



# Triangle Expressway

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## Roadway Operations Statistics Report

**2019 Third Quarter**  
July - September



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# Introduction

## Purpose

The North Carolina Turnpike Authority (NCTA) presents the operations statistics for the Triangle Expressway during the third quarter (July – September) of 2019. The report includes data related to traffic volumes, roadway operations, and maintenance. The statistics will allow for future analysis to identify quarterly and annual trends over time, providing a quantifiable method to track performance.

## Project

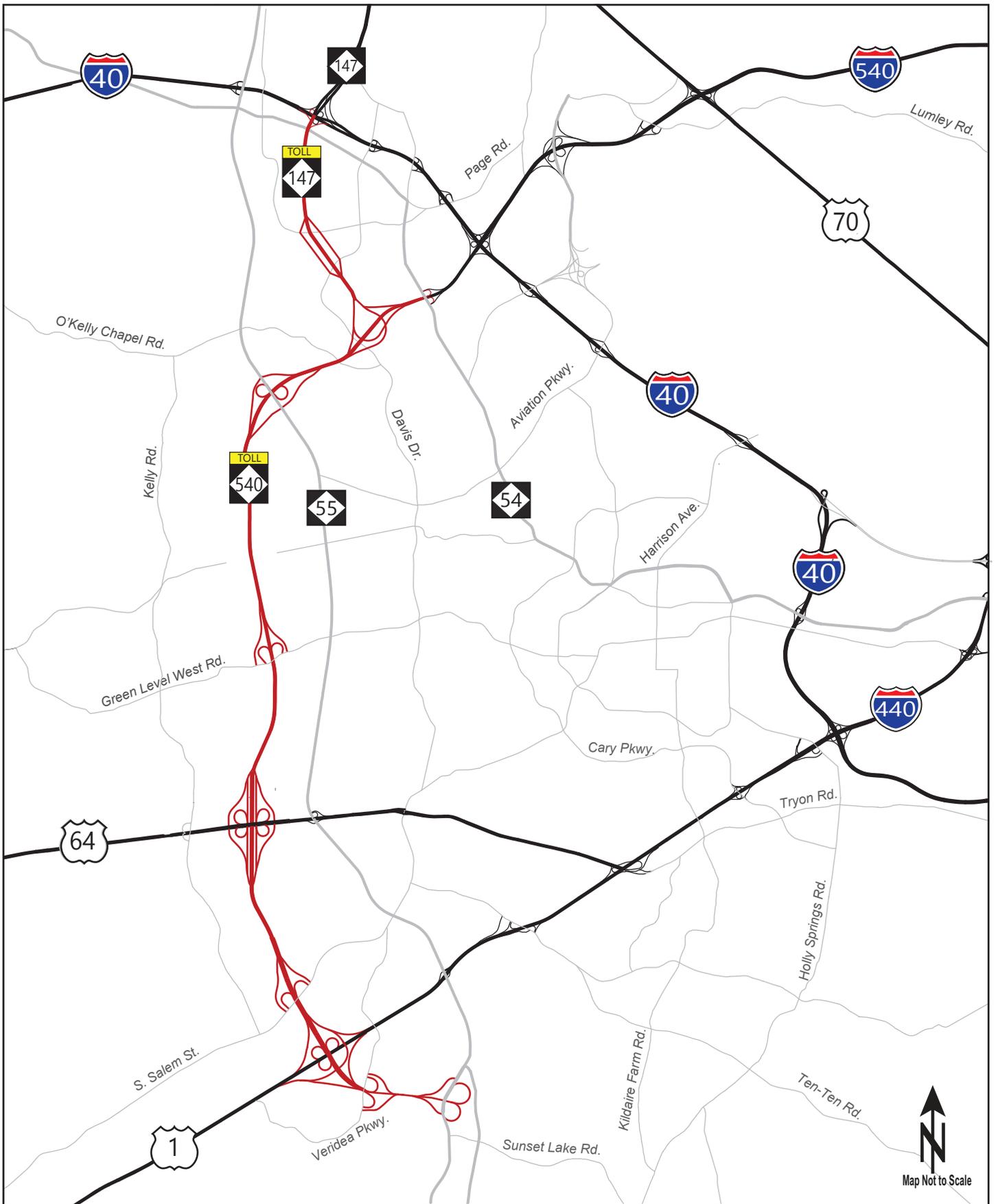
The Triangle Expressway is an 18.8-mile toll road that extends the partially completed “Outer Loop” around the greater Raleigh, North Carolina area from I-40 to N.C. 55 Bypass. The six-lane, controlled-access toll facility relieves congestion on N.C. 55 while improving access to the Research Triangle Park by reducing travel times for commuters residing to the south and east. The Triangle Expressway is currently comprised of two sections: Toll N.C. 147 and Toll N.C. 540.

Toll N.C. 147 includes 3.4 miles of toll road between I-40 and Toll N.C. 540. This section of the Triangle Expressway includes interchanges at Hopson Road, Davis Drive, and Toll N.C. 540. It opened to toll-free traffic on December 8, 2011; tolling on this section began on January 3, 2012.

Toll N.C. 540 includes 15.4 miles of toll road between N.C. 54 in western Cary and the N.C. 55 Bypass near the Town of Holly Springs. The section from N.C. 54 to U.S. 64 opened to general traffic (toll-free) on August 1, 2012, and toll collection started on August 2, 2012. This section includes interchanges at N.C. 54, N.C. 55, Green Level West Road, and U.S. 64. The section from U.S. 64 to N.C. 55 Bypass opened to general traffic (toll-free) on December 20, 2012, and toll collection started on January 2, 2013. This section includes interchanges at S. Salem Street, U.S. 1, and N.C. 55 Bypass. On April 3, 2017, a new interchange at Veridea Parkway was opened in this last section of Toll N.C. 540.

The Triangle Expressway utilizes an all-electronic, non-stop tolling system where there are no toll plazas at which drivers stop and pay cash tolls. Instead, free-flow toll zones are employed where vehicles are detected while traveling at highway speeds. Payments are accepted through an Electronic Toll Collection (ETC) program called NC Quick Pass® or a video billing program called Bill by Mail.

NCTA toll zones are located along the Triangle Expressway at mainline, ramp, and loop locations. An illustration of the Triangle Expressway can be seen in *Figure 1*.



**Triangle Expressway System Map**

**Figure  
1**

# Traffic Statistics

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# Traffic Statistics

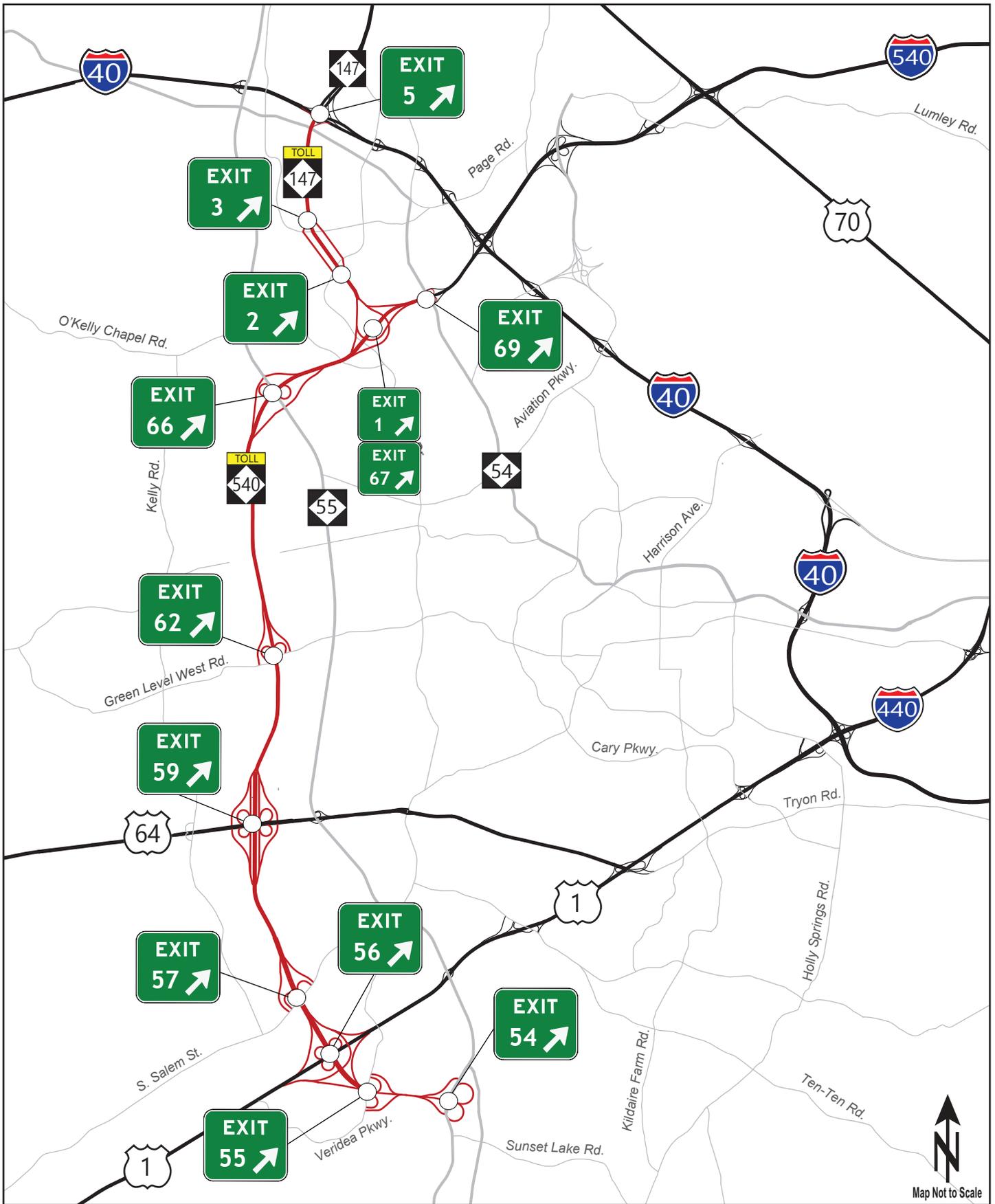
Current and historical traffic data is collected and stored using roadside microwave vehicle detectors (MVDs) installed throughout the Triangle Expressway, providing an overview of the roadway's current utilization. The data is analyzed to identify trends that could more accurately predict future utilization.

