



NORTH CAROLINA  
**Turnpike Authority**

## Maintenance Rating Program

Triangle Expressway

### 2019 Third Quarter Report

1 S. Wilmington Street  
Raleigh, NC 27601



Last Updated:  
November 8, 2019

## CONSULTANT CERTIFICATION OF COMPLETION

November 7, 2019

Dennis Jernigan, P.E.  
Director of Highway Operations, NCTA  
1 South Wilmington Street  
Raleigh, NC 27601

### NCTA Triangle Expressway Roadway Maintenance Performance Rating Program; Q3, FY 2019 Rating

This is to certify that I, Ken M. McEntire, PE am an authorized official representative of the company The Kercher Group, Inc., which is a subconsultant to HNTB North Carolina, P.C. Collaboratively; we are working as the Triangle Expressway Roadway and Facility Maintenance Performance Rating Program Consultants.

I know of my own personal knowledge, and do hereby certify, that the work of the contract described above has been independently performed in accordance with, and in conformity to, the *NCTA Roadway and Facility Maintenance Performance Standards*.

Sincerely,

The Kercher Group, Inc.

A handwritten signature in blue ink that reads "Ken M. McEntire". The signature is written in a cursive style with a large initial "K" and "M".

Ken M. McEntire, PE  
Principal

1100 Navaho Drive, Suite 125  
Raleigh, NC 27609

**Table of Contents**

List of Figures ..... ii

List of Tables ..... ii

1.0 EXECUTIVE SUMMARY ..... 1

2.0 INTRODUCTION ..... 2

3.0 MRP PROCEDURE ..... 2

4.0 TRIANGLE EXPRESSWAY DESCRIPTION ..... 5

5.0 TRIANGLE EXPRESSWAY ASSET INVENTORY UPDATE ..... 6

6.0 MRP THIRD QUARTER ASSESSMENT ..... 7

    6.1 Quarterly Results ..... 7

    6.2 Analysis and Recommendations ..... 9

7.0 CURRENT ROLLING MRP RATING ..... 11

8.0 GREEN LEVEL HISTORIC DISTRICT SIGNS ..... 13

    8.1 Analysis and Recommendations ..... 13

9.0 CONCLUSION ..... 14

Maintenance Rating Program for the Triangle Expressway

2019 Third Quarter (July – September)

---

**List of Figures**

Figure 1: Maintenance Elements and Characteristics ..... 3  
Figure 2: Triangle Expressway Map ..... 5  
Figure 3: Pavement Striping Inspection Results Sample..... 10  
Figure 4: Green Level West Historic District Signs, Landscape Areas ..... 13

**List of Tables**

Table 1: MRP Element Results for the 2019 Third Quarter Assessment ..... 1  
Table 2: MRP Rolling Element Results ..... 1  
Table 3: Asset Inventory ..... 6  
Table 4: MRP Element Results for Q3 2019 ..... 7  
Table 5: MRP Characteristic Results for Q3 2019 ..... 8  
Table 6: MRP Element Results for 2019..... 11  
Table 7: MRP Rolling Element Results ..... 12

**Appendices**

- A. Triangle Expressway 2019 Third Quarter Asset Assessment Locations
- B. Triangle Expressway 2019 Third Quarter Table Results of Assets Failing MRP



## Maintenance Rating Program for the Triangle Expressway

2019 Third Quarter (July – September)

### 1.0 EXECUTIVE SUMMARY

The North Carolina Turnpike Authority (NCTA) Maintenance Rating Program (MRP) is a maintenance evaluation program for roadway features and toll facilities on the NCTA system. This report presents results from the 2019 Third Quarter Assessment of the Triangle Expressway.

The overall 2019 third quarter maintenance rating of the Triangle Expressway was 92.5, meeting the NCTA target rating of 90. As shown in **Table 1**, all five elements assessed achieved a rating greater than the target rating of 85.

Table 1: MRP Element Results for the 2019 Third Quarter Assessment		
Element	MRP Rating	Target Rating
Road Surface	96.9	85.0
Unpaved Shoulders and Ditches	94.7	85.0
Drainage	92.3	85.0
Roadside	94.7	85.0
Traffic Control Devices	86.6	85.0
<b>Overall MRP Performance Rating</b>	<b>92.5</b>	<b>90.0</b>

This report also provides a rolling rating of the latest four quarterly inspections of the Triangle Expressway. As presented in **Table 2**, the rolling maintenance rating of the Triangle Expressway was 94.0.

Table 2: MRP Rolling Element Results					
Element	Q4 2018 Rating	Q1 2019 Rating	Q2 2019 Rating	Q3 2019 Rating	Rolling Rating
Road Surface	99.2	96.0	92.6	96.9	96.4
Unpaved Shoulders and Ditches	99.0	97.4	97.8	94.7	97.4
Drainage	92.8	91.3	94.0	92.3	92.6
Roadside	97.1	92.8	92.8	94.7	94.5
Traffic Control Devices	95.1	92.1	87.9	86.6	90.8
<b>Overall MRP Performance Rating</b>	<b>96.6</b>	<b>93.7</b>	<b>92.1</b>	<b>92.5</b>	<b>94.0</b>

In addition, the report provides findings of the Green Level Historic District signs inspection. This quarter, two of three signs were inspected. One sign has been temporarily removed due to a nearby redevelopment project. Both signs were found to be in good physical condition, and the landscaped areas around the signs were maintained in accordance with NCTA MRP standards.

## 2.0 INTRODUCTION

The NCTA 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 thresholds criteria. The program analysis is accomplished using sampling procedures that capture the level of service being provided for individual assets. The evaluation procedure is based on the establishment of threshold conditions that quantify the maximum defect allowed on assets. Over time, the results can be charted to identify work needs and subsequent necessary actions.

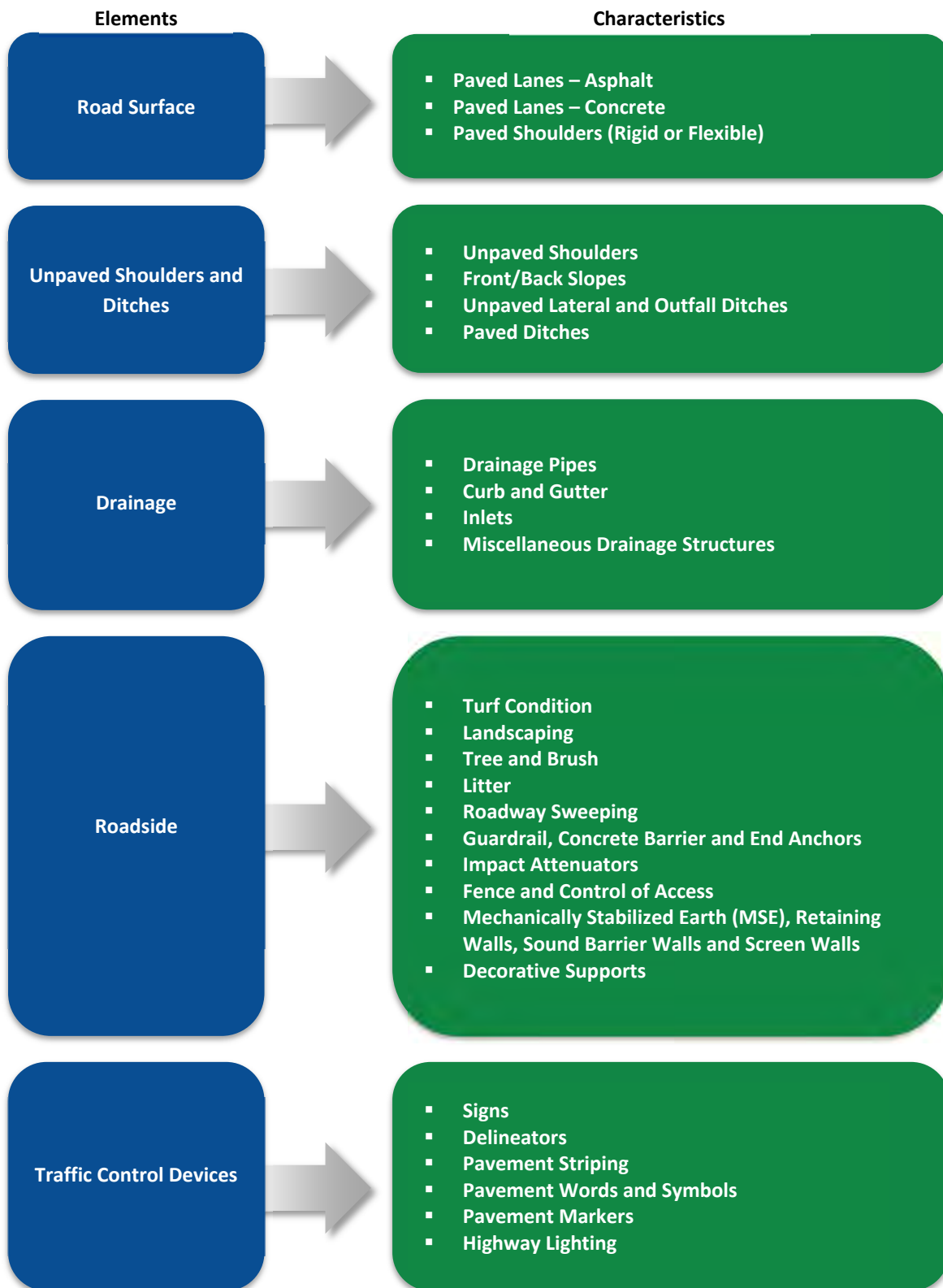
The NCTA performance standards, threshold criteria, and maintenance rating program were developed through a collaborative effort by NCTA managers, NCDOT maintenance staff, and consultants.

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 can be used to schedule and prioritize routine maintenance activities and provide uniform maintenance conditions that meet established objectives.

## 3.0 MRP PROCEDURE

Per the *NCTA Roadway and Facility Maintenance Performance Standards V6*, roadway assets or characteristics on NCTA facilities have been grouped into elements. These elements and corresponding characteristics can be seen in **Figure 1**:

Figure 1: Maintenance Elements and Characteristics



## Maintenance Rating Program for the Triangle Expressway

### 2019 Third Quarter (July – September)

---

A weighting system has been established to identify the importance of each element and characteristic. This system consists of two weighting factors: one that accounts for the importance of individual characteristics within a given maintenance element (1-9), and one that accounts for the importance of the maintenance elements to the total rating (by % of score). This two-factor system reveals deficiencies among characteristics and elements.

The program analysis is accomplished using statistically valid, random sampling procedures that capture the level of service for individual characteristics with a 95% confidence level in sampling. The sample characteristics selected are evaluated during quarterly inspections, which are performed during the months of February, May, August, and November to account for dynamic changes in assets during the various seasons. The evaluation process is completed using electronic data collection tablets and is based on established threshold conditions described in the *NCTA Roadway and Facility Maintenance Standards V6*. Those characteristics that meet or exceed the threshold are coded as PASSING; those that do not meet the threshold are coded as NOT PASSING.

When the evaluation process is completed, the number of PASSING samples and total samples are multiplied by the weighted values (1-9) to determine the actual and possible rating points for characteristics and elements. MRP ratings for elements and characteristics are then calculated as the ratio of the actual rating points to possible rating points. The MRP ratings represent the maintenance level of service currently being provided, as they define the percent of characteristics and elements that meet the maintenance condition standard. For instance, an MRP rating of 83 signifies that 83 percent of the inspected elements/characteristics met the standard.

The overall MRP rating is determined by calculating the sum of the elements ratings multiplied by the following weighted factors:

<b>Road Surface =</b>	<b>25%</b>
<b>Unpaved Shoulders =</b>	<b>13%</b>
<b>Drainage =</b>	<b>15%</b>
<b>Roadside =</b>	<b>17%</b>
<b>Traffic Control Devices =</b>	<b>30%</b>
<hr/>	
<b>Total</b>	<b>100%</b>

The NCTA's overall target rating is 90, with elements scoring 85 or higher, and characteristics 80 or higher. In addition to quarterly ratings, the cumulative rolling annual rating is calculated each quarter. This rating is obtained by adding the ratings of the latest four quarterly inspections to compensate for the likelihood of uneven sample sizes.

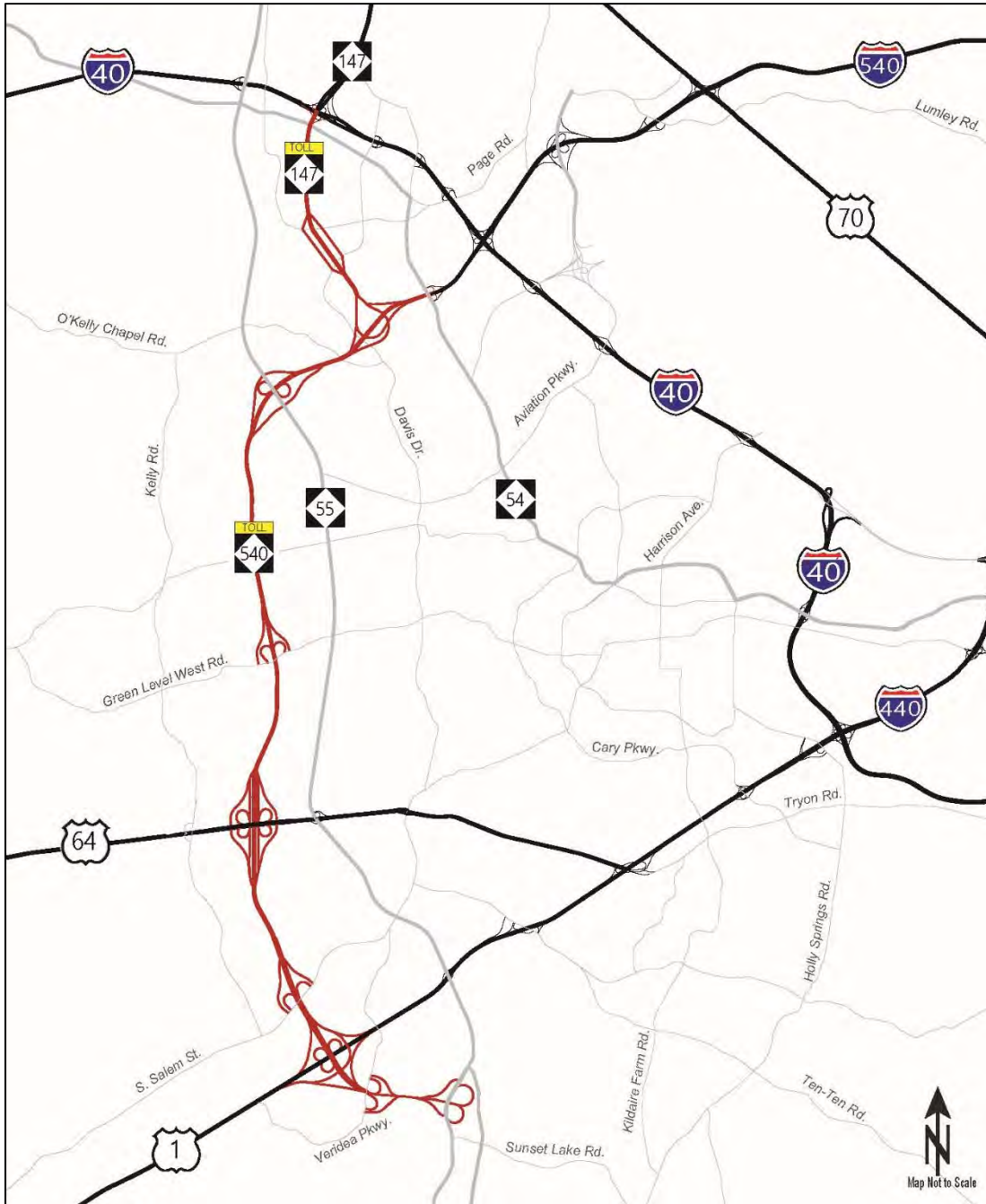
## Maintenance Rating Program for the Triangle Expressway

2019 Third Quarter (July – September)

### 4.0 TRIANGLE EXPRESSWAY DESCRIPTION

The Triangle Expressway extends for approximately 18.8 miles from the interchange of I-40 and Toll NC-147 in Durham to the NC-55 Bypass near Holly Springs (**Figure 2**). It includes a one-mile segment on Toll NC-540 extending north from the Toll NC-540 / Toll NC-147 interchange to the NC-54 interchange. The Triangle Expressway consists of eleven interchanges and twenty all-electronic toll collection zones.

