



Triangle Expressway

Roadway Operations Statistics Report

2020 Fourth Quarter
October - December

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Introduction

Purpose

The North Carolina Turnpike Authority (NCTA) presents the operations statistics for the Triangle Expressway during the fourth quarter (October – December) of 2020. 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.

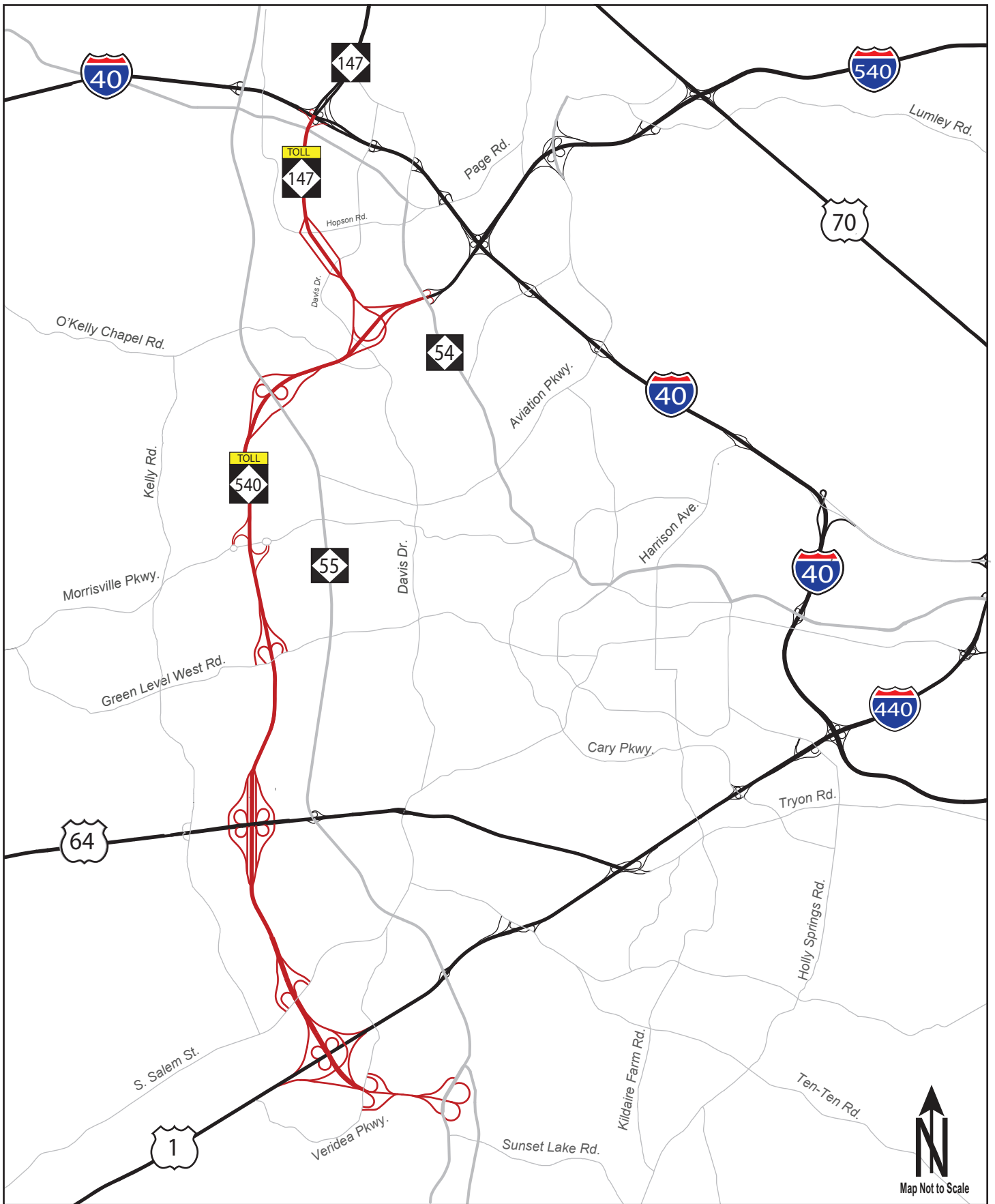
Toll N.C. 147 includes 3.4 miles of toll road between I-40 and Toll N.C. 540. This section of the Triangle Expressway includes interchanges at Hopson Road, Davis Drive, and Toll N.C. 540. It opened to toll-free traffic on December 8, 2011; tolling on this section began on January 3, 2012.

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. On February 3rd, 2020, an interchange at Morrisville Parkway between N.C. 55 and Green Level West Road was opened to motorists.

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

Traffic Statistics

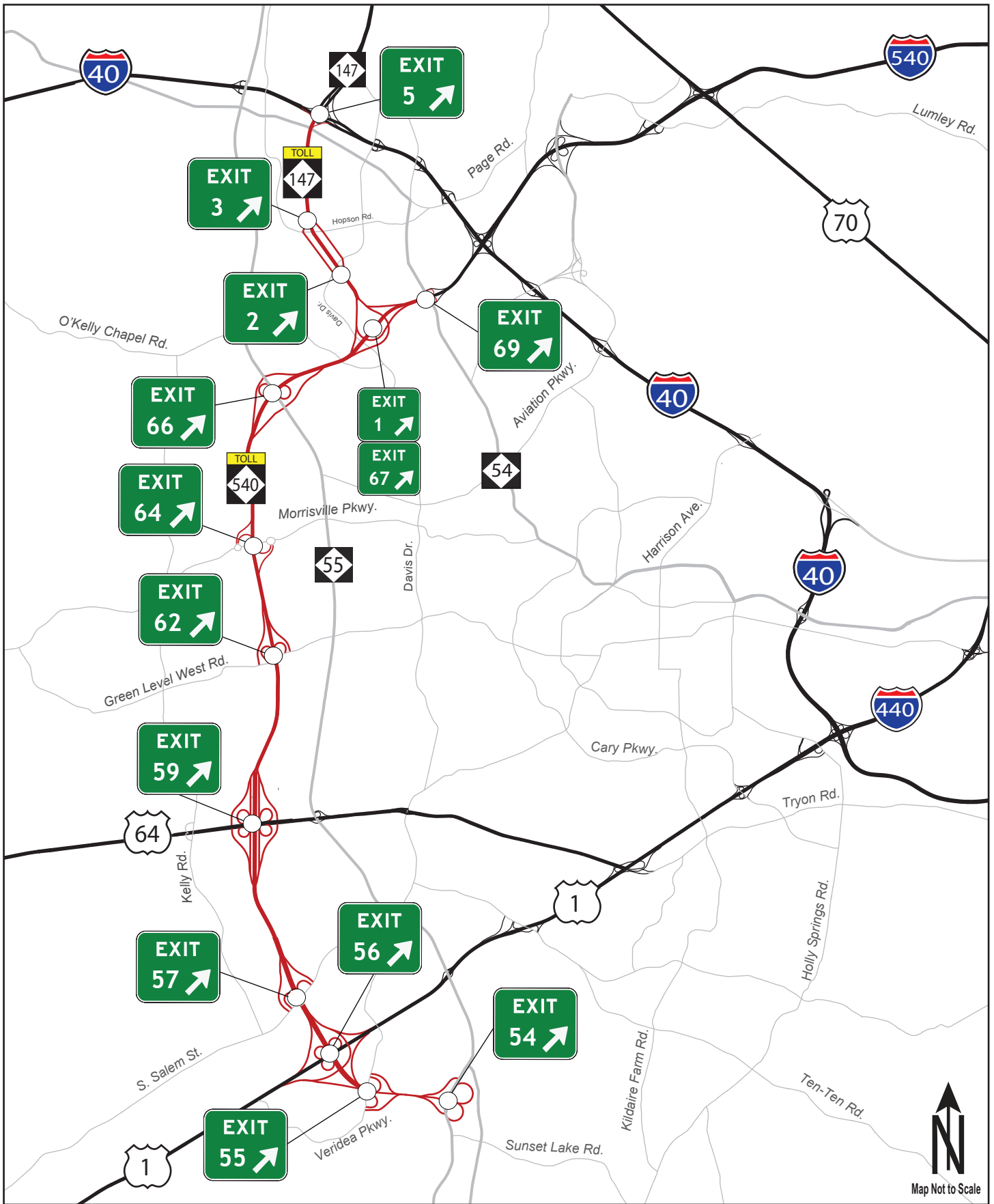
Current and historical traffic data is collected and stored using roadside microwave vehicle detectors (MVDs) installed throughout the Triangle Expressway, providing an overview of the roadway's current utilization. The data is analyzed to identify trends that could more accurately predict future utilization.