It should be noted that the Triangle Expressway is transitioning from a traffic pattern known as “ramp-up” to a stabilized pattern. During a ramp-up period, the traffic volumes on a new facility increase at a faster rate than typical growth on existing facilities. Traffic volumes increase significantly as the customers become more familiar with the facility. The Triangle Expressway is expected to reach a more stabilized pattern through 2020.

## Average Weekday Traffic (AWT)

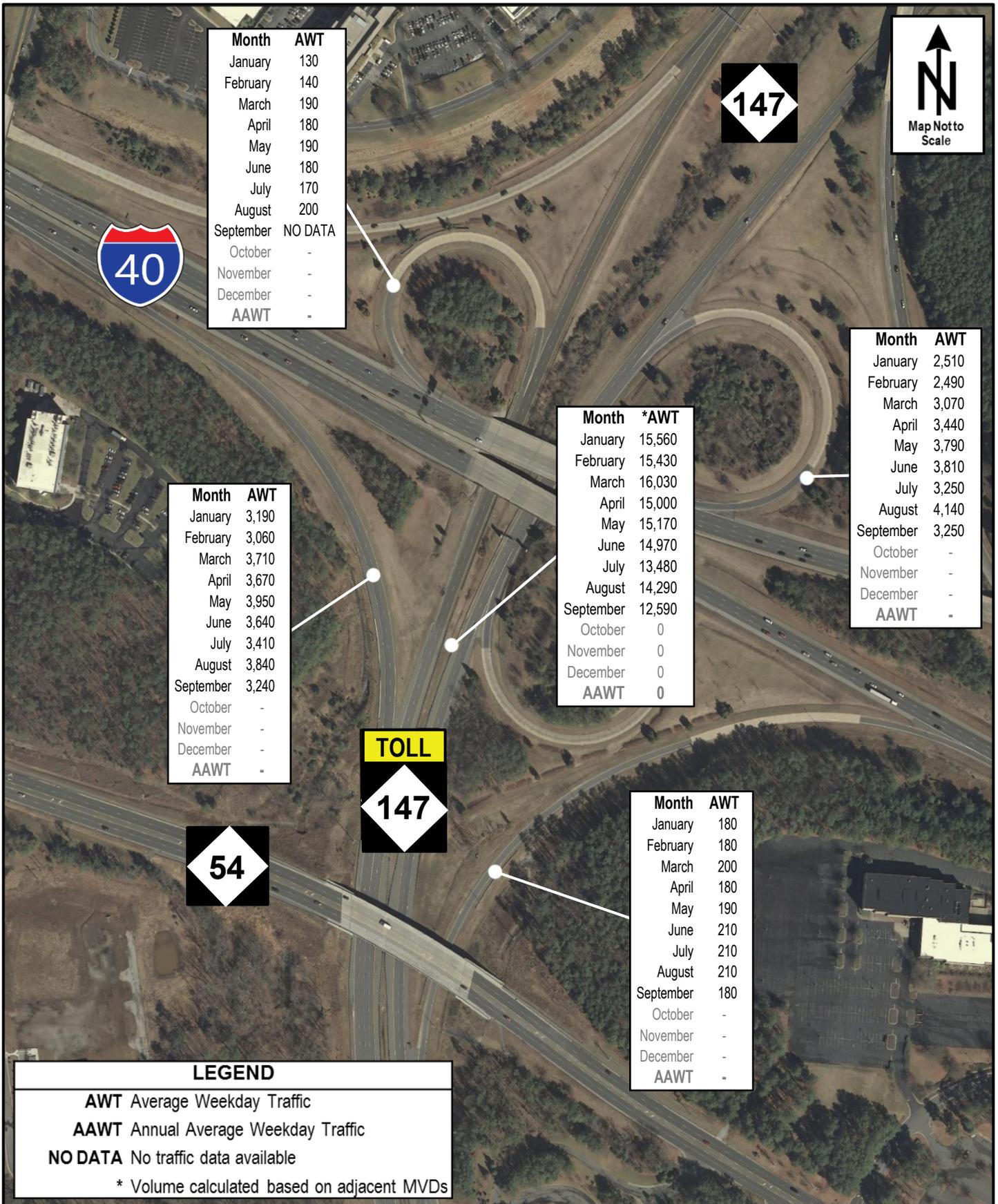
Traffic volume data is collected at all ramps and mainline segments between interchanges. The location of interchanges along the Triangle Expressway can be seen in *Figure 2*. Typically, there is a large difference between peak and off-peak volumes, as well as between weekday and weekend volumes. This gap becomes significantly larger for a tolled facility because it tends to have a much higher percentage of traffic on weekdays during peak hours than non-toll facilities, as there is less of a benefit for toll users during off-peak hours. For this reason, Average Weekday Traffic (AWT) is reported instead of Average Daily Traffic (ADT). AWT is a measure of the average daily traffic collected on a typical Monday through Friday over a designated time period.

Data collected by the MVDs is utilized to present AWT along the facility in *Figures 3 to 14*. It should be noted that if an MVD fails to provide reliable data (meeting the established threshold) for at least five days in a month then “NO DATA” is reported for that MVD. Reliability of MVD devices are monitored daily by comparing volumes with transaction counts and expected volumes. Maintenance tickets are submitted if MVD devices do not meet established thresholds.