**Figure 2: Triangle Expressway Map**



Maintenance Rating Program for the Triangle Expressway

2019 Third Quarter (July – September)

5.0 TRIANGLE EXPRESSWAY ASSET INVENTORY UPDATE

Through normal day-to-day maintenance activities and the construction of special projects, roadside assets are continuously being added or modified on the roadway. NCTA coordinates closely with NCDOT Division 5 Maintenance and conducts routine field visits to maintain an accurate asset inventory and ensure the validity of the MRP survey.

During this quarter assets on Toll NC 540 North from Green Level West Road to Carpenter Fire Station Road were removed from the inventory due to the Morrisville Parkway Interchange construction project. **Table 3** presents the updated number of assets that are currently available for inspections.

Table 3: Asset Inventory		
Assets	Total Inventory	2019 Eligible Inventory
Barriers	738	704
Curb and Gutter	394	373
Decorative Supports	279	269
Drainage	1174	1129
Misc. Drainage	212	196
Fences	498	464
Highway Lighting	397	387
Impact Attenuators	47	45
Inlets	1091	1042
Linear Segments	767	730
Plant Beds	266	246
Paved Ditches	2	2
Pavement Symbols	610	610
Signs	1101	1091
Tree and Brush	586	530
Turf	1037	987
Walls	86	84

## 6.0 MRP THIRD QUARTER ASSESSMENT

### 6.1 Quarterly Results

The overall 2019 third quarter maintenance rating of the Triangle Expressway was 92.5, meeting NCTA’s target overall rating of 90. All elements assessed achieved ratings above the target rating of 85 established for element groups. Pavement Striping (78) is the only characteristic that scored below the target rating of 80.

It is important to note that these results are only representative of the third quarter sample, one of the four surveys to provide an intermediate snapshot of seasonal conditions. Therefore, they are not a statistically valid representation of the assets; only the total of all four quarterly inspections, reported at the end of each calendar year, provides a 95% confidence level in statistical sampling. The third quarter MRP performance ratings for elements and characteristics are presented in **Table 4** and **Table 5**, respectively.

Table 4: MRP Element Results for Q3 2019	
Element	Q3 2019 MRP Rating
Road Surface	96.9
Unpaved Shoulders and Ditches	94.7
Drainage	92.3
Roadside	94.7
Traffic Control Devices	86.6
<b>Overall MRP Performance Rating</b>	<b>92.5</b>

**Maintenance Rating Program for the Triangle Expressway**

**2019 Third Quarter (July – September)**

**Table 5: MRP Characteristic Results for Q3 2019**

<b>Road Surface</b>	<b>Sample Passed</b>	<b>Sample Total</b>	<b>Weighted Values</b>	<b>Actual Pts</b>	<b>Available Pts</b>	<b>Q3 Rating</b>
Paved Lanes Asphalt	13	14	9	117	126	93
Paved Lanes Concrete	18	18	9	162	162	100
Paved Shoulder	31	32	5	155	160	97
<b>Element Total</b>				<b>434</b>	<b>448</b>	<b>96.9</b>
<b>Unpaved Shoulders and Ditches</b>	<b>Sample Passed</b>	<b>Sample Total</b>	<b>Weighted Values</b>	<b>Actual Pts</b>	<b>Available Pts</b>	<b>Q3 Rating</b>
Unpaved Shoulder	28	32	9	252	288	88
Front/Back Slopes	32	32	6	192	192	100
Lateral and Outfall Ditches, Unpaved	32	32	6	192	192	100
Ditches, Paved	2	2	5	10	10	100
<b>Element Total</b>				<b>646</b>	<b>682</b>	<b>94.7</b>
<b>Drainage</b>	<b>Sample Passed</b>	<b>Sample Total</b>	<b>Weighted Values</b>	<b>Actual Pts</b>	<b>Available Pts</b>	<b>Q3 Rating</b>
Drainage Pipes	33	34	7	231	238	97
Curb and Gutter	26	28	6	156	168	93
Inlets	32	34	7	224	238	94
Misc. Drainage Structure	30	37	4	120	148	81
<b>Element Total</b>				<b>724</b>	<b>792</b>	<b>92.3</b>
<b>Roadside</b>	<b>Sample Passed</b>	<b>Sample Total</b>	<b>Weighted Values</b>	<b>Actual Pts</b>	<b>Available Pts</b>	<b>Q3 Rating</b>
Turf Condition	29	32	7	203	224	91
Landscaping	24	24	4	96	96	100
Trees and Brush	29	30	4	116	120	97
Litter	30	32	4	120	128	94
Roadway Sweeping	32	32	5	160	160	100
Guardrail, Concrete Barrier and End Anchors	30	32	9	270	288	94
Impact Attenuators	9	9	9	81	81	100
Fence, Control Access	28	29	7	196	203	97
Retaining Walls and Sound Barrier Walls	12	14	5	60	70	86
Decorative Supports	21	25	5	105	125	84
Graffiti and Stain Removal	44	44	4	176	176	100
<b>Element Total</b>				<b>1574</b>	<b>1671</b>	<b>94.7</b>
<b>Traffic Control Devices</b>	<b>Sample Passed</b>	<b>Sample Total</b>	<b>Weighted Values</b>	<b>Actual Pts</b>	<b>Available Pts</b>	<b>Q3 Rating</b>
Signs	31	33	7	217	231	94
Delineators	32	32	3	96	96	100
Pavement Striping/Marking	25	32	8	200	256	78
Words and Symbols	26	31	7	182	217	84
Pavement Markers	27	32	9	243	288	84
Highway Lighting	25	28	6	150	168	89
<b>Element Total</b>				<b>1088</b>	<b>1256</b>	<b>86.6</b>



## Maintenance Rating Program for the Triangle Expressway

---

### 2019 Third Quarter (July – September)

Additionally, **Appendix A** includes maps that present the location of all assets assessed during the third quarter. **Appendix B** includes a list of the individual assets that did not achieve their target ratings.

## 6.2 Analysis and Recommendations

### Elements

During the third quarter, all elements exceeded NCTA's threshold criteria of 85. All elements, apart from Traffic Control Devices (86.6), continued exceeding a quarter score higher than 90. Traffic Control Devices (86.6) experienced a decrease in rolling rating of 1.8 points since last report.

Road Surface (96.9) experienced a decrease in rolling rating compared to the previous quarter's rolling rating. The rolling rating for this element was 0.7 points lower than the second quarter ratings. The decrease can be attributed to a decrease in rolling rating for Paved Lanes Asphalt (93) by 2.0 from the previous quarter's rolling rating. Repaving and subsequent striping of all asphalt lanes is scheduled to begin during the first quarter of next year.

Unpaved Shoulders and Ditches (94.7) experienced a decrease in rolling rating compared to the previous quarter. The rating for this element was 0.5 points lower than the second quarter rolling rating. The decrease was predominately due to lower Q3 rating for Unpaved Shoulders (88).

Drainage (92.3) experienced a decrease in rolling rating of 1.0 points. Misc. Drainage Structures (81) continued to score above 80 for the second quarter, increasing the characteristics rolling rating by 0.4 points. Roadside (94.7) experienced a decrease of 0.1 points from the previous quarter. Turf Condition (91) rolling rating increased 0.6 points after two quarters below the target threshold criteria.

Recommendations to improve specific critical characteristic ratings are provided in the following sections.

### Characteristics

This quarter, all but one characteristic, Pavement Striping (78), met the NCTA target threshold criteria of 80. A description of the characteristics' conditions and future work planning recommendations are provided below. Pictures of all characteristic failures are included in **Appendix B**.

## Maintenance Rating Program for the Triangle Expressway

2019 Third Quarter (July – September)

Pavement Striping (78 rating – 24 of the 33 assets passed): There were 9 pavement striping/markings segments that did not pass inspection, these segments were identified as missing sections or not meeting the required line width, and not reflecting during the nighttime inspection. Two of the pavement striping and marking segments that did not pass inspection are presented in **Figure 3**.

**Figure 3: Pavement Striping Inspection Results Sample**



To maintain a well-defined lane delineation throughout the Triangle Expressway, it is recommended that the maintenance provider consider scheduling pavement striping/markings replacement cycles in accordance with the *NCTA Roadway and Facility Maintenance Standards V6*, referenced below.

### Maintenance Program:

- 1) Pavement striping is observed daily and inspected every 4 months for compliance to the standard.
- 2) Worn or missing markings are evaluated for compliance annually, and generally are scheduled on a 3-5 year replacement cycle depending on the material.

### Maintenance and Evaluation Standards:

Pavement Striping/Marking does not meet the maintenance standards when any of the following criteria is observed:

- 1) More than 10% of the length of any line is less than 5.4 inches wide.
- 2) More than 10% of each line is not visible at a distance of 160 feet during nighttime observation.
- 3) More than 10% of the length of any line is missing.
- 4) More than 10% of the length of any line is covered by soil, grass, or debris.

Pavement striping/markings were installed along Toll NC-540 in the Summer of 2018. A majority of the segments that did not pass inspections this quarter were along Toll NC-147 or Y-lines. NCTA has made preparations in its capital budget and work schedule for the replacement of pavement striping/markings following pavement resurfacing. A pavement resurfacing contract for Toll NC-147 is scheduled to be awarded in 2020.

## Maintenance Rating Program for the Triangle Expressway

2019 Third Quarter (July – September)

### 7.0 CURRENT ROLLING MRP RATING

The rolling maintenance rating of the Triangle Expressway was 94.0, exceeding NCTA’s target overall rating of 90. All elements exceeded NCTA’s rolling rating threshold criteria of 85. Also, all but one characteristic rating met or exceeded the target rating of 80. The rolling rating for Miscellaneous Drainage Structure was 75 with a rating below the target rating of 80 in Q4 2018 and Q1 2019.

The 2018/2019 results are presented in **Tables 6 and 7**. These results are a collection of the four quarterly inspections conducted in the last year.

<b>Element</b>	<b>Q4 2018 RATING</b>	<b>Q1 2019 RATING</b>	<b>Q2 2019 RATING</b>	<b>Q3 2019 RATING</b>	<b>ROLLING RATING</b>
Road Surface	99.2	96.0	92.6	96.9	96.4
Unpaved Shoulders and Ditches	99.0	97.4	97.8	94.7	97.4
Drainage	92.8	91.3	94.0	92.3	92.6
Roadside	97.1	92.8	92.8	94.7	94.5
Traffic Control Devices	95.1	92.1	87.9	86.6	90.8
<b>Overall MRP Performance Rating</b>	<b>96.6</b>	<b>93.7</b>	<b>92.1</b>	<b>92.5</b>	<b>94.0</b>

**Maintenance Rating Program for the Triangle Expressway**

**2019 Third Quarter (July – September)**

<b>Table 7: MRP Rolling Element Results</b>					
<b>Road Surface</b>	<b>Q4 2018 RATING</b>	<b>Q1 2019 RATING</b>	<b>Q2 2019 RATING</b>	<b>Q3 2019 RATING</b>	<b>ROLLING RATING</b>
Paved Lanes Asphalt	100	86	93	93	93
Paved Lanes Concrete	100	100	94	100	99
Paved Shoulder	98	100	91	97	96
<b>Element Total</b>	<b>99.2</b>	<b>96.0</b>	<b>92.6</b>	<b>96.9</b>	<b>96.4</b>
<b>Unpaved Shoulders and Ditches</b>	<b>Q4 2018 RATING</b>	<b>Q1 2019 RATING</b>	<b>Q2 2019 RATING</b>	<b>Q3 2019 RATING</b>	<b>ROLLING RATING</b>
Unpaved Shoulder	98	94	97	88	94
Front/Back Slopes	100	100	100	100	100
Lateral and Outfall Ditches, Unpaved	100	100	97	100	99
Ditches, Paved	100	100	100	100	100
<b>Element Total</b>	<b>99.0</b>	<b>97.4</b>	<b>97.8</b>	<b>94.7</b>	<b>97.4</b>
<b>Drainage</b>	<b>Q4 2018 RATING</b>	<b>Q1 2019 RATING</b>	<b>Q2 2019 RATING</b>	<b>Q3 2019 RATING</b>	<b>ROLLING RATING</b>
Drainage Pipes	100	97	100	97	99
Curb and Gutter	97	96	86	93	93
Inlets	97	97	97	94	96
Misc. Drainage Structure	65	65	89	81	75
<b>Element Total</b>	<b>92.8</b>	<b>91.3</b>	<b>94.0</b>	<b>92.3</b>	<b>92.6</b>
<b>Roadside</b>	<b>Q4 2018 RATING</b>	<b>Q1 2019 RATING</b>	<b>Q2 2019 RATING</b>	<b>Q3 2019 RATING</b>	<b>ROLLING RATING</b>
Turf Condition	90	76	73	91	84
Landscaping	100	96	96	100	98
Trees and Brush	100	93	97	97	97
Litter	100	88	100	94	96
Roadway Sweeping	100	97	100	100	99
Guardrail, Concrete Barrier and End Anchors	100	100	100	94	98
Impact Attenuators	100	100	100	100	100
Fence, Control Access	95	90	93	97	94
Retaining Walls and Sound Barrier Walls	100	100	86	86	93
Decorative Supports	96	92	80	84	88
Graffiti and Stain Removal	100	100	100	100	100
<b>Element Total</b>	<b>97.1</b>	<b>92.8</b>	<b>92.8</b>	<b>94.7</b>	<b>94.5</b>
<b>Traffic Control Devices</b>	<b>Q4 2018 RATING</b>	<b>Q1 2019 RATING</b>	<b>Q2 2019 RATING</b>	<b>Q3 2019 RATING</b>	<b>ROLLING RATING</b>
Signs	97	94	91	94	94
Delineators	100	86	85	100	94
Pavement Striping/Marking	98	100	88	78	91
Words and Symbols	100	100	84	84	92
Pavement Markers	91	84	84	84	86
Highway Lighting	90	82	96	89	90
<b>Element Total</b>	<b>95.1</b>	<b>92.1</b>	<b>87.9</b>	<b>86.6</b>	<b>90.8</b>

## 8.0 GREEN LEVEL HISTORIC DISTRICT SIGNS

Green Level Historic District signs and surrounding landscaped areas were installed as part of the Triangle Expressway construction project. Currently, NCDOT is maintaining the Green Level Historic District Signs and the Town of Cary is providing maintenance to the landscaped areas surrounding these signs.

### 8.1 Analysis and Recommendations

As part of each quarterly inspection, an assessment team visits the three Green Level Historic District signs to conduct a visual inspection of each sign and ensure they are in good standing. Two of the three signs included in the inspection inventory were found to be in good condition, with the landscaped areas being well maintained. The third sign had been temporarily removed due to nearby construction activities.

**Figure 4** shows the two signs assessed and the area of the third sign.

**Figure 4: Green Level West Historic District Signs, Landscape Areas**



## 9.0 CONCLUSION

This report presents the 2019 third quarter assessment of the Triangle Expressway. The NCTA's target ratings are 90 for the rolling rating, 90 overall, 85 for elements, and 80 for characteristics. The third quarter 2019 overall rating was 92.5 and the rolling rating was 94.0, both ratings met the target rating of 90.

All element ratings were above the target ratings for the quarter and rolling assessment. During the third quarter assessment, all characteristics except Pavement Striping (78) met or exceeded the target rating of 80. Miscellaneous Drainage, with a rolling rating of 75 averaged from the last four quarter assessments, was the only characteristic that did not meet the rolling rating target of 80.

To maintain/improve the condition ratings, it is recommended the pavement striping/markings replacement cycles are completed as planned in the capital budget.

To continue to improve upon characteristic ratings that scored a rating below 80 in the last four quarters, continue a routine pattern of patrols and clearing of obstructions from the shoulder drains. Additionally, to meet/exceed NCTA's threshold criteria for turf, it is recommended to continue to follow the maintenance program and standards presented in the *NCTA Roadway and Facility Maintenance Standards V6*.

This quarter, the two Green Level Historic District signs inspected were found to be in good condition while the third sign was identified to have been removed for a Town of Cary development project near Green Level West Road. Additionally, the landscaped areas surrounding the signs were found to be well maintained.

