, 2012, and 2013; 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 that year. 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 in 2010, 2011, 2012, and 2013. 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 in 2010, 2011, 2012, and 2013. No significant changes were observed.

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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	A	A							
US 301 at SR 896	C	C	C	C	C	C	C	C							
US 301 at Armstrong Corner Rd	C	C	D	D	C	C	C	C							
Existing US 301 at SR 71	C	D	C	D	C	D	C	D							
Existing US 301 at SR 299	D	D	D	D	D	D	D	D							

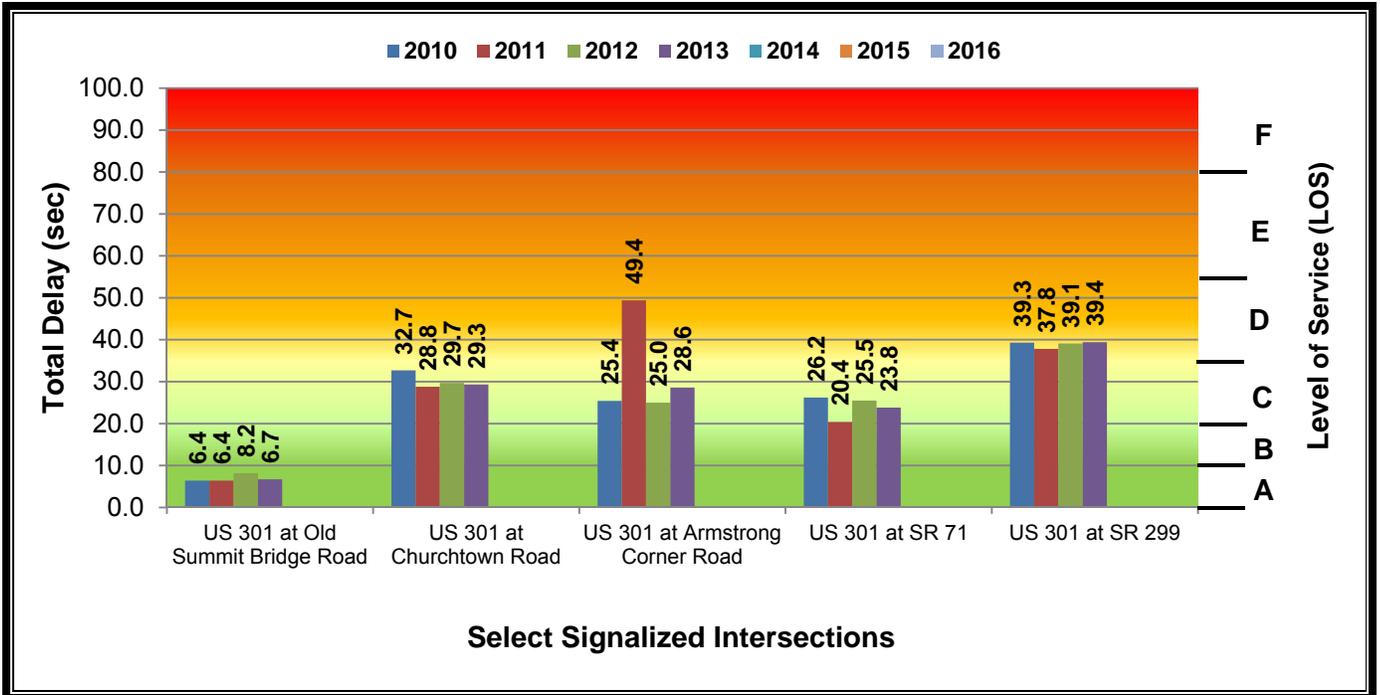


Figure 12: Total Delay and Corresponding Level of Service (LOS) at Select Signalized Intersections along US 301 during the AM Peak Hour

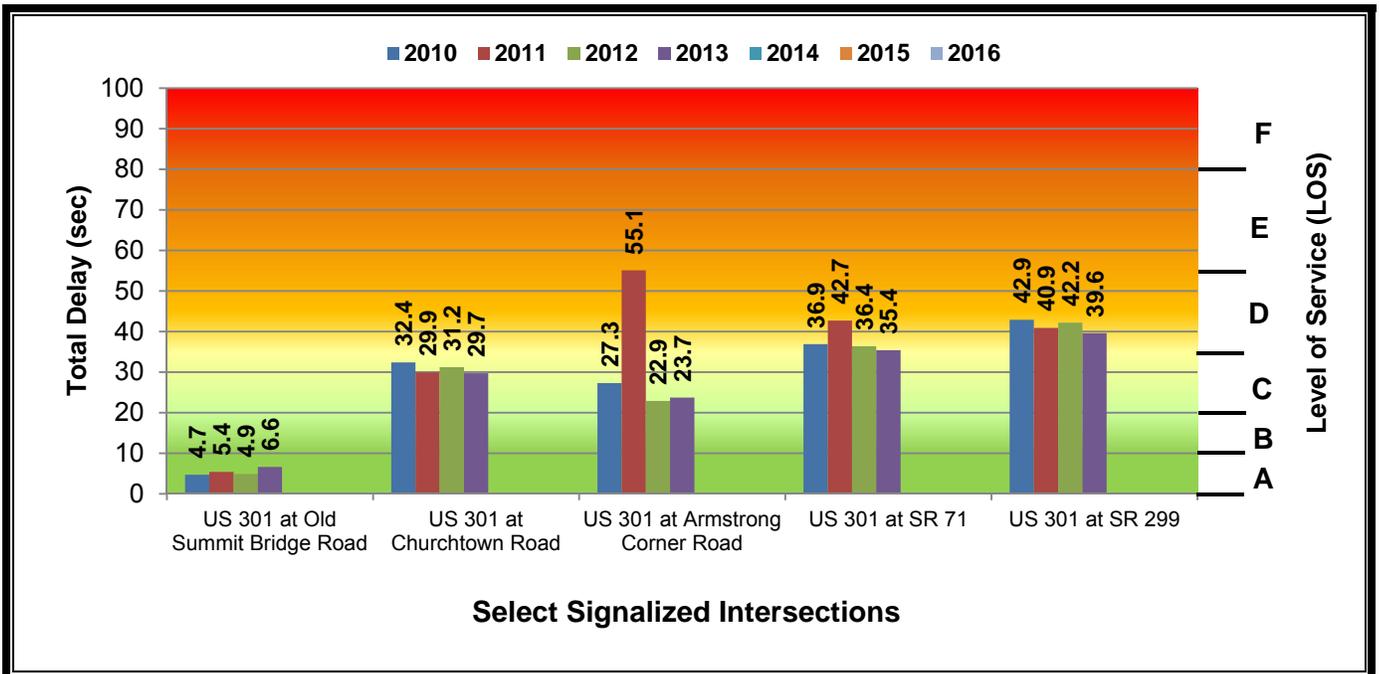


Figure 13: Total Delay and Corresponding Level of Service (LOS) at Select Signalized Intersections along US 301 during the PM Peak Hour



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 2013, the average control delay was 32 seconds per vehicle (LOS D) at the intersection of US 301 and Old School House Road, 17 seconds per vehicle (LOS C) at the intersection of US 301 at Keenan Auto Body and 5 seconds per vehicle (LOS A) at the intersection of Choptank Road and Clayton Manor Drive. A comparison of the 2010, 2011, 2012, and 2013 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) in 2012. The delay decreased again in 2013 to approximately 17 seconds per vehicle.

The delay decreased at the intersection of Choptank Road and Clayton Manor Drive in 2013 (by 6 seconds) compared to 2010 data. Lastly, there was a decrease in delay at the intersection of US 301 and Old School House Road in 2013 (by 8 seconds per vehicle) compared to 2010 data.

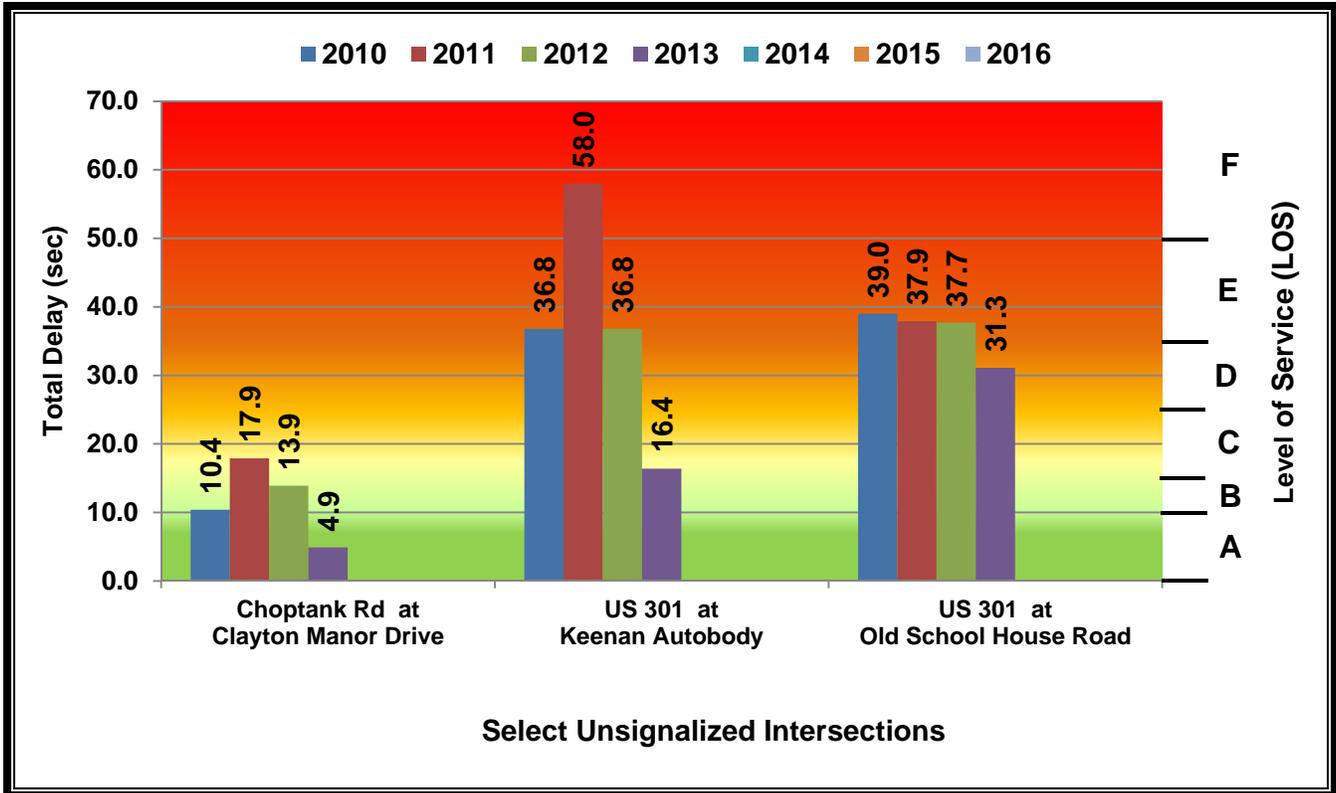


Figure 14: Total Delay and Corresponding Level of Service (LOS) at Select Unsignalized Intersections along US 301 during the PM Peak Hour

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, 2012 and 2013 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. The DelDOT Safety Section provided the Statewide and New Castle County Average Crash Rates for 2010, 2011, 2012, and 2013. According to the comparison, three (3) of the eight roadway segments being monitored had higher crash rates than the Statewide and New Castle County Average Rate in 2013.



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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 (Boyd's Corner Rd)	32	1.44	0.75	0.55	21	0.93	0.74	0.53	21	0.95	0.47	0.55	23	0.98	0.73	0.51		
The "curve" between Summit Bridge and Bethel Church Rd	2				5				4				5					
The intersection of US 301 and Bethel Church Rd	3				3				3				6					
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	1.30	1.42	50	1.72	1.38	1.39		
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	3.04	3.79	19	2.12	3.4	3.81		
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	1.3	1.42	11	0.73	1.38	1.39		
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	0.65	2.85	1	0.65	2.06	2.78		
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	0.65	2.85	12	1.51	2.06	2.78		
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	0.65	2.85	6	5.88	2.06	2.78		
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	1.09	1.09	71	0.51	1.38	1.10		

In general, the number of crashes decreased between 2010 and 2012 at most of the locations being monitored. Only two locations experienced an increase of crashes between 2010 and 2012. However, the number of crashes increased between 2012 and 2013 for five of the roadway segments being monitored. This included US 301 between Summit Bridge and SR 896 (Boyd's Corner Road), where the number of crashes increased from 21 to 23, US 301 between SR 896 (Boyd's Corner Road) and Peterson Road, where the number of crashes increased from 42 to 50, US 301 between Levels Road and the DE / MD state line, where the number of crashes increased from 10 to 11, Choptank Road between Bethel Church Road and Bunker Hill Road, where the number of crashes increased from 10 to 12, and SR 1 between Roth Bridge and US 13/ SR 1 Split (Tybouts Corner), where the number of crashes increased from 47 to 71.

The number of crashes decreased from 2012 to 2013 for two of the segments being monitored. This included the US 301 between Peterson Road and Levels Road, where the number of crashes decreased from 22 to 19, and Bethel Church Road between US 301 and Choptank Road, where the number of crashes decreased from 3 to 1.