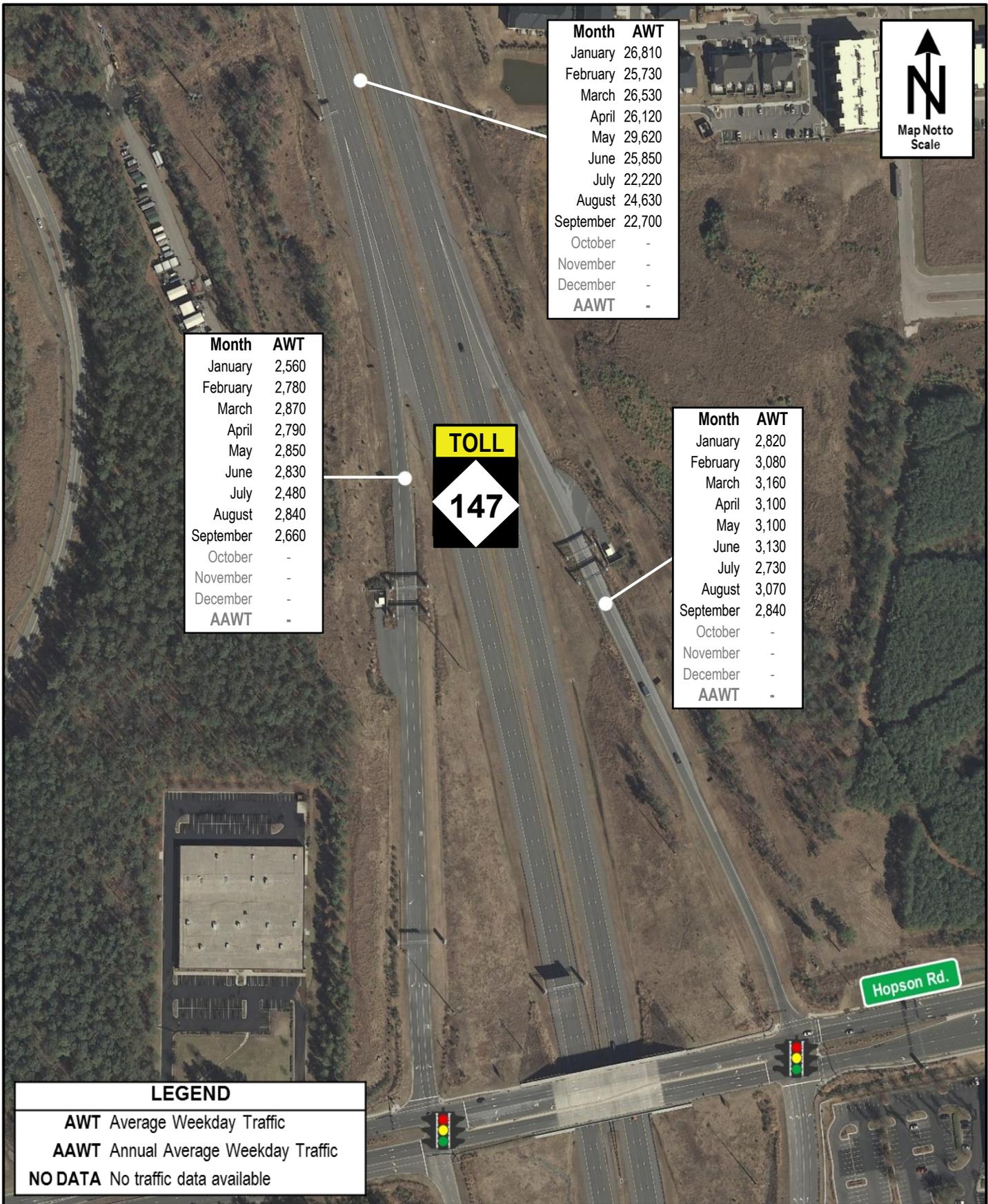
**Triangle Expressway Interchange Map**

**Figure 2**



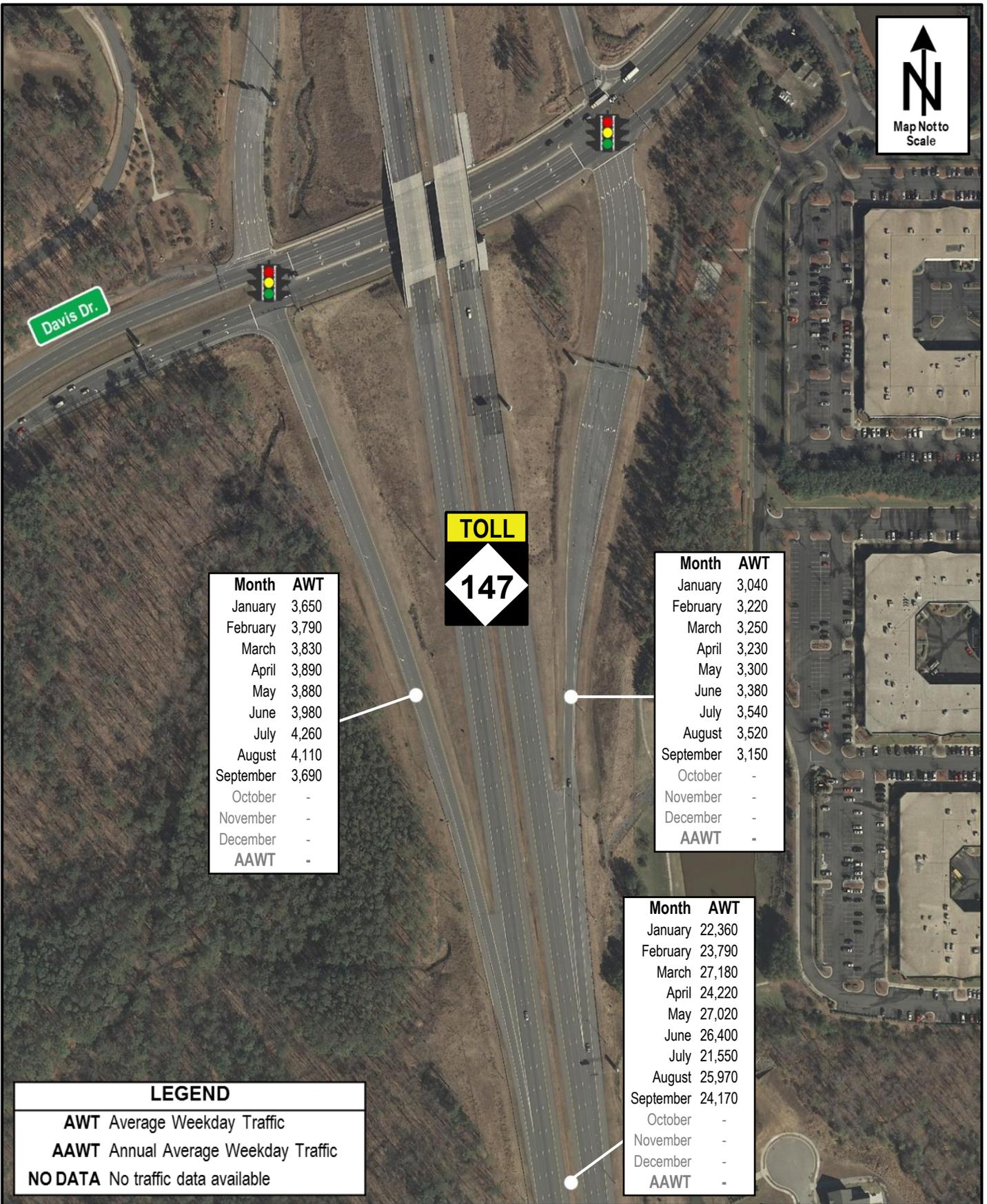
**NC-147 at I-40 Interchange**  
**2019 Average Weekday Traffic**

**Figure**  
**3**



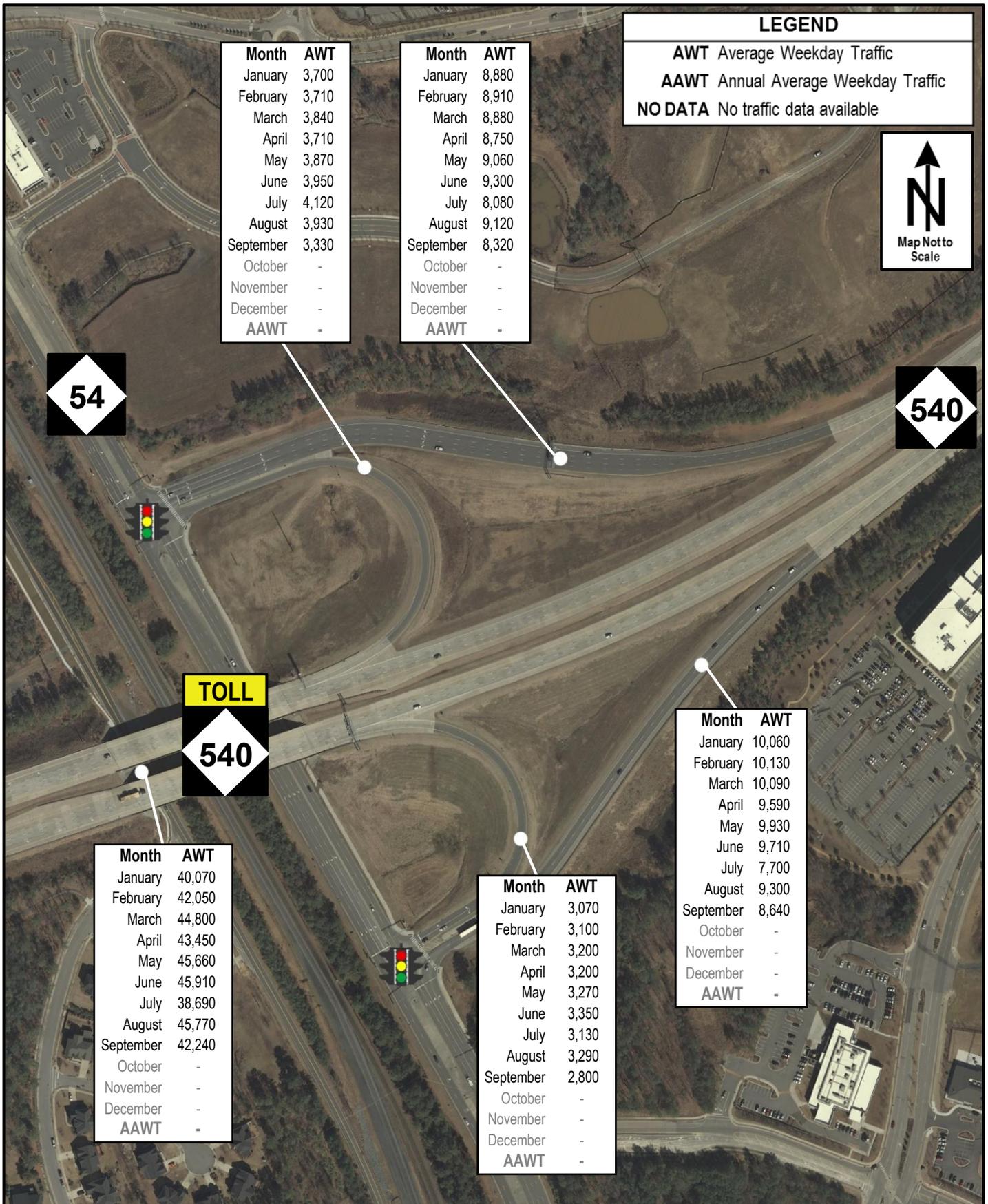
**NC-147 at Hopson Rd. Interchange**  
 2019 Average Weekday Traffic