It should be noted that due to the state of emergency declaration on March 10th, 2020 in response to novel coronavirus, travel and gatherings were restricted statewide. Therefore, traffic statistics this year are not representative of historical utilization trends.

Average Weekday Traffic (AWT)

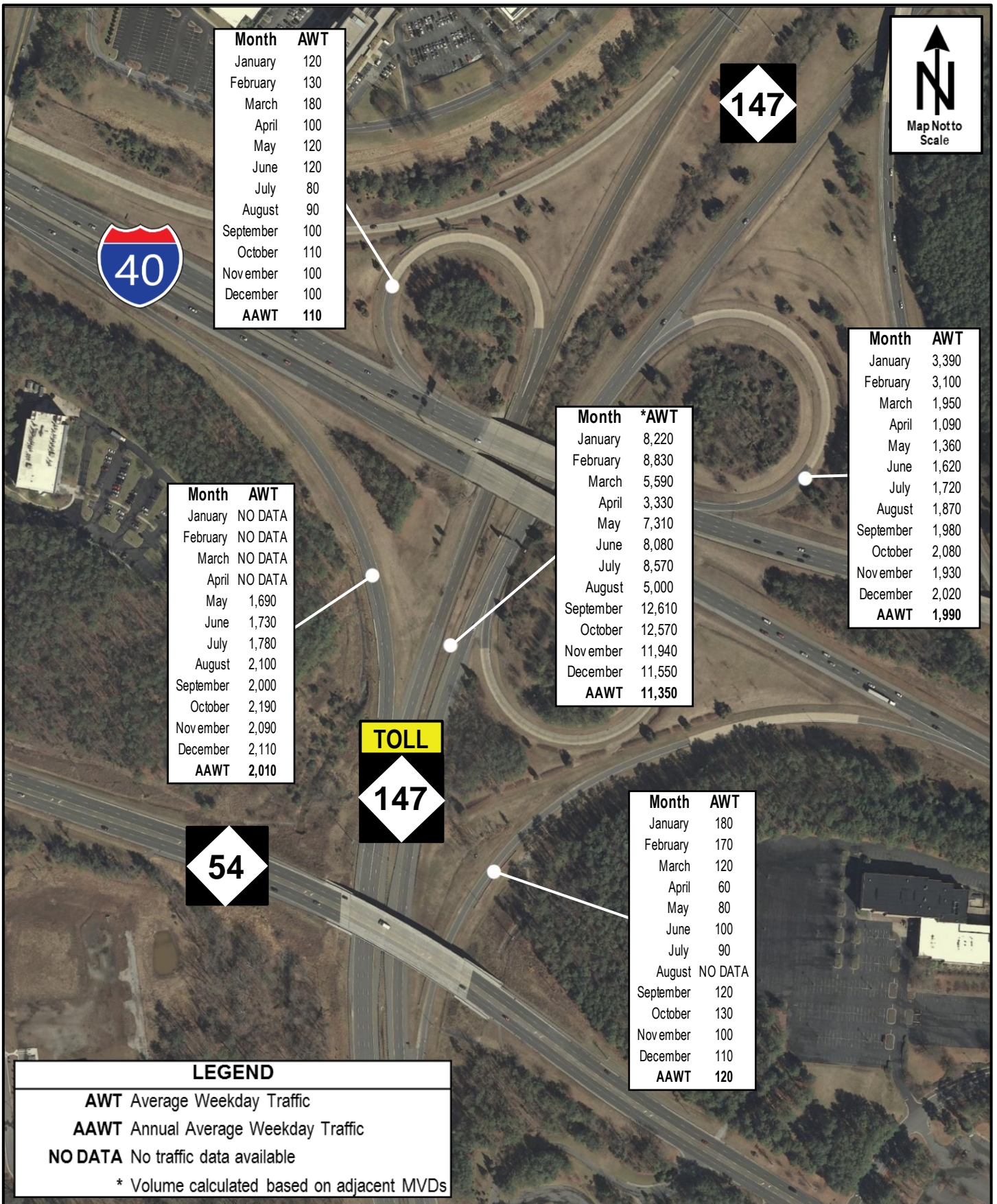
Traffic volume data is collected at all ramps and mainline segments between interchanges. The location of interchanges along the Triangle Expressway can be seen in *Figure 2*. Typically, there is a large difference between peak and off-peak volumes, as well as between weekday and weekend volumes. This 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 15*. 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. Replacement of MVD devices by Kapsch began in June 2020 and has continued through February 2021.