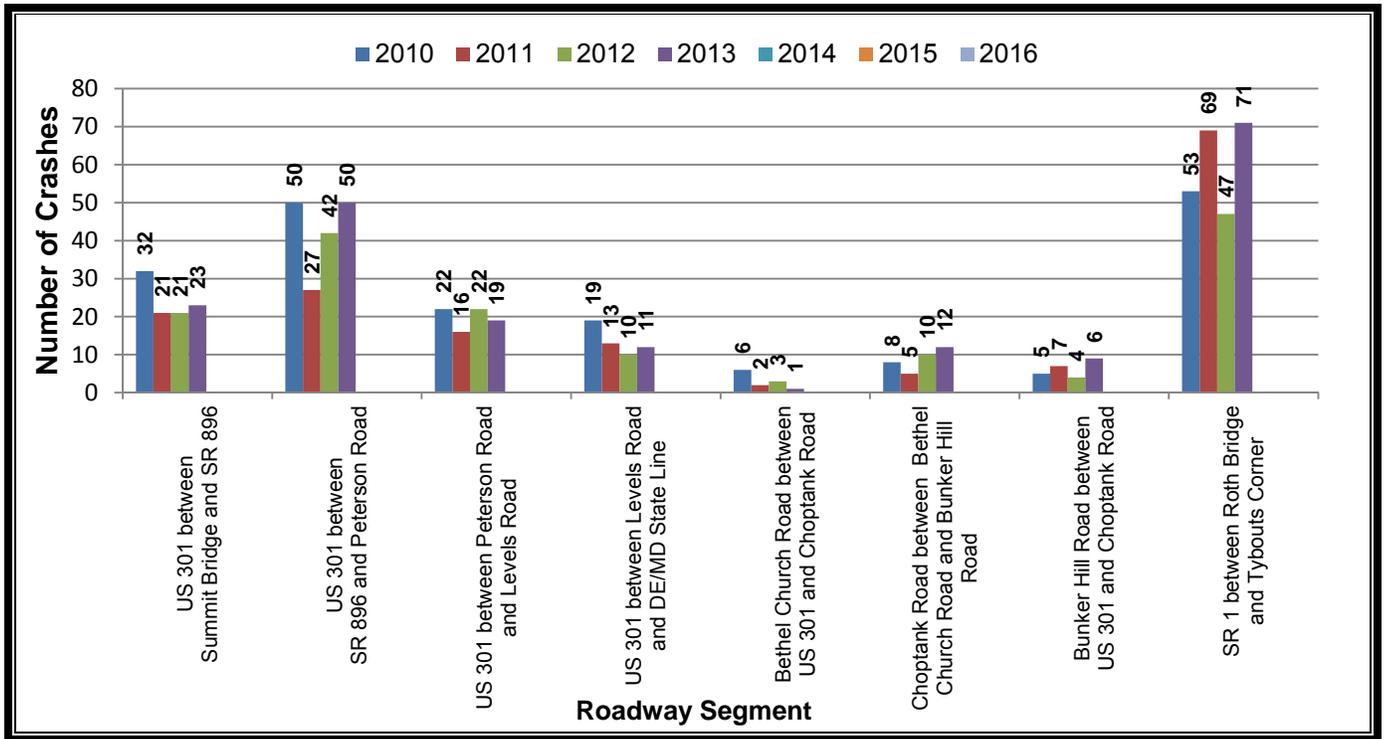


Figure 15: Comparison of Crashes for Select Roadways in the US 301 Corridor

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 2013 can be found in Tables 5 and 6.



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Table 5: Hazard Elimination Program Locations – From 2006 to 2013			
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 / SR 896	0.44 miles north of Beaston Road	0.46 miles south of Bethel Church Road	2013

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Table 6: High Risk Rural Roads Program Locations – from 2007 to 2013			
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 76 incidents, including 8 in 2013, that have resulted in 200 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 2013, 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 2013 Monitoring Report		April 2014	
Table 7: Construction Activity in the US 301 Project Area in 2013			
Contract Number	Project Title	Start/End	Project Description
T201007102	Chesapeake City Road Bridge (BR 1-366) Construction	February 2013 / May 2013	Replaced the deteriorated structure with precast pre-stressed concrete box beams and the reconstruction of the approach roadway
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 / Summer 2014	Bridge repair work requiring 3-week lane closures periods.



Appendix A
Proposed Development for Southern New Castle County

PLAN_NAME	Plan Status	Total Units to be Built	SQ_FT NRES	Units Unbuilt 2009	Units Unbuilt 2010	Units Unbuilt 2011	Units Unbuilt 2012	Units Unbuilt 2013	Units Built 2010	Units Built 2011	Units Built 2012	Units Built 2013
449 ARMSTRONG CORNER	Expired	0	24,000	0	0	0	0	0	0	0	0	0
ARMSTRONG CORNER	PENDING	0	88,623	0	0	0	0	0	0	0	0	0
ASBURY CHASE II	Approved	47	0	47	47	16	0	0	0	31	47	47
BAYBERRY NORTH	Approved	951	0	951	951	938	886	815	0	13	65	136
BAYBERRY SOUTH	Approved	1,190	0	1,186	1,186	1,186	1,186	1,066	4	4	4	124
BAYBERRY TOWN CENTER	APPROVED	0	559,204	0	0	0	0	0	0	0	0	0
BIGGS FARM	Approved	20	0	20	20	20	20	20	0	0	0	0
BOHEMIA MILL POND	Approved	50	0	22	22	22	22	22	28	28	28	28
Boyd's Corner Farm	Pending	116	146,800	116	116	116	0	0	0	0	0	0
CANALVIEW AT CROSSLAND (South)	Approved	432	0	405	401	346	287	287	31	86	140	145
CARTER FARM	Pending	578	0	578	578	578	578	578	0	0	0	0
CEDAR LANE	Approved	78	0	77	77	77	77	77	0	0	0	0
Christiana Care	Approved	0	64,000	0	0	0	0	0	0	0	0	0
CHURCHTOWN MANOR	Pending	273	0	273	273	273	273	273	0	0	0	0
COUNTRY ACRES II	Approved	6	0	6	6	6	0	0	0	0	6	6
COUNTRY CLUB ESTS	Expired	407	0	407	407	407	407	407	0	0	0	0
DEATS FARM	Pending	1,381	0	1,381	1,381	1,381	1,381	1,381	0	0	0	0
ESTATES AT RIDGEFIELD	Expired	16	0	16	16	16	16	16	0	0	0	0
ESTATES AT ST ANNES	Approved	466	0	326	302	291	249	205	164	175	217	261
Gander Hill	Approved	80	0	80	48	47	47	47	32	33	33	33
HYETTS CORNER	Approved	143	0	136	109	103	87	86	34	40	56	57
Isaacs Subdivision	Exploratory	87	0	87	87	87	87	87	0	0	0	0
Kohl Properties	Approved	0	0	0	0	0	0	0	0	0	0	0
LOREWOOD ESTATES	Approved	10	0	5	4	4	4	4	6	6	6	6
Merrimack Commons	Approved	78	0	0	78	78	78	78	0	0	0	0
Middletown Auto Mall	Approved	0	0	0	0	0	0	0	0	0	0	0
Middletown Bus. Park	Approved	0	0	0	0	0	0	0	0	0	0	0
OASIS AT CYPRESS RIDGE	Expired	29	0	29	29	29	29	29	0	0	0	0
PARKSIDE	Approved	491	0	333	326	316	313	307	166	176	179	184
PLEASANTON	Expired	434	0	434	434	434	434	434	0	0	0	0
Poole Property	Pending	0	420,000	0	0	0	0	0	0	0	0	0
Promedade at Middletown	Approved	273	145,000	273	273	273	273	273	0	0	0	0
ROTHWELL VILLAGE	Approved	150	0	150	150	150	150	150	0	0	0	0
SCOTT RUN BUSINESS PK	Approved	0	1,700,000	0	0	0	0	0	0	0	0	0
SHANNON COVE	EXPIRED	446	0	343	311	301	277	277	99	108	132	169
SPRING ARBOR AT South Ridge	Approved	317	0	0	206	195	163	137	111	122	154	180
SUMMIT CROSSING PH 2	Approved	0	5,500	0	0	0	0	0	0	0	0	0
The Highlands	Approved	1,242	0	1,242	1,242	1,242	1,242	1,242	0	0	0	0
The Highlands @ Backcreek	Approved	42	0	42	42	42	42	42	0	0	0	0
THE PARKWAY AT SOUTH RIDGE	Approved	446	0	0	413	407	407	401	33	39	39	45
Townsend Acres	Approved	49	0	49	49	49	49	49	0	0	0	0
TOWNSEND VILLAGE	Approved	242	0	158	147	143	131	120	95	99	111	122
TOWNSEND VILLAGE	Approved	336	0	166	162	154	151	151	174	182	185	185
TSAGANOS	Approved	0	16,960	0	0	0	0	0	0	0	0	0
VILLAGE OF SCOTT RUN	Pending	271	0	271	271	271	271	271	0	0	0	0
Westown (Levels)	Approved	1,800	0	1,800	1,800	1,800	1,800	1,800	0	0	0	0

PLAN_NAME	Plan Status	Total Units to be Built	SQ_FT NRES	Units Unbuilt 2009	Units Unbuilt 2010	Units Unbuilt 2011	Units Unbuilt 2012	Units Unbuilt 2013	Units Built 2010	Units Built 2011	Units Built 2012	Units Built 2013
Westown Commercial	Approved	0	0	0	0	0	0	0	0	0	0	0
Westown Commercial	Approved	0	0	0	0	0	0	0	0	0	0	0
Westown Commercial	Approved	0	0	0	0	0	0	0	0	0	0	0
Westown Commercial (Amazon)	Approved	0	1,250,000	0	0	0	0	0	0	0	0	0
Whitehall Phase A	Pending	1,361	79,300	0	0	1,361	1,361	1,361	0	0	0	0
Whitehall Phase B	Pending	529	79,300	0	0	529	529	529	0	0	0	0
Whitehall Phase C	Pending	1,853	79,300	0	0	1,853	1,853	1,853	0	0	0	0
WILLOW GROVE MILL Phase II	Approved	192	58,700	120	87	74	70	56	105	118	122	136
WINCHELSEA	Pending	513	0	513	513	513	513	513	0	0	0	0
Windsor Commons at Hyetts Corner	Approved	316	0	149	149	149	149	316	0	0	0	0
WOODGRIFF FARMS	Expired	4	0	4	4	0	0	0	0	4	4	4
Browning Creek (Cecil)	Expired	47	0	47	47	47	47	47	0	0	0	0
John Harrison (Cecil)	Expired	4	0	4	4	4	4	4	0	0	0	0
John Curtis (Cecil)	Approved	3	0	3	3	3	3	3	0	0	0	0
Worsell Manor (Cecil)	Pending	41	0	41	41	41	41	41	0	0	0	0
Blossom View (Cecil)	approved	29	0	29	29	29	29	29	0	0	0	0
Bayside Development (Cecil)	Pending	18	0	18	18	18	18	18	0	0	0	0
Horse Trails at Worsell Manor (Cecil)	Expired	27	0	27	27	27	27	27	0	0	0	0
Sycamore Lane Nursery (Cecil)	Pending	90	0	90	90	90	90	90	0	0	0	0
Frisby Meadows (Cecil)	Pending	75	0	75	75	75	75	75	0	0	0	0
Glenn Maple (Cecil)	Approved	7	0	7	7	7	7	7	0	0	0	0
Butlers Crossing (Cecil)	Pending	7	0	7	7	7	7	7	0	0	0	0
Spirit Airpark (Cecil)	Expired	20	0	20	20	20	20	20	0	0	0	0
		18,113	4,716,687	12,563	13,085	16,645	16,260	16,128	1,082	1,264	1,528	1,868



Appendix B
Residential Construction in the Town of Middletown

US 301 Spur Road 2013 Monitoring Report															April 2014	
Appendix B: Apartment Complex Construction in the Town of Middletown																
Site	Proposed	2010		2011		2012		2013		2014		2015		2016		
		Built	Unbuilt													
Highlands	336	0	336	0	336	0	336	0	336							
Middletown Village	300	300	0	300	0	300	0	300	0							
Parkway at South Ridge	204	0	204	0	204	0	204	0	204							
Promenade / Middletown Condos	273	0	273	0	273	0	273	0	273							
Westown (Levels)	108	0	108	0	108	0	108	0	108							
Total	1,221	300	921	300	921	300	921	300	921							

US 301 Spur Road 2013 Monitoring Report															April 2014	
Appendix B: Duplex construction in the Town of Middletown																
Site	Proposed	2010		2011		2012		2013		2014		2015		2016		
		Built	Unbuilt													
Highlands	206	0	206	0	206	0	206	0	206							
Spring Arbor at South Ridge	12	8	4	8	4	8	4	8	4							
Parkway at South Ridge	16	0	16	0	16	0	16	0	16							
Westown (Levels)	260	0	260	0	260	0	260	0	260							
Total	494	8	486	8	486	8	486	8	486							

**Appendix B:
Townhouse construction in the Town of Middletown**

Site	Proposed	2010		2011		2012		2013		2014		2015		2016	
		Built	Unbuilt												
Highlands	700	0	700	0	700	0	700	0	700						
Spring Arbor at South Ridge	123	48	75	55	68	74	49	87	36						
Parkway at South Ridge	226	33	193	39	187	39	187	45	181						
Westown (Levels)	403	0	403	0	403	0	403	0	403						
Willow Grove Mill	248	202	46	202	46	248	0	248	0						
Willow Grove Mill II	192	105	87	115	77	115	77	122	70						
Total	1,892	388	1,504	411	1,481	476	1,416	502	1,390						