# **Appendix A**

**Triangle Expressway 2019 Third Quarter Asset Assessment Locations**

## Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations

Provided below are a series of maps outlining the assets that were a part of this quarter's sample and their corresponding result. Assets are defined by an Inventory ID, which is a unique identifier given to each individual asset. The components that make up the Inventory ID are an asset specific prefix along with a number, such as LS\_1. All assets and their respective prefixes are listed below:

- Guardrail, Concrete Barrier and End Anchors – BR
- Curb and Gutter – CG
- Decorative Supports – DS
- Drainage Pipes – DP
- Misc. Drainage Structures – MDP
- Fence and Control of Access – FN
- Graffiti - GF
- Highway Lighting – HL
- Impact Attenuators – IA
- Inlets – IN
- Landscaping – PB
- Linear Samples – LS
  - Paved Lanes – Asphalt
  - Paved Lanes – Concrete
  - Paved Shoulders
  - Unpaved Shoulders
  - Front/Back Slopes
  - Unpaved Lateral and Outfall Ditches
  - Litter
  - Roadway Sweeping
  - Pavement Striping/Markings
  - Pavement Markers
  - Delineators
- Paved Ditches – PD
- Pavement Words and Symbols – PS
- Signs – SN
- Tree and Brush – TB
- Turf Condition – TF
- MSE/Retaining Walls, Sound Barrier Walls, and Screen Walls – WL