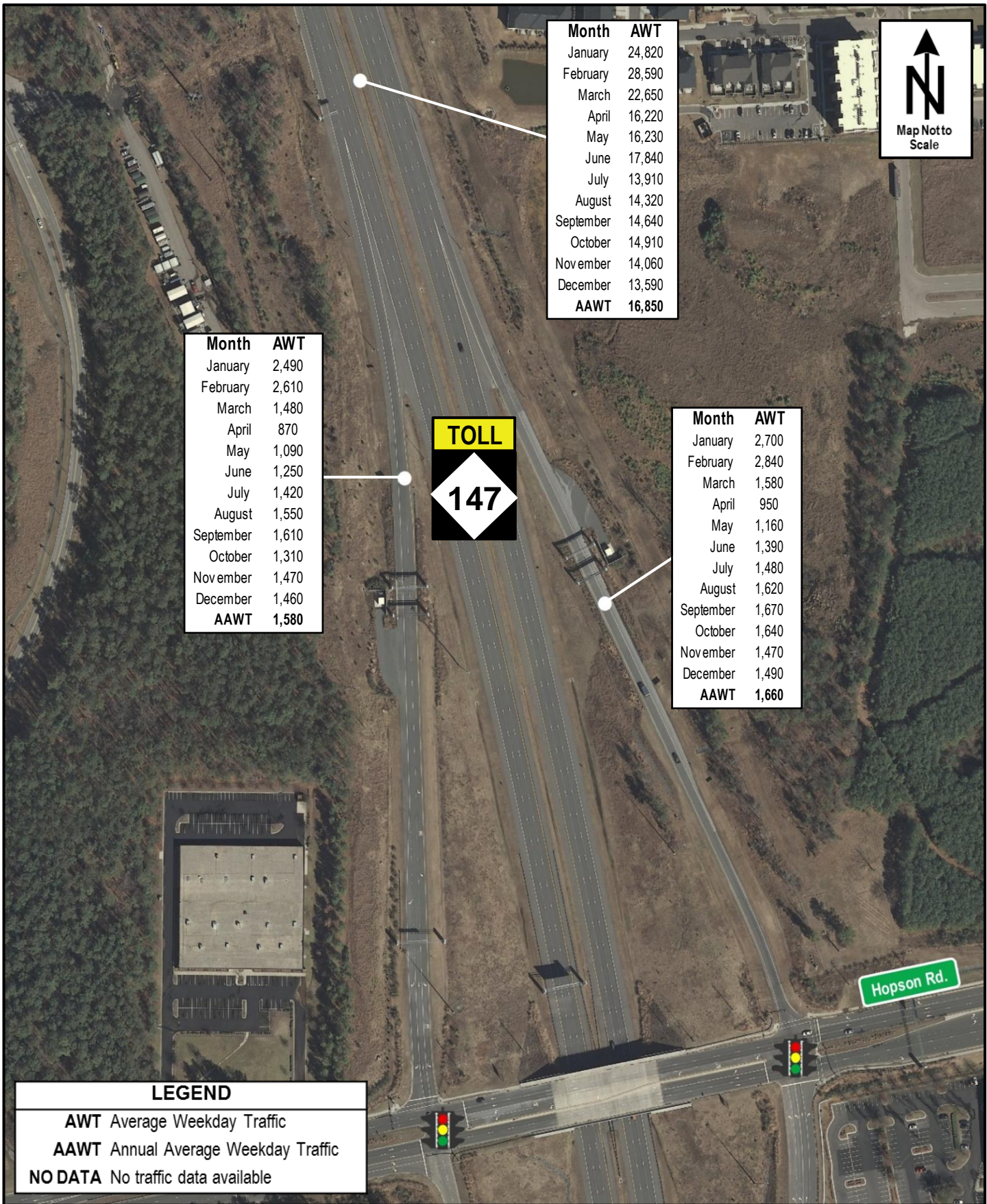
Triangle Expressway Interchange Map

Figure 2



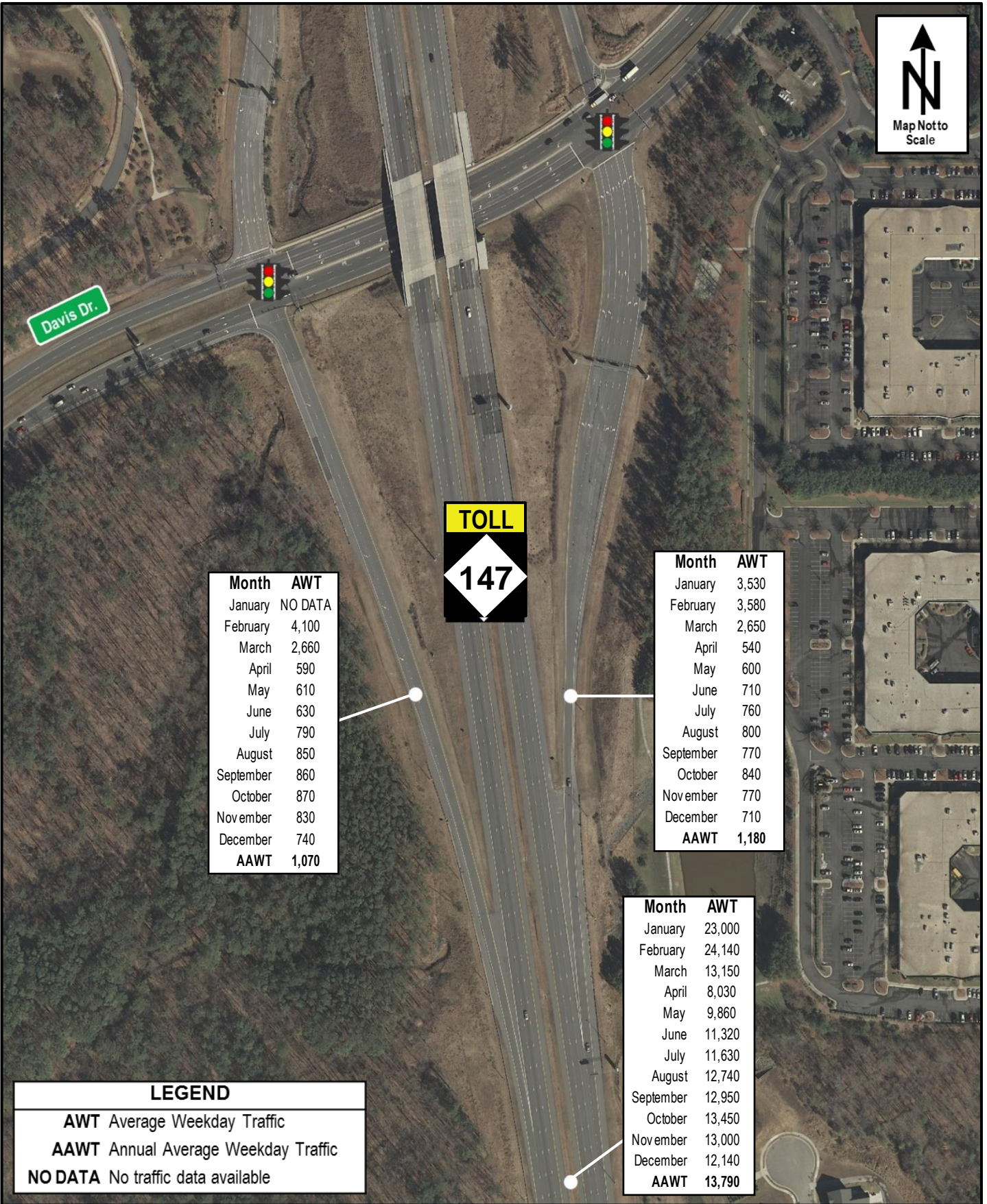
NC-147 at I-40 Interchange
 2020 Average Weekday Traffic

Figure
3



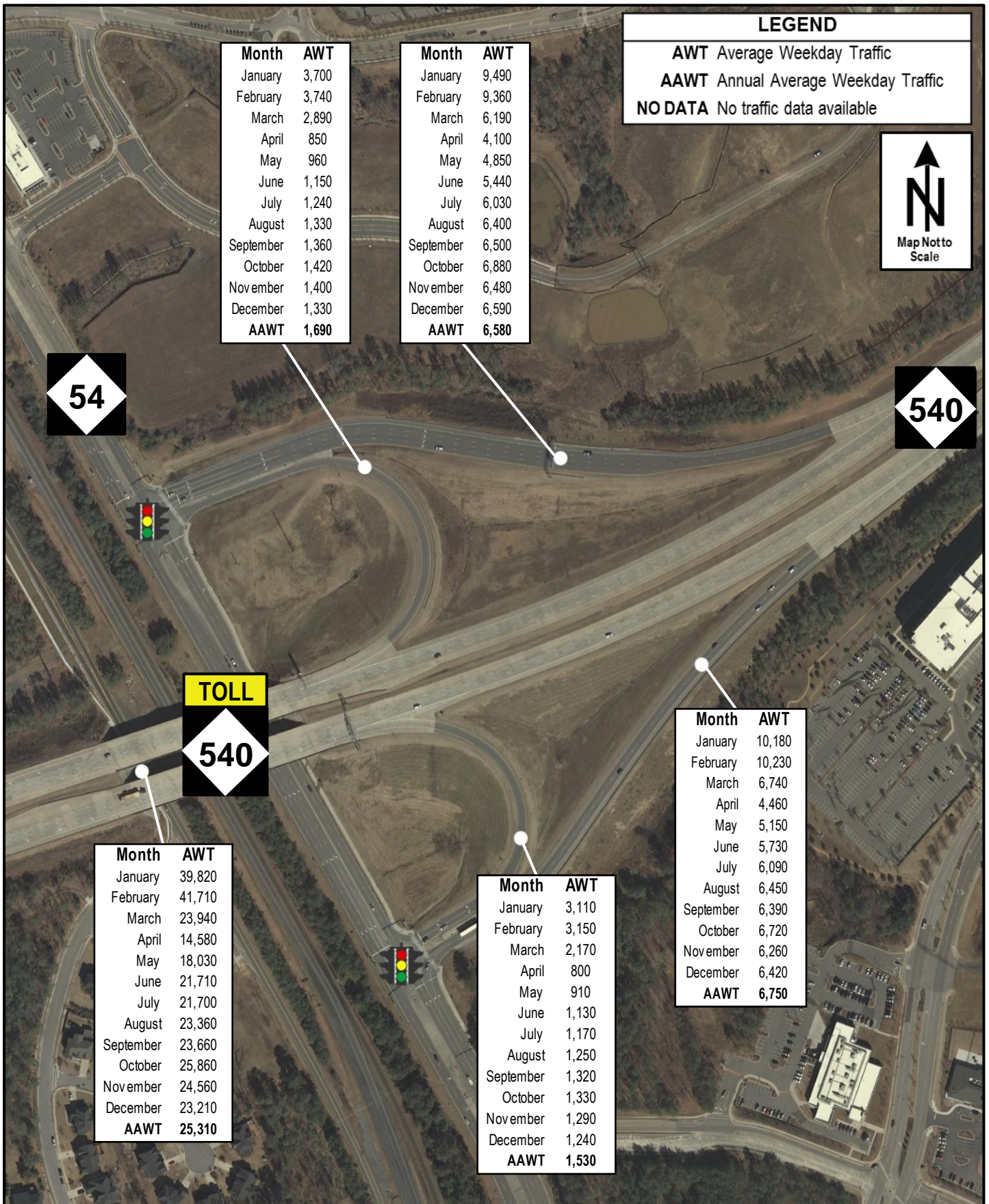
NC-147 at Hopson Rd. Interchange
 2020 Average Weekday Traffic