**Appendix B:
Single Family House Construction in the Town of Middletown**

Site	Proposed	2010		2011		2012		2013		2014		2015		2016	
		Built	Unbuilt												
Estate at St. Andrews	466	157	309	177	289	217	249	261	205						
Lakeside	185	184	1	184	1	184	1	184	1						
Legends	378	377	1	377	1	377	1	377	1						
Longmeadow	243	239	4	239	4	239	4	239	4						
Merrimac Commons	78	0	78	0	78	0	78	0	78						
Middletown Crossing	134	125	9	125	9	125	9	125	9						
Middletown Village	262	253	9	253	9	254	8	255	7						
Parkside	492	166	326	174	318	179	313	184	308						
Springmill	362	361	1	362	0	362	0	362	0						
Spring Arbor at South Ridge	182	55	127	59	123	72	110	85	97						
Westown (Levels)	1,000	0	1,000	0	1,000	0	1,000	0	1,000						
Willow Grove Mill	339	338	1	339	0	339	0	339	0						
Total	4,121	2,255	1,866	2,289	1,832	2,347	1,774	2,411	1,710						



Appendix C
US 301 Corridor Crash Reports

	Date	Time	MP	Type	Severity	Weather	Surface	Direction
1	1/4/2013	1:52 PM	0.27	Left-turn	PDO	Clear	Dry	SB / NB LT
2	1/27/2013	1:23 PM	2.13	Rear-end	PDO	Clear	Dry	NB/NB
3	2/1/2013	2:34 PM	2.71	HFO (Fence)	PDO	Clear	Dry	WB
4	2/25/2013	10:31 AM	2.7	Rear-end	Injury	Clear	Dry	NB/NB
5*	3/13/2013	7:31 AM	2.17	Rear-end	PDO	Clear	Dry	NB/NB
6	3/22/2013	3:48 PM	?	Rear-end	Injury	Clear	Dry	SB/SB
7	4/11/2013	8:23 AM	1.84	Rear-end	Injury	Clear	Dry	NB/NB
8*	4/25/2013	8:20 AM	2.81	Rear-end	PDO	Cloudy	Dry	NB/NB/NB
9	5/8/2013	6:48 AM	2.15	Rear-end	PDO	Rain	Wet	NB/NB
10	5/8/2013	7:49 AM	2.15	Rear-end	PDO	Rain	Wet	NB/NB
11	5/18/2013	9:30 AM	0	Rear-end	PDO	Cloudy	Dry	SB/SB
12	5/19/2013	11:00 PM	2.02	Hit Deer	PDO	Rain	Wet	SB
13*	6/8/2013	1:38 AM	?	ROR/HFO	PDO	Cloudy	Wet	NB
14*	6/21/2013	4:08 PM	2.21	Sideswipe	PDO	Clear	Dry	SB/SB
15	6/25/2013	9:30 AM	1.42	Angle	PDO	Clear	Dry	WB / SB
16	8/8/2013	10:28 AM	2.14	Rear-end	PDO	Cloudy	Dry	NB/NB
17	8/20/2013	7:08 PM	1.42	Rear-end	PDO	Clear	Dry	NB /NB
18	8/28/2013	5:34 PM	0.3	Rear-end	PDO	Rain	Wet	SB/SB
19*	10/6/2013	2:23 PM	2.8	Rear-end	PDO	Clear	Dry	NB/NB
20	10/9/2013	3:00 PM	0.17	Angle	PDO	Cloudy	Dry	EB LT / SB
21	10/17/2013	8:39 AM	2.04	Rear-end	Injury	Cloudy	Dry	NB/NB/NB
22	10/29/2013	5:39 AM	2.02	Hit Deer	PDO	Clear	Dry	NB
23	11/17/2013	10:24 AM	1.42	Rear-end	PDO	Clear	Dry	NB/NB
2013 Total Number of Crashes								23

HFO: Hit-fixed-object

ROR: Run-off the Road

PDO: Property Damage Only

Note: * are crashes that occurred v

US 301 between Summit Bridge and SR896

A total of twenty-three (23) crashes were reported in 2013, and the following trends were identified:

- Four (17 percent) of the twenty-three reported crashes resulted in personal injury.
- Nineteen (83 percent) of the twenty-three crashes resulted in property damage only.
- Fifteen (65 percent) of the reported crashes were rear-end crashes.
- Two (9 percent) of the reported crashes were angle crashes.
- Two (9 percent) of the reported crashes involved a deer and a motor vehicle.
- Two (9 percent) of the reported crashes were run-off-the-road/hit-fixed-object crashes.
- One (4 percent) of the reported crashes was a left-turn crash.
- One (4 percent) of the reported crashes was a sideswipe-same direction crash.

	Date	Time	MP	Type	Severity	Weather	Surface	Direction
1	1/8/2013	2:44 PM	2.13	Sideswipe (passing)	PDO	Clear	Dry	NB/NB
2	2/8/2013	12:58 AM	3.83	ROR	PDO	Clear	Dry	SB
3	2/10/2013	2:15 PM	1.65	Rear-end	Injury	Clear	Dry	SB/SB
4	2/21/2013	6:21 AM	4.29	Rear-end	Injury	Clear	Dry	NB/NB
5	3/9/2013	2:25 PM	0.99	Rear-end	PDO	Clear	Dry	SB/SB
6	3/10/2013	5:01 PM	3.87	ROR / ditch	PDO	Clear	Dry	NB
7	3/12/2013	4:14 PM	1.33	ROR / hit tree	PDO	Rain	Wet	NB
8	3/15/2013	12:24 AM	0.98	ROR / hit utility pole	PDO	Clear	Dry	SB
9	4/16/2013	3:47 PM	3.53	ROR / hit tree	Injury	Clear	Dry	SB
10	4/17/2013	6:49 AM	3.87	Rear-end	Injury	Clear	Dry	NB/NB
11	5/15/2013	1:43 PM	6:14	Rear-end	PDO	Clear	Dry	SB/SB
12	5/18/2013	2:26 PM	2.1	Rear-end	Injury	Cloudy	Dry	NB/NB
13	5/18/2013	12:00 AM	1.07	ROR/HFO	Injury	Clear	Dry	NB
14	5/21/2013	3:45 PM	4.35	Rear-end	Injury	Clear	Dry	SB/SB
15	6/12/2013	6:15 PM	0.99	Rear-end	Injury	Clear	Dry	SB/SB
16	6/16/2013	3:00 PM	1.07	Rear-end	PDO	Cloudy	Dry	SB/SB
17	6/18/2013	5:10 PM	4.33	Rear-end	Injury	Rain	Wet	NB/NB
18	6/25/2013	5:14 PM	0.99	Rear-end	PDO	Clear	Dry	SB/SB
19	6/28/2013	2:15 PM	1.54	Sideswipe	PDO	Clear	Dry	SB/SB
20	7/3/2013	5:47 PM	2.09	Rear-end	PDO	Cloudy	Dry	NB/NB
21	7/3/2013	4:09 PM	2.15	Rear-end	PDO	Cloudy	Dry	SB/SB/SB
22	7/14/2013	6:00 PM	2.04	Rear-end	PDO	Clear	Dry	NB/NB/NB/NB
23	7/17/2013	5:06 PM	2.17	Rear-end	PDO	Clear	Dry	SB/SB
24	7/22/2013	1:54 PM	3.87	Angle	Injury	Clear	Dry	SB/EB
25	7/28/2013	2:37 AM	2.14	Sideswipe (passing)	PDO	Clear	Dry	SB/SB
26	7/29/2013	7:27 AM	2.52	Sideswipe (passing)	PDO	Clear	Dry	NB/NB
27	8/21/2013	6:17 PM	3.92	Rear-end	PDO	Clear	Dry	NB/NB
28	9/3/2013	7:00 AM	1.58	Rear-end	Injury	Clear	Dry	NB/NB/NB
29	9/4/2013	5:10 PM	?	Rear-end	PDO	Clear	Dry	NB / NB
30	9/7/2013	4:48 PM	2.15	Rear-end	Injury	Clear	Dry	SB/SB/SB
31	9/17/2013	5:50 PM	?	Rear-end	Injury	Clear	Dry	SB/SB/SB
32	9/23/2013	10:04 AM	0.98	Sideswipe - H&R	PDO	Clear	Dry	NB/NB
33	9/24/2013	2:25 PM	1.66	Rear-end	PDO	Clear	Dry	SB/SB

Crash Reports Summary

US 301 between
SR 896 and Peterson Road

3/31/2014

	Date	Time	MP	Type	Severity	Weather	Surface	Direction
34	10/5/2013	4:20 AM	3.65	ROR / Utility Pole	PDO	Clear	Dry	NB
35	10/15/2013	8:55 PM	0.99	Sideswipe - opposite	Injury	Clear	Dry	SB/NB
36	10/17/2013	12:15 PM	2.56	Rear-end	Injury	Cloudy	Dry	NB/NB
37	10/21/2013	1:03 AM	4.15	Hit deer	PDO	Clear	Dry	NB
38	10/30/2013	2:15 PM	3.87	Angle	Injury	Cloudy	Dry	SB/EB
39	11/11/2013	9:00 AM	1.03	Angle	PDO	Clear	Dry	SB / EB
40	11/18/2013	1:47 PM	1.69	Rear-end	PDO	Clear	Dry	SB/SB
41	11/25/2013	6:41 PM	1.37	Rear-end	PDO	Cloudy	Dry	NB/NB/NB
42	11/26/2013	9:47 AM	1.62	Rear-end	Injury	Clear	Dry	SB/SB
43	11/26/2013	8:49 AM	1.01	Rear-end	PDO	Clear	Dry	SB/SB
44	11/27/2013	8:04 AM	4.33	Rear-end	PDO	Rain	Wet	NB/NB
45	12/1/2013	3:20 PM	3.87	Rear-end	PDO	Clear	Dry	NB/NB
46	12/7/2013	5:30 PM	4.34	Rear-end	PDO	Clear	Dry	NB/NB
47	12/9/2013	12:47 PM	3.87	Angle	PDO	Cloudy	Wet	SB/EB
48	12/12/2013	5:59 PM	3.69	Rear-end	PDO	Clear	Dry	NB/NB/NB
49	12/17/2013	1:20 PM	1.61	Rear-end	Injury	Rain	Wet	SB/SB
50	12/22/2013	4:39 PM	3.87	Angle	Injury	Rain	Wet	SB/EB
2013 Total Number of Crashes								50

HFO: Hit-fixed-object

ROR: Run-off the Road

PDO: Property Damage Only

US 301 between SR896 and Peterson Road

A total of fifty (50) crashes were reported in 2013, and the following trends were identified:

- Nineteen (38 percent) of the fifty reported crashes resulted in personal injury.
- Thirty-one (62 percent) of the fifty reported crashes resulted in property-damage-only.
- Thirty-one (62 percent) of the reported crashes were rear-end crashes.
- Seven (14 percent) of the reported crashes were run-off-the-road/hit-fixed-object crashes.
- Five (10 percent) of the reported crashes were angle crashes.
- Five (10 percent) of the reported crashes were sideswipe-same direction crashes.
- One (2 percent) of the reported crashes was a sideswipe-opposite direction crash.
- One (2 percent) of the reported crashes involved a motor vehicle and an animal a deer.

	Date	Time	MP	Type	Severity	Weather	Surface	Direction
1	1/3/2013	7:40 PM	2.68	Left-turn	Injury	Clear	Dry	SB / NB LT
2	1/15/2013	8:00 AM	0	Left-turn	Injury	Rain	Wet	NB/SB LT
3	1/24/2013	11:56 AM	0.73	Left-turn	PDO	Clear	Dry	NB / SB LT
4	2/1/2013	8:16 PM	3.13	HFO - sign / H & R	PDO	Windy	Dry	Unknown
5	2/17/2013	11:55 AM	0	Rear-end	PDO	Clear	Dry	NB RT / NB RT
6	5/4/2013	4:50 AM	2.38	HFO - signal pole	PDO	Clear	Dry	NB
7	5/7/2013	2:15 PM	2.74	Sideswipe - same	PDO	Cloudy	Dry	NB/NB
8	7/30/2013	6:23 PM	2.89	Rear-end	Injury	Clear	Dry	SB/SB
9	8/7/2013	11:13 PM	0.73	Left-turn	PDO	Clear	Dry	NB / SB LT
10	8/8/2013	6:13 PM	0.48	Rear-end	Injury	Cloudy	Dry	SB/SB
11	8/20/2013	8:25 PM	3.47	Rear-end	PDO	Clear	Dry	SB/SB
12	8/24/2013	11:30 AM	2.88	Angle	Injury	Clear	Dry	EB/WB/SB
13	8/27/2013	7:05 AM	3.33	Sideswipe - same	PDO	Clear	Dry	SB/SB
14	9/9/2013	8:20 PM	2.38	Angle	Injury	Clear	Dry	SB/WB
15	9/24/2013	1:10 PM	3.13	Rear-end	PDO	Clear	Dry	SB/SB
16	12/5/2013	7:45 AM	3.13	Sideswipe - same	PDO	Cloudy	Dry	SB/SB
17	12/14/2013	7:21 AM	2.44	Rear-end	Injury	Cloudy	Dry	SB/SB
18	12/14/2013	4:50 PM	2.38	Left-turn / U-turn	PDO	Rain	Wet	NB/SB UT
19	12/19/2013	5:36 PM	0.73	Sideswipe - same	PDO	Clear	Dry	NB LT / NB LT
2013 Total Number of Crashes								19

HFO: Hit-fixed-object

ROR: Run-off the Road

PDO: Property Damage Only

US 301 between Peterson Road and Levels Road

A total of nineteen (19) crashes were reported in 2013, and the following trends were identified:

- Seven (37 percent) of the nineteen reported crashes resulted in personal injury.
- Twelve (63 percent) of the reported crashes resulted in property-damage-only.
- Six (32 percent) of the reported crashes were rear-end crashes.
- Five (26 percent) of the reported crashes were left-turn crashes.
- Four (21 percent) of the reported crashes were sideswipe-same direction crashes.
- Two (10.5 percent) of the reported crashes were angle crashes.
- Two (10.5 percent) of the reported crashes were run-off-the-road/hit-fixed-object crashes.