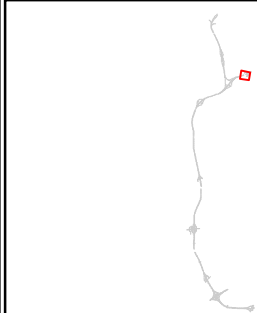


# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



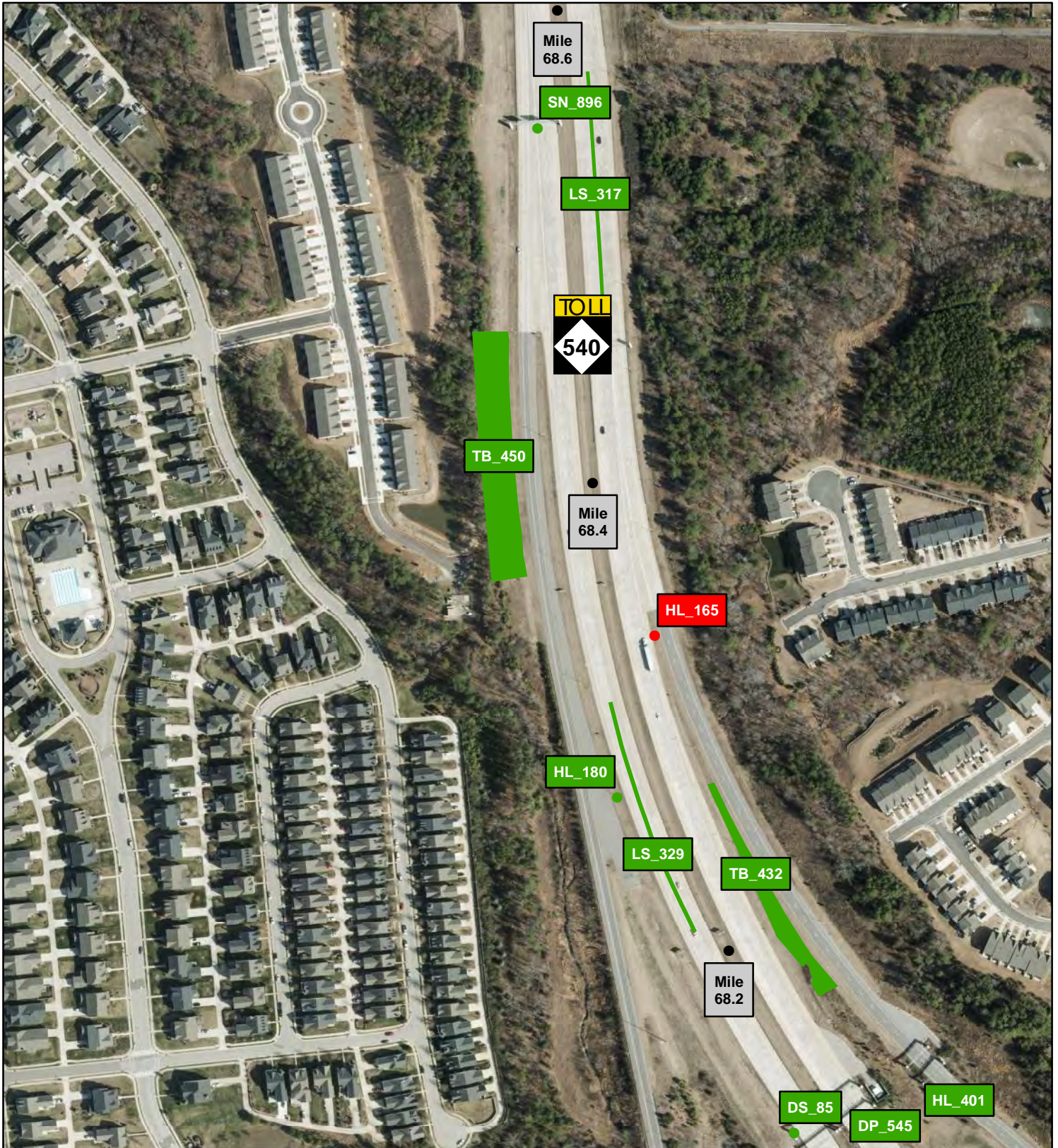
## Legend

- Failing Asset
- Passing Asset



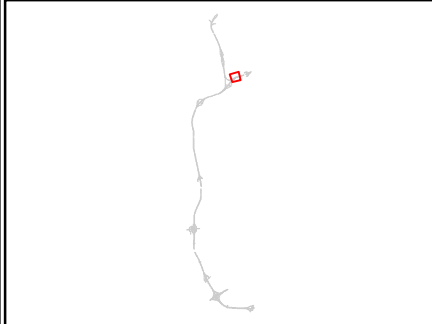


# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset





# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset





# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



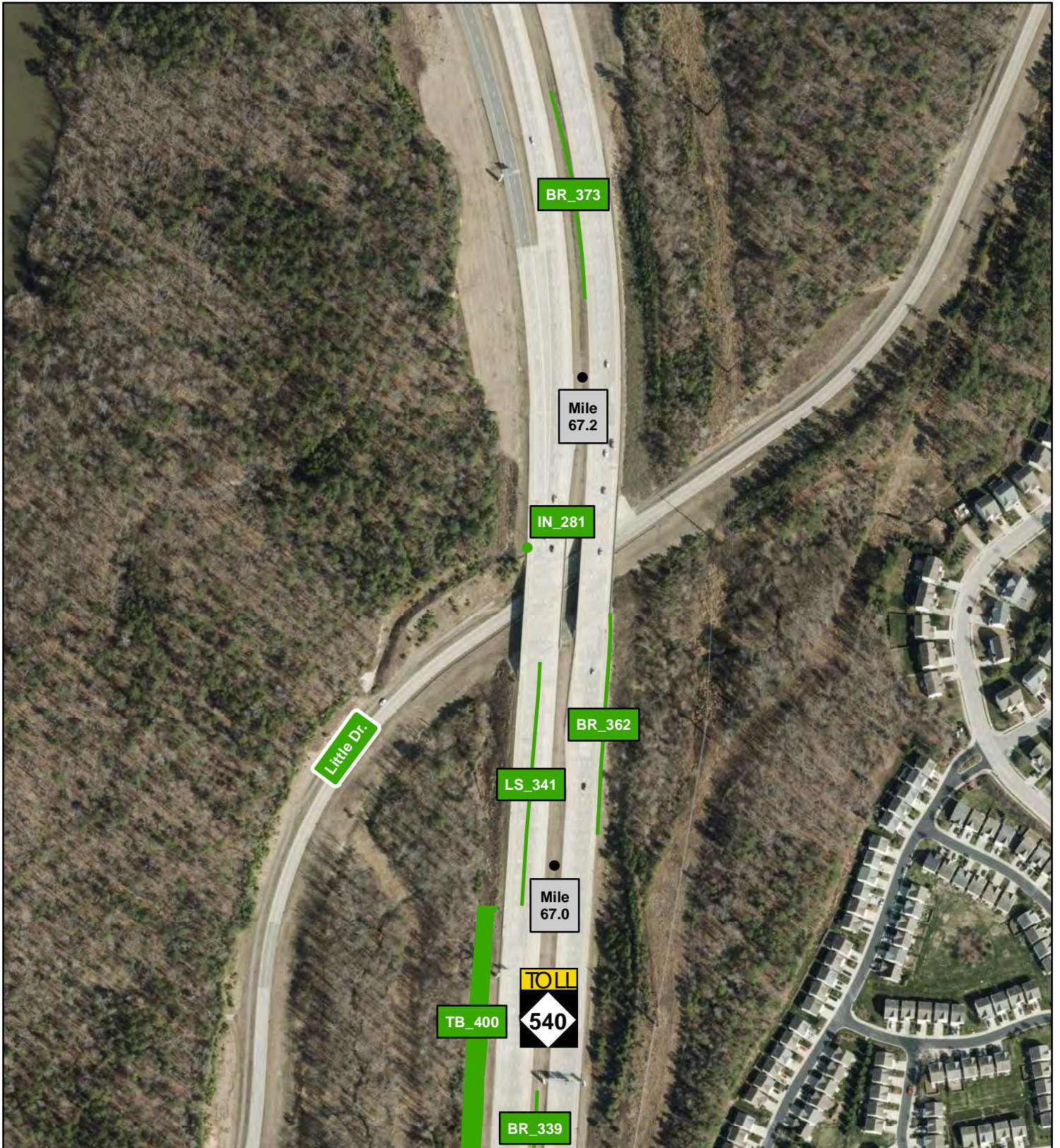
## Legend

- Failing Asset
- Passing Asset







# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



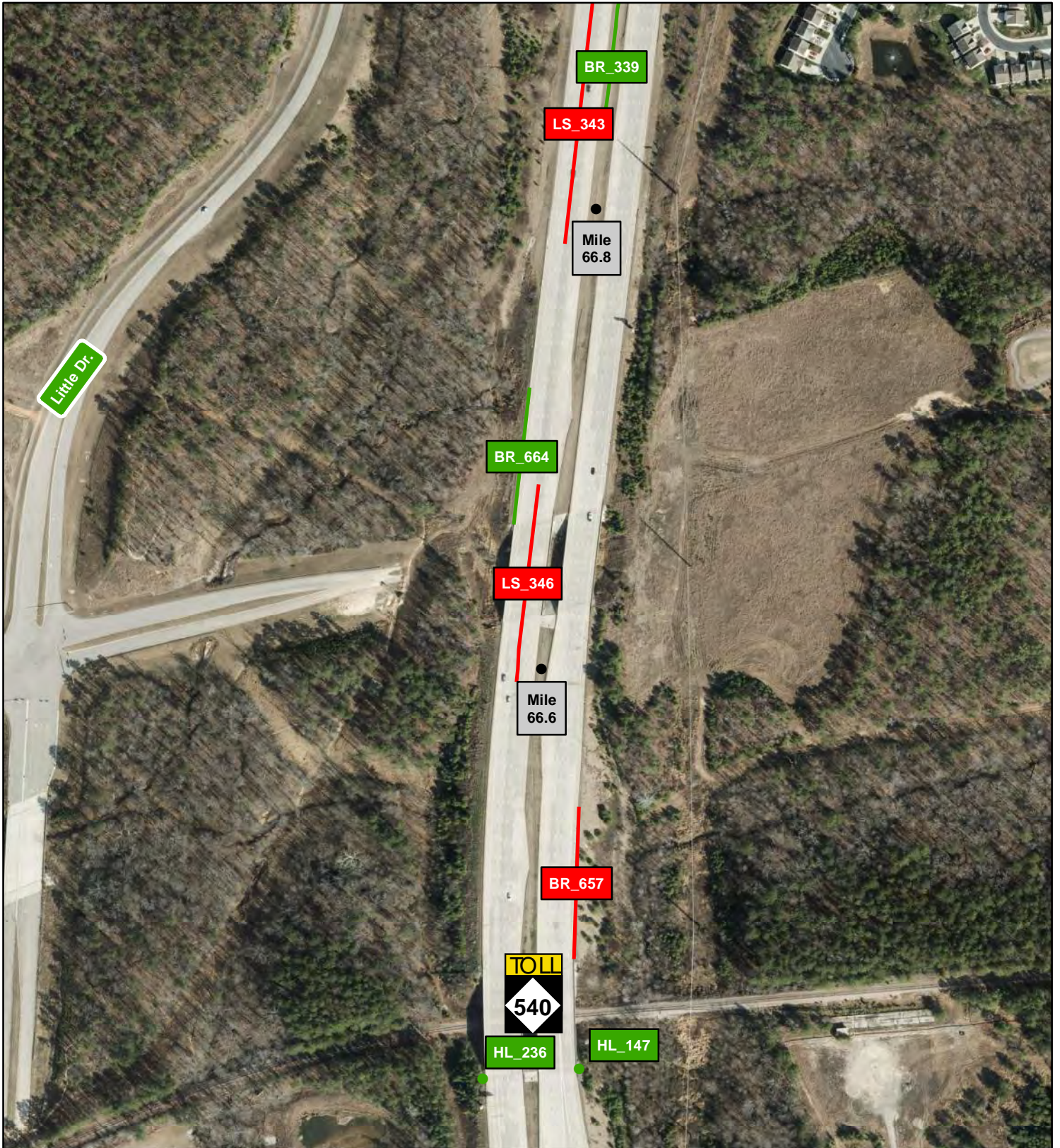
## Legend

-  Failing Asset
-  Passing Asset







# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



## Legend

-  Failing Asset
-  Passing Asset



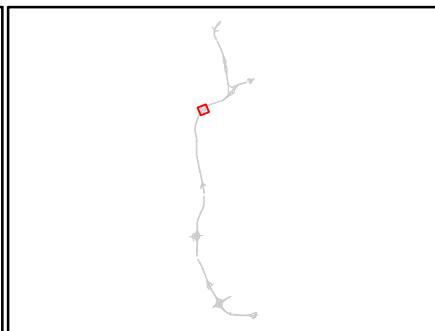


# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset

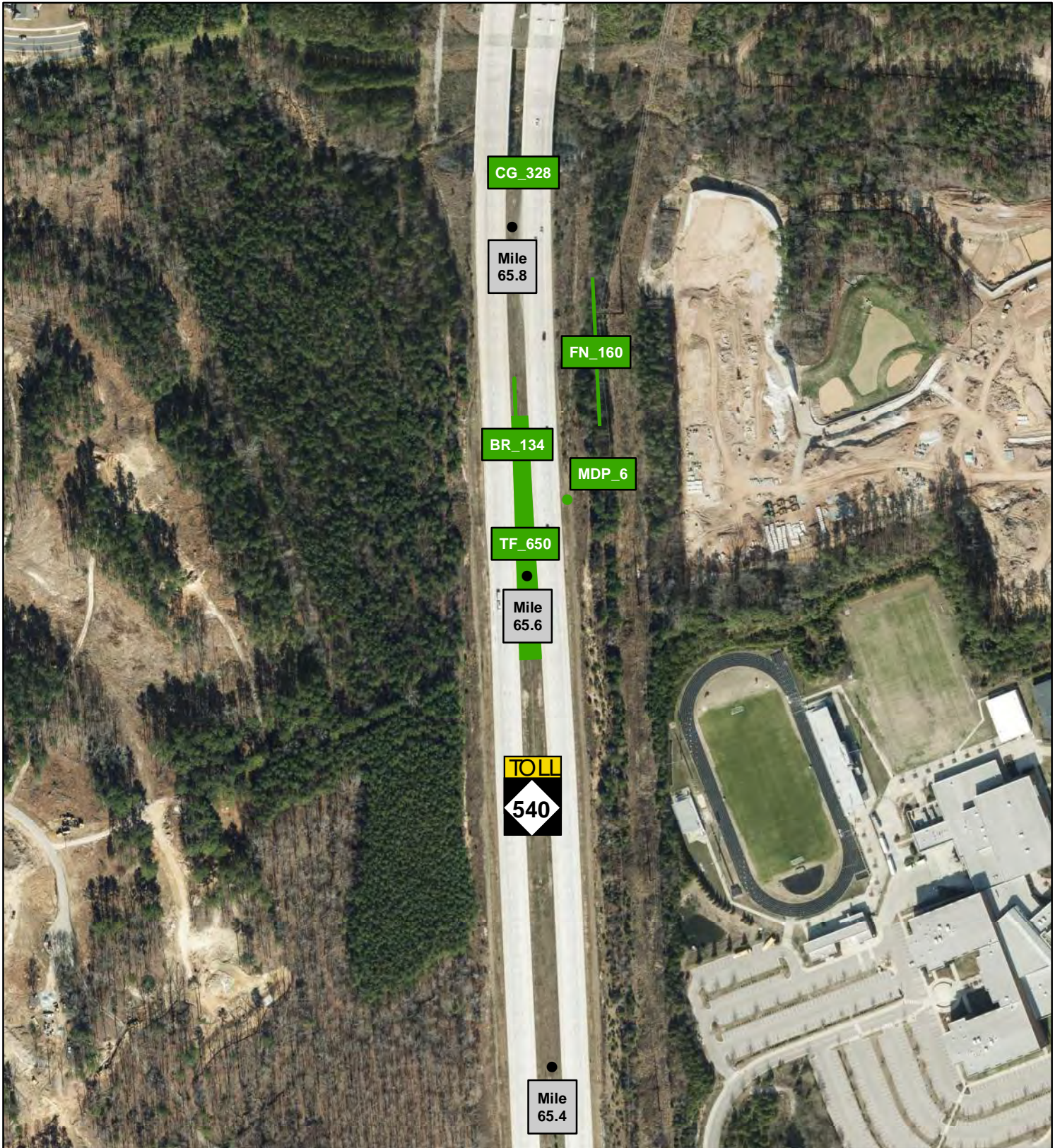


NORTH CAROLINA  
**Turnpike Authority**



A7



# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



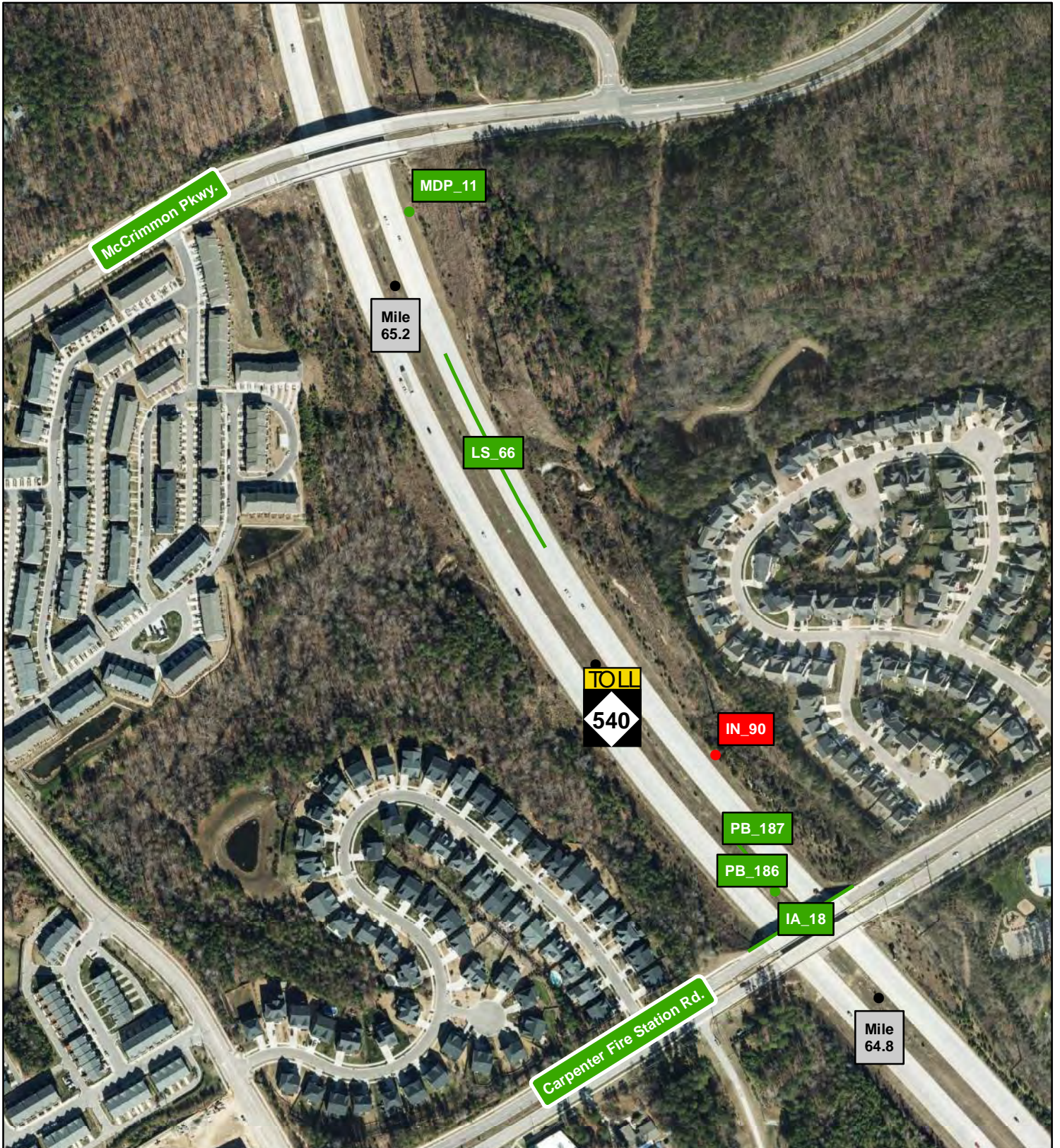
## Legend

-  Failing Asset
-  Passing Asset



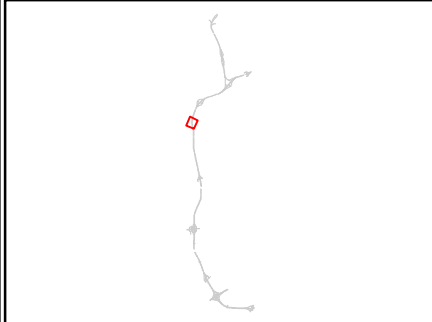


# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset







# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



## Legend

-  Failing Asset
-  Passing Asset







# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



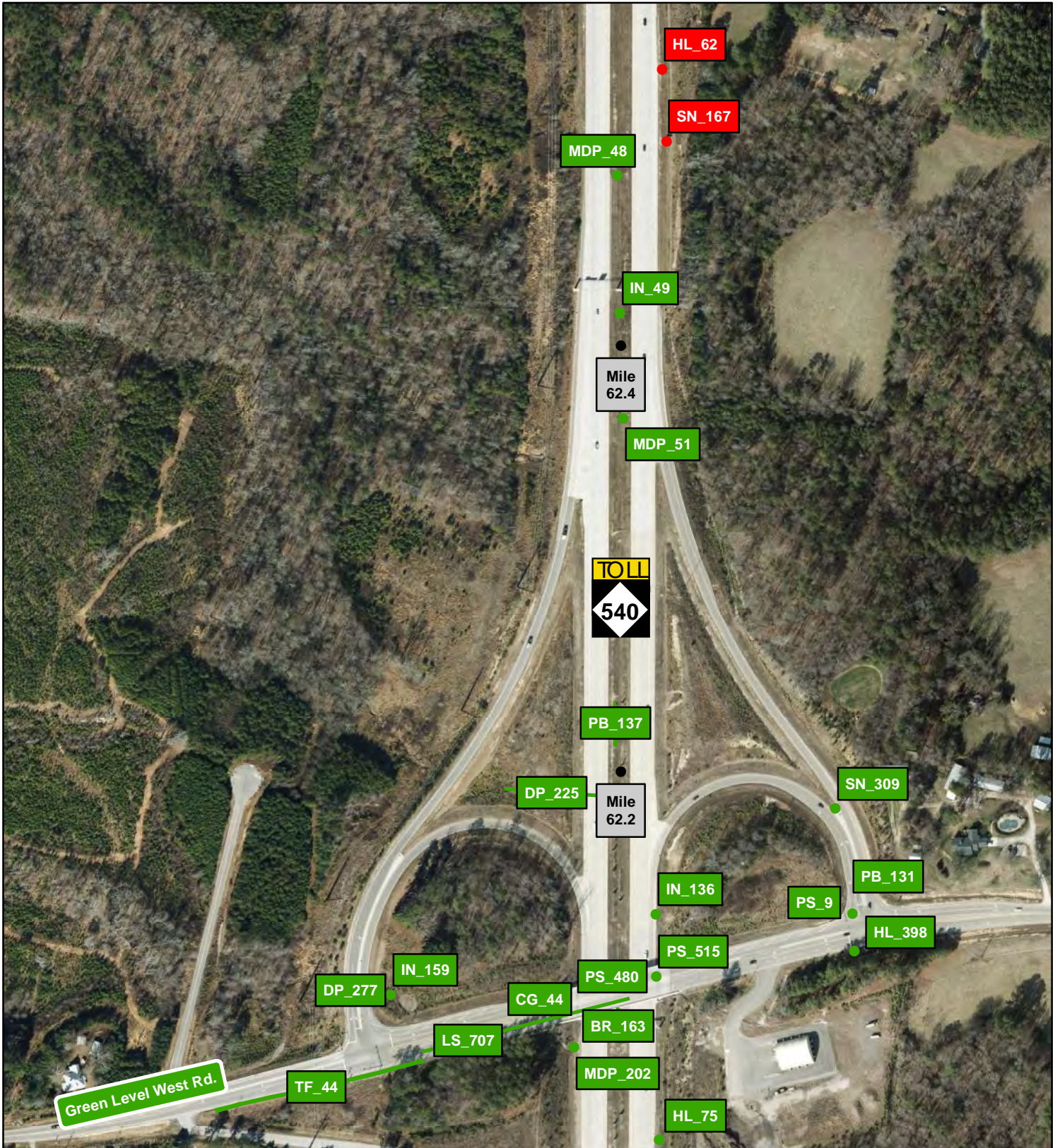
## Legend

-  Failing Asset
-  Passing Asset





# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



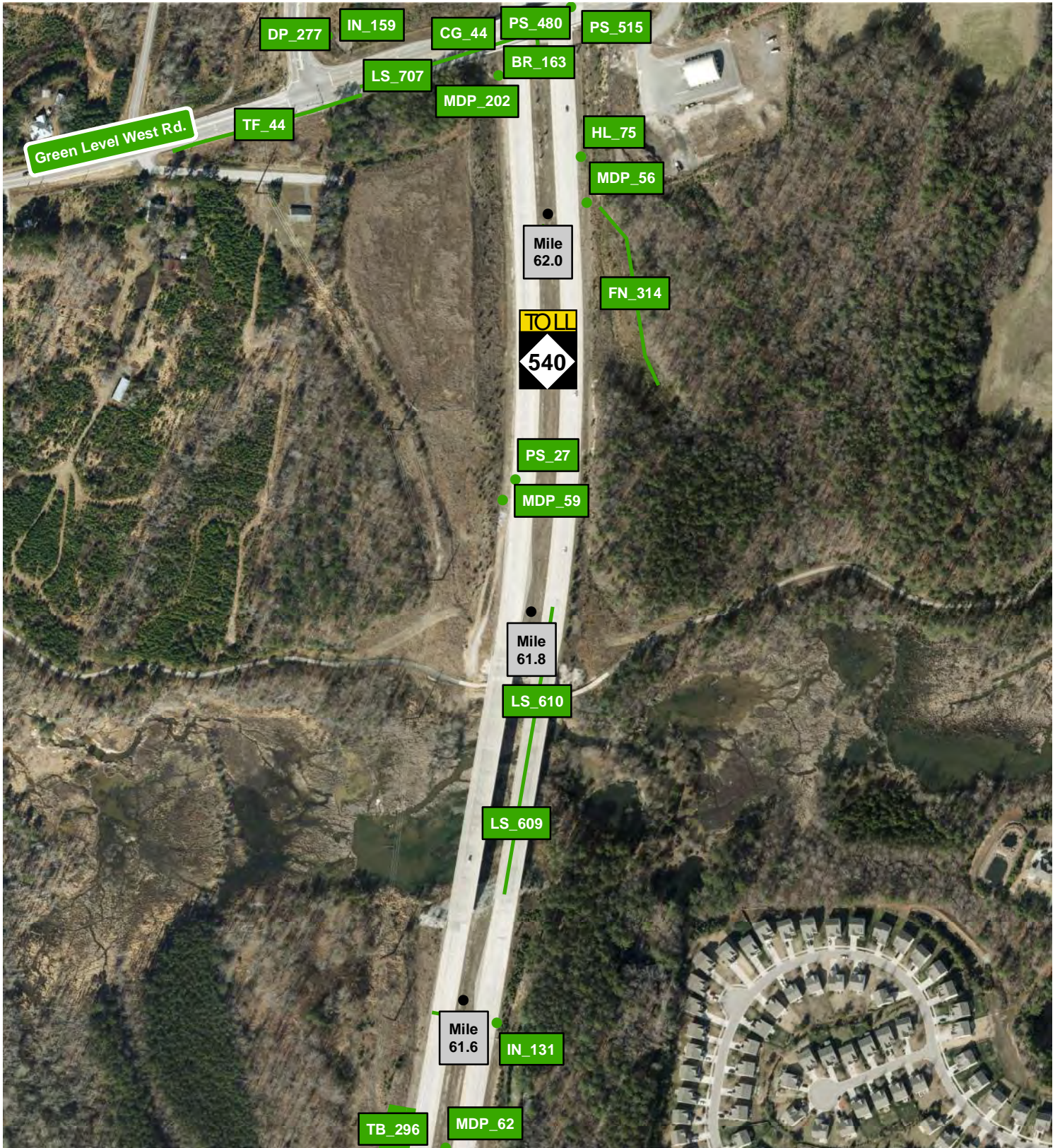
## Legend

- Failing Asset
- Passing Asset



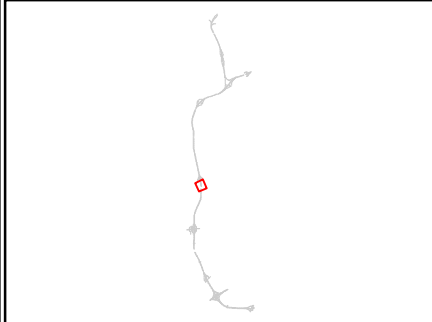


# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