Figure
4



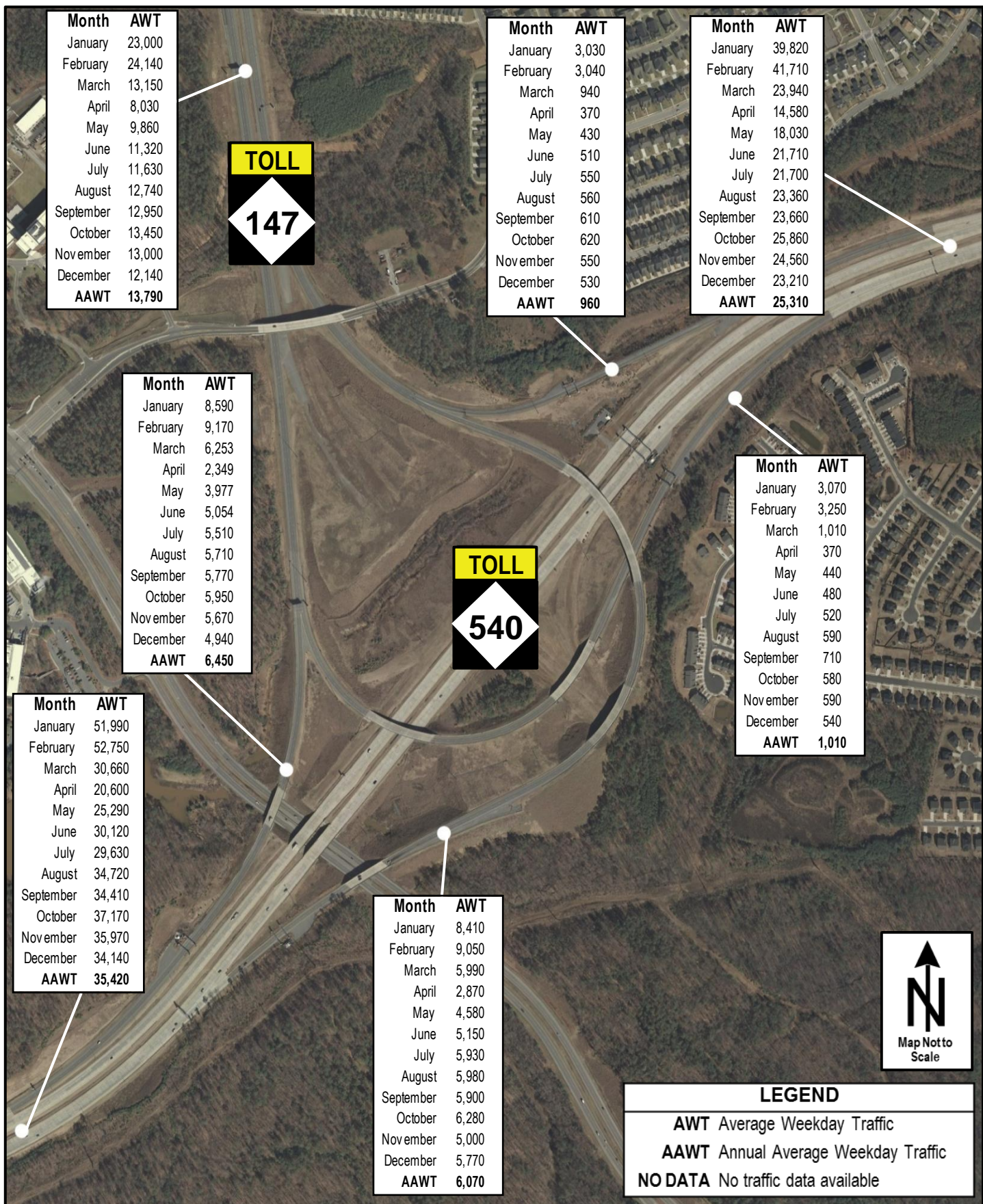
NC-147 at Davis Dr. Interchange
2020 Average Weekday Traffic

Figure
5



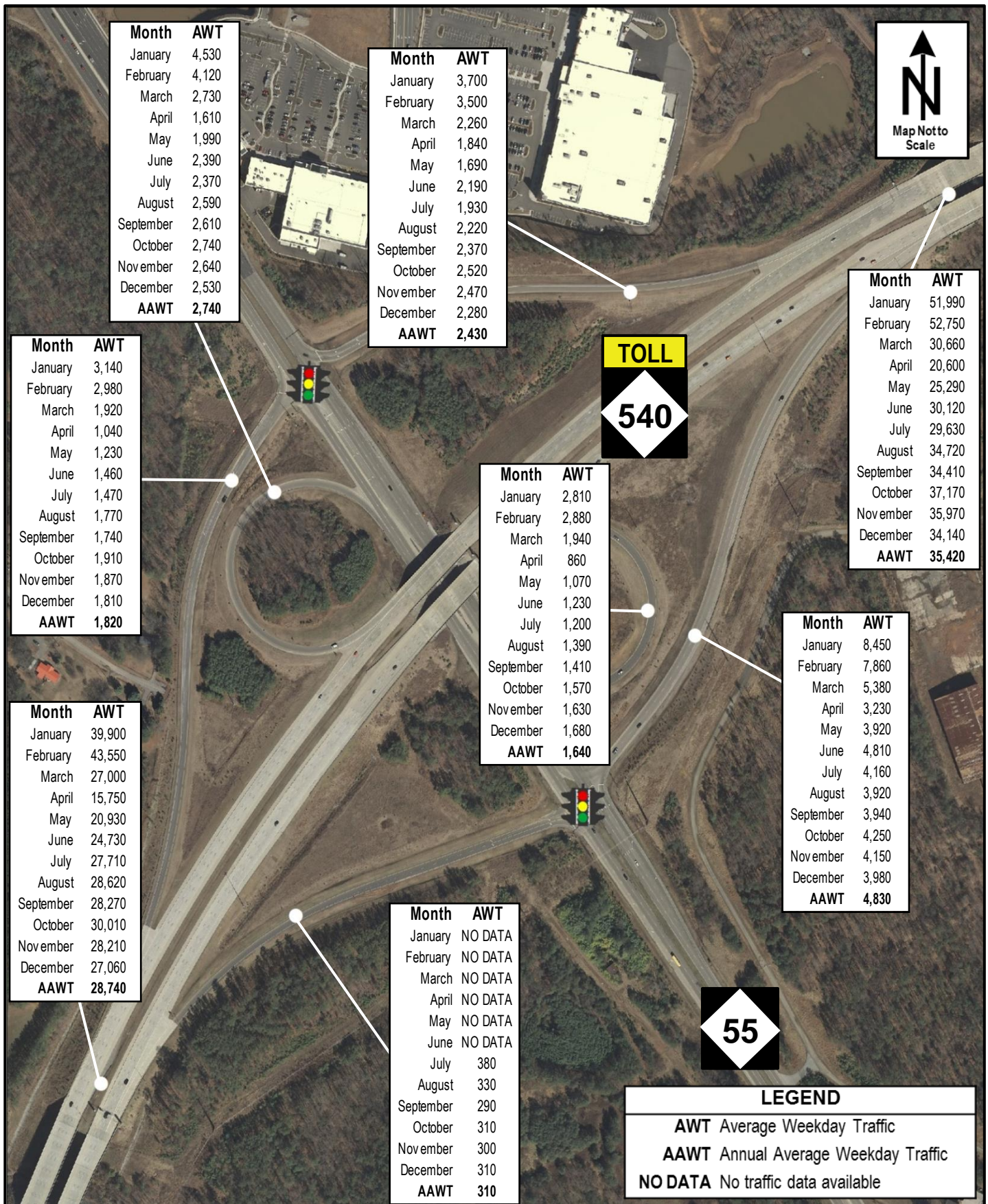
NC-540 at NC-54 Interchange
 2020 Average Weekday Traffic