**Figure**  
**4**



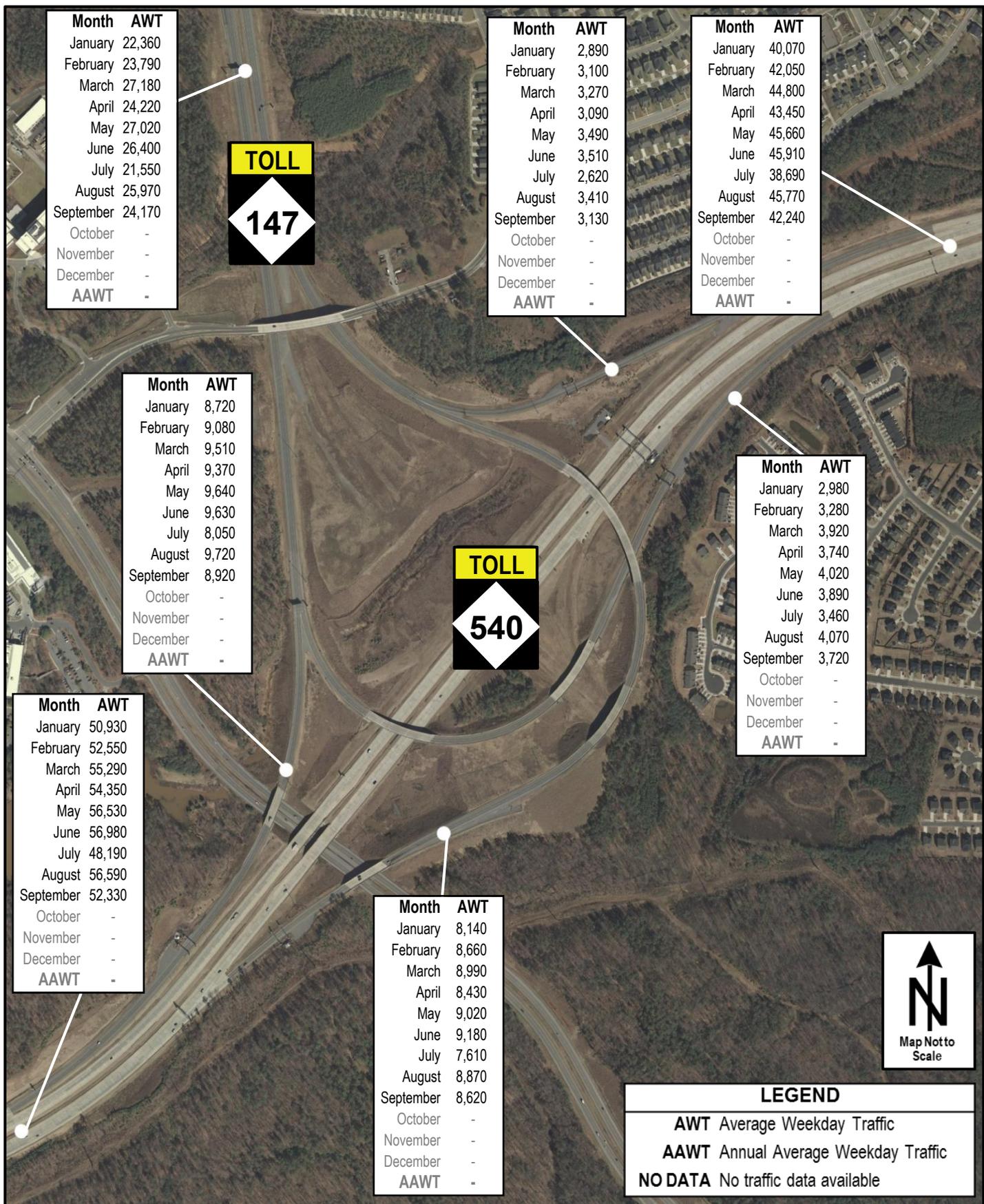
**NC-147 at Davis Dr. Interchange**  
2019 Average Weekday Traffic

**Figure**  
**5**



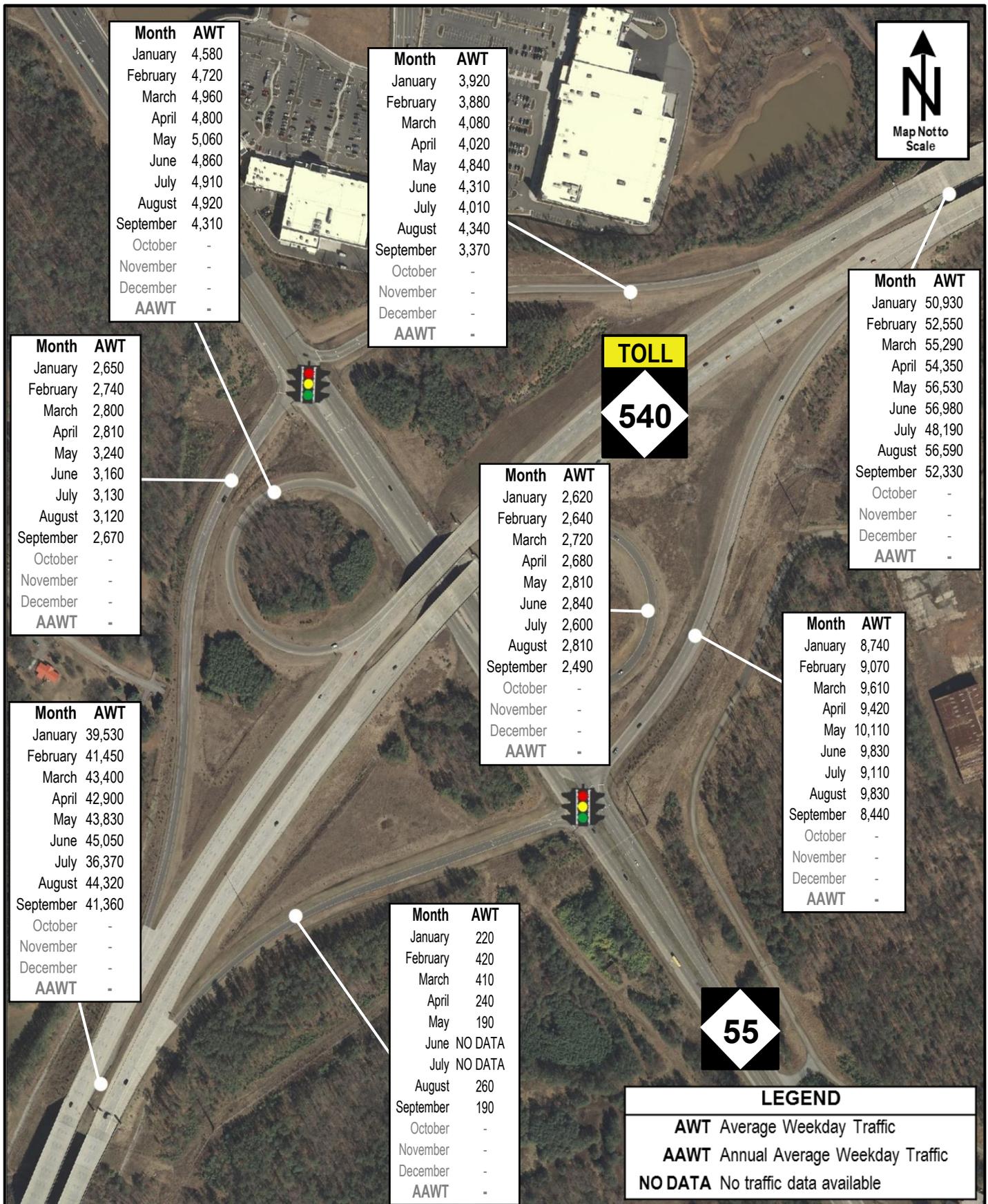
**NC-540 at NC-54 Interchange**  
 2019 Average Weekday Traffic

**Figure**  
**6**



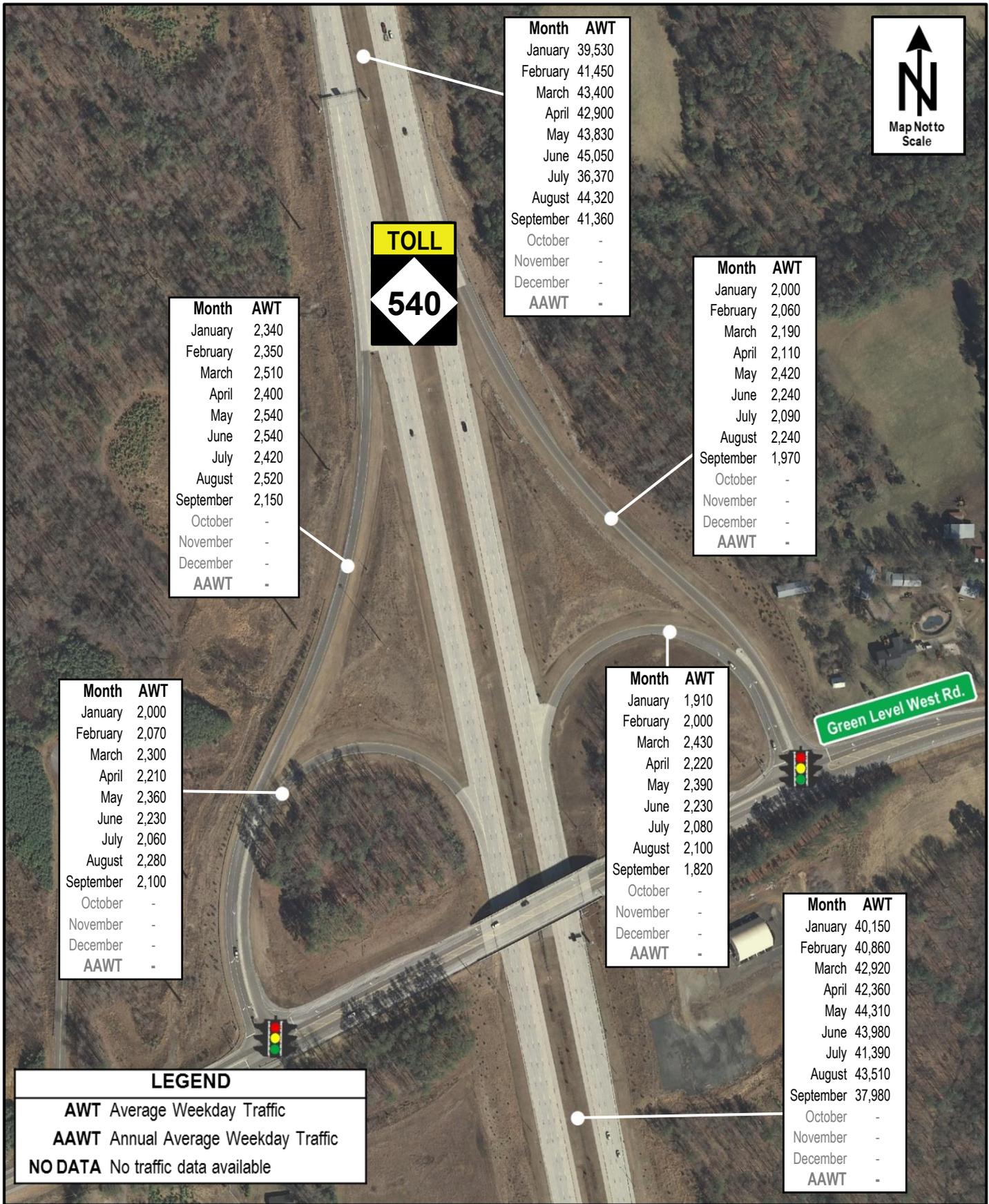
**NC-540 at NC-147 Interchange**  
2019 Average Weekday Traffic