	Date	Time	MP	Type	Severity	Weather	Surface	Direction
1	3/28/2013	12:40 PM		Sideswipe - same	PDO	Clear	Dry	SB/SB
2	4/23/2013	8:13 PM	0.68	Hit Deer	PDO	Clear	Dry	NB
3	4/30/2013	2:04 AM	0.77	Head-on	Injury	Cloudy	Dry	SB/NB
4	7/1/2013	12:30 PM	1.44	Rear-end	PDO	Rain	Wet	NB/NB
5	8/25/2013	2:37 PM	1.78	Angle	PDO	Clear	Dry	NB/WB
6	9/14/2013	10:18 AM	1.01	Sideswipe - same	PDO	Clear	Dry	SB/SB
7	10/4/2013	6:09 PM	1.92	Left-turn	Injury	Clear	Dry	NB/SB LT
8	10/5/2013	9:25 PM	0.68	Angle	PDO	Cloudy	Dry	NB/EB
9	10/21/2013	5:29 PM	0.09	Rear-end	Injury	Clear	Dry	NB/NB
10	12/21/2013	5:16 PM	2.02	Sideswipe - same	PDO	Clear	Dry	SB/SB
11	12/23/2013	7:45 PM	0.25	Rear-end	PDO	Cloudy	Wet	SB LT / SB
2013 Total Number of Crashes								11

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 eleven (11) crashes were reported in 2013, and the following trends were identified:

- Three (27 percent) of the eleven reported crashes resulted in personal injury.
- Eight (73 percent) of the eleven reported crashes resulted in property-damage-only.
- Three (27.5 percent) of the reported crashes were rear-end crashes.
- Three (27.5 percent) of the reported crashes were sideswipe-same direction crashes.
- Two (18 percent) of the reported crashes were angle crashes.
- One (9 percent) of the reported crashes was a head-on crash.
- One (9 percent) of the reported crashes was a left-turn crash.
- One (9 percent) of the reported crashes involved a motor vehicle and a deer.

Crash Report Summary

Bethel Church Road between
US 301 and Choptank Road

3/31/2014

	Date	Time	MP	Type	Severity	Weather	Surface	Direction
1	1/15/2013	1:06 PM	1.9	ROR/HFO - Utility Pole	PDO	Clear	Wet	WB
2013 Total Number of Crashes								1

HFO: Hit-fixed-object

ROR: Run-off the Road

PDO: Property Damage Only

Bethel Church Road between US 301 and Choptank Road

One (1) crash was reported in 2013, and the following trends were identified:

- There was one (1) run-off-the-road / hit-fixed-object crash, which resulted in property-damage-only.
- The crash involved a westbound motor vehicle, which exited the roadway and hit a utility pole.

	Date	Time	MP	Type	Severity	Weather	Surface	Direction
1	1/6/2013	8:45 AM	3.58	ROR/HFO-pillar	PDO	Other	Ice	NB
2	1/26/2013	5:35 PM	1.95	Head-on	Injury	Clear	Dry	SB/NB
3	4/25/2013	2:35 PM	0.28	Rear-end	PDO	Cloudy	Dry	NB/NB
4	5/29/2013	2:39 PM	2.07	Rear-end	PDO	Clear	Dry	NB/NB/NB
5	6/13/2013	6:40 PM	3.93	ROR/HFO-bridge	PDO	Rain	Wet	SB
6	6/18/2013	7:10 PM	?	ROR/HFO-Guardrail	Injury	Rain	Wet	SB
7	6/26/2013	6:30 PM	0	Sideswipe - Angle	PDO	Cloudy	Dry	NB
8	10/2/2013	9:12 PM	0.58	Hit Deer	PDO	Clear	Dry	SB
9	10/31/2013	4:27 PM	0.02	Sideswipe - same	PDO	Cloudy	Dry	NB/NB
10	11/16/2013	6:13 PM	4.06	Hit Deer	PDO	Cloudy	Dry	NB
11	11/22/2013	2:42 PM	2.01	Rear-end	PDO	Cloudy	Dry	NB/NB
12	11/23/2013	12:31 AM	?	ROR/HFO-utility Pole	Injury	Clear	Wet	NB
2013 Total Number of Crashes								12

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 twelve (12) crashes were reported in 2013, and the following trends were identified:

- Three (25 percent) of the twelve reported crashes resulted in personal injury.
- Nine (75 percent) of the twelve reported crashes resulted in property damage only.
- Four (33 percent) of the reported crashes were run-off-the-road type crashes.
- Three (25 percent) of the reported crashes were rear-end crashes.
- Two (17 percent) of the reported crashes were sideswipe crashes. One of the sideswipe crashes involved a motor vehicle traveling northbound on Choptank Drive at Ernest Drive. The second sideswipe crash was a sideswipe-same direction crash which involved northbound vehicles just south of Bethel Church Road.
- Two (17 percent) of the reported crashes involved motor vehicles and a deer.
- One (8 percent) of the reported crashes was head-on crash.

Crash Report Summary

Bunker Hill Road between
Choptank Road and US 301

3/31/2014

	Date	Time	MP	Type	Severity	Weather	Surface	Direction
1	3/25/2013	7:37 AM	2.23	Rear-end	PDO	Snow	Slush	WB/WB
2	3/25/2013	7:45 AM	2.23	Rear-end	PDO	Snow	Slush	WB/WB
3	6/23/2013	2:07 PM	0	Angle	PDO	Rain	Wet	SB/NB
4	8/7/2013	5:00 PM	2.54	Angle	Injury	Rain	Wet	EB/SB
5	12/23/2013	7:10 AM	1.76	Hit deer	PDO	Rain	Wet	EB
6	12/23/2013	7:45 PM	2.57	Sideswipe - same	PDO	Cloudy	Wet	WB/WB
2013 Total Number of Crashes								6

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 six (6) crashes were reported in 2013, and the following trends were identified:

- One (17 percent) of the reported crashes resulted in personal injury.
- Five (83 percent) of the reported crashes resulted in property-damage-only.
- Two (33 percent) of the crashes were angle crashes.
- Two (33 percent) of the crashes were rear-end crashes.
- One (17 percent) of the crashes was a sideswipe-same direction crash.
- One (17 percent) of the crashes involved a motor vehicle and a deer.

	Date	Time	MP	Type	Severity	Weather	Surface	Direction
1	1/2/2013	11:50 PM	5.09	Hit Deer	PDO	Clear	Dry	SB
2	1/11/2013	2:56 PM	5.4	hit by detached wheel	PDO	Cloudy	Dry	NB/SB
3	1/16/2013	4:04 PM	5.57	Rear-end	Injury	Cloudy	Wet	SB/SB
4	1/17/2013	6:28 PM	3.97	Rear-end	PDO	Clear	Dry	SB/SB
5	1/21/2013	8:00 PM	4.45	Rear-end	PDO	Snow	Wet	NB/NB
6	1/25/2013	6:16 PM	3.61	Rear-end	PDO	Snow	Snow	NB/NB
7	1/27/2013	8:20 PM	3.7	ROR/HFO-Embankment	Injury	Clear	Dry	SB
8	2/1/2013	4:16 AM	3.84	ROR/HFO-Guardrail	PDO	Cloudy	Dry	SB
9	2/7/2013	6:04 AM	6.81	Detached trailer/SS	PDO	Clear	Dry	SB/SB
10	2/7/2013	11:26 AM	3.08	Rear-end	PDO	Clear	Dry	NB/NB
11	2/17/2013	7:17 PM	0.76	Hit parked vehicle	Injury	Clear	Dry	NB/NB
12	2/27/2013	9:31 AM	5.05	Hit VMS sign	PDO	Rain	Wet	NB
13	3/4/2013	5:46 PM	3.53	hit by detached wheel	PDO	Clear	Dry	NB/SB
14	3/6/2013	12:00 AM	3.5	Hit Road Debris	PDO	Rain	Wet	NB/NB
15	3/25/2013	6:11 PM	1.9	Hit Deer	PDO	Rain	Wet	NB
16	3/29/2013	7:17 AM	3.91	Debris/Rear-end	PDO	Clear	Dry	NB/NB/NB
17	3/29/2013	11:41 AM	2.22	ROR/HFO-Guardrail	Injury	Clear	Dry	NB/NB
18	4/2/2013	4:38 AM	?	ROR/HFO-Barrier	Injury	Clear	Dry	SB
19	4/10/2013	12:54 PM	?	Sideswipe - same	PDO	Clear	Dry	SB/SB
20	4/13/2013	11:30 PM	5.47	Rear-end	PDO	Clear	Dry	NB/NB
21	4/15/2013	9:53 PM	5.38	ROR/overturn	Injury	Clear	Dry	SB
22	5/2/2013	1:57 PM	7.86	Hit Road Debris	PDO	Clear	Dry	SB
23	5/7/2013	1:40 AM	?	Rear-end	PDO	Fog	Wet	SB/SB
24	5/17/2013	8:07 AM	5.42	Hit Road Debris	PDO	Clear	Dry	NB
25	5/30/2013	5:17 PM	5.64	ROR/HFO-Guardrail	Injury	Clear	Dry	NB
26	6/10/2013	1:51 PM	0.69	HFO-Barrier	PDO	Rain	Wet	NB
27	6/16/2013	4:38 AM	3.32	Hit Deer	PDO	Clear	Dry	NB
28	6/18/2013	2:45 PM	3.69	HFO-Barrier / Rear-end	PDO	Rain	Wet	SB/SB
29	6/26/2013	4:45 PM	0.84	Rear-end	PDO	Clear	Dry	NB/NB
30	7/5/2013	6:05 PM	3.04	Sideswipe -same	Injury	Clear	Dry	NB/NB
31	7/12/2013	10:30 AM	0.6	Hit Road Debris	Injury	Rain	Wet	NB
32	7/12/2013	4:15 PM	3.89	Rear-end	PDO	Rain	Wet	SB/SB/SB
33	7/12/2013	10:39 AM	3.98	Rear-end	PDO	Cloudy	Dry	SB/SB

	Date	Time	MP	Type	Severity	Weather	Surface	Direction
34	8/13/2013	7:45 AM	?	ROR/HFO-Barrier	Injury	Rain	Wet	SB
35	8/17/2013	8:46 PM	4.01	Sideswipe - same	PDO	Clear	Dry	NB/NB
36	8/17/2013	6:40 PM	?	Vehicle fire	PDO	Clear	Dry	NB
37	8/22/2013	8:15 AM	3.82	Sideswipe - same	PDO	Clear	Dry	NB/NB
38	9/10/2013	6:23 AM	?	Detached trailer (car)	PDO	Clear	Dry	NB
39	10/6/2013	1:00 AM	?	Rear-end	PDO	Clear	Dry	NB/NB
40	10/10/2013	3:47 AM	3.84	Hit parked vehicle	Injury	Rain	Wet	NB/NB
41	10/10/2013	5:57 AM	3.64	Rear-end	Injury	Rain	Wet	NB/NB
42	10/16/2013	5:52 AM	5.98	Hit Deer	PDO	Clear	Dry	SB
43	10/17/2013	7:04 AM	?	ROR/Detached trailer	Injury	Cloudy	Dry	NB
44	10/18/2013	2:06 PM	5.37	Rear-end	PDO	Clear	Dry	NB/NB
45	10/21/2013	6:10 PM	7.94	Hit Road Debris	PDO	Clear	Dry	SB
46	10/21/2013	6:10 PM	7.95	Hit Road Debris	PDO	Clear	Dry	SB
47	10/23/2013	7:43 AM	4.58	Rear-end	PDO	Clear	Dry	NB/NB/NB
48	10/25/2013	8:55 PM	?	Hit by Road Debris	PDO	Clear	Dry	NB
49	10/25/2013	12:00 AM	4.06	Rear-end	Injury	Clear	Dry	NB/NB/NB
50	10/25/2013	6:32 AM	5.43	Rear-end	PDO	Clear	Dry	NB/NB
51	10/25/2013	9:25 AM	1.03	Sideswipe - H&R	PDO	Clear	Dry	NB/NB
52	10/29/2013	8:32 AM	4.9	Rear-end	PDO	Clear	Dry	NB/NB
53	10/30/2013	6:35 AM	3.63	Rear-end	PDO	Rain	Wet	NB x 5
54	10/30/2013	6:20 AM	5.13	Rear-end	PDO	Cloudy	Dry	NB/NB
55	10/31/2013	6:55 AM	4.79	Rear-end	PDO	Cloudy	Dry	NB/NB/NB
56	11/1/2013	6:20 AM	5.17	Rear-end	PDO	Cloudy	Dry	NB/NB
57	11/4/2013	5:36 PM	7.93	Rear-end	PDO	Clear	Dry	SB/SB
58	11/6/2013	5:24 AM	?	Hit dead deer	PDO	Clear	Dry	NB
59	11/6/2013	12:00 AM	1.04	Hit Deer	PDO	Cloudy	Dry	NB
60	11/28/2013	8:35 AM	3.77	Hit parked vehicle	PDO	Clear	Dry	NB/NB
61	11/29/2013	12:00 PM	1.12	Hit parked vehicle-H&R	PDO	Clear	Dry	NB/NB
62	12/5/2013	10:14 AM	1.48	Rear-end	PDO	Cloudy	Dry	NB/NB
63	12/5/2013	10:57 PM	5.06	Rear-end	PDO	Clear	Dry	SB/SB
64	12/5/2013	12:28 AM	4.51	ROR/HFO-Guardrail	Injury	Clear	Dry	NB
65	12/6/2013	11:03 PM	5.29	ROR/HFO-Embankment	PDO	Rain	Wet	SB
66	12/8/2013	11:20 AM	?	ROR/HFO-Barrier	Injury	Snow	Snow	NB