Figure
6



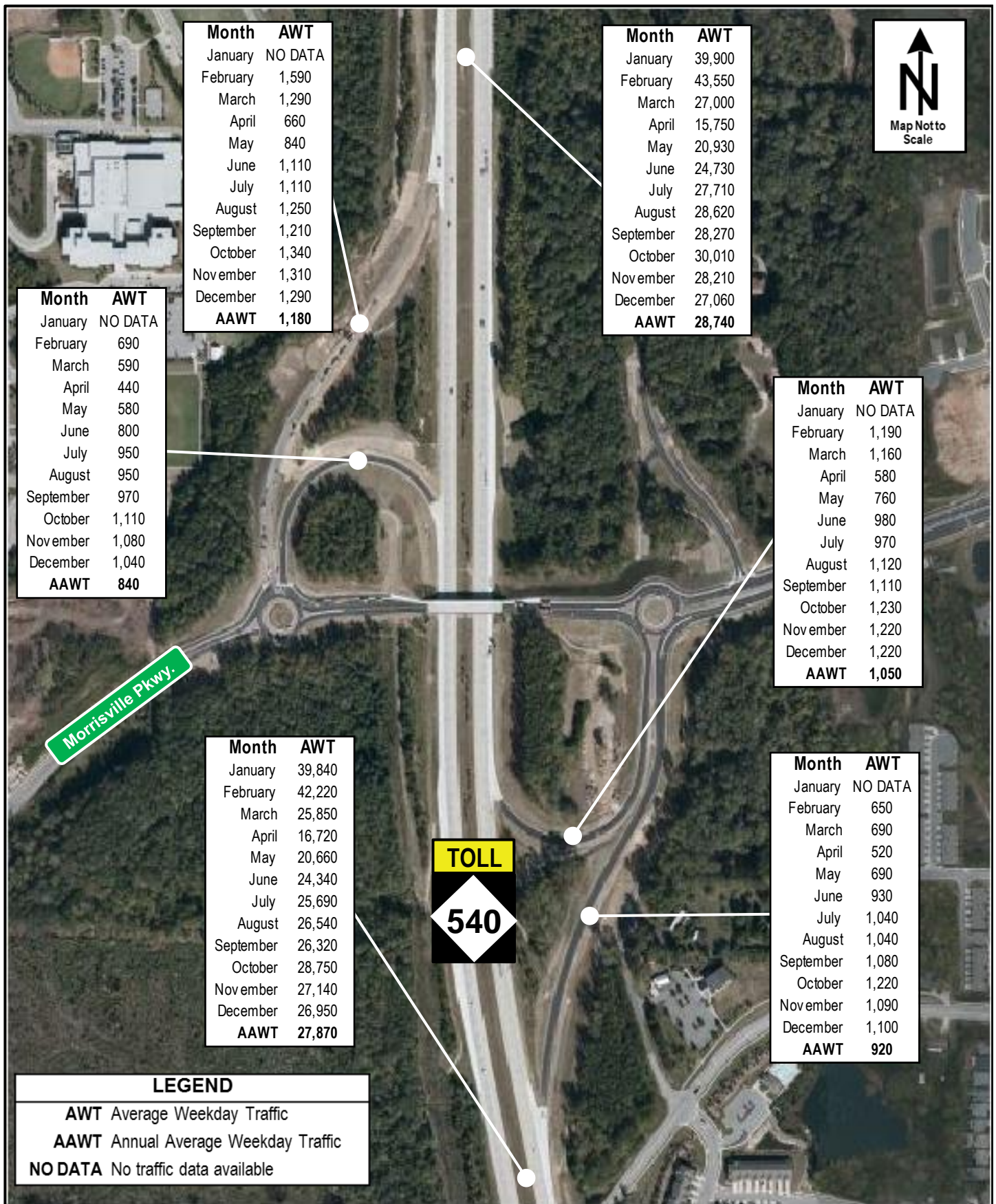
NC-540 at NC-147 Interchange
2020 Average Weekday Traffic

Figure
7



NC-540 at NC-55 Interchange
2020 Average Weekday Traffic

Figure
8



NC-540 at Morrisville Pkwy. Interchange
 2020 Average Weekday Traffic

Figure
9

Month	AWT
January	39,840
February	42,220
March	25,850
April	16,720
May	20,660
June	24,340
July	25,690
August	26,540
September	26,320
October	28,750
November	27,140
December	26,950
AAWT	27,870



Month	AWT
January	2,310
February	2,080
March	1,390
April	690
May	820
June	990
July	930
August	1,080
September	1,060
October	1,140
November	1,160
December	1,170
AAWT	1,220

Month	AWT
January	2,130
February	1,970
March	1,350
April	650
May	800
June	900
July	1,020
August	1,350
September	1,370
October	1,560
November	1,440
December	1,390
AAWT	1,340

Month	AWT
January	2,060
February	1,810
March	1,310
April	700
May	930
June	1,040
July	1,050
August	1,120
September	1,250
October	1,340
November	1,270
December	1,270
AAWT	1,280

Month	AWT
January	1,900
February	1,620
March	1,140
April	870
May	920
June	1,150
July	1,130
August	1,530
September	1,470
October	1,570
November	1,480
December	1,470
AAWT	1,370

Green Level West Rd.

Month	AWT
January	40,780
February	41,640
March	27,840
April	16,520
May	20,310
June	24,070
July	27,340
August	28,040
September	27,930
October	30,190
November	28,000
December	28,050
AAWT	28,510

LEGEND

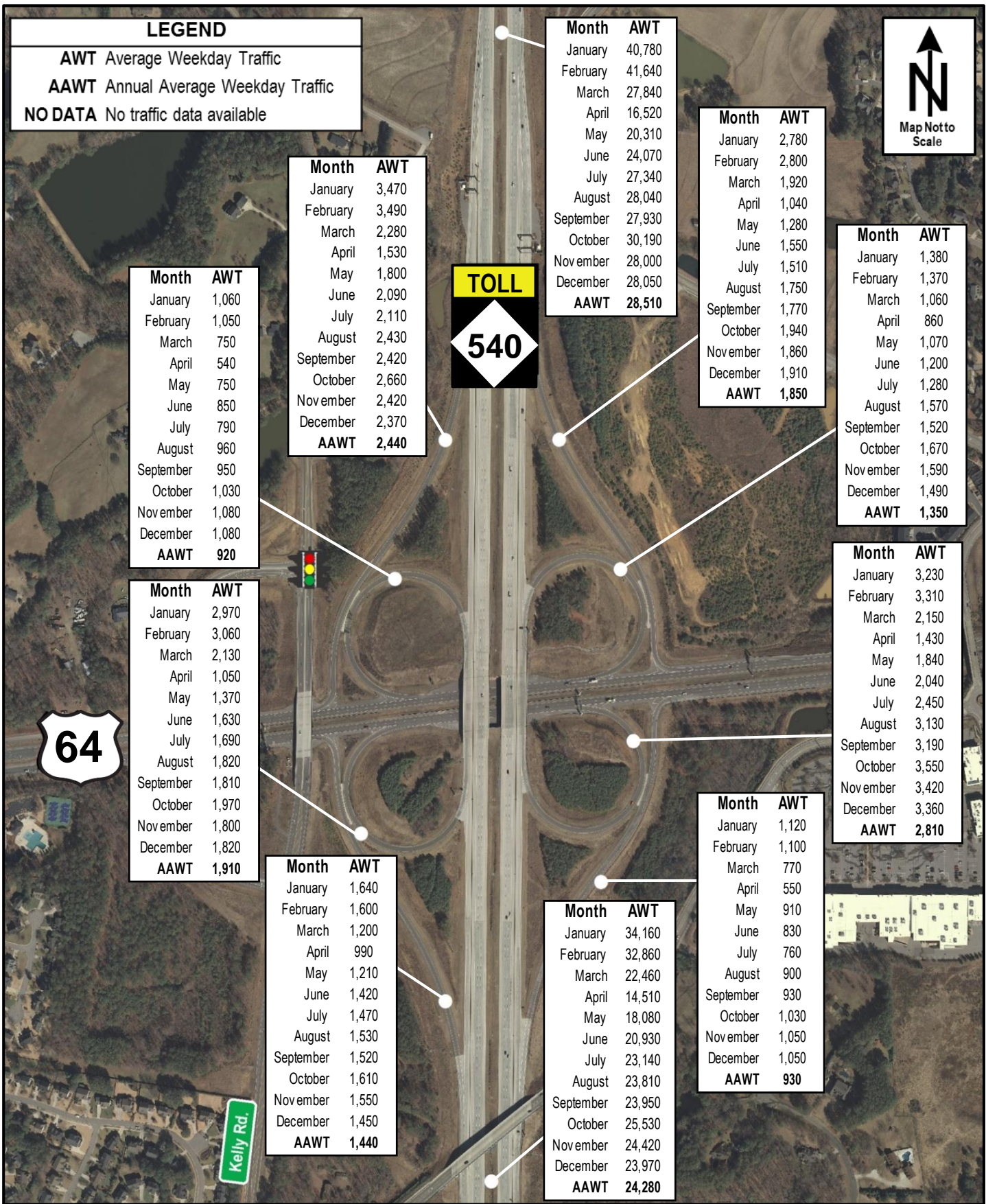
AWT Average Weekday Traffic

AAWT Annual Average Weekday Traffic

NO DATA No traffic data available

NC-540 at Green Level West Rd. Interchange
2020 Average Weekday Traffic

Figure 10



NC-540 at US-64 Interchange
 2020 Average Weekday Traffic

Figure
11



Month	AWT
January	34,160
February	32,860
March	22,460
April	14,510
May	18,080
June	20,930
July	23,140
August	23,810
September	23,950
October	25,530
November	24,420
December	23,970
AAWT	24,280