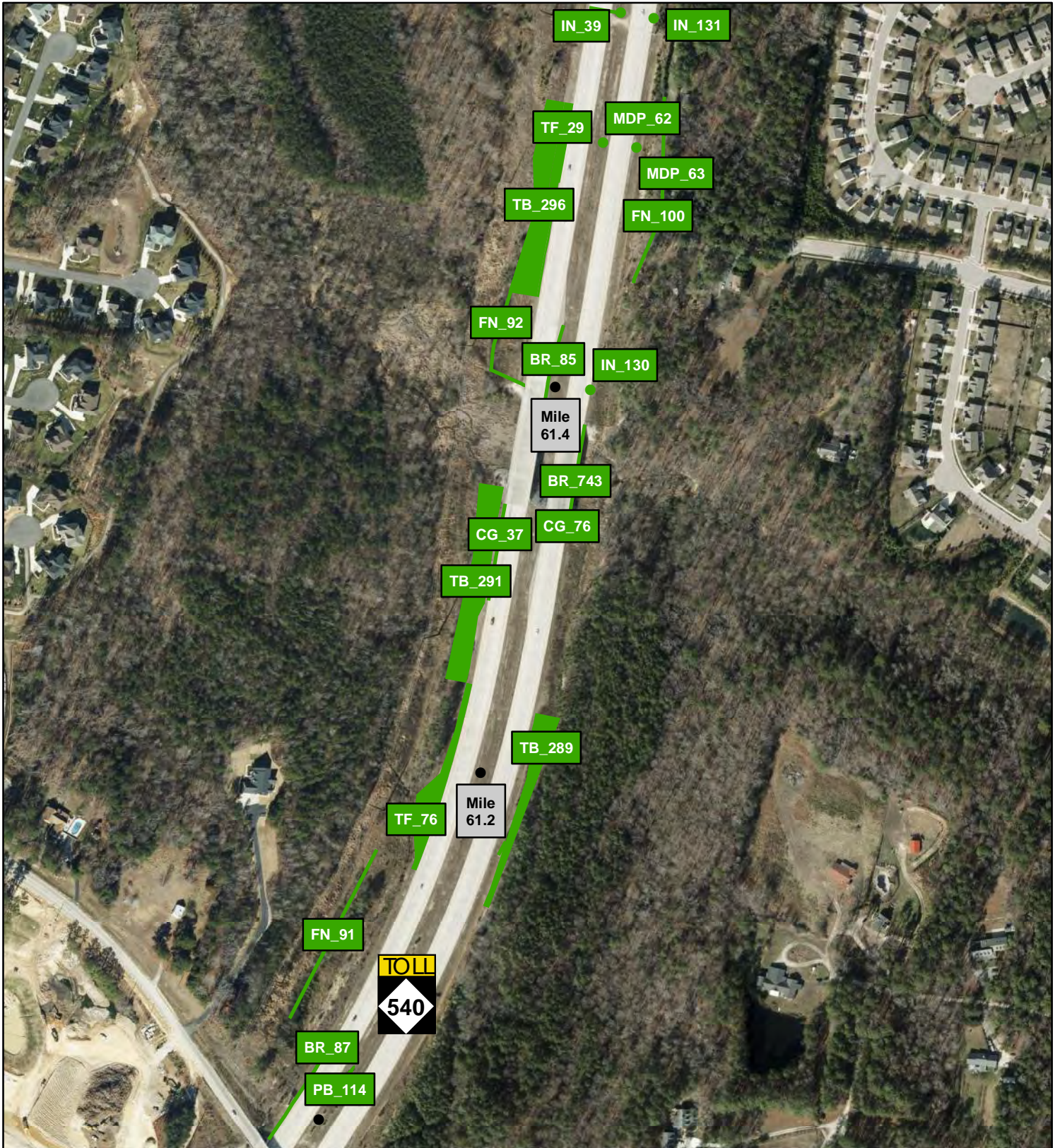
## Legend

- Failing Asset
- Passing Asset





# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



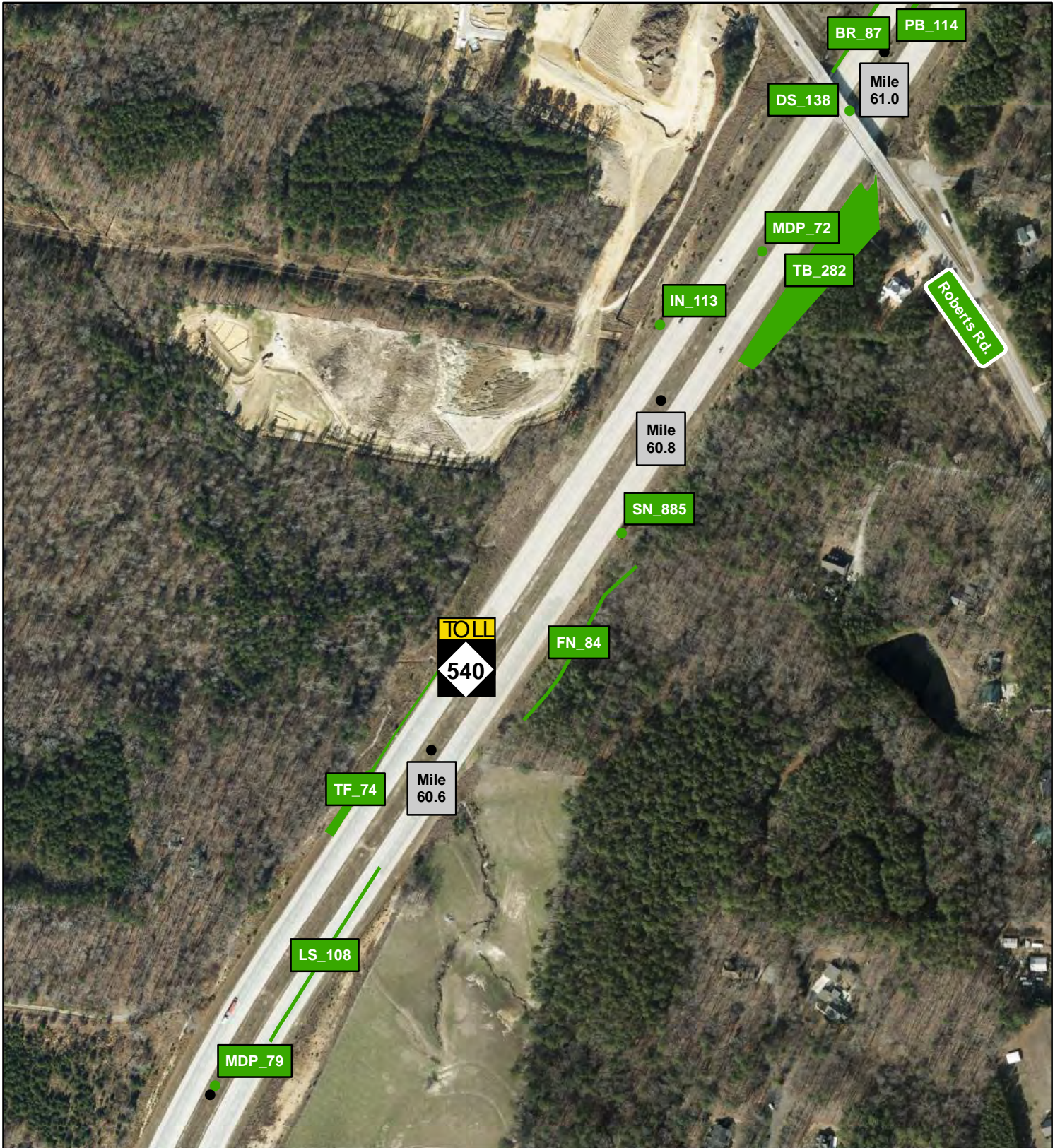
## Legend

- Failing Asset
- Passing Asset





# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



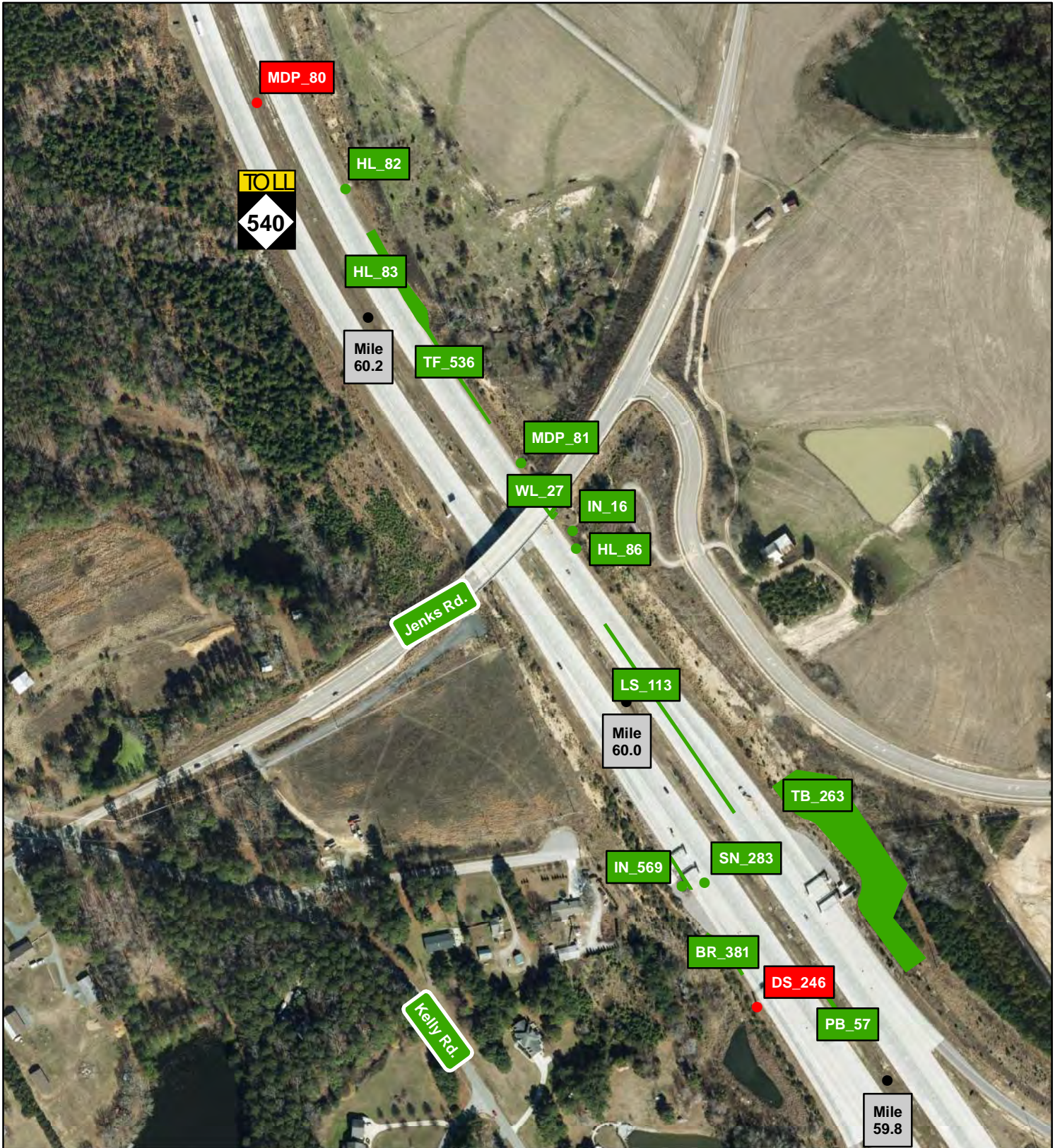
## Legend

- Failing Asset
- Passing Asset



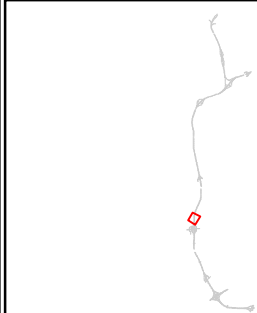


# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset





# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset







# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



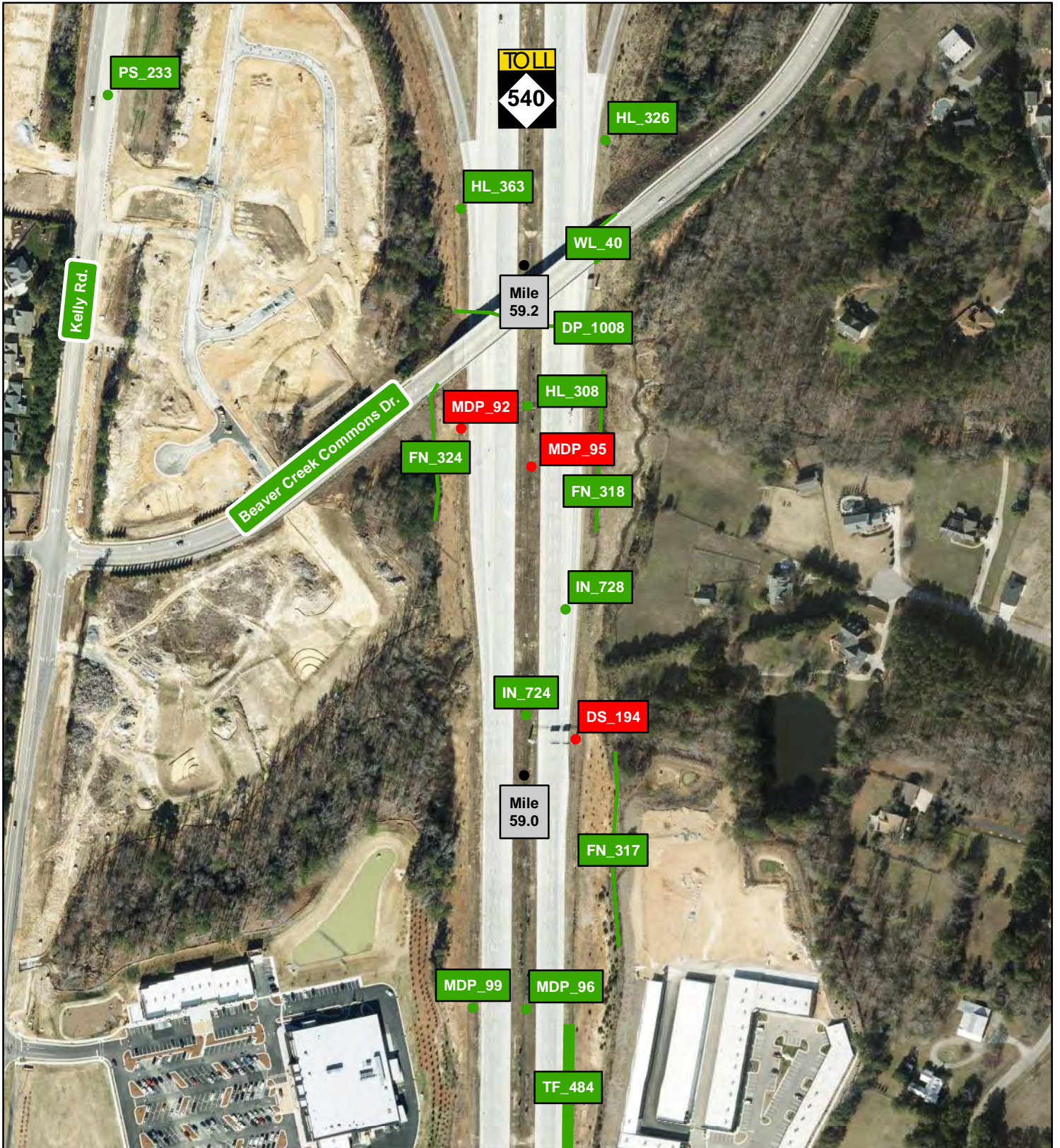
## Legend

-  Failing Asset
-  Passing Asset



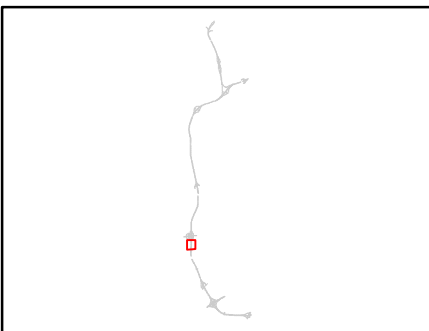


# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset



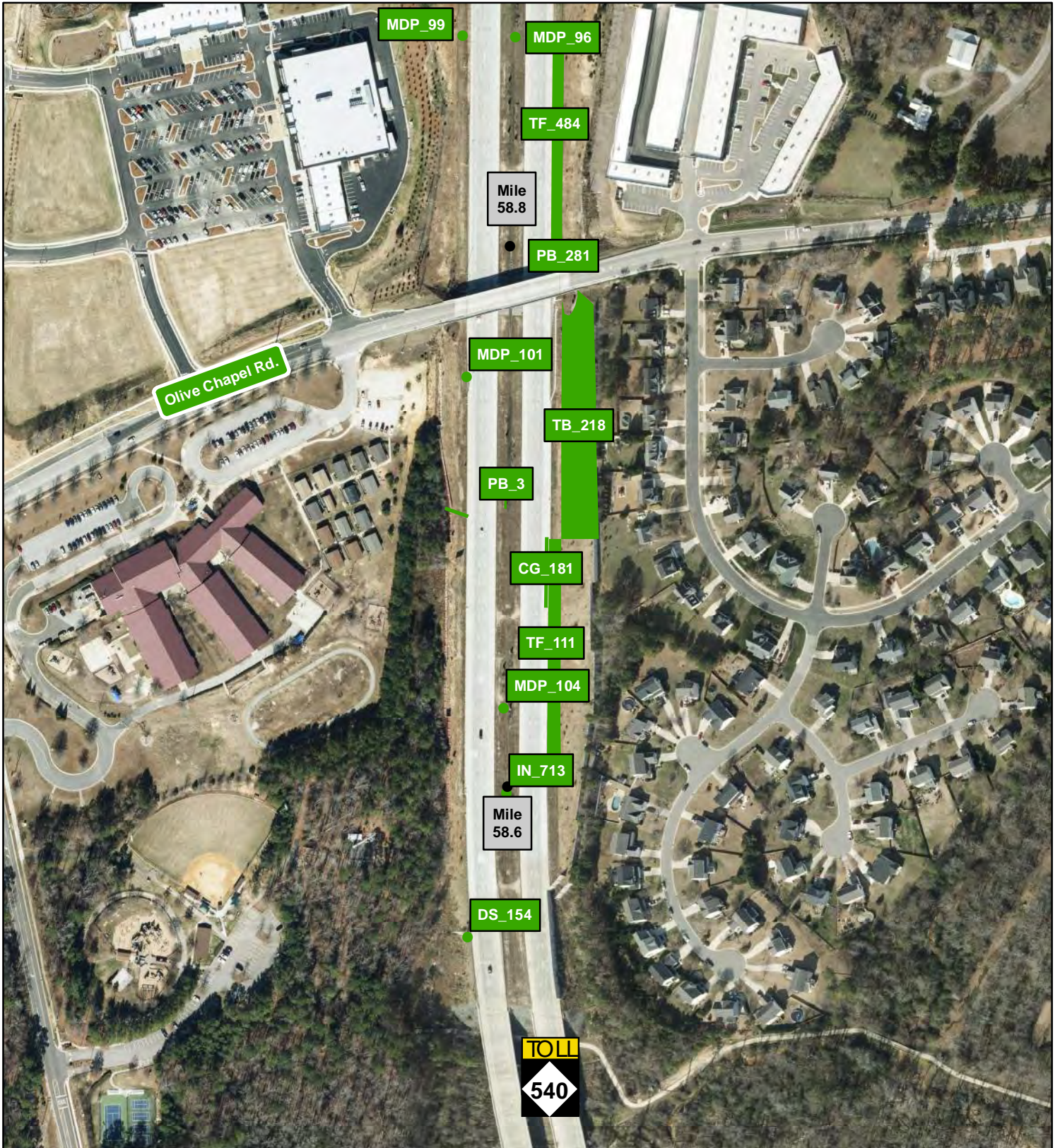

  