**Figure**  
**7**



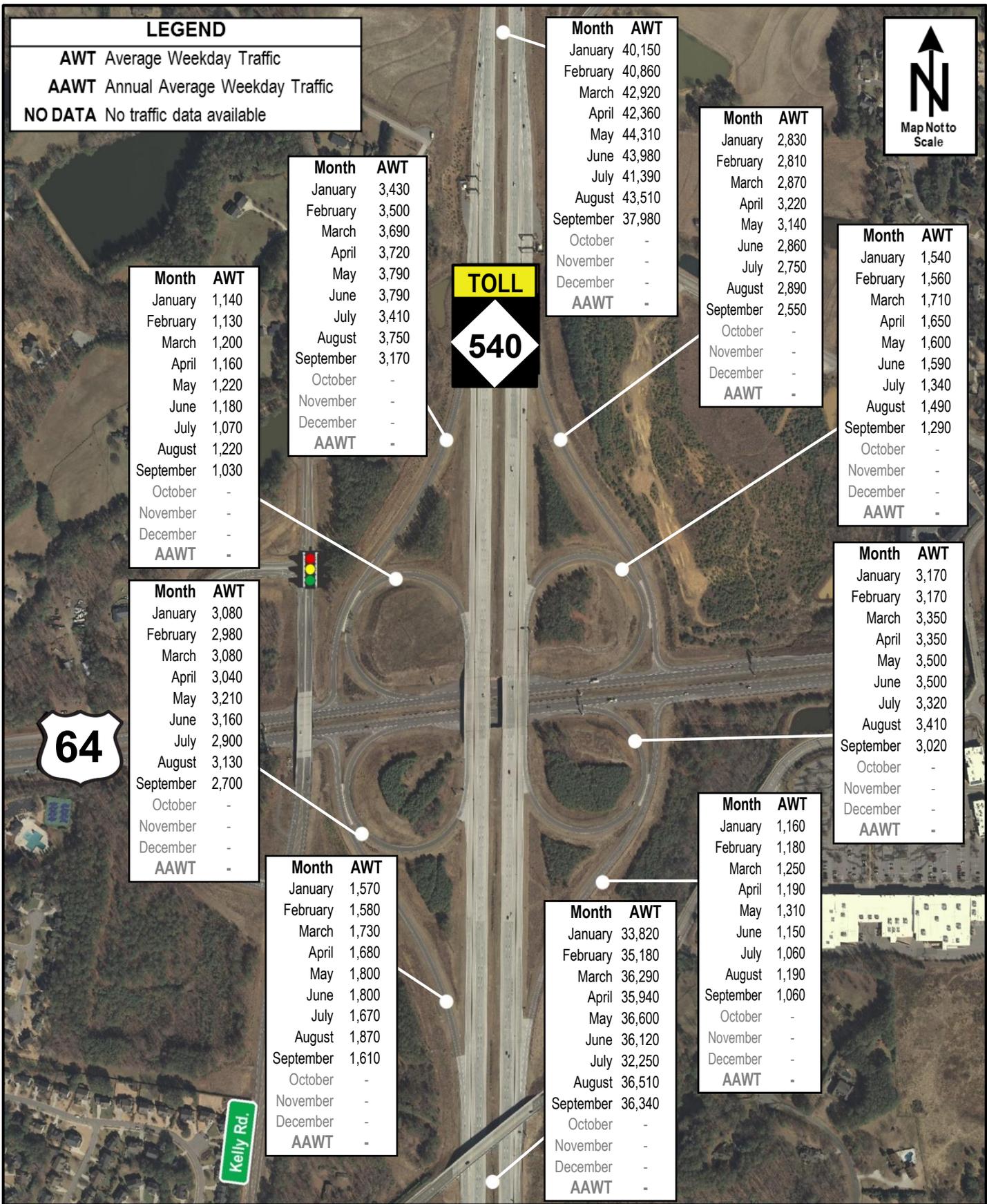
**NC-540 at NC-55 Interchange**  
 201 Average Weekday Traffic

**Figure**  
**8**



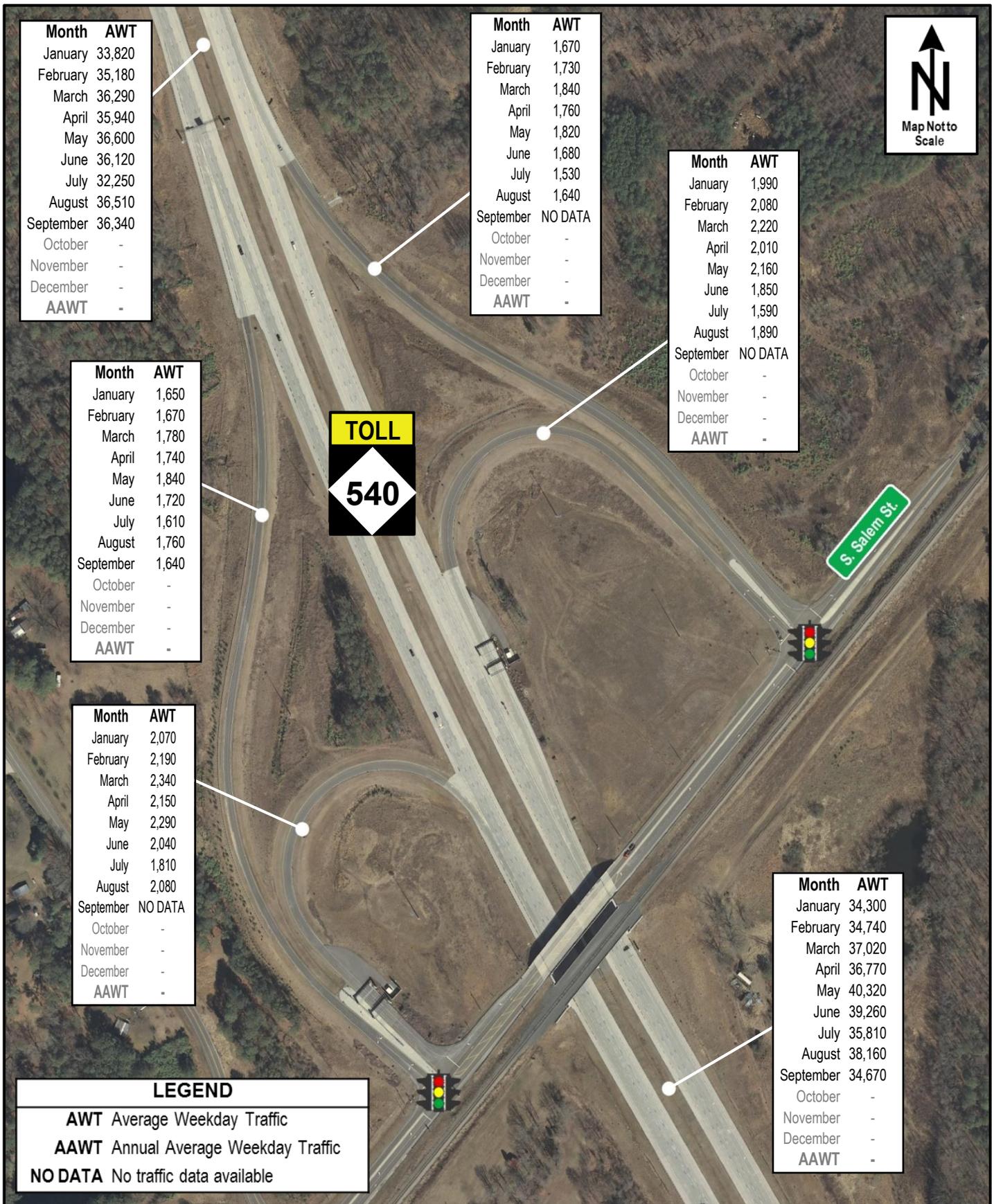
**NC-540 at Green Level West Rd. Interchange**  
 2019 Average Weekday Traffic