Crash Report Summary

SR 1 between Roth Bridge
and Tybouts Corner

3/31/2014

	Date	Time	MP	Type	Severity	Weather	Surface	Direction
67	12/9/2013	12:06 AM	7.93	HFO-Bridge median	PDO	Sleet	Ice	SB
68	12/11/2013	3:56 PM	?	Rear-end	PDO	Clear	Dry	SB/SB
69	12/23/2013	3:03 PM	1.96	hit by detached wheel	PDO	Rain	Wet	NB/NB
70	12/24/2013	4:09 AM	?	ROR/HFO-Guardrail	Injury	Clear	Dry	SB
71	12/30/2013	2:16 PM	5.68	ROR/HFO-Guardrail	Injury	Clear	Dry	SB
2013 Total Number of Crashes								71

HFO: Hit-fixed-object

ROR: Run-off the Road

PDO: Property Damage Only

SR1 between Roth Bridge and Tybouts Corner

A total of seventy-one (71) crashes were reported in 2013, and the following trends were identified:

- Eighteen (25 percent) of the reported crashes resulted in personal injury.
- Fifty-three (75 percent) of the reported crashes resulted in property-damage-only.
- Twenty-six (37 percent) of the reported crashes were rear-end crashes.
- Nineteen (27 percent) of the reported crashes were run-off-the-road / hit-fixed-object crashes.
- Seven (10 percent) of the reported crashes involved a motor vehicle and debris on the roadway.
- Six (9 percent) of the reported crashes involved a motor vehicle and a deer.
- Five (7 percent) of the reported crashes were sideswipe-same direction crashes.
- Three (4 percent) of the reported crashes involved a motor vehicle and a trailer that detached from the tow vehicle.
- Three (4 percent) of the reported crashes involved motor vehicles and a wheel that detached from a motor vehicle.
- One (1 percent) of the reported crashes involved a motor vehicle that ran-off-the roadway and overturned.
- One (1 percent) of the reported crashes was a motor vehicle fire.

	Date	Time	MP	Type	Severity	Weather	Surface	Direction
1	1/27/2013	1:23 PM	2.13	Rear-end	PDO	Clear	Dry	NB/NB/NB
2	5/8/2013	6:48 AM	2.15	Rear-end	PDO	Rain	Wet	NB/NB
3	5/8/2013	7:49 AM	2.15	Rear-end	PDO	Rain	Wet	NB/NB/NB
4	5/19/2013	11:00 PM	2.02	Hit Deer	PDO	Rain	Wet	SB
5	8/8/2013	10:28 AM	2.14	Rear-end	PDO	Cloudy	Dry	NB/NB
6	6/21/2013	4:08 PM	2.21	Sideswipe - same	PDO	Clear	Dry	SB/SB
2013 Total Number of Crashes								6

HFO: Hit-fixed-object

ROR: Run-off the Road

PDO: Property Damage Only

US 301 at Bethel Church Road

A total of six (6) crashes were reported in 2013, and the following trends were identified:

- All (100 percent) of the reported crashes resulted in property-damage-only.
- Four (66 percent) of the crashes were rear-end crashes.
- One (17 percent) of the crashes was a sideswipe-same direction crash.
- One (17 percent) of the crashes involved a motor vehicle and a deer.



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
1/30/2013	NB SR 1 near Christiana Mall Exit	Vehicle Crash within the Construction Zone	1 Hour	SR 273 / I-95

**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
3/8/2013	NB SR 1 work zone near I-95 Interchange	Construction equipment malfunction – NB SR 1 Closed	2 Hours	SR 273 / I-95
5/25/2013	SB I-95 s/o I-95 Ramps	Vehicle Rollover Crash – Ramp Closed	0.5 Hours	SR 273 / I-95
6/14/2013	NB SR 1 near I-95 Ramps	Unknown	1 Hour	SR 273 / I-95
6/29/2013	SB I-95 Ramp to SB SR 1	Vehicle crash – Maintenance of Traffic	1 Hour	SR 273 / I-95
10/15/2013	NB SR 1 n/o Biddles Plaza	Disabled Vehicle – Maintenance of Traffic	1 Hour	US 13 / SR 896
12/12/2013	SB SR 1 n/o SR 273	Vehicle Crash – Maintenance of Traffic	1 Hour	SR 273
Total			149 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 Rd/oad	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
3/17/2013	US 301 north of Armstrong Corner Road	Utility pole blocking travel lanes following a motor vehicle crash	4.0 Hours	Armstrong Corner Road / Choptank Road
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

Location: US 301 at SR 299
Date: 10/2/2013
County: New Castle
Counter: RJM

File Name : Existing US 301 at SR 299
Site Code : 00000004
Start Date : 10/2/2013
Page No : 2

Start Time	US 301 Southbound					US 301 Northbound					SR 299 Westbound					SR 299 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	20	106	16	0	142	13	110	23	0	146	76	41	18	0	135	11	38	9	0	58	481
07:00 AM	34	115	45	0	194	14	113	28	0	155	62	60	20	0	142	11	22	6	0	39	530
07:15 AM	29	110	21	0	160	10	99	32	0	141	84	60	24	0	168	22	50	10	0	82	551
07:30 AM	22	64	10	0	96	7	97	40	0	144	41	28	11	0	80	11	34	6	0	51	371
Total Volume	105	395	92	0	592	44	419	123	0	586	263	189	73	0	525	55	144	31	0	230	1933
% App. Total	17.7	66.7	15.5	0		7.5	71.5	21	0		50.1	36	13.9	0		23.9	62.6	13.5	0		
PHF	.772	.859	.511	.000	.763	.786	.927	.769	.000	.945	.783	.788	.760	.000	.781	.625	.720	.775	.000	.701	.877
Cars and Peds	98	359	92	0	549	40	326	113	0	479	236	170	64	0	470	55	142	31	0	228	1726
% Cars and Peds	93.3	90.9	100	0	92.7	90.9	77.8	91.9	0	81.7	89.7	89.9	87.7	0	89.5	100	98.6	100	0	99.1	89.3
U-Turns and Bikes	5	0	0	0	5	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	6
% U-Turns and Bikes	4.8	0	0	0	0.8	0	0	0	0	0	0.4	0	0	0	0.2	0	0	0	0	0	0.3
Trucks	2	36	0	0	38	4	93	10	0	107	26	19	9	0	54	0	2	0	0	2	201
% Trucks	1.9	9.1	0	0	6.4	9.1	22.2	8.1	0	18.3	9.9	10.1	12.3	0	10.3	0	1.4	0	0	0.9	10.4

Rummel, Klepper & Kahl, LLP

Consulting Engineers
81 W Mosher St
Baltimore MD 21217

Location: US 301 at SR 299
Date: 10/2/2013
County: New Castle
Counter: RJM

File Name : Existing US 301 at SR 299
Site Code : 00000004
Start Date : 10/2/2013
Page No : 3

Start Time	US 301 Southbound					US 301 Northbound					SR 299 Westbound					SR 299 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 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	40	141	14	0	195	13	148	67	0	228	83	42	33	0	158	20	63	12	0	95	676
05:15 PM	44	132	7	0	183	18	121	57	0	196	94	48	29	0	171	26	62	15	0	103	653
05:30 PM	36	151	6	0	193	5	175	85	0	265	86	37	26	1	150	30	64	7	0	101	709
05:45 PM	43	121	10	0	174	12	147	62	0	221	106	49	20	0	175	16	49	16	0	81	651
Total Volume	163	545	37	0	745	48	591	271	0	910	369	176	108	1	654	92	238	50	0	380	2689
% App. Total	21.9	73.2	5	0		5.3	64.9	29.8	0		56.4	26.9	16.5	0.2		24.2	62.6	13.2	0		
PHF	.926	.902	.661	.000	.955	.667	.844	.797	.000	.858	.870	.898	.818	.250	.934	.767	.930	.781	.000	.922	.948
Cars and Peds	141	482	37	0	660	44	508	251	0	803	358	170	106	0	634	92	238	48	0	378	2475
% Cars and Peds	86.5	88.4	100	0	88.6	91.7	86.0	92.6	0	88.2	97.0	96.6	98.1	0	96.9	100	100	96.0	0	99.5	92.0
U-Turns and Bikes	20	0	0	0	20	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	21
% U-Turns and Bikes	12.3	0	0	0	2.7	0	0	0	0	0	0	0	0	100	0.2	0	0	0	0	0	0.8
Trucks	2	63	0	0	65	4	83	20	0	107	11	6	2	0	19	0	0	2	0	2	193
% Trucks	1.2	11.6	0	0	8.7	8.3	14.0	7.4	0	11.8	3.0	3.4	1.9	0	2.9	0	0	4.0	0	0.5	7.2

Rummel, Klepper & Kahl, LLP

Consulting Engineers
81 W Mosher St
Baltimore MD 21217

Location: US 301 at Armstrong Corner Road
Date: 10/2/2013
County: New Castle
Counter: RJM

File Name : Existing US 301 at Armstrong Corner Road
Site Code : 00000388
Start Date : 10/2/2013
Page No : 2

Start Time	US 301 Southbound					US 301 Northbound					Armstrong Corner Road Westbound					Armstrong Corner Road 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	12	177	3	0	192	11	186	10	0	207	15	8	23	0	46	3	7	6	0	16	461
07:00 AM	15	183	3	0	201	9	205	8	0	222	17	10	36	0	63	0	6	11	0	17	503
07:15 AM	16	150	1	0	167	5	212	17	0	234	17	8	38	0	63	2	14	9	0	25	489
07:30 AM	23	134	1	0	158	6	197	12	0	215	17	9	31	0	57	3	25	5	0	33	463
Total Volume	66	644	8	0	718	31	800	47	0	878	66	35	128	0	229	8	52	31	0	91	1916
% App. Total	9.2	89.7	1.1	0		3.5	91.1	5.4	0		28.8	15.3	55.9	0		8.8	57.1	34.1	0		
PHF	.717	.880	.667	.000	.893	.705	.943	.691	.000	.938	.971	.875	.842	.000	.909	.667	.520	.705	.000	.689	.952
Cars and Peds	60	535	5	0	600	23	682	44	0	749	58	32	119	0	209	7	49	27	0	83	1641
% Cars and Peds	90.9	83.1	62.5	0	83.6	74.2	85.3	93.6	0	85.3	87.9	91.4	93.0	0	91.3	87.5	94.2	87.1	0	91.2	85.6
U-Turns and Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% U-Turns and Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trucks	6	109	3	0	118	8	118	3	0	129	8	3	9	0	20	1	3	4	0	8	275
% Trucks	9.1	16.9	37.5	0	16.4	25.8	14.8	6.4	0	14.7	12.1	8.6	7.0	0	8.7	12.5	5.8	12.9	0	8.8	14.4

Rummel, Klepper & Kahl, LLP

Consulting Engineers
81 W Mosher St
Baltimore MD 21217

Location: US 301 at Armstrong Corner Road
Date: 10/2/2013
County: New Castle
Counter: RJM

File Name : Existing US 301 at Armstrong Corner Road
Site Code : 00000388
Start Date : 10/2/2013
Page No : 3

Start Time	US 301 Southbound					US 301 Northbound					Armstrong Corner Road Westbound					Armstrong Corner Road 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 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	30	242	4	0	276	11	156	20	0	187	11	16	27	0	54	1	14	13	0	28	545
05:15 PM	28	209	3	0	240	19	182	19	0	220	20	10	14	1	45	1	14	9	0	24	529
05:30 PM	25	225	3	0	253	10	150	12	0	172	25	10	20	1	56	1	18	10	2	31	512
05:45 PM	33	232	1	0	266	14	185	18	0	217	23	19	15	0	57	2	13	9	0	24	564
Total Volume	116	908	11	0	1035	54	673	69	0	796	79	55	76	2	212	5	59	41	2	107	2150
% App. Total	11.2	87.7	1.1	0		6.8	84.5	8.7	0		37.3	25.9	35.8	0.9		4.7	55.1	38.3	1.9		
PHF	.879	.938	.688	.000	.938	.711	.909	.863	.000	.905	.790	.724	.704	.500	.930	.625	.819	.788	.250	.863	.953
Cars and Peds	116	812	10	0	938	49	569	62	0	680	72	50	72	2	196	5	56	41	1	103	1917
% Cars and Peds	100	89.4	90.9	0	90.6	90.7	84.5	89.9	0	85.4	91.1	90.9	94.7	100	92.5	100	94.9	100	50.0	96.3	89.2
U-Turns and Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
% U-Turns and Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50.0	0.9	0.0
Trucks	0	96	1	0	97	5	104	7	0	116	7	5	4	0	16	0	3	0	0	3	232
% Trucks	0	10.6	9.1	0	9.4	9.3	15.5	10.1	0	14.6	8.9	9.1	5.3	0	7.5	0	5.1	0	0	2.8	10.8

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81 W Mosher St
Baltimore MD 21217

Location: US 301 at SR 896 (Boyd's Corner Road)
Date: 10/1/2013
County: New Castle
Counter: RJM

File Name : US 301 at SR 896 (Boyd's Corner Road)
Site Code : 00001030
Start Date : 10/1/2013
Page No : 2