Month	AWT
January	1,670
February	1,620
March	1,090
April	600
May	740
June	890
July	1,060
August	1,100
September	1,120
October	1,230
November	1,130
December	1,140
AAWT	1,130

Month	AWT
January	1,960
February	2,040
March	1,310
April	750
May	990
June	1,250
July	NO DATA
August	NO DATA
September	1,560
October	1,550
November	1,540
December	1,440
AAWT	1,460

Month	AWT
January	1,750
February	1,720
March	1,200
April	660
May	770
June	1,020
July	990
August	1,080
September	1,080
October	1,170
November	1,150
December	1,100
AAWT	1,140



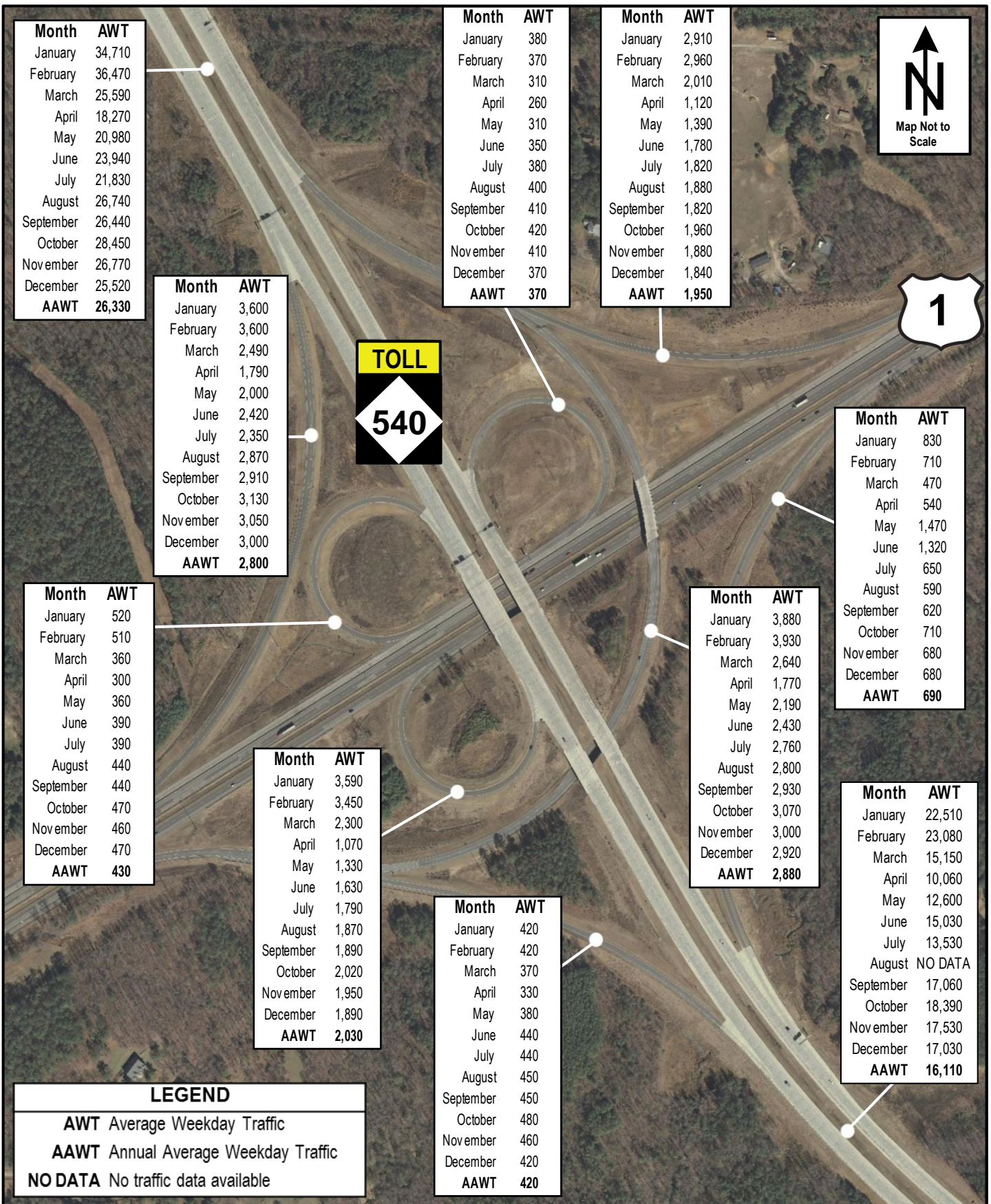
Month	AWT
January	2,080
February	2,190
March	1,410
April	810
May	1,040
June	1,390
July	1,320
August	1,400
September	1,420
October	1,470
November	1,380
December	1,420
AAWT	1,460

Month	AWT
January	34,710
February	36,470
March	25,590
April	18,270
May	20,980
June	23,940
July	21,830
August	26,740
September	26,440
October	28,450
November	26,770
December	25,520
AAWT	26,330

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

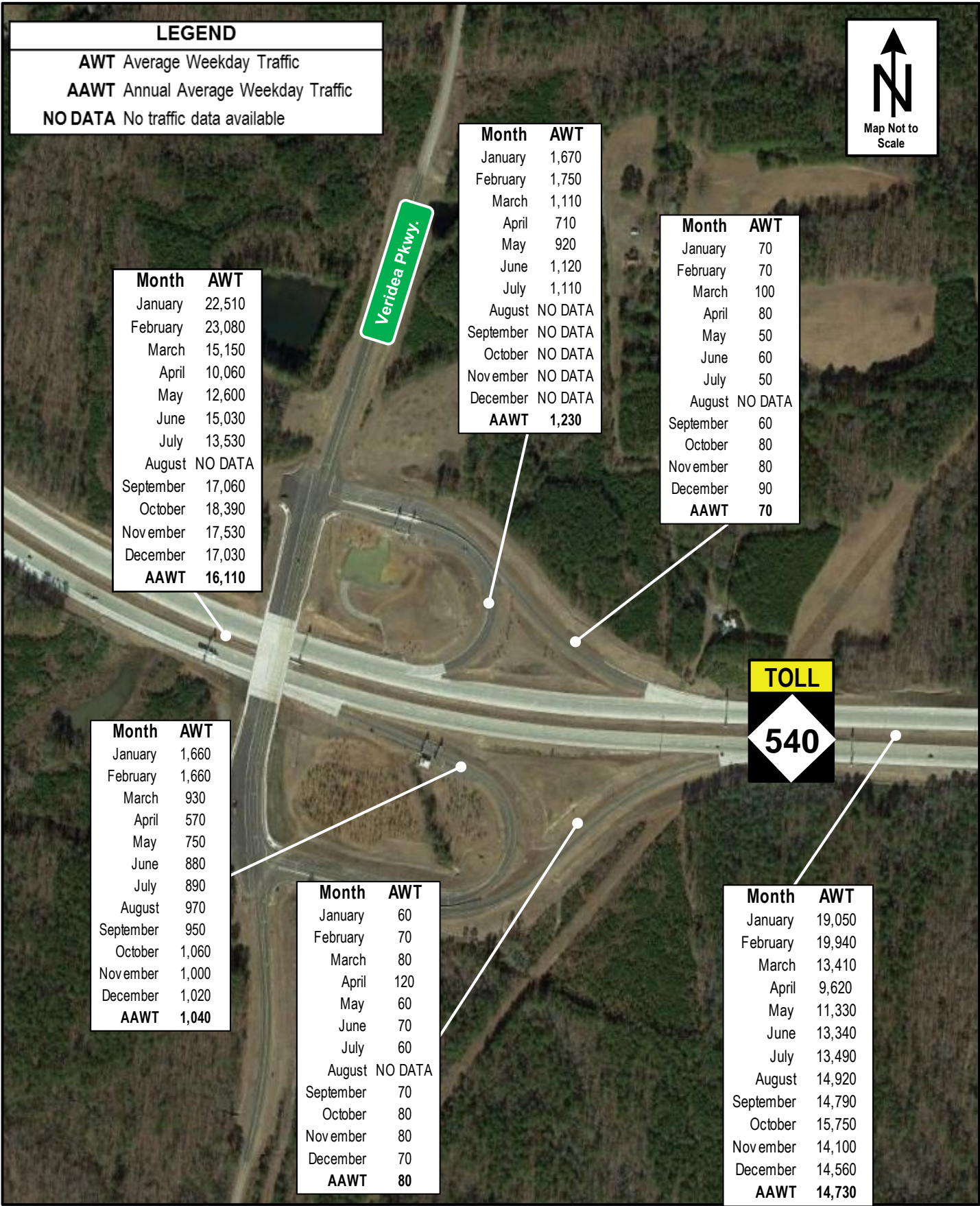
NC-540 at S. Salem St. Interchange
2020 Average Weekday Traffic