**Figure**  
**9**



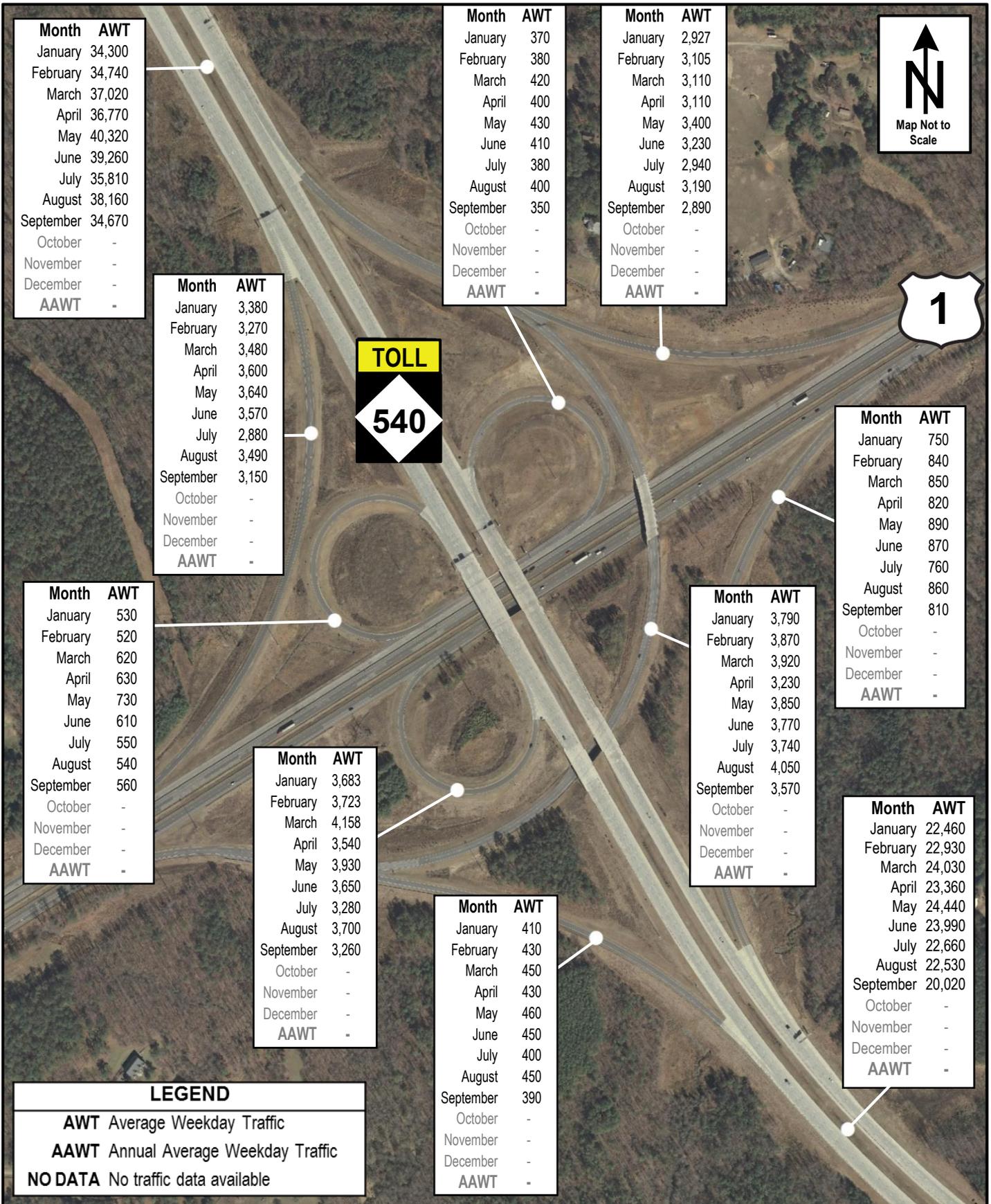
**NC-540 at US-64 Interchange**  
 2019 Average Weekday Traffic

**Figure**  
**10**



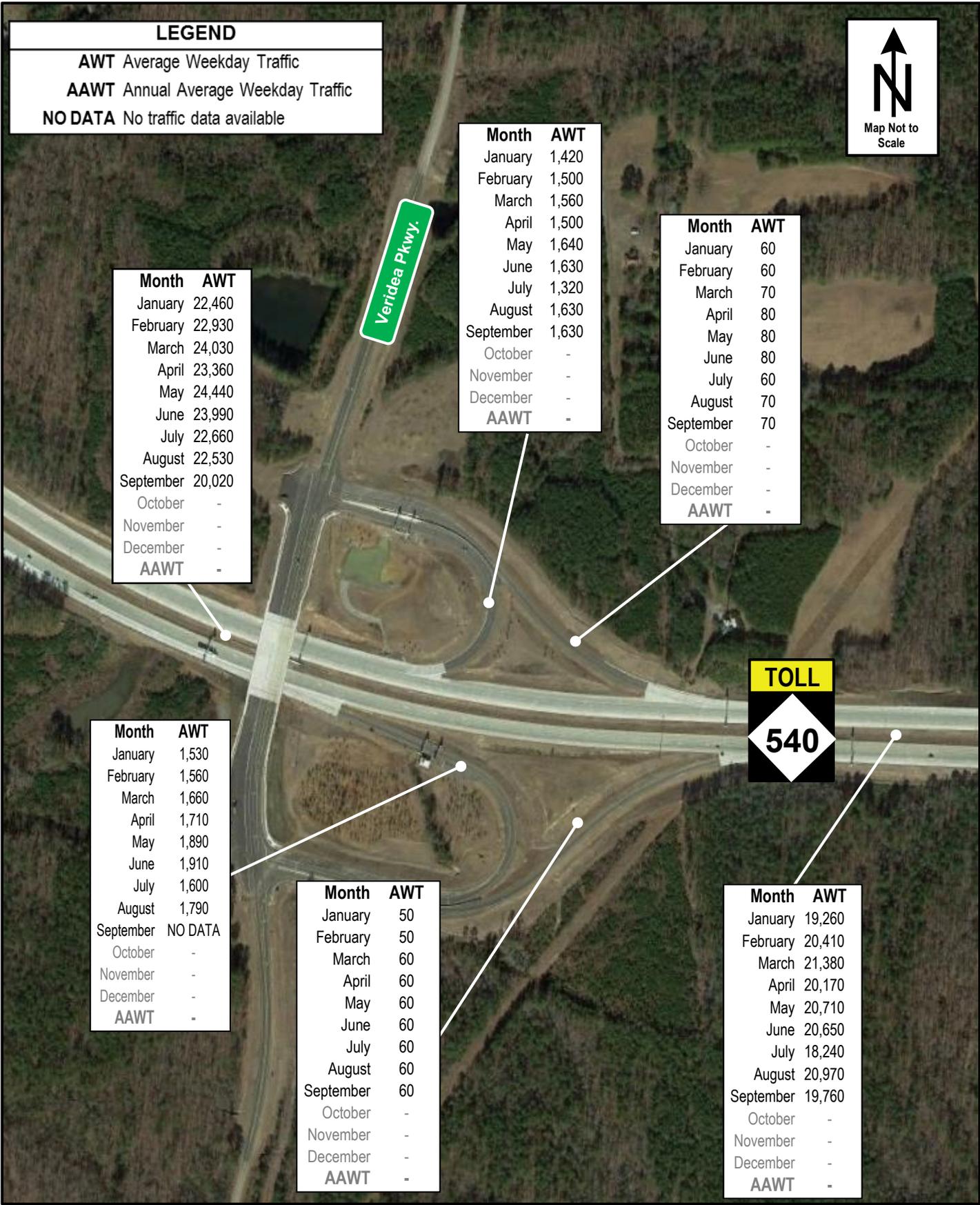
**NC-540 at S. Salem St. Interchange**  
2019 Average Weekday Traffic

**Figure**  
**11**



**NC-540 at US-1 Interchange**  
2019 Average Weekday Traffic

**Figure**  
**12**



LEGEND	
AWT	Average Weekday Traffic
AAWT	Annual Average Weekday Traffic
NO DATA	No traffic data available



Month	AWT
January	22,460
February	22,930
March	24,030
April	23,360
May	24,440
June	23,990
July	22,660
August	22,530
September	20,020
October	-
November	-
December	-
AAWT	-

Month	AWT
January	1,420
February	1,500
March	1,560
April	1,500
May	1,640
June	1,630
July	1,320
August	1,630
September	1,630
October	-
November	-
December	-
AAWT	-

Month	AWT
January	60
February	60
March	70
April	80
May	80
June	80
July	60
August	70
September	70
October	-
November	-
December	-
AAWT	-

Month	AWT
January	1,530
February	1,560
March	1,660
April	1,710
May	1,890
June	1,910
July	1,600
August	1,790
September	NO DATA
October	-
November	-
December	-
AAWT	-

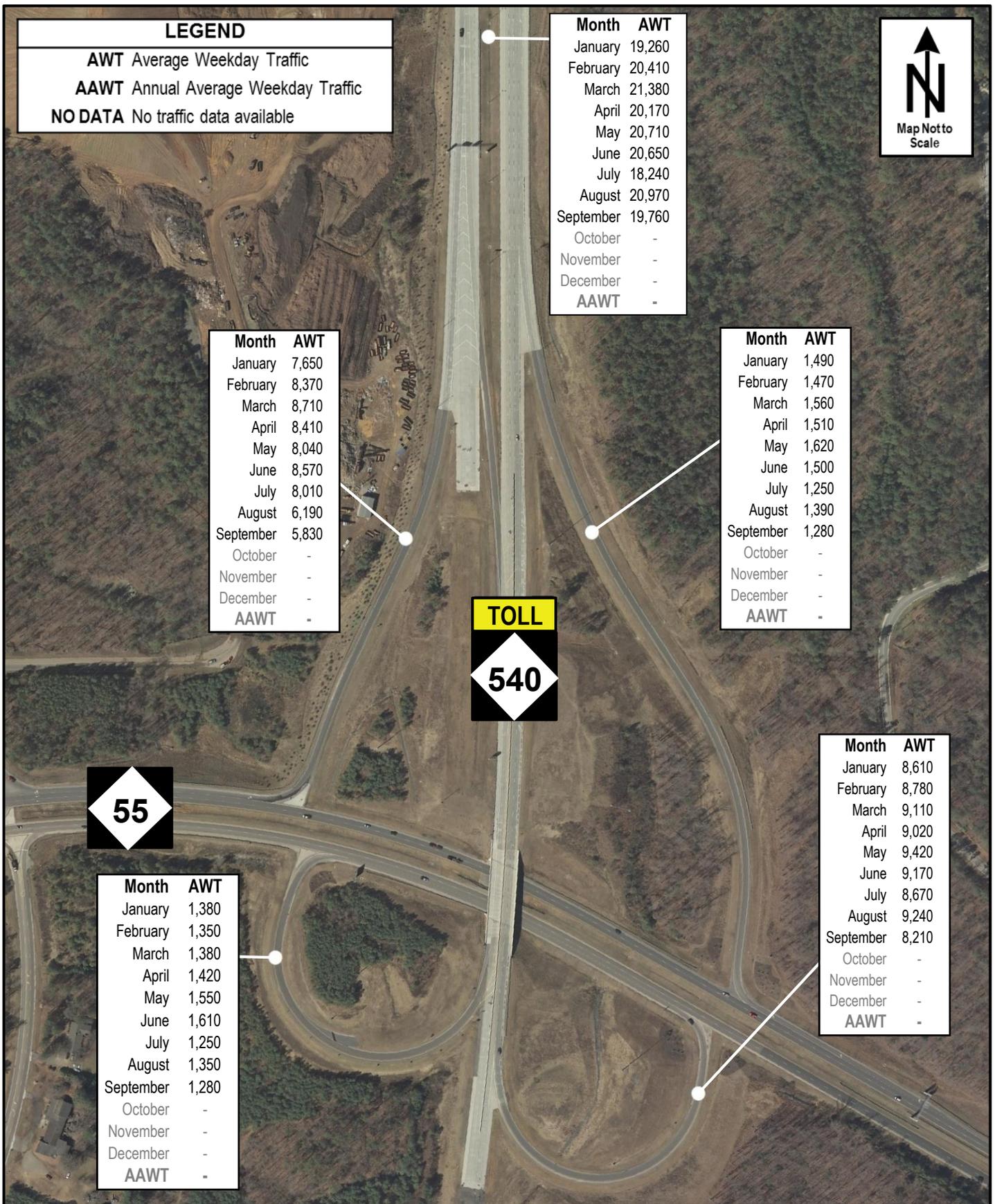
Month	AWT
January	50
February	50
March	60
April	60
May	60
June	60
July	60
August	60
September	60
October	-
November	-
December	-
AAWT	-