Start Time	US 301 Southbound					US 301 Northbound					SR 896 Westbound					SR 896 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	41	143	8	0	192	3	179	40	0	222	53	7	54	4	118	16	26	2	0	44	576
07:00 AM	58	153	9	0	220	2	186	35	0	223	44	12	79	0	135	15	41	4	0	60	638
07:15 AM	52	105	3	0	160	1	201	57	0	259	30	17	113	0	160	16	31	6	0	53	632
07:30 AM	41	145	3	0	189	1	186	51	0	238	36	4	66	0	106	9	24	6	0	39	572
Total Volume	192	546	23	0	761	7	752	183	0	942	163	40	312	4	519	56	122	18	0	196	2418
% App. Total	25.2	71.7	3	0		0.7	79.8	19.4	0		31.4	7.7	60.1	0.8		28.6	62.2	9.2	0		
PHF	.828	.892	.639	.000	.865	.583	.935	.803	.000	.909	.769	.588	.690	.250	.811	.875	.744	.750	.000	.817	.947
Cars and Peds	167	510	19	0	696	4	709	143	0	856	129	39	302	4	474	55	118	16	0	189	2215
% Cars and Peds	87.0	93.4	82.6	0	91.5	57.1	94.3	78.1	0	90.9	79.1	97.5	96.8	100	91.3	98.2	96.7	88.9	0	96.4	91.6
U-Turns and Bikes	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1
% U-Turns and Bikes	0	0	0	0	0	0	0	0	0	0	0.6	0	0	0	0.2	0	0	0	0	0	0.0
Trucks	25	36	4	0	65	3	43	40	0	86	33	1	10	0	44	1	4	2	0	7	202
% Trucks	13.0	6.6	17.4	0	8.5	42.9	5.7	21.9	0	9.1	20.2	2.5	3.2	0	8.5	1.8	3.3	11.1	0	3.6	8.4

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Location: US 301 at SR 896 (Boyd's Corner Road)
Date: 10/1/2013
County: New Castle
Counter: RJM

File Name : US 301 at SR 896 (Boyd's Corner Road)
Site Code : 00001030
Start Date : 10/1/2013
Page No : 3

Start Time	US 301 Southbound					US 301 Northbound					SR 896 Westbound					SR 896 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 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	77	214	15	0	306	2	150	36	0	188	60	31	50	0	141	10	10	0	0	20	655
05:15 PM	94	216	24	0	334	5	158	33	0	196	62	30	53	0	145	16	13	6	0	35	710
05:30 PM	80	234	17	0	331	3	131	27	0	161	70	36	45	0	151	6	16	7	0	29	672
05:45 PM	74	202	14	0	290	6	147	32	0	185	53	26	56	0	135	15	4	9	1	29	639
Total Volume	325	866	70	0	1261	16	586	128	0	730	245	123	204	0	572	47	43	22	1	113	2676
% App. Total	25.8	68.7	5.6	0		2.2	80.3	17.5	0		42.8	21.5	35.7	0		41.6	38.1	19.5	0.9		
PHF	.864	.925	.729	.000	.944	.667	.927	.889	.000	.931	.875	.854	.911	.000	.947	.734	.672	.611	.250	.807	.942
Cars and Peds	316	832	70	0	1218	16	555	102	0	673	198	119	194	0	511	46	41	22	1	110	2512
% Cars and Peds	97.2	96.1	100	0	96.6	100	94.7	79.7	0	92.2	80.8	96.7	95.1	0	89.3	97.9	95.3	100	100	97.3	93.9
U-Turns and Bikes	0	0	0	0	0	0	0	0	0	0	5	0	0	0	5	0	0	0	0	0	5
% U-Turns and Bikes	0	0	0	0	0	0	0	0	0	0	2.0	0	0	0	0.9	0	0	0	0	0	0.2
Trucks	9	34	0	0	43	0	31	26	0	57	42	4	10	0	56	1	2	0	0	3	159
% Trucks	2.8	3.9	0	0	3.4	0	5.3	20.3	0	7.8	17.1	3.3	4.9	0	9.8	2.1	4.7	0	0	2.7	5.9

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Baltimore MD 21217

Location: US 301 at Old Summit Bridge Road
Date: 10/1/2013
County: New Castle
Counter: RJM

File Name : US 301 at Old Summit Bridge Road
Site Code : 00000002
Start Date : 10/1/2013
Page No : 2

Start Time	US 301 Southbound					US 301 Northbound					Old Summit Bridge Road Westbound					Old Summit Bridge Road 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	6	203	0	0	209	0	216	8	0	224	22	0	1	0	23	0	0	0	0	0	456
07:00 AM	8	207	0	0	215	0	302	6	0	308	19	0	7	0	26	0	0	0	0	0	549
07:15 AM	18	158	0	0	176	1	288	12	0	301	7	0	4	0	11	0	0	0	0	0	488
07:30 AM	16	177	0	0	193	0	254	5	0	259	11	0	5	0	16	0	0	0	0	0	468
Total Volume	48	745	0	0	793	1	1060	31	0	1092	59	0	17	0	76	0	0	0	0	0	1961
% App. Total	6.1	93.9	0	0		0.1	97.1	2.8	0		77.6	0	22.4	0		0	0	0	0		
PHF	.667	.900	.000	.000	.922	.250	.877	.646	.000	.886	.670	.000	.607	.000	.731	.000	.000	.000	.000	.000	.893
Cars and Peds	44	667	0	0	711	0	1030	31	0	1061	56	0	15	0	71	0	0	0	0	0	1843
% Cars and Peds	91.7	89.5	0	0	89.7	0	97.2	100	0	97.2	94.9	0	88.2	0	93.4	0	0	0	0	0	94.0
U-Turns and Bikes	1	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
% U-Turns and Bikes	2.1	0	0	0	0.1	100	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0.1
Trucks	3	78	0	0	81	0	30	0	0	30	3	0	2	0	5	0	0	0	0	0	116
% Trucks	6.3	10.5	0	0	10.2	0	2.8	0	0	2.7	5.1	0	11.8	0	6.6	0	0	0	0	0	5.9

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Baltimore MD 21217

Location: US 301 at Old Summit Bridge Road
Date: 10/1/2013
County: New Castle
Counter: RJM

File Name : US 301 at Old Summit Bridge Road
Site Code : 00000002
Start Date : 10/1/2013
Page No : 3

Start Time	US 301 Southbound					US 301 Northbound					Old Summit Bridge Road Westbound					Old Summit Bridge Road 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 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	11	280	0	0	291	0	192	13	0	205	15	0	2	0	17	0	0	0	0	0	513
05:15 PM	16	322	0	0	338	0	185	15	0	200	14	0	5	0	19	0	0	0	0	0	557
05:30 PM	17	290	0	0	307	0	199	17	0	216	17	0	8	0	25	0	0	0	0	0	548
05:45 PM	16	301	0	0	317	0	188	15	0	203	16	0	8	0	24	0	0	0	0	0	544
Total Volume	60	1193	0	0	1253	0	764	60	0	824	62	0	23	0	85	0	0	0	0	0	2162
% App. Total	4.8	95.2	0	0		0	92.7	7.3	0		72.9	0	27.1	0		0	0	0	0		
PHF	.882	.926	.000	.000	.927	.000	.960	.882	.000	.954	.912	.000	.719	.000	.850	.000	.000	.000	.000	.000	.970
Cars and Peds	60	1144	0	0	1204	0	724	59	0	783	62	0	22	0	84	0	0	0	0	0	2071
% Cars and Peds	100	95.9	0	0	96.1	0	94.8	98.3	0	95.0	100	0	95.7	0	98.8	0	0	0	0	0	95.8
U-Turns and Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% U-Turns and Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trucks	0	49	0	0	49	0	40	1	0	41	0	0	1	0	1	0	0	0	0	0	91
% Trucks	0	4.1	0	0	3.9	0	5.2	1.7	0	5.0	0	0	4.3	0	1.2	0	0	0	0	0	4.2

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Location: US 301 at SR 71 (Broad Street)
Date: 10/2/2013
County: New Castle
Counter: RJM

File Name : Existing US 301 at SR 71 (Broad Street)
Site Code : 00000004
Start Date : 10/2/2013
Page No : 2

Start Time	US 301 Southbound					US 301 Northbound					SR 71 Westbound					SR 71 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	70	155	0	0	225	0	132	33	0	165	26	0	78	0	104	0	0	0	0	0	494
07:00 AM	39	179	0	0	218	0	166	28	0	194	44	0	90	0	134	0	0	0	0	0	546
07:15 AM	38	145	0	0	183	0	156	38	0	194	35	0	90	0	125	0	0	0	0	0	502
07:30 AM	43	108	0	0	151	0	141	43	0	184	26	0	87	0	113	0	0	0	0	0	448
Total Volume	190	587	0	0	777	0	595	142	0	737	131	0	345	0	476	0	0	0	0	0	1990
% App. Total	24.5	75.5	0	0		0	80.7	19.3	0		27.5	0	72.5	0		0	0	0	0		
PHF	.679	.820	.000	.000	.863	.000	.896	.826	.000	.950	.744	.000	.958	.000	.888	.000	.000	.000	.000	.000	.911
Cars and Peds	168	492	0	0	660	0	508	137	0	645	129	0	333	0	462	0	0	0	0	0	1767
% Cars and Peds	88.4	83.8	0	0	84.9	0	85.4	96.5	0	87.5	98.5	0	96.5	0	97.1	0	0	0	0	0	88.8
U-Turns and Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% U-Turns and Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trucks	22	95	0	0	117	0	87	5	0	92	2	0	12	0	14	0	0	0	0	0	223
% Trucks	11.6	16.2	0	0	15.1	0	14.6	3.5	0	12.5	1.5	0	3.5	0	2.9	0	0	0	0	0	11.2

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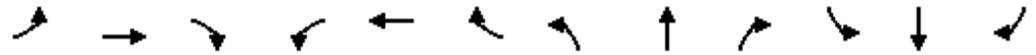
Location: US 301 at SR 71 (Broad Street)
Date: 10/2/2013
County: New Castle
Counter: RJM

File Name : Existing US 301 at SR 71 (Broad Street)
Site Code : 00000004
Start Date : 10/2/2013
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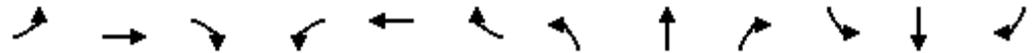
Start Time	US 301 Southbound					US 301 Northbound					SR 71 Westbound					SR 71 Eastbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	85	193	0	0	278	0	145	57	0	202	61	0	63	0	124	0	0	0	0	0	604
05:15 PM	93	194	0	0	287	0	132	61	0	193	51	0	66	0	117	0	0	0	0	0	597
05:30 PM	89	212	0	0	301	0	137	58	0	195	53	0	66	2	121	0	0	0	0	0	617
05:45 PM	82	203	0	0	285	0	152	68	0	220	66	0	64	0	130	0	0	0	0	0	635
Total Volume	349	802	0	0	1151	0	566	244	0	810	231	0	259	2	492	0	0	0	0	0	2453
% App. Total	30.3	69.7	0	0		0	69.9	30.1	0		47	0	52.6	0.4		0	0	0	0		
PHF	.938	.946	.000	.000	.956	.000	.931	.897	.000	.920	.875	.000	.981	.250	.946	.000	.000	.000	.000	.000	.966
Cars and Peds	340	708	0	0	1048	0	494	238	0	732	230	0	255	0	485	0	0	0	0	0	2265
% Cars and Peds	97.4	88.3	0	0	91.1	0	87.3	97.5	0	90.4	99.6	0	98.5	0	98.6	0	0	0	0	0	92.3
U-Turns and Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	2
% U-Turns and Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0.4	0	0	0	0	0	0.1
Trucks	9	94	0	0	103	0	72	6	0	78	1	0	4	0	5	0	0	0	0	0	186
% Trucks	2.6	11.7	0	0	8.9	0	12.7	2.5	0	9.6	0.4	0	1.5	0	1.0	0	0	0	0	0	7.6

US 301 SMR 2013 AM
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)	55	144	31	263	189	73	44	419	123	105	395	92
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
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3502	3574	1615	3183	3282	1442	1656	2959	1495	1770	3312	1615
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3502	3574	1615	3183	3282	1442	1656	2959	1495	1770	3312	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			138			138			131			121
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	0.70	0.70	0.70	0.78	0.78	0.78	0.95	0.95	0.95	0.76	0.76	0.76
Heavy Vehicles (%)	0%	1%	0%	10%	10%	12%	9%	22%	8%	2%	9%	0%
Adj. Flow (vph)	79	206	44	337	242	94	46	441	129	138	520	121
Shared Lane Traffic (%)												
Lane Group Flow (vph)	79	206	44	337	242	94	46	441	129	138	520	121
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



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)	8.8	15.2	15.2	21.2	27.6	15.2	9.5	73.7	73.7	16.9	83.2	83.2
Actuated g/C Ratio	0.06	0.10	0.10	0.14	0.18	0.10	0.06	0.49	0.49	0.11	0.55	0.55
v/c Ratio	0.39	0.57	0.15	0.75	0.40	0.35	0.44	0.30	0.16	0.69	0.28	0.13
Control Delay	73.0	70.0	1.1	72.3	55.0	5.6	79.8	25.6	4.6	78.1	17.5	4.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	73.0	70.0	1.1	72.3	55.0	5.6	79.8	25.6	4.6	78.1	17.5	4.1
LOS	E	E	A	E	D	A	E	C	A	E	B	A
Approach Delay		61.5			56.8			25.2			26.1	
Approach LOS		E			E			C			C	