Figure 12



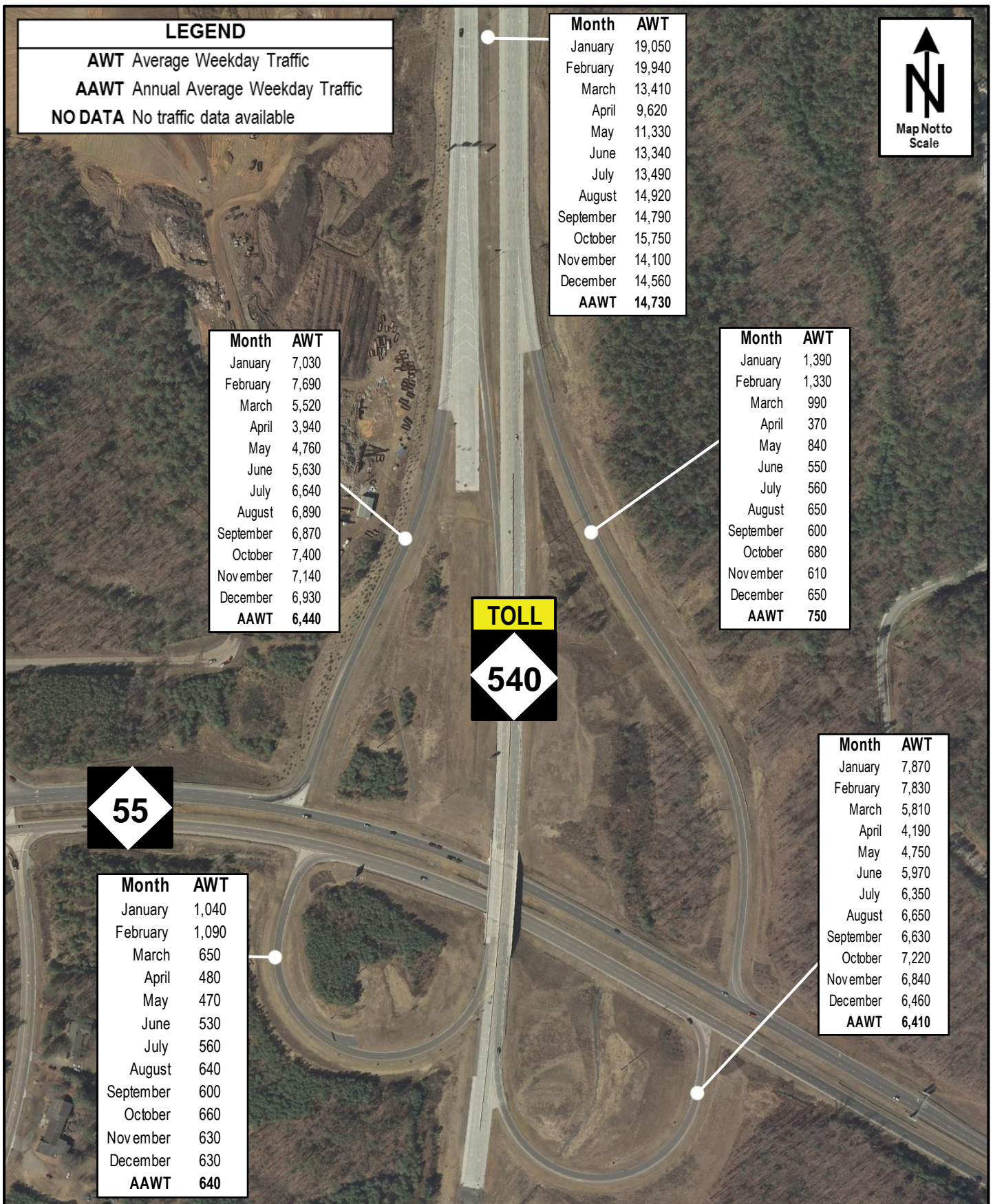
NC-540 at US-1 Interchange
 2020 Average Weekday Traffic

Figure
13



NC-540 at Veridea Pkwy. Interchange
 2020 Average Weekday Traffic

Figure
14



NC-540 at NC-55 Bypass Interchange
 2020 Average Weekday Traffic

Figure 15

Roadway Safety Statistics

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 fourth 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 December 1, 2017 to November 30, 2020 for each segment. The AADT used for this quarter's analysis was collected from the NCDOT 2019 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 fourth quarter analysis.

Table 1: Safety Statistics, December 1, 2017 – November 30, 2020

Segment	Length	AADT ¹	Total Crashes	Vehicle Exposure (MVMT)	Total Crash Rate	Statewide Crash Rate ²	Critical Crash Rate
Toll N.C. 147 I-40 to Toll N.C. 540	3.1	17,000	46	57.82	79.55	129.58	155.07
Toll N.C. 540 I-40 to N.C. 55	2.8	43,000	74	131.60	56.23	129.58	146.28
Toll N.C. 540 N.C. 55 to U.S. 64	6.7	36,000	99	263.29	37.60	129.58	141.31
Toll N.C. 540 U.S. 64 to N.C. 55 Bypass	5.9	26,000	90	166.86	53.94	129.58	144.38
Triangle Expressway	18.4	30,700	309	619.93	49.84	129.58	137.18

¹ AADT provided from NCDOT 2019 AADT Maps, Wake County

² Statewide Crash Rate for Urban Interstate Facilities Applied

Roadway Operations Statistics

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 fourth quarter of 2020. 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 2020. "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: 2020 SHP Chargeable Activities, YTD

Chargeable Activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Speed Violations	20	51	14	20	20	47	38	36	32	32	25	26	361
Alcohol Violations	0	0	0	0	0	1	0	1	0	1	0	1	4
Seat Belt Violations	5	5	3	0	1	6	5	7	10	1	3	4	50
Child Restraint Violations	1	0	0	0	0	0	0	0	0	0	0	1	2
Reckless Driving	1	4	6	4	4	5	1	4	3	0	1	5	38
Drug Violations	0	0	0	0	0	0	0	3	0	0	0	0	3
Obstructed Plates	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Violations	32	56	76	16	15	26	11	7	20	18	16	17	310
Total Charges	59	116	99	40	40	85	55	58	65	52	45	54	768