Month	AWT
January	19,260
February	20,410
March	21,380
April	20,170
May	20,710
June	20,650
July	18,240
August	20,970
September	19,760
October	-
November	-
December	-
AAWT	-

**NC-540 at Veridea Pkwy. Interchange**  
2019 Average Weekday Traffic

**Figure**  
**13**



**NC-540 at NC-55 Bypass Interchange**  
 2019 Average Weekday Traffic

**Figure**  
**14**

# Roadway Safety Statistics

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# Roadway Safety Statistics

Vehicle crashes are often related to deficiencies in the safety and capacity characteristics of a transportation facility. To identify these deficiencies early, and therefore reduce the likelihood of crashes on the Triangle Expressway, NCTA monitors safety conditions on the facility through quarterly crash analyses. These analyses involve the use of the Traffic Engineering Accident Analysis System (TEAAS) to collect monthly crash data along the facility, separated into four (4) segments:

- Toll N.C. 147, from I-40 to Toll N.C. 540
- Toll N.C. 540, from I-40 to N.C. 55
- Toll N.C. 540, from N.C. 55 to U.S. 64
- Toll N.C. 540, from U.S. 64 to N.C. 55 Bypass

The data collected includes total crashes and the number of fatal and injury crashes reported along each segment. This data is analyzed over a rolling three-year period to determine the Total Crash Rate of each of the four segments selected, as well as for the entire facility. These crash rates can then be compared to the Critical Crash Rates.

Total Crash Rates are a function of the length of roadway, average daily traffic, and number of reported crashes along a route during a specific time frame. These rates are expressed in crashes per 100 million vehicle miles traveled (MVMT). In the crash analysis conducted during the third quarter, the Total Crash Rates of the four segments selected and the entire facility were calculated based on the roadway segment length, the average annual daily traffic (AADT) and the number of crashes recorded from September 1, 2016 to August 31, 2019 for each segment. The AADT used for this quarter analysis was collected from the NCDOT 2016 Wake County AADT Map. The Statewide Crash Rate (129.58 crashes per 100 MVMT) used for comparison purposes in this analysis was collected from the 2015-2017 NCDOT Statewide Total Crash Rates for urban interstate facilities, as the Triangle Expressway operates more like an interstate than a state route.

Critical Crash Rates are crash rates that have been statistically adjusted with a 95% level of confidence to remove the elements of chance and randomness. They are used as a reference to determine if the Total Crash Rate at a given location is significantly higher than a predetermined average rate for locations with similar characteristics.

*Table 1* provides a summary of the crash data collected and the results of the second quarter analysis.

**Table 1: Safety Statistics, September 1, 2016 – August 31, 2019**

Segment	Length	AADT <sup>1</sup>	Total Crashes	Vehicle Exposure (MVMT)	Total Crash Rate	Statewide Crash Rate <sup>2</sup>	Critical Crash Rate
Toll N.C. 147 I-40 to Toll N.C. 540	3.1	15,400	51	52.38	97.36	129.58	156.41
Toll N.C. 540 I-40 to N.C. 55	2.8	38,800	71	118.75	59.79	129.58	147.18
Toll N.C. 540 N.C. 55 to U.S. 64	6.7	31,000	93	226.72	41.02	129.58	142.24
Toll N.C. 540 U.S. 64 to N.C. 55 Bypass	5.9	22,800	80	146.33	54.67	129.58	145.40
<b>Triangle Expressway</b>	<b>18.4</b>	<b>27,000</b>	<b>295</b>	<b>545.22</b>	<b>54.11</b>	<b>129.58</b>	<b>137.69</b>

<sup>1</sup> AADT provided from NCDOT 2016 AADT Maps, Wake County

<sup>2</sup> Statewide Crash Rate for Urban Interstate Facilities Applied

# Roadway Operations Statistics

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# Roadway Operations Statistics

Highly trained NCTA operators monitor and manage traffic operations and coordinate incident response and maintenance/construction work along the Triangle Expressway. These operators work at the Traffic Management Center (TMC) located in the North Carolina National Guard's Joint Force Headquarters in Raleigh. They are responsible for monitoring the facility 24 hours a day, 7 days a week, and 365 days a year using closed-circuit TV (CCTV) cameras, microwave vehicle detectors (MVD), and toll zone security cameras. Additionally, they monitor roadside toll technology and toll facilities.

Operators can communicate travel conditions and emergencies to customers via 10 full-color Dynamic Message Signs (DMS), NCDOT's 511 system, and NCDOT's Traveler Information Management System (TIMS) website. They can also quickly dispatch toll technology technicians to address equipment failures via the Maintenance Online Management Software (MOMS). Additionally, in the event of incidents on the facility, they can use interoperable 800MHz radio frequency dispatch from local 911 and statewide Highway Patrol communications to dispatch Incident Management Assistance Patrol (IMAP).

The NCTA Toll Safety Patrol program consists of dedicated SHP and IMAP services provided on the Triangle Expressway. This program provides one SHP officer and one IMAP responder to the facility during working hours, Monday through Friday. During this time, the assigned SHP officer and IMAP driver are responsible for patrolling the facility and responding to reported incidents.

This section presents operations statistics reported by SHP and IMAP during the third quarter of 2019. It includes driver violations and warnings issued by SHP and total IMAP assistance recorded, as well as average monthly IMAP response and clearance time.

*Table 2 and Table 3* present SHP operation statistics during 2019. "Chargeable Activities" are SHP activities involving fines. It should be noted that the "Other Violations" category includes chargeable activities such as load and equipment violations, driver's license violations, vehicle registration violations, and littering.

**Table 2: 2019 SHP Chargeable Activities, YTD**

Chargeable Activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Speed Violations	56	56	53	45	42	38	33	36	32				391
Alcohol Violations	0	0	1	0	0	2	0	1	0				4
Seat Belt Violations	5	12	14	21	18	5	2	13	3				93
Child Restraint Violations	2	1	0	0	0	1	0	0	0				4
Reckless Driving	5	2	5	5	1	4	5	4	2				33
Drug Violations	0	0	0	0	0	1	0	0	0				1
Obstructed Plates	0	0	0	0	0	0	0	0	5				5
Other Violations	40	23	39	24	34	26	22	35	17				260
<b>Total Charges</b>	<b>108</b>	<b>94</b>	<b>112</b>	<b>95</b>	<b>95</b>	<b>77</b>	<b>62</b>	<b>89</b>	<b>59</b>				<b>791</b>

**Table 3: 2019 SHP Non-Chargeable Activities, YTD**

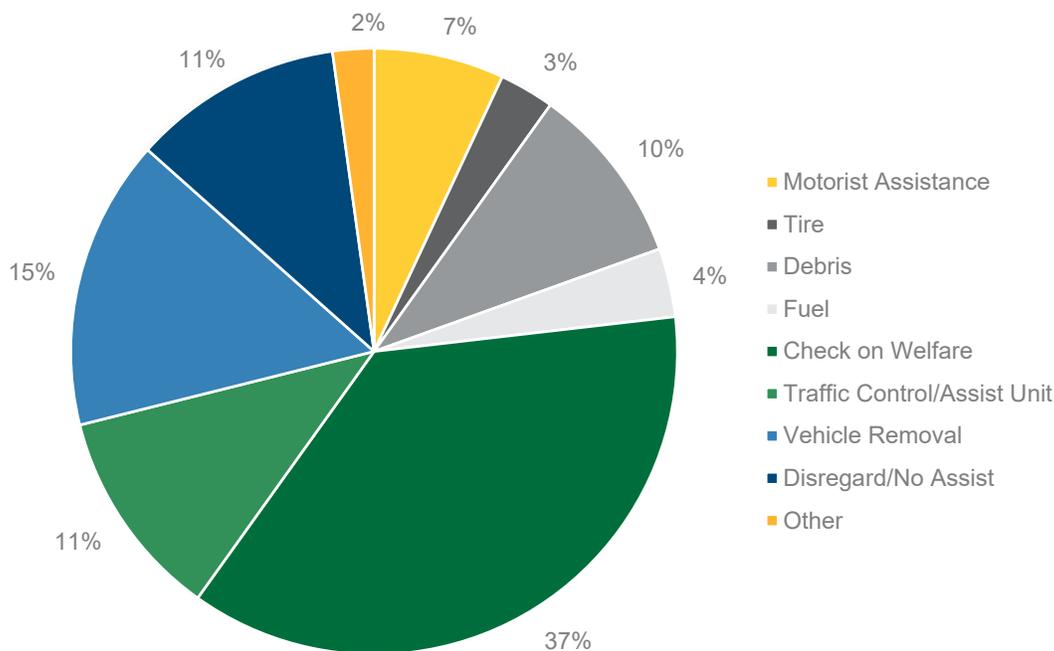
Non-Chargeable Activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Warnings	42	47	56	48	76	51	71	96	77				564
Vehicles Towed	0	0	0	0	0	0	0	0	0				0
Crashes Investigated	9	5	12	5	11	8	5	6	7				68
<b>Total</b>	<b>51</b>	<b>52</b>	<b>68</b>	<b>53</b>	<b>87</b>	<b>59</b>	<b>76</b>	<b>102</b>	<b>84</b>				<b>632</b>