**NORTH CAROLINA**  
**Turnpike Authority**

A19



# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



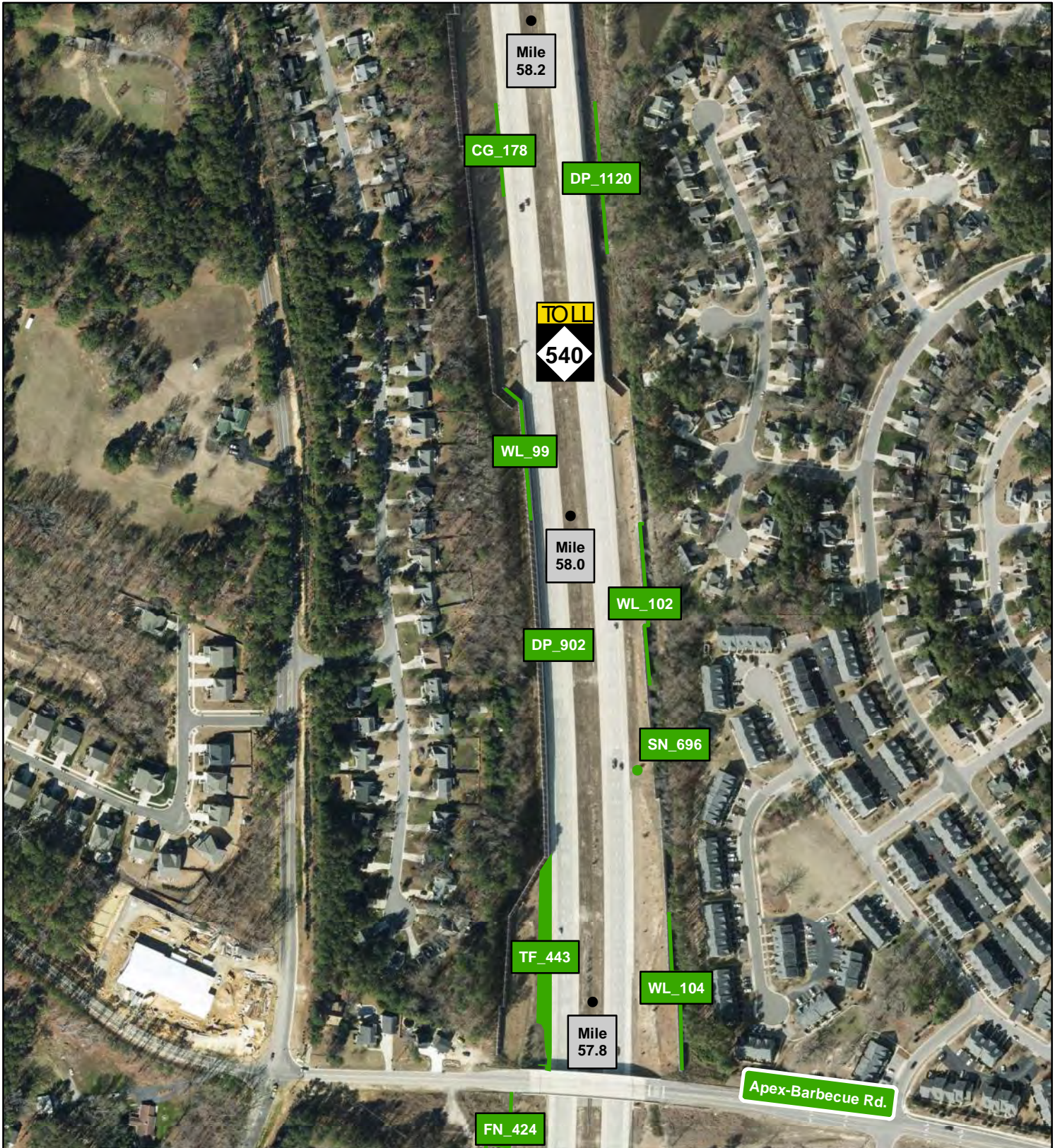
## Legend

- Failing Asset
- Passing Asset







# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



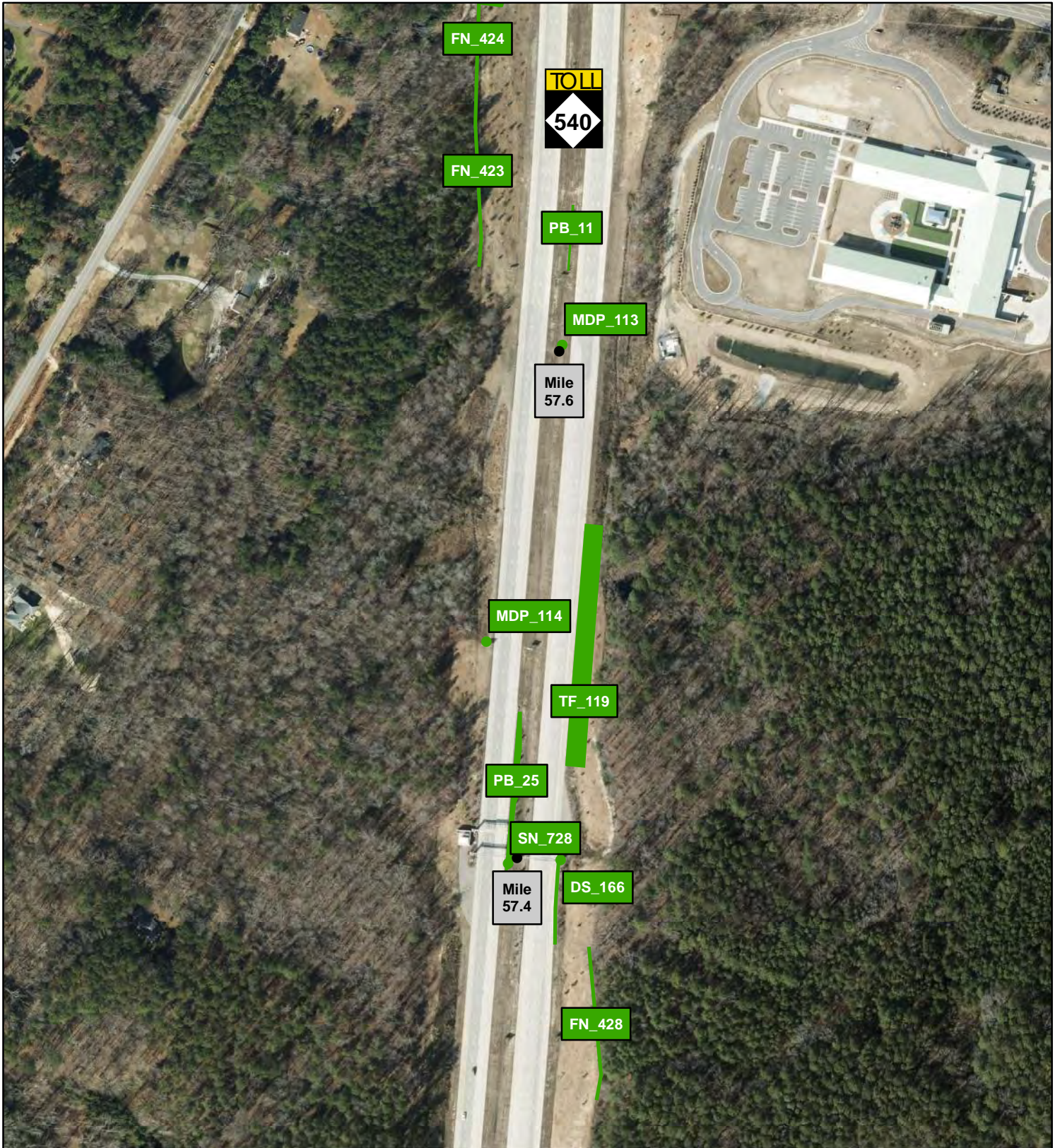
## Legend

-  Failing Asset
-  Passing Asset







# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



## Legend

-  Failing Asset
-  Passing Asset





# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset







# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



## Legend

-  Failing Asset
-  Passing Asset



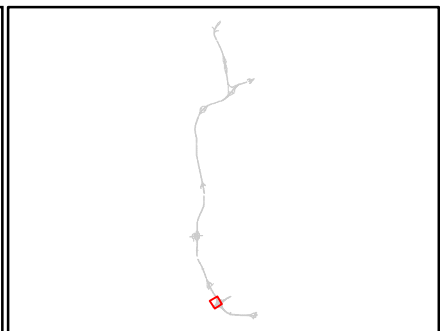


# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset









A25

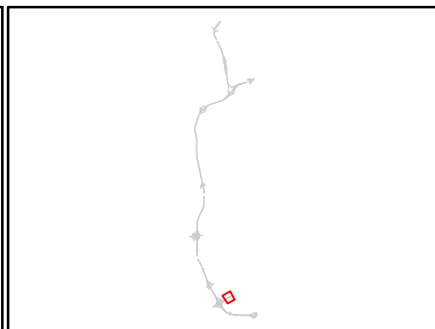


# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



**Legend**

-  Failing Asset
-  Passing Asset

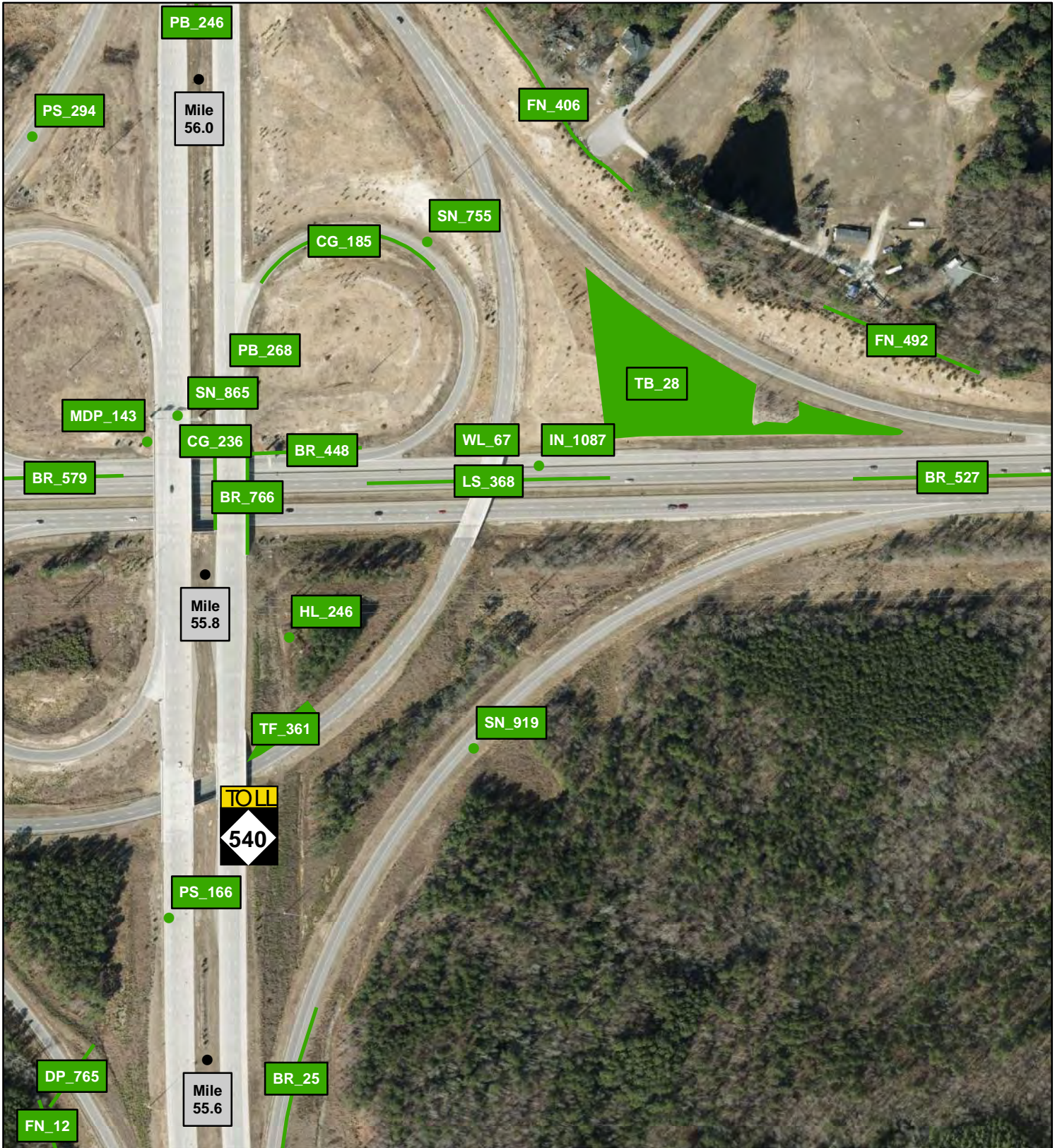
  


NORTH CAROLINA  
**Turnpike Authority**

A26



# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



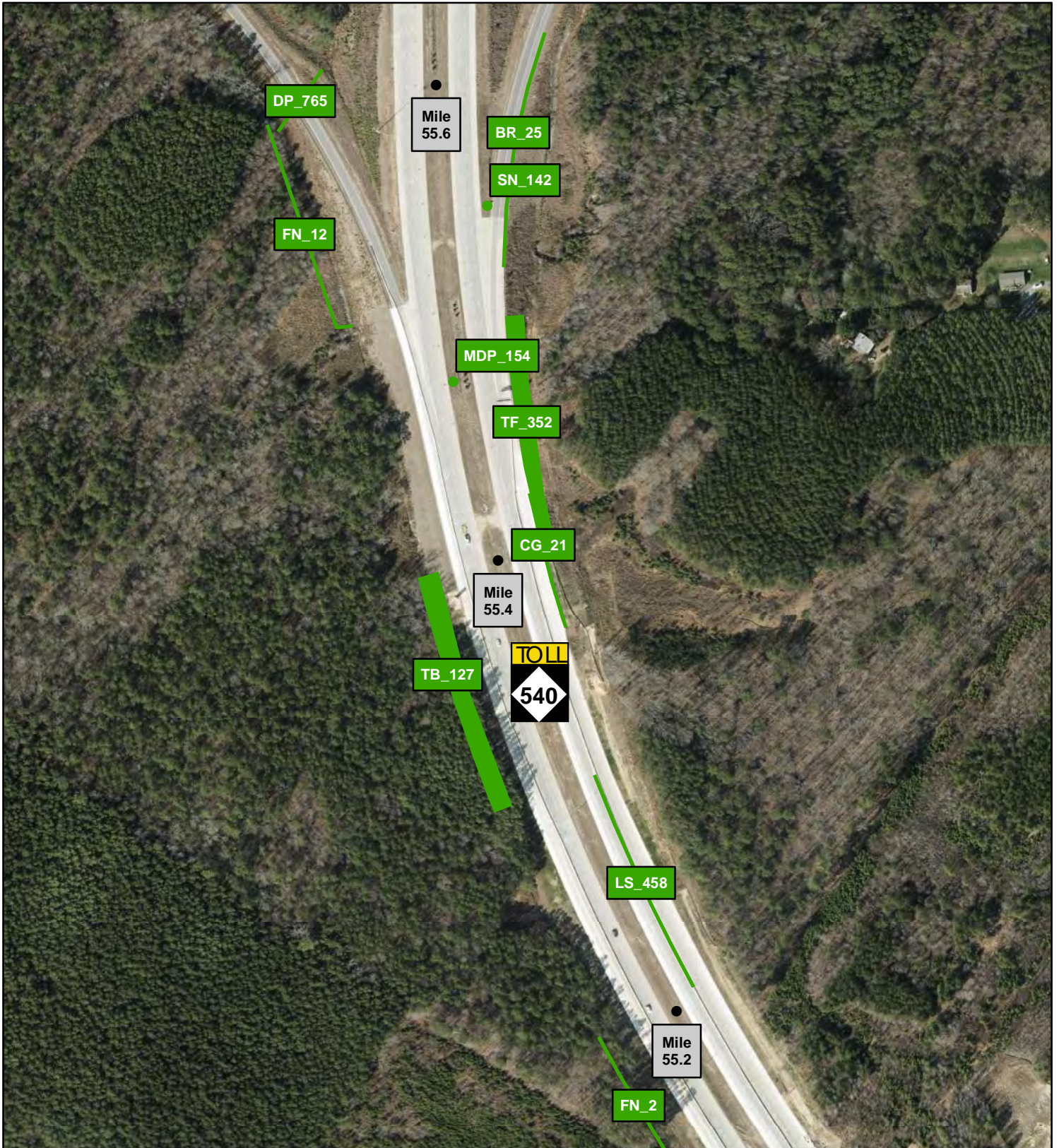
## Legend

- Failing Asset
- Passing Asset







# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



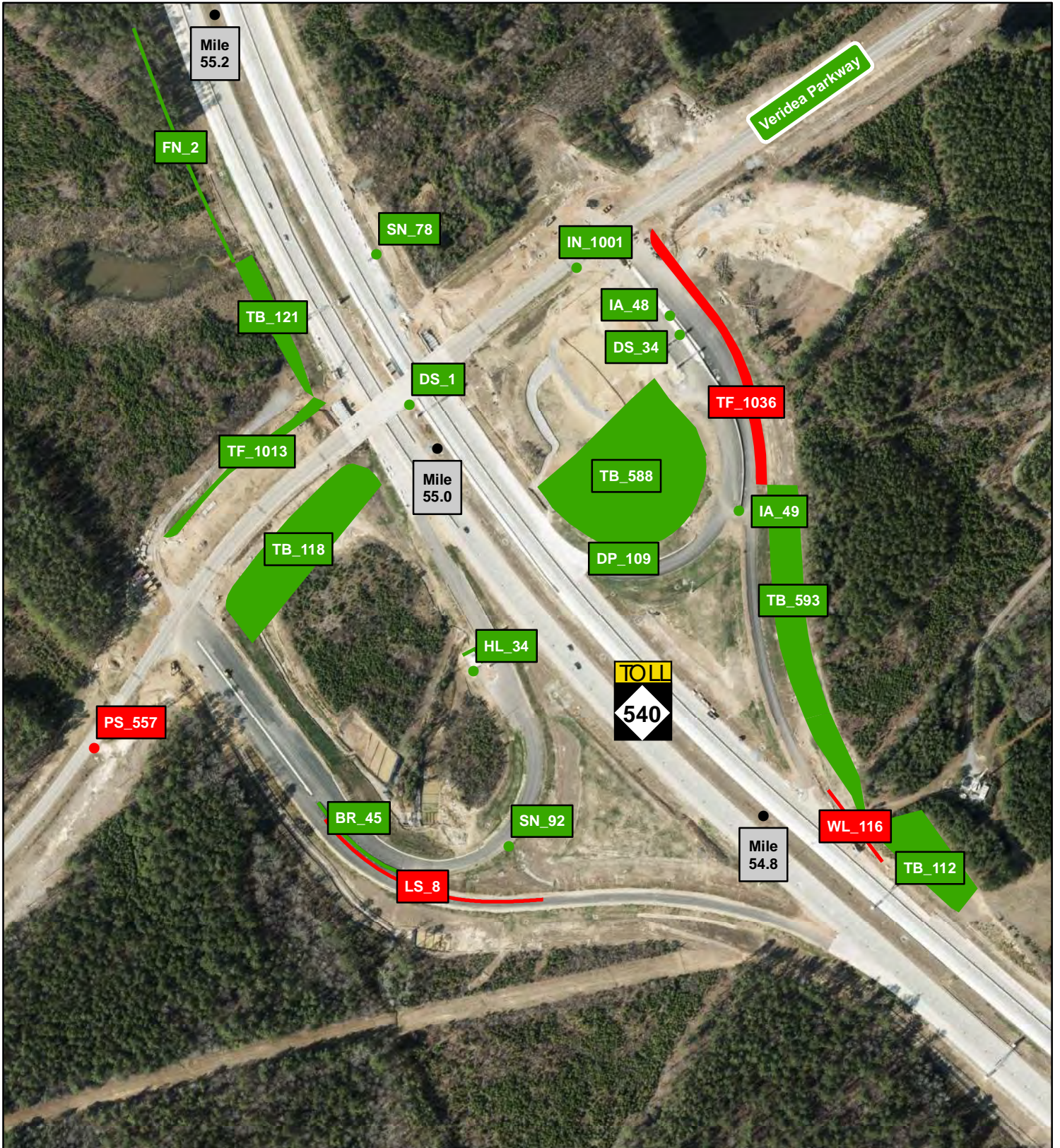
## Legend

-  Failing Asset
-  Passing Asset



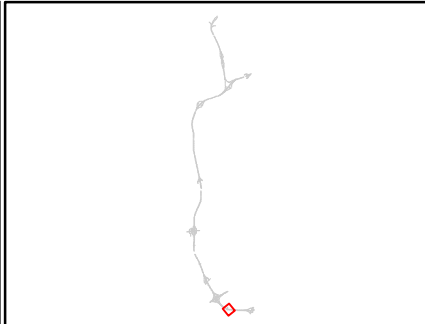


# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset







# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



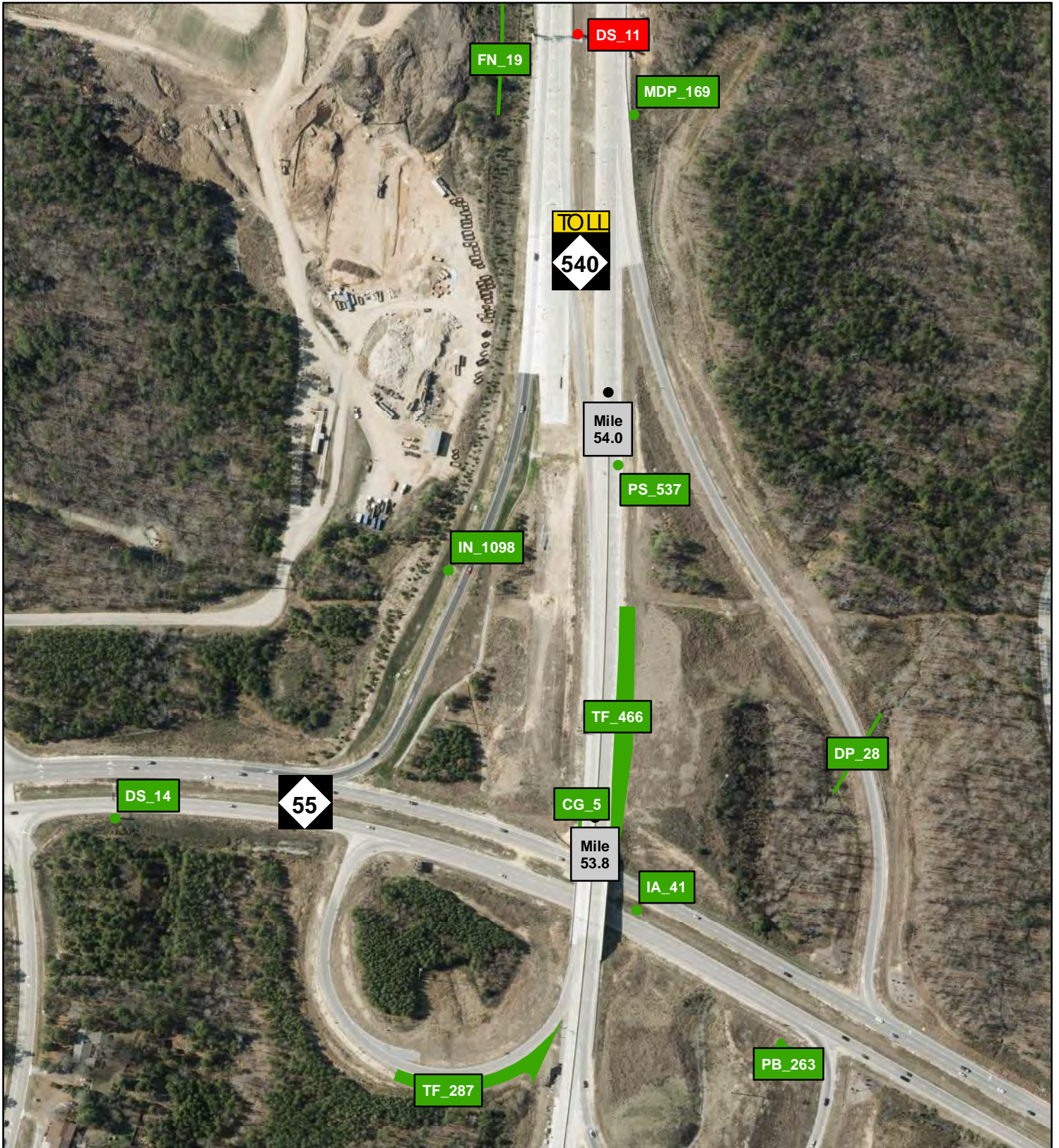
## Legend

-  Failing Asset
-  Passing Asset



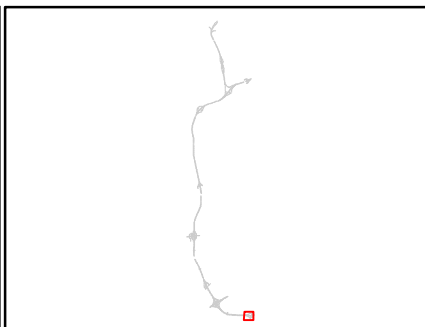


# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset



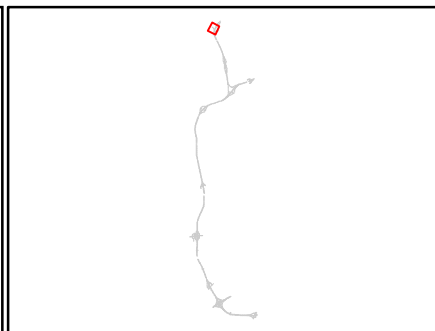


# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset







**NORTH CAROLINA**  
**Turnpike Authority**



A32



# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



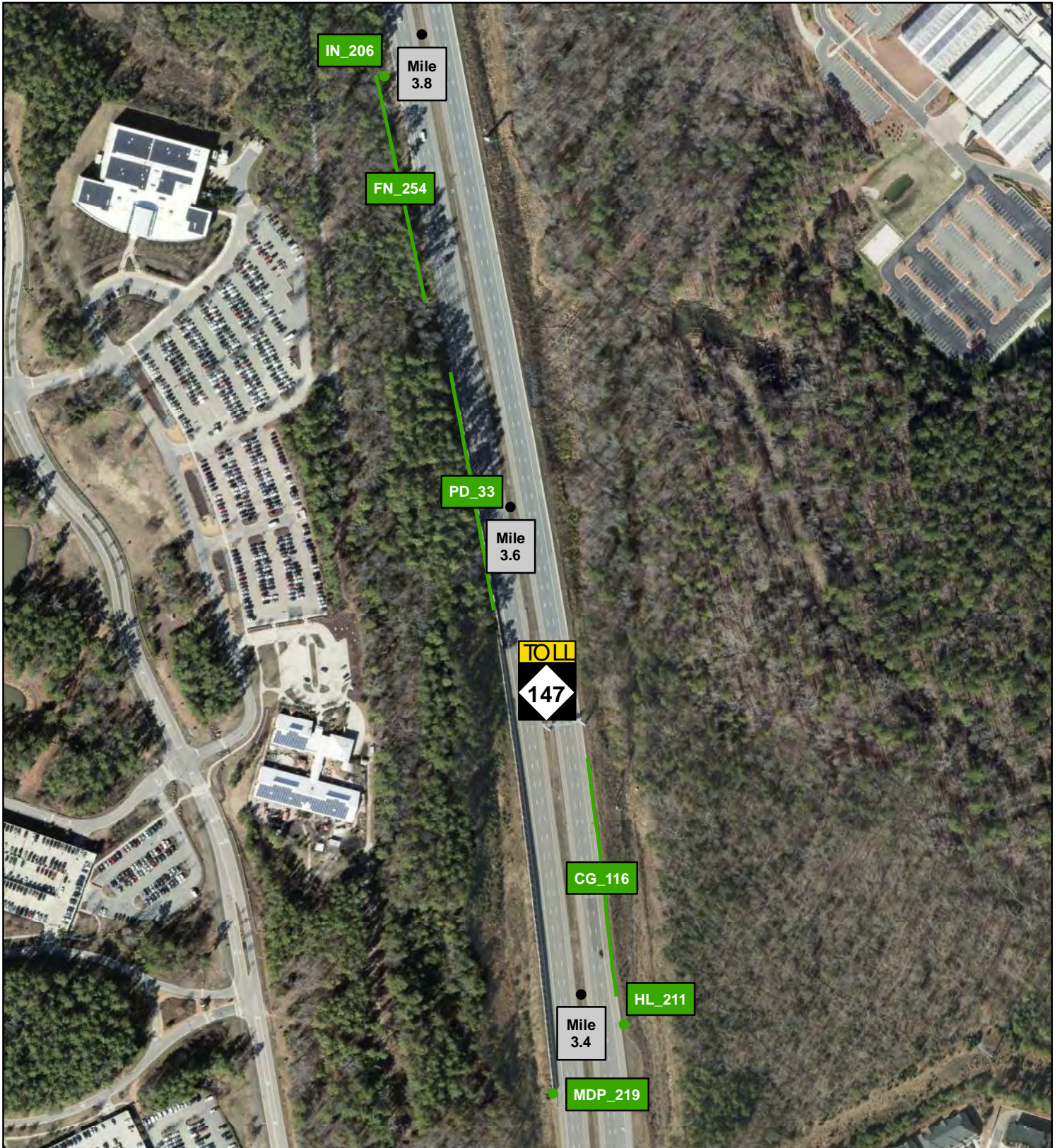
## Legend

-  Failing Asset
-  Passing Asset







# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



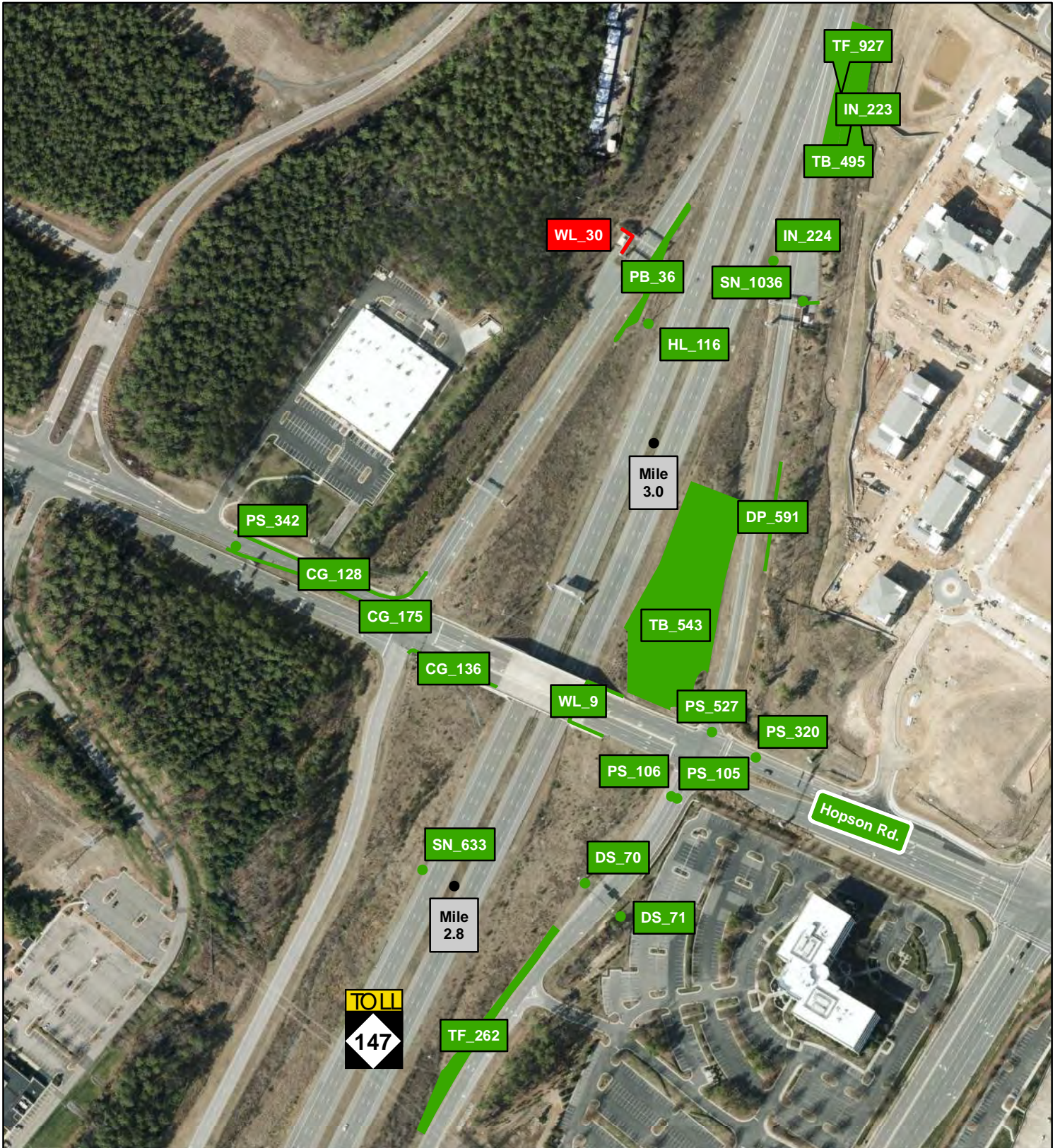
## Legend

-  Failing Asset
-  Passing Asset



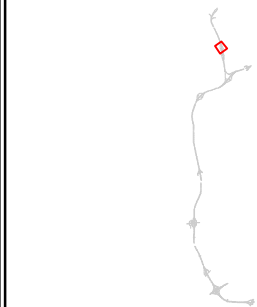


# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



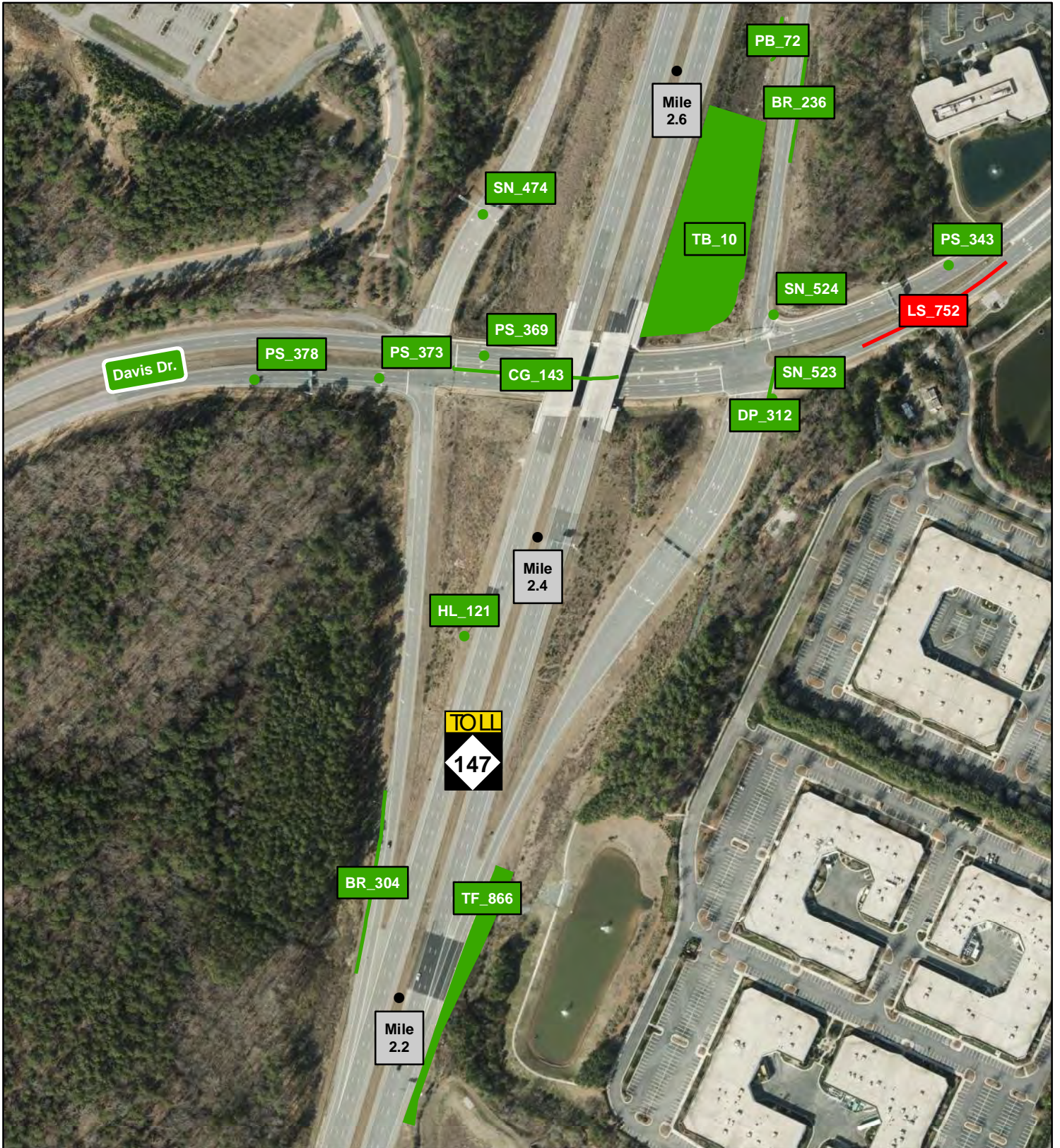
## Legend

- Failing Asset
- Passing Asset





# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



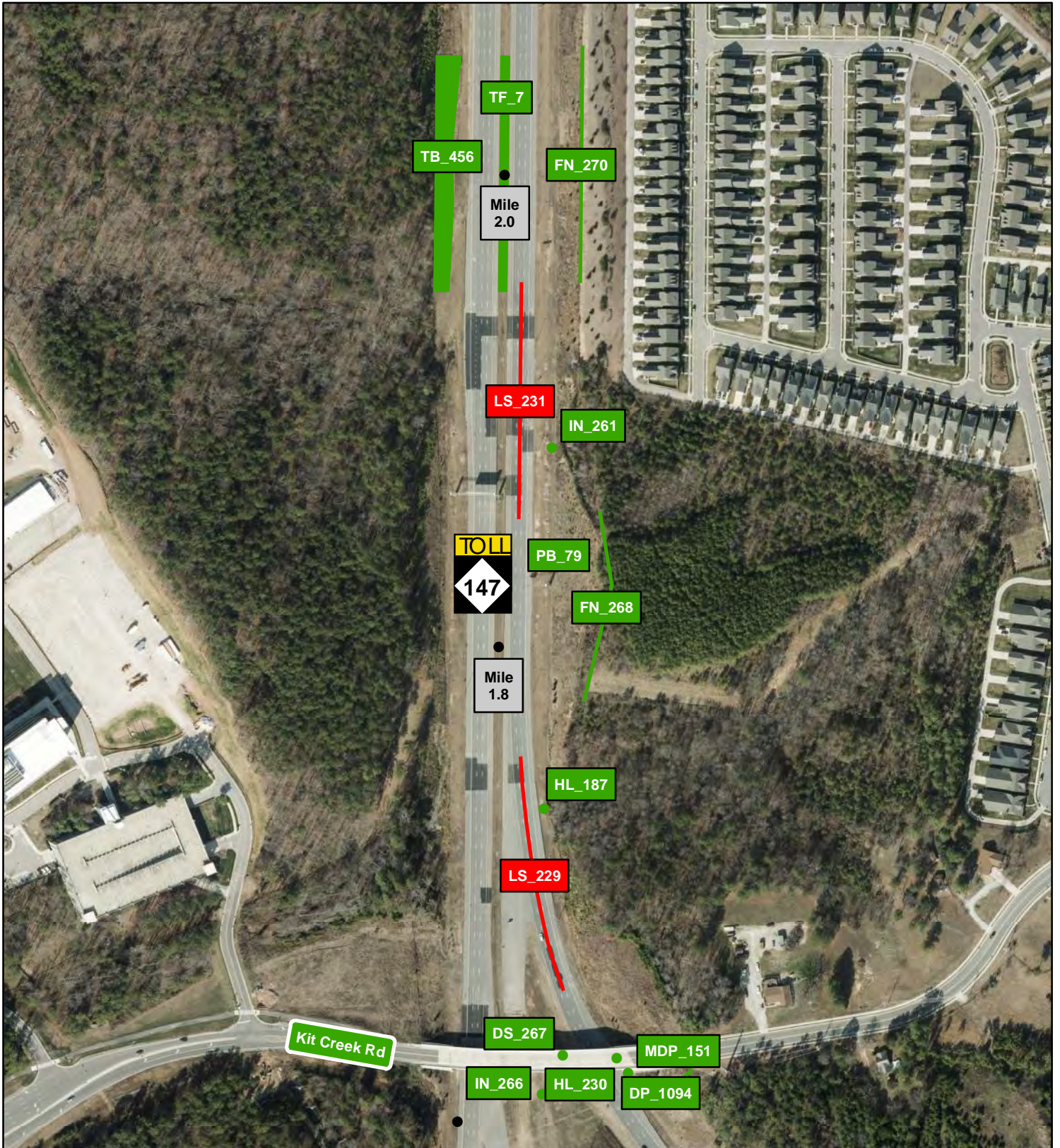
## Legend

- Failing Asset
- Passing Asset





# Appendix A: Triangle Expressway 2019 Third Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset





## **Appendix B**

**Triangle Expressway 2019 Third Quarter Table Results of Assets Failing MRP**



**Appendix B: Triangle Expressway 2019 Third Quarter Table Results of Assets Failing MRP**

Provided below are a series of tables outlining the existing failures that occurred throughout the facility. Assets are defined by an Inventory ID, which is a unique identifier given to each individual asset. The components that make up the Inventory ID are an asset specific prefix along with a number, such as LS\_1. All assets and their respective prefixes are listed below:



Guardrail, Concrete Barrier and End Anchors (BR)..... 2  
Curb and Gutter (CG) ..... 3  
Decorative Supports (DS) ..... 4  
Drainage Pipes (DP)..... 5  
Misc. Drainage Structure (MDP) ..... 6  
Fence and Control of Access (FN) ..... 8  
Graffiti (GR) ..... 9  
Highway Lighting (HL) ..... 10  
Impact Attenuators (IA) ..... 11  
Inlets (IN)..... 12  
Landscaping (PB) ..... 13  
Paved Lanes – Asphalt (LS)..... 14  
Paved Lanes – Concrete (LS) ..... 15  
Paved Shoulders (LS)..... 16  
Unpaved Shoulders (LS) ..... 17  
Front/Back Slopes (LS) ..... 18  
Unpaved Lateral and Outfall Ditches (LS) ..... 19  
Litter (LS) ..... 20  
Roadway Sweeping (LS) ..... 21  
Pavement Striping (LS)..... 22  
Pavement Markers (LS)..... 24  
Delineators (LS) ..... 25  
Paved Ditches (PD)..... 26  
Pavement Words and Symbols (PS)..... 27  
Signs (SN) ..... 28  
Tree and Brush (TB) ..... 29  
Turf Condition (TF) ..... 30  
MSE/Retaining Walls, Sound Barrier Walls and Screen Walls (WL)..... 31



The Inventory ID and GIS Reference Page number correspond to the provided map packets and allow for quick location of particular asset failures. Photos of failures were provided when applicable.





### Guardrail, Concrete Barrier and End Anchors (BR)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Guardrail	BR_644	Twisted Blocks		A7
2	Guardrail	BR_657	Functional Damage		A6







**Curb and Gutter (CG)**

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Shoulder Berm Gutter	CG_4	Settlement		A30
2	Shoulder Berm Gutter	CG_9	Settlement		A30



## Decorative Supports (DS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Overhead Sign Support	DS_11	Scaling		A31
2	Gantry Support	DS_44	Scaling		A11
3	Overhead Sign Support	DS_194	Scaling		A19
4	Overhead Sign Support	DS_246	Scaling		A16







**Drainage Pipes (DP)**

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Drain	DP_725	Obstruction		A3