Table 3: 2020 SHP Non-Chargeable Activities, YTD

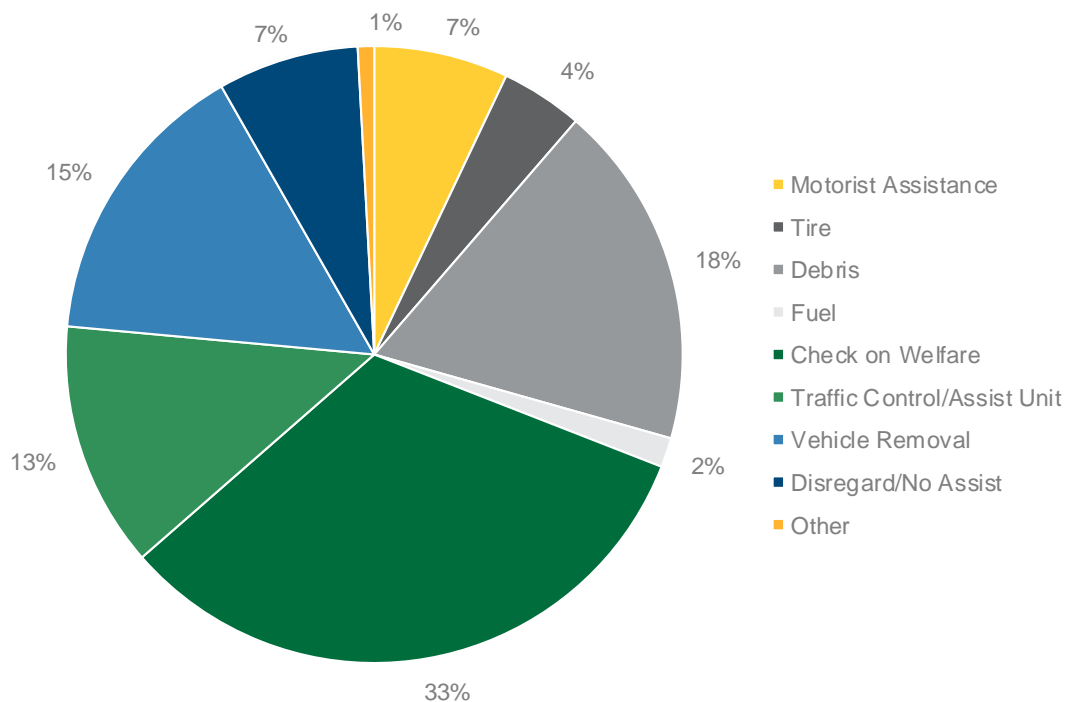
Non-Chargeable Activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Warnings	76	40	64	7	9	24	13	29	20	35	26	26	369
Crashes Investigated	5	15	18	10	5	7	4	2	5	5	7	6	89
Calls for Service	31	24	20	30	19	29	26	43	34	33	31	24	344
Total	112	79	102	47	33	60	43	74	59	73	64	56	802

The IMAP assists with stranded motorists and incident clearance, thereby maintaining the flow of traffic along the roadway. *Table 4* and *Figure 16* present the monthly breakdown of IMAP services, by type, for the Triangle Expressway during 2020. The “other” category includes extinguish fire service, first aid service, and other rare miscellaneous services.

Table 4: 2020 IMAP Services, YTD

Assist Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Motorist Assistance	10	2	2	1	2	3	3	3	5	7	0	3	41
Tire	1	2	0	2	1	3	3	4	3	2	2	2	25
Debris	13	11	12	1	3	11	7	7	13	13	7	7	105
Fuel	1	0	0	0	1	1	1	1	0	1	1	2	9
Check on Welfare	31	27	29	6	3	10	16	18	14	13	14	9	190
Traffic Control / Assist Unit	8	12	8	3	3	8	7	6	4	4	9	3	75
Vehicle Removal	17	10	7	1	2	5	3	8	7	10	7	12	89
Disregard / No Assist	5	6	2	0	1	5	4	3	2	10	3	2	43
Other	1	1	3	0	0	0	0	0	0	0	0	0	5
Total Assists	87	71	63	14	16	46	44	50	48	60	43	40	582

Figure 16: 2020 IMAP Services by Type, YTD



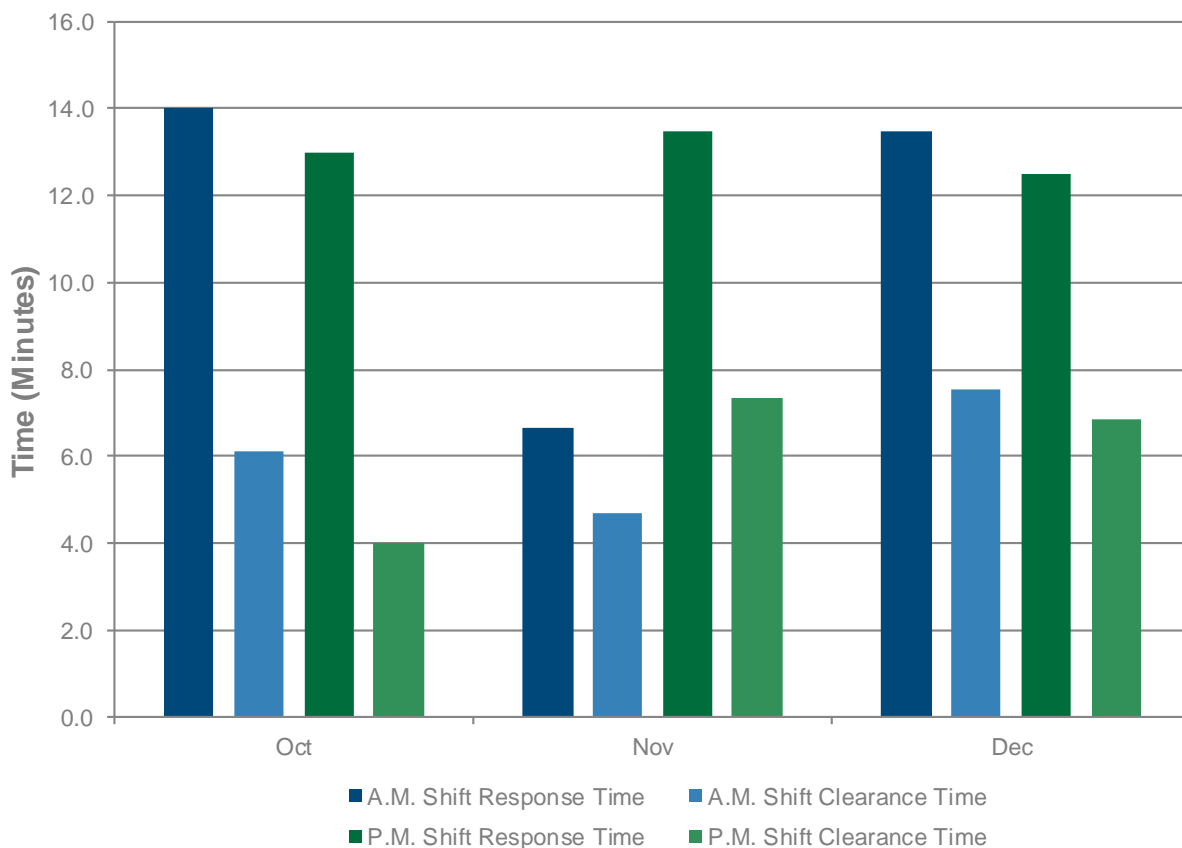
The response and clearance times for all IMAP assists are logged by IMAP and provided to the NCTA. Response time is the time from which a responder receives a call to the time they arrive on the scene. Clearance time is the time it takes the responder to clear the incident and return the roadway to normal 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 17 present the average IMAP assistance response and clearance times, in minutes, for the Triangle Expressway.

Table 5: 2020 Average IMAP Response & Clearance Times (Minutes), YTD

Response Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2020 Average
A.M. Shift Response	7.0	9.0	18.8	8.7	16.0	14.3	8.0	10.0	14.8	14.0	6.7	13.5	11.7
A.M. Shift Clearance	6.7	12.8	8.5	15.6	9.0	6.9	5.0	5.8	7.2	6.1	4.7	7.6	8.0
P.M. Shift Response	8.9	16.7	8.4	9.0	7.5	7.6	17.7	7.5	10.8	13.0	13.5	12.5	11.1
P.M. Shift Clearance	12.4	6.9	13.9	6.6	8.2	9.8	6.6	11.0	8.1	4.0	7.3	6.9	8.5

Figure 17: Average IMAP Response & Clearance Times (Minutes), Fourth Quarter by Month



Roadway Maintenance Statistics

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 performed in 2020.

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 2020 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 until after the fourth quarter; only the annual rating provides a 95% confidence level in statistical sampling.

Table 6: MRP Assessment Results

Element	Q1 2020 Rating	Q2 2020 Rating	Q3 2020 Rating	Q4 2020 Rating	2020 Annual Rating
Road Surface	94.9	93.8	96.3*	96.2*	95.2**
Unpaved Shoulders and Ditches	98.7	92.5	96.5	98.8	96.6
Drainage	91.9	92.5	89.2	87.6	90.3
Roadside	94.7	91.7	91.1	89.1	91.6
Traffic Control Devices	90.4	87.0	84.0*	85.2*	86.8**
Overall MRP Performance Rating	93.6	91.0	90.7*	90.7*	91.5**

* Excludes asphalt surface pavement condition as well as markers, striping, and symbols on mainline NC-147 and ramps/loops.

** Excludes third and fourth quarter ratings for the characteristics listed above.