Intersection Summary

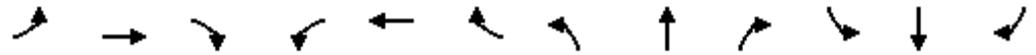
Area Type:	Other
Cycle Length:	150
Actuated Cycle Length:	150
Offset:	76 (51%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle:	60
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.75
Intersection Signal Delay:	39.4
Intersection LOS:	D
Intersection Capacity Utilization:	50.0%
ICU Level of Service:	A
Analysis Period (min):	15

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



US 301 SMR 2013 AM
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)	8	52	31	66	35	128	31	800	47	66	644	8
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		0.954			0.924				0.850			0.850
Flt Protected		0.995			0.986		0.950			0.950		
Satd. Flow (prot)	0	1654	0	0	1592	0	1433	1652	1524	1656	1624	1170
Flt Permitted		0.948			0.773		0.295			0.159		
Satd. Flow (perm)	0	1576	0	0	1248	0	445	1652	1524	277	1624	1170
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		16			39				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	0.69	0.69	0.69	0.91	0.91	0.91	0.94	0.94	0.94	0.89	0.89	0.89
Heavy Vehicles (%)	13%	6%	13%	12%	9%	7%	26%	15%	6%	9%	17%	38%
Adj. Flow (vph)	12	75	45	73	38	141	33	851	50	74	724	9
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	132	0	0	252	0	33	851	50	74	724	9
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



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)		29.3		29.3	29.3		98.7	90.1	90.1	107.1	100.3	100.3
Actuated g/C Ratio		0.20		0.20	0.20		0.66	0.60	0.60	0.71	0.67	0.67
v/c Ratio		0.41		0.92	0.92		0.10	0.86	0.05	0.25	0.67	0.01
Control Delay		49.0		85.7	85.7		3.4	19.5	0.1	10.2	20.7	0.0
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		49.0		85.7	85.7		3.4	19.5	0.1	10.2	20.7	0.0
LOS		D		F	F		A	B	A	B	C	A
Approach Delay		49.0		85.7	85.7			17.9			19.5	
Approach LOS		D		F	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: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.92
 Intersection Signal Delay: 28.5
 Intersection LOS: C
 Intersection Capacity Utilization 82.4%
 ICU Level of Service E
 Analysis Period (min) 15

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



US 301 SMR 2013 AM
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)	56	122	18	163	40	312	7	752	183	192	546	23
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		0.981				0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1792	0	2918	1845	1568	1262	3406	1324	3099	3374	1380
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	1792	0	2918	1845	1568	1262	3406	1324	3099	3374	1380
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4				385			201			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	0.82	0.82	0.82	0.81	0.81	0.81	0.91	0.91	0.91	0.87	0.87	0.87
Heavy Vehicles (%)	2%	3%	11%	20%	3%	3%	43%	6%	22%	13%	7%	17%
Adj. Flow (vph)	68	149	22	201	49	385	8	826	201	221	628	26
Shared Lane Traffic (%)												
Lane Group Flow (vph)	68	171	0	201	49	385	8	826	201	221	628	26
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

US 301 SMR 2013 AM
 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)	59	17	1	1060	31	48	745
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
Frt		0.850			0.850		
Flt Protected	0.950		0.950			0.950	
Satd. Flow (prot)	1719	1298	1805	3505	1615	1703	3252
Flt Permitted	0.950		0.346			0.188	
Satd. Flow (perm)	1719	1298	657	3505	1615	337	3252
Right Turn on Red		Yes			Yes		
Satd. Flow (RTOR)		23			35		
Link Speed (mph)	35			55			55
Link Distance (ft)	277			1231			2058
Travel Time (s)	5.4			15.3			25.5
Peak Hour Factor	0.73	0.73	0.89	0.89	0.89	0.92	0.92
Heavy Vehicles (%)	5%	12%	0%	3%	0%	6%	11%
Parking (#/hr)		0					
Adj. Flow (vph)	81	23	1	1191	35	52	810
Shared Lane Traffic (%)							
Lane Group Flow (vph)	81	23	1	1191	35	52	810
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	Prot	Perm	pm+pt	NA	Perm	pm+pt	NA
Protected Phases	4		1	6		5	2



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)	6.9	6.9	56.1	52.2	52.2	58.8	56.9
Actuated g/C Ratio	0.09	0.09	0.75	0.70	0.70	0.78	0.76
v/c Ratio	0.51	0.16	0.00	0.49	0.03	0.14	0.33
Control Delay	44.6	16.6	3.0	6.4	2.5	3.1	4.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.6	16.6	3.0	6.4	2.5	3.1	4.9
LOS	D	B	A	A	A	A	A
Approach Delay	38.4			6.3			4.8
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: 50
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.51
 Intersection Signal Delay: 7.2
 Intersection LOS: A
 Intersection Capacity Utilization 51.0%
 ICU Level of Service A
 Analysis Period (min) 15

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



						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	131	345	595	142	190	587
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
Flt		0.850		0.850		
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1770	1553	1652	1553	1612	1638
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1770	1553	1652	1553	1612	1638
Right Turn on Red		Yes		No		
Satd. Flow (RTOR)		388				
Link Speed (mph)	35		45			50
Link Distance (ft)	1186		916			549
Travel Time (s)	23.1		13.9			7.5
Peak Hour Factor	0.89	0.89	0.95	0.95	0.86	0.86
Heavy Vehicles (%)	2%	4%	15%	4%	12%	16%
Adj. Flow (vph)	147	388	626	149	221	683
Shared Lane Traffic (%)						
Lane Group Flow (vph)	147	388	626	149	221	683
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	Perm	Free	NA	Prot	Prot	NA
Protected Phases			6	6	5	2
Permitted Phases	7	Free				

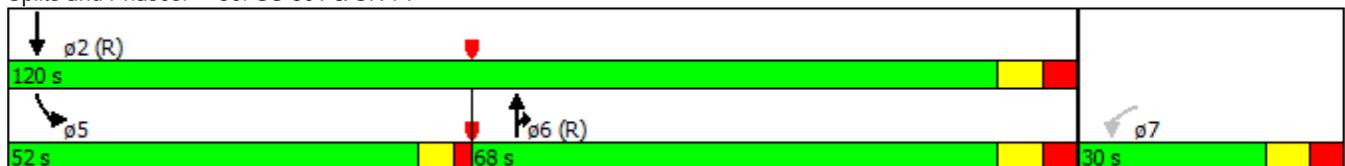


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Detector Phase	7		6	6	5	2
Switch Phase						
Minimum Initial (s)	6.0		15.0	15.0	8.0	15.0
Minimum Split (s)	16.0		30.0	30.0	15.0	30.0
Total Split (s)	30.0		68.0	68.0	52.0	120.0
Total Split (%)	20.0%		45.3%	45.3%	34.7%	80.0%
Maximum Green (s)	21.0		59.0	59.0	46.0	111.0
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)	17.8	150.0	81.3	81.3	27.0	114.2
Actuated g/C Ratio	0.12	1.00	0.54	0.54	0.18	0.76
v/c Ratio	0.70	0.25	0.70	0.18	0.76	0.55
Control Delay	81.1	0.4	24.4	10.3	87.9	6.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	81.1	0.4	24.4	10.3	87.9	6.6
LOS	F	A	C	B	F	A
Approach Delay	22.6		21.7			26.4
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: 80
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.76
 Intersection Signal Delay: 23.8
 Intersection LOS: C
 Intersection Capacity Utilization 69.1%
 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

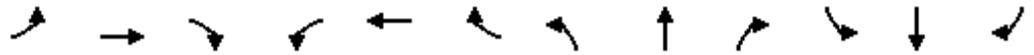
NEMA Compliant Phasing
Timing Plan: ACTRA - PM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	92	238	50	369	176	108	48	591	271	163	545	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)	3502	3610	1553	3400	3505	1583	1671	3167	1509	1787	3223	1615
Fl _t Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3502	3610	1553	3400	3505	1583	1671	3167	1509	1787	3223	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			138			138			315			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	0.92	0.92	0.92	0.93	0.93	0.93	0.86	0.86	0.86	0.95	0.95	0.95
Heavy Vehicles (%)	0%	0%	4%	3%	3%	2%	8%	14%	7%	1%	12%	0%
Adj. Flow (vph)	100	259	54	397	189	116	56	687	315	172	574	39
Shared Lane Traffic (%)												
Lane Group Flow (vph)	100	259	54	397	189	116	56	687	315	172	574	39
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/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)	9.7	18.0	18.0	22.8	31.1	18.0	10.4	66.7	66.7	19.5	78.1	78.1
Actuated g/C Ratio	0.06	0.12	0.12	0.15	0.21	0.12	0.07	0.44	0.44	0.13	0.52	0.52
v/c Ratio	0.44	0.60	0.18	0.77	0.26	0.37	0.49	0.49	0.37	0.74	0.34	0.04
Control Delay	73.3	68.1	1.2	71.2	49.6	8.4	80.5	33.0	4.5	79.1	19.7	0.6
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	73.3	68.1	1.2	71.2	49.6	8.4	80.5	33.0	4.5	79.1	19.7	0.6
LOS	E	E	A	E	D	A	F	C	A	E	B	A
Approach Delay		60.6			55.0			27.1			31.8	
Approach LOS		E			E			C			C	

Intersection Summary

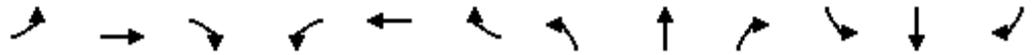
Area Type:	Other
Cycle Length:	150
Actuated Cycle Length:	150
Offset:	62 (41%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle:	60
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.77
Intersection Signal Delay:	39.6
Intersection LOS:	D
Intersection Capacity Utilization	61.6%
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

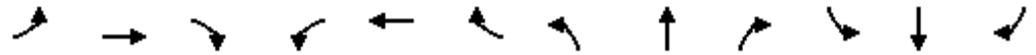
NEMA Compliant Phasing
Timing Plan: ACTRA - PM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↑	↕	↕	↑	↕
Volume (vph)	5	59	41	79	55	76	54	673	69	116	908	11
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		0.947			0.951				0.850			0.850
Flt Protected		0.998			0.982		0.950			0.950		
Satd. Flow (prot)	0	1747	0	0	1650	0	1656	1638	1468	1805	1712	1482
Flt Permitted		0.985			0.738		0.148			0.217		
Satd. Flow (perm)	0	1724	0	0	1240	0	258	1638	1468	412	1712	1482
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		20			18				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	0.86	0.86	0.86	0.93	0.93	0.93	0.91	0.91	0.91	0.94	0.94	0.94
Heavy Vehicles (%)	0%	5%	0%	9%	9%	5%	9%	16%	10%	0%	11%	9%
Adj. Flow (vph)	6	69	48	85	59	82	59	740	76	123	966	12
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	123	0	0	226	0	59	740	76	123	966	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)		28.6		28.6	28.6		99.2	89.7	89.7	107.7	97.9	97.9
Actuated g/C Ratio		0.19		0.19	0.19		0.66	0.60	0.60	0.72	0.65	0.65
v/c Ratio		0.36		0.90	0.90		0.24	0.76	0.08	0.30	0.86	0.01
Control Delay		45.5		89.8	89.8		3.9	10.3	0.1	8.5	29.1	0.0
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		45.5		89.8	89.8		3.9	10.3	0.1	8.5	29.1	0.0
LOS		D		F	F		A	B	A	A	C	A
Approach Delay		45.5		89.8	89.8		9.0				26.4	
Approach LOS		D		F	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: 0.90
 Intersection Signal Delay: 27.0
 Intersection LOS: C
 Intersection Capacity Utilization 85.5%
 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

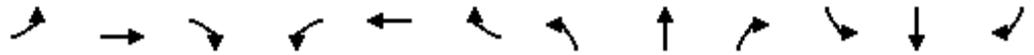
NEMA Compliant Phasing
Timing Plan: ACTRA - PM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	47	43	22	245	123	204	16	586	128	325	866	70
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		0.949				0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1745	0	2993	1845	1538	1805	3438	1346	3400	3471	1615
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	1745	0	2993	1845	1538	1805	3438	1346	3400	3471	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		15				215			138			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	0.81	0.81	0.81	0.95	0.95	0.95	0.93	0.93	0.93	0.94	0.94	0.94
Heavy Vehicles (%)	2%	5%	0%	17%	3%	5%	0%	5%	20%	3%	4%	0%
Adj. Flow (vph)	58	53	27	258	129	215	17	630	138	346	921	74
Shared Lane Traffic (%)												
Lane Group Flow (vph)	58	80	0	258	129	215	17	630	138	346	921	74
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)	12.0	12.0		21.4	21.4	21.4	8.0	69.3	69.3	21.3	90.5	90.5
Actuated g/C Ratio	0.08	0.08		0.14	0.14	0.14	0.05	0.46	0.46	0.14	0.60	0.60
v/c Ratio	0.41	0.52		0.61	0.49	0.53	0.18	0.40	0.20	0.72	0.44	0.07
Control Delay	73.2	65.1		65.8	64.6	11.4	97.4	11.5	1.8	65.6	17.5	1.8
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	73.2	65.1		65.8	64.6	11.4	97.4	11.5	1.8	65.6	17.5	1.8
LOS	E	E		E	E	B	F	B	A	E	B	A
Approach Delay		68.5			46.1			11.7			29.0	
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: 29.8
 Intersection LOS: C
 Intersection Capacity Utilization 62.3%
 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)	62	23	0	764	60	60	1193
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	1553	1900	3438	1583	1805	3471
Flt Permitted	0.950					0.302	
Satd. Flow (perm)	1805	1553	1900	3438	1583	574	3471
Right Turn on Red		Yes			Yes		
Satd. Flow (RTOR)		27			63		
Link Speed (mph)	35			55			55
Link Distance (ft)	277			1227			2058
Travel Time (s)	5.4			15.2			25.5
Peak Hour Factor	0.85	0.85	0.95	0.95	0.95	0.93	0.93
Heavy Vehicles (%)	0%	4%	0%	5%	2%	0%	4%
Adj. Flow (vph)	73	27	0	804	63	65	1283
Shared Lane Traffic (%)							
Lane Group Flow (vph)	73	27	0	804	63	65	1283
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	Prot	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
30: US 301 & SR 71