The IMAP assists with stranded motorists and incident clearance, thereby maintaining the flow of traffic along the roadway. *Table 4* and *Figure 15* present the monthly breakdown of IMAP services, by type, for the Triangle Expressway during 2019. The “other” category includes extinguish fire service, first aid service, and other rare miscellaneous services.

**Table 4: 2019 IMAP Services, YTD**

Assist Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Motorist Assistance	11	4	1	7	6	7	8	10	3				57
Tire	3	3	0	3	1	2	7	0	5				24
Debris	4	6	5	5	6	12	20	11	10				79
Fuel	9	2	2	0	3	4	4	5	1				30
Check on Welfare	18	24	31	40	28	37	53	37	33				301
Traffic Control / Assist Unit	6	7	6	15	8	10	18	13	9				92
Vehicle Removal	4	5	9	8	17	20	25	17	22				127
Disregard / No Assist	0	3	11	9	14	14	17	16	8				92
Other	0	4	1	3	0	0	3	5	2				18
<b>Total Charges</b>	<b>55</b>	<b>58</b>	<b>66</b>	<b>90</b>	<b>83</b>	<b>106</b>	<b>155</b>	<b>114</b>	<b>93</b>				<b>820</b>

**Figure 15: 2019 IMAP Services by Type, YTD**



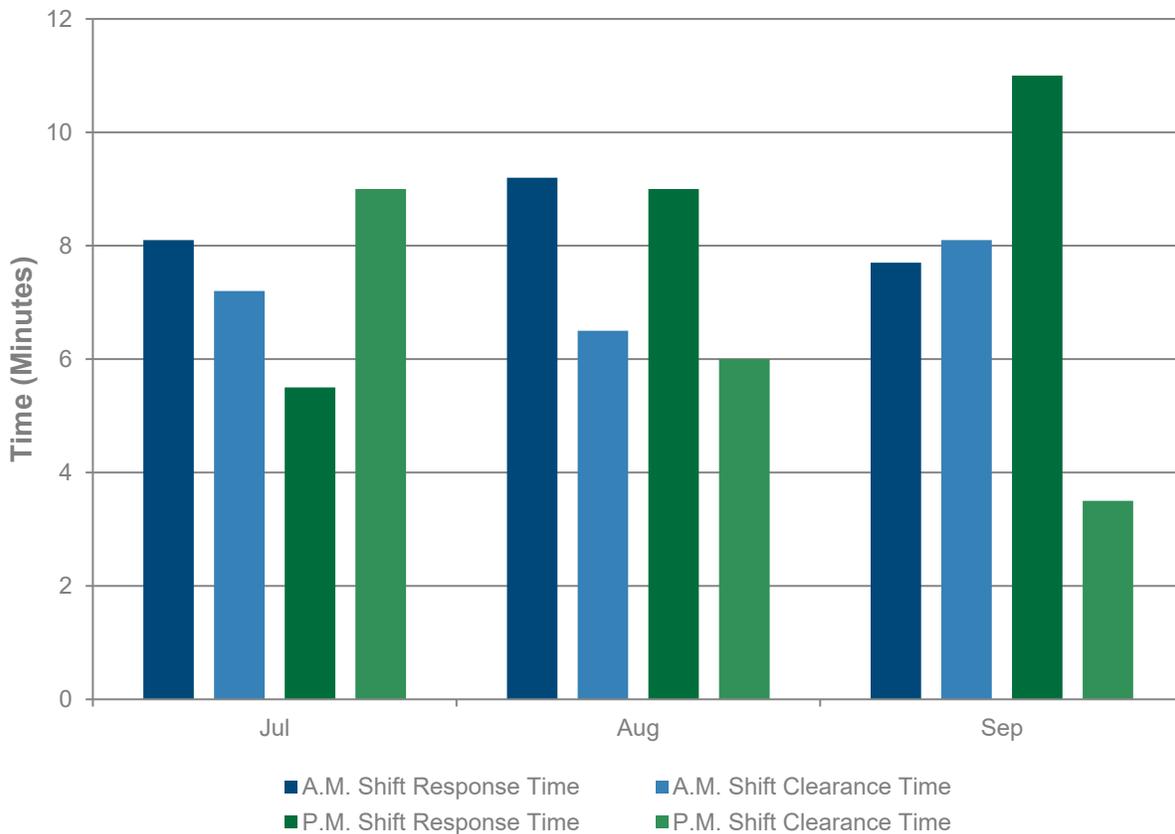
The response and clearance times for all IMAP assists are logged by IMAP and provided to the NCTA. Response time is the time from which a responder receives a call to the time they arrive on the scene. Clearance time is the time it takes the responder to clear the incident and return the roadway to normal operation. The IMAP staff’s A.M. shift occurs from 6AM to 2PM, while the P.M. shift occurs from 2PM to 10PM. Shift response times may differ due to the number of drivers on duty and their coverage areas.

Table 5 and Figure 16 present the average IMAP assistance response and clearance times, in minutes, for the Triangle Expressway.

**Table 5: 2019 Average IMAP Assistance Response and Clearance Times (Minutes), YTD**

Response Type	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	2019 Average
A.M. Shift Response	9	10	5	8	8	4	8	9	8				8
A.M. Shift Clearance	4	4	6	8	9	8	7	7	8				7
P.M. Shift Response	7	11	8	8	9	9	6	9	11				9
P.M. Shift Clearance	6	7	6	8	8	8	9	6	4				7

**Figure 16: Average IMAP Assistance Response and Clearance Times (Minutes), Third Quarter by Month**



# Roadway Maintenance Statistics

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# Roadway Maintenance Statistics

This section outlines the NCTA Maintenance Rating Program (MRP), which is a maintenance evaluation program for roadway features and toll facilities. MRP is a comprehensive planning, measuring, and managing process that provides a means for communicating to managers, stakeholders, and customers the impacts of policy and budget decisions on program service delivery.

Using outcome-based performance measures and the service level scale (0 through 100), the inspection results are rated against established threshold criteria. The program analysis is accomplished using sampling procedures that capture the level of service being provided for individual asset features. Over time, these ratings will then be charted to identify work needs and subsequent necessary actions. The evaluations are based on the establishment of threshold conditions that quantify the maximum defect allowed to exist for a characteristic before it is considered unacceptable. The NCTA performance standards, threshold criteria, and Maintenance Rating Program were developed through a collaborative effort by NCTA managers, NCDOT maintenance staff, and consultants.

Using field survey information, a maintenance matrix can be developed to show the ties between maintenance activities and the characteristics of various roadway features. The purpose of this evaluation is to provide information that will be used to schedule and prioritize routine maintenance activities and provide uniform maintenance conditions that meet established objectives.

## Assessment Schedule

As part of the NCTA MRP, a “baseline” assessment is scheduled for each newly opened roadway section soon after opening to toll collection. The baseline assessments include a complete inventory data collection and assessment on 100% of the roadway assets. A baseline assessment for the Veridea Parkway interchange was completed in March of 2018. A baseline assessment for Morrisville Parkway Interchange will similarly be done upon substantial completion.

After the baseline assessment is completed, future assessments for that segment switch over to a statistical sampling assessment. Inspections are performed during the months of February, May, August, and November to account for dynamic seasonal changes to assets. These inspections are accomplished using statistically valid, random sampling procedures that capture the level of service for individual assets with a 95% confidence level in sampling.

## Assessment Results

Table 6 presents the 2019 quarterly and annual MRP Assessment rating for the Triangle Expressway. It is important to note that the Quarterly Ratings are only representative of the samples inspected during each quarter. Therefore, they are not a statistically valid representation of the assets' conditions; only the annual rating provides a 95% confidence level in statistical sampling.

**Table 6: MRP Assessment Results**

Element	Q1 2019 Rating	Q2 2019 Rating	Q3 2019 Rating	Q4 2019 Rating	2019 Annual Rating
Road Surface	96.0	92.6	96.9	N/A	N/A
Unpaved Shoulders and Ditches	97.4	97.8	94.7	N/A	N/A
Drainage	91.3	94.0	92.3	N/A	N/A
Roadside	92.8	92.8	94.7	N/A	N/A
Traffic Control Devices	92.1	87.9	86.6	N/A	N/A
<b>Overall MRP Performance Rating</b>	<b>93.7</b>	<b>92.1</b>	<b>92.5</b>	<b>N/A</b>	<b>N/A</b>

N/A (Not Applicable) – MRP Assessment has not yet been conducted.