### Misc. Drainage Structure (MDP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Shoulder Drain	MDP_80	Missing Rodent Screen		A11
2	Shoulder Drain	MDP_89	Missing Rodent Screen		A18
3	Shoulder Drain	MDP_92	Missing Rodent Screen		A19
4	Shoulder Drain	MDP_95	Obstruction		A19




### Misc. Drainage Structure (MDP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Shoulder Drain	MDP_124	Missing Rodent Screen		A23
6	Shoulder Drain	MDP_149	Missing Rodent Screen		A23
7	Shoulder Drain	MDP_209	Missing Rodent Screen/ Obstruction		A1



**Fence and Control of Access (FN)**

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Woven	FN_504	Fence Height		A17






**Graffiti (GR)**

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
This asset did not produce any failures.					



## Highway Lighting (HL)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Single Roadway	HL_62	Part Damage		A12
2	Double Roadway	HL_139	Part Damage		A4
3	Double Roadway	HL_165	Part Damage		A2





**Impact Attenuators (IA)**

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
This asset did not produce any failures.					



## Inlets (IN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Drop Inlet	IN_90	Obstruction		A9
2	Drop Inlet	IN_848	Obstruction		A18




**Landscaping (PB)**

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
This asset did not produce any failures.					



### Paved Lanes – Asphalt (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_267	Unsealed Cracks		A32




**Paved Lanes – Concrete (LS)**

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
This asset did not produce any failures.					







**Paved Shoulders (LS)**

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_149	Pavement Edge Drop-Off		A11



## Unpaved Shoulders (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_8	Shoulder Drop-Off		A29
2	Concrete	LS_346	Shoulder Build-Up		A6
3	Asphalt	LS_545	Shoulder Drop-Off		A23
4	Asphalt	LS_552	Shoulder Drop-Off		A17

**Front/Back Slopes (LS)**



#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
This asset did not produce any failures.					



**Unpaved Lateral and Outfall Ditches (LS)**

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
This asset did not produce any failures.					

## Litter (LS)





#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_343	Litter		A6
2	Asphalt	LS_545	Litter		A23





**Roadway Sweeping (LS)**

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
This asset did not produce any failures.					





## Pavement Striping (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_59	Line Missing		A7
2	Asphalt	LS_229	Line Missing		A37
3	Asphalt	LS_231	Line Missing		A37
4	Asphalt	LS_267	Line Missing		A32



5	Asphalt	LS_301	Line Missing	 A photograph showing a close-up view of an asphalt road surface. A white dashed line is visible on the right side of the road, but it appears to be missing or faded in the distance. The road is bordered by a grassy embankment on the right.	A3, A4
6	Asphalt & Concrete	LS_303	Line Missing	 A photograph showing a road with a concrete curb on the left side. The road surface is asphalt. A white dashed line is visible on the right side of the road, but it appears to be missing or faded in the distance. The road is bordered by trees and a grassy area on the right.	A4

## Pavement Markers (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_229	Reflective Marker Missing & Nighttime Reflectivity		A37
2	Asphalt	LS_231	Reflective Marker Missing & Nighttime Reflectivity		A37
3	Asphalt	LS_267	Reflective Marker Missing & Nighttime Reflectivity		A32
4	Asphalt & Concrete	LS_303	Reflective Marker Missing & Nighttime Reflectivity		A4
5	Asphalt	LS_741	Nighttime Reflectivity	Not Available for Nighttime Failure	A1



**Delineators (LS)**

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
This asset did not produce any failures.					

**Paved Ditches (PD)**



#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
This asset did not produce any failures.					



## Pavement Words and Symbols (PS)


#	Symbol Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Only	PS_44	Daytime Assessment & Nighttime Reflectivity		A33
2	Stop Bar	PS_163	Nighttime Reflectivity	Not Available for Nighttime Failure	A17
3	Left Turn	PS_409	Daytime Assessment & Nighttime Reflectivity		A1
4	Thru Lane	PS_438	Daytime Assessment & Nighttime Reflectivity		A7
5	Thru and Right	PS_557	Nighttime Reflectivity		A29

## Signs (SN)




#	Sign Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Toll Payments	SN_167	Slip Base		A12
2	Speed Limit Ramp	SN_353	Height Requirement		A7



**Tree and Brush (TB)**



#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Tree and Brush	TB_149	Vertical Clearance		A26

**Turf Condition (TF)**

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Turf	TF_239	Bare Ground		A25
2	Turf	TF_498	Bare Ground		A17
3	Turf	TF_1036	Bare Ground		A26



### MSE/Retaining Walls, Sound Barrier Walls and Screen Walls (WL)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Screen Wall	WL_30	Paint Scale		A35
2	Retaining Wall	WL_116	Unsealed Cracks & Vegetation		A29