NEMA Compliant Phasing
Timing Plan: ACTRA - PM

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	231	259	566	244	349	802
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	1583	1681	1568	1752	1696
Fl _t Permitted	0.950				0.950	
Satd. Flow (perm)	1805	1583	1681	1568	1752	1696
Right Turn on Red		Yes		No		
Satd. Flow (RTOR)		273				
Link Speed (mph)	35		45			50
Link Distance (ft)	1186		916			549
Travel Time (s)	23.1		13.9			7.5
Peak Hour Factor	0.95	0.95	0.92	0.92	0.96	0.96
Heavy Vehicles (%)	0%	2%	13%	3%	3%	12%
Adj. Flow (vph)	243	273	615	265	364	835
Shared Lane Traffic (%)						
Lane Group Flow (vph)	243	273	615	265	364	835
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	Perm	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

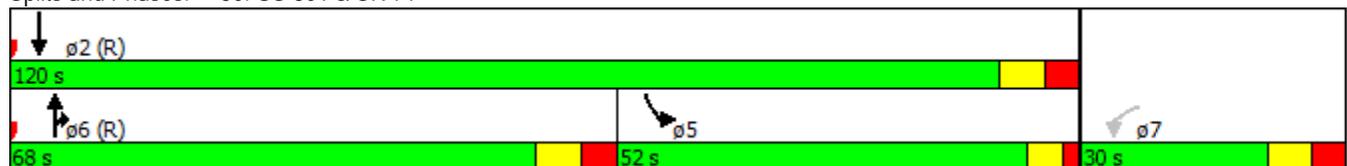


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Detector Phase	7		6	6	5	2
Switch Phase						
Minimum Initial (s)	6.0		15.0	15.0	8.0	15.0
Minimum Split (s)	16.0		30.0	30.0	15.0	30.0
Total Split (s)	30.0		68.0	68.0	52.0	120.0
Total Split (%)	20.0%		45.3%	45.3%	34.7%	80.0%
Maximum Green (s)	21.0		59.0	59.0	46.0	111.0
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)	25.3	150.0	63.6	63.6	37.1	106.7
Actuated g/C Ratio	0.17	1.00	0.42	0.42	0.25	0.71
v/c Ratio	0.80	0.17	0.86	0.40	0.84	0.69
Control Delay	79.0	0.2	54.5	37.0	60.8	7.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	79.0	0.2	54.5	37.0	60.8	7.4
LOS	E	A	D	D	E	A
Approach Delay	37.3		49.2			23.6
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: 0.86
 Intersection Signal Delay: 35.0
 Intersection LOS: D
 Intersection Capacity Utilization 81.9%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 30: US 301 & SR 71



Intersection Delay Study - Field Sheet

Request No.:										4:45 PM	
Job No.:											
Location:										Choptank Rd at Clayton Manor Dr	
Date:										10/8/2013	
Direction:										EB	
Weather:										Clear	
Recorder:										JG	
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	
Total Number of Vehicles										Approach Volume:	
Stopped In Approach At Time:										Number	
										Number not	
No	Begin	End	0 SEC+	15 SEC +	30 SEC+	45 SEC+	Stopped	Stopped			
1	16:45	16:46	2	0	0	0	0	0			
2	16:46	16:47	0	0	0	0	0	0			
3	16:47	16:48	0	0	0	0	0	0			
4	16:48	16:49	0	0	0	0	0	0			
5	16:49	16:50	0	0	0	0	0	1			
6	16:50	16:51	0	0	0	0	0	0			
7	16:51	16:52	0	0	0	0	0	1			
8	16:52	16:53	0	0	0	0	0	1			
9	16:53	16:54	0	0	0	0	0	1			
10	16:54	16:55	0	0	0	0	0	0			
11	16:55	16:56	0	1	1	1	2	0			
12	16:56	16:57	0	0	0	1	1	0			
13	16:57	16:58	0	0	0	0	0	1			
14	16:58	16:59	0	0	0	0	0	0			
15	16:59	17:00	0	0	0	1	1	3			
SUBTOTAL			2	1	1	3	4	8			
TOTAL			7				12				
Comments:											
(Cell C50)											
Total Delay = Total Number Stopped X Sampling Interval											
=			7	X	15	=	105 Veh-Sec/	3600 =	0.029167 Veh - Hr		
Average Delay Per Stopped Vehicle = Total Delay / Number of Stopped Vehicles											
=			105	/	4	=	26.25	Sec			
Average Delay Per Approach Vehicle = Total Delay / Approach Volume											
=			105	/	12	=	8.75	Sec			
Percent of Vehicles Stopped = Number of Stopped Vehicles / Approach Volume											
=			4	/	12	=	0.333333				

Intersection Delay Study - Field Sheet

Request No.:										4:30 PM
Job No.:										
Location:										US 301 at Keenan Auto Body
Date:										10/15/2013
Direction:										WB
Weather:										Clear
Recorder:										JG
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
Total Number of Vehicles										
Stopped In Approach At Time:										
Approach Volume:										
Number										Number not
No	Begin	End	0 SEC+	15 SEC +	30 SEC+	45 SEC+	Stopped	Stopped		
1	16:30	16:31	0	0	0	0	0	0	1	
2	16:31	16:32	0	0	0	0	0	0	0	
3	16:32	16:33	0	0	0	0	0	0	1	
4	16:33	16:34	0	0	0	0	0	0	0	
5	16:34	16:35	0	0	0	0	0	0	0	
6	16:35	16:36	0	0	0	0	0	0	0	
7	16:36	16:37	0	0	0	0	0	0	0	
8	16:37	16:38	0	0	1	0	1	1	0	
9	16:38	16:39	0	0	0	0	0	0	0	
10	16:39	16:40	0	0	0	0	0	0	0	
11	16:40	16:41	0	0	0	0	0	0	0	
12	16:41	16:42	0	0	0	0	0	0	0	
13	16:42	16:43	0	0	0	0	0	0	0	
14	16:43	16:44	0	0	0	0	0	0	0	
15	16:44	16:45	0	0	0	0	0	0	0	
SUBTOTAL			0	0	1	0	1	2		
TOTAL				1			3			
Comments:										
(Cell C50)										
Total Delay = Total Number Stopped X Sampling Interval										
	=	1	X	15	=	15	Veh-Sec/ 3600 =	0.004167	Veh - Hr	
Average Delay Per Stopped Vehicle = Total Delay / Number of Stopped Vehicles										
	=	15	/	1	=	15	Sec			
Average Delay Per Approach Vehicle = Total Delay / Approach Volume										
	=	15	/	3	=	5	Sec			
Percent of Vehicles Stopped = Number of Stopped Vehicles / Approach Volume										
	=	1	/	3	=	0.333333				

Intersection Delay Study - Field Sheet

Intersection Delay Study - Field Sheet									
Request No.:		4:45 PM							
Job No.:									

Location:		US 301 at Keenan Auto Body				Weather:		Clear	
Date:		10/15/2013				Recorder:		JG	
Direction:		WB				Start Time:		16:45	
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							

Total Number of Vehicles						Approach Volume:			
Stopped In Approach At Time:						Number		Number not	
No	Begin	End	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	0	0	0	0	0	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	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			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

5:00 PM

Request No.:

Job No.:

Location: US 301 at Keenan Auto Body

Weather: Clear

Date: 10/15/2013

Recorder: JG

Direction: WB

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

Total Number of Vehicles

Approach Volume:

Stopped In Approach At Time:

Number Number not

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

SUBTOTAL

TOTAL

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 / 4 = 33.75 Sec

Average Delay Per Approach Vehicle = Total Delay / Approach Volume

= 135 / 7 = 19.28571 Sec

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

= 4 / 7 = 0.571429

Intersection Delay Study - Field Sheet

4:45 PM

Request No.:

Job No.:

Location: Existing US 301 at Old Schoolhouse Rd

Weather: Clear

Date: 10/8/2013

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

Total Number of Vehicles

Approach Volume:

Stopped In Approach At Time:

Number Number not

No	Begin	End	Stopped In Approach At Time:				Approach Volume:	
			0 SEC+	15 SEC +	30 SEC+	45 SEC+	Number Stopped	Number not Stopped
1	16:45	16:46	0	0	0	0	0	0
2	16:46	16:47	0	0	0	0	1	0
3	16:47	16:48	1	1	1	1	0	1
4	16:48	16:49	0	0	0	0	0	0
5	16:49	16:50	0	0	0	0	1	0
6	16:50	16:51	1	1	1	0	0	0
7	16:51	16:52	0	0	0	0	0	0
8	16:52	16:53	0	0	0	0	0	1
9	16:53	16:54	0	0	0	0	1	0
10	16:54	16:55	1	1	1	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	1	1	1	0
SUBTOTAL			3	3	4	2	4	2
TOTAL				12			6	

No	Begin	End	0 SEC+	15 SEC +	30 SEC+	45 SEC+	Number Stopped	Number not Stopped
1	16:45	16:46	0	0	0	0	0	0
2	16:46	16:47	0	0	0	0	1	0
3	16:47	16:48	1	1	1	1	0	1
4	16:48	16:49	0	0	0	0	0	0
5	16:49	16:50	0	0	0	0	1	0
6	16:50	16:51	1	1	1	0	0	0
7	16:51	16:52	0	0	0	0	0	0
8	16:52	16:53	0	0	0	0	0	1
9	16:53	16:54	0	0	0	0	1	0
10	16:54	16:55	1	1	1	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	1	1	1	0
SUBTOTAL			3	3	4	2	4	2
TOTAL				12			6	

SUBTOTAL

TOTAL

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 / 4 = 45 Sec

Average Delay Per Approach Vehicle = Total Delay / Approach Volume

= 180 / 6 = 30 Sec

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

= 4 / 6 = 0.666667

Intersection Delay Study - Field Sheet

Request No.:										5:00 PM	
Job No.:											
Location:										Existing US 301 at Old Schoolhouse Rd	
Date:										10/8/2013	
Direction:										EB	
Weather:										Clear	
Recorder:										JG	
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	
Total Number of Vehicles										Approach Volume:	
Stopped In Approach At Time:										Number	
0 SEC+ 15 SEC + 30 SEC+ 45 SEC+										Number not	
No Begin End										Stopped Stopped	
1	17:00	17:01	1	2	1	0	1	0			
2	17:01	17:02	0	1	1	1	1	0			
3	17:02	17:03	1	1	1	0	0	0			
4	17:03	17:04	0	0	0	0	0	0			
5	17:04	17:05	0	0	0	0	1	0			
6	17:05	17:06	1	2	2	1	1	0			
7	17:06	17:07	0	0	0	0	0	0			
8	17:07	17:08	0	0	0	0	0	0			
9	17:08	17:09	0	0	0	0	0	0			
10	17:09	17:10	0	0	0	0	1	0			
11	17:10	17:11	1	1	0	0	0	0			
12	17:11	17:12	0	1	0	0	1	0			
13	17:12	17:13	0	0	0	0	0	0			
14	17:13	17:14	0	0	0	0	1	0			
15	17:14	17:15	1	1	1	1	0	0			
SUBTOTAL			5	9	6	3	7	0			
TOTAL			23				7				
Comments:											
(Cell C50)											
Total Delay = Total Number Stopped X Sampling Interval											
= 23 X 15 = 345 Veh-Sec/ 3600 = 0.095833 Veh - Hr											
Average Delay Per Stopped Vehicle = Total Delay / Number of Stopped Vehicles											
= 345 / 7 = 49.28571 Sec											
Average Delay Per Approach Vehicle = Total Delay / Approach Volume											
= 345 / 7 = 49.28571 Sec											
Percent of Vehicles Stopped = Number of Stopped Vehicles / Approach Volume											
= 7 / 7 = 1											

Intersection Delay Study - Field Sheet

Intersection Delay Study - Field Sheet									
Request No.:						5:15 PM			
Job No.:									

Location:	Existing US 301 at Old Schoolhouse Rd					Weather:	Clear		
Date:	10/8/2013					Recorder:	JG		
Direction:	EB					Start Time:	17:15		
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									

Total Number of Vehicles						Approach Volume:			
Stopped In Approach At Time:						Number		Number not	
No	Begin	End	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	0	
4	17:18	17:19	0	0	0	0	1	0	
5	17:19	17:20	1	0	0	1	1	0	
6	17:20	17:21	1	1	1	0	0	0	
7	17:21	17:22	0	0	0	0	0	0	
8	17:22	17:23	0	0	0	0	0	0	
9	17:23	17:24	0	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	1	
12	17:26	17:27	0	0	0	0	0	0	
13	17:27	17:28	0	0	0	0	1	0	
14	17:28	17:29	1	1	0	1	1	0	
15	17:29	17:30	0	0	0	1	1	0	
SUBTOTAL			3	2	1	3	5	1	
TOTAL				9			6		
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	/	5	=	27		Sec
Average Delay Per Approach Vehicle = Total Delay / Approach Volume									
	=		135	/	6	=	22.5		Sec
Percent of Vehicles Stopped = Number of Stopped Vehicles / Approach Volume									
	=		5	/	6	=	0.833333		

