



NORTH CAROLINA  
**Turnpike Authority**

## Maintenance Rating Program

Triangle Expressway

## 2021 First Quarter and Annual Report

1 S. Wilmington Street  
Raleigh, NC 27601



Last Updated:  
May 11, 2021



## CONSULTANT CERTIFICATION OF COMPLETION

May 11, 2021

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

### NCTA Triangle Expressway Roadway Maintenance Performance Rating Program; Q1, CY 2021 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

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## Maintenance Rating Program for the Triangle Expressway

2021 First Quarter (January – March)

### 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 2021 First Quarter Assessment of the Triangle Expressway.

The overall 2021 first quarter maintenance rating of the Triangle Expressway was **88.9**, below the NCTA target rating of **90**. As shown in **Table 1**, four of five elements assessed achieved a rating greater than the target rating of 85.

Table 1: MRP Element Results for the 2021 First Quarter Assessment		
Element	MRP Rating	Target Rating
Road Surface	90.5 <sup>1</sup>	85.0
Unpaved Shoulders and Ditches	99.3	85.0
Drainage	88.6	85.0
Roadside	90.6	85.0
Traffic Control Devices	82.2 <sup>1</sup>	85.0
<b>Overall MRP Performance Rating</b>	<b>88.9<sup>1</sup></b>	<b>90.0</b>

<sup>1</sup>Excludes asphalt surface pavement condition as well as markers, striping, and symbols on mainline NC-147 and ramps/loops.

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 **90.3**.

Table 2: MRP Rolling Element Results					
Element	Q2 2020 Rating	Q3 2020 Rating	Q4 2020 Rating	Q1 2021 Rating	Rolling Rating
Road Surface	93.8	96.3 <sup>1</sup>	96.2 <sup>1</sup>	90.5 <sup>1</sup>	94.1 <sup>2</sup>
Unpaved Shoulders and Ditches	92.5	96.5	98.8	99.3	96.9
Drainage	92.5	89.2	87.6	88.6	99.5
Roadside	91.7	91.1	89.1	90.6	90.6
Traffic Control Devices	87.0	84.0 <sup>1</sup>	85.2 <sup>1</sup>	82.2 <sup>1</sup>	84.6 <sup>2</sup>
<b>Overall MRP Performance Rating</b>	<b>91.0</b>	<b>90.7<sup>1</sup></b>	<b>90.7<sup>1</sup></b>	<b>88.9<sup>1</sup></b>	<b>90.3<sup>2</sup></b>

<sup>1</sup>Excludes asphalt surface pavement condition as well as markers, striping, and symbols on mainline NC-147 and ramps/loops.

<sup>2</sup>Excludes quarter ratings for characteristics listed above.

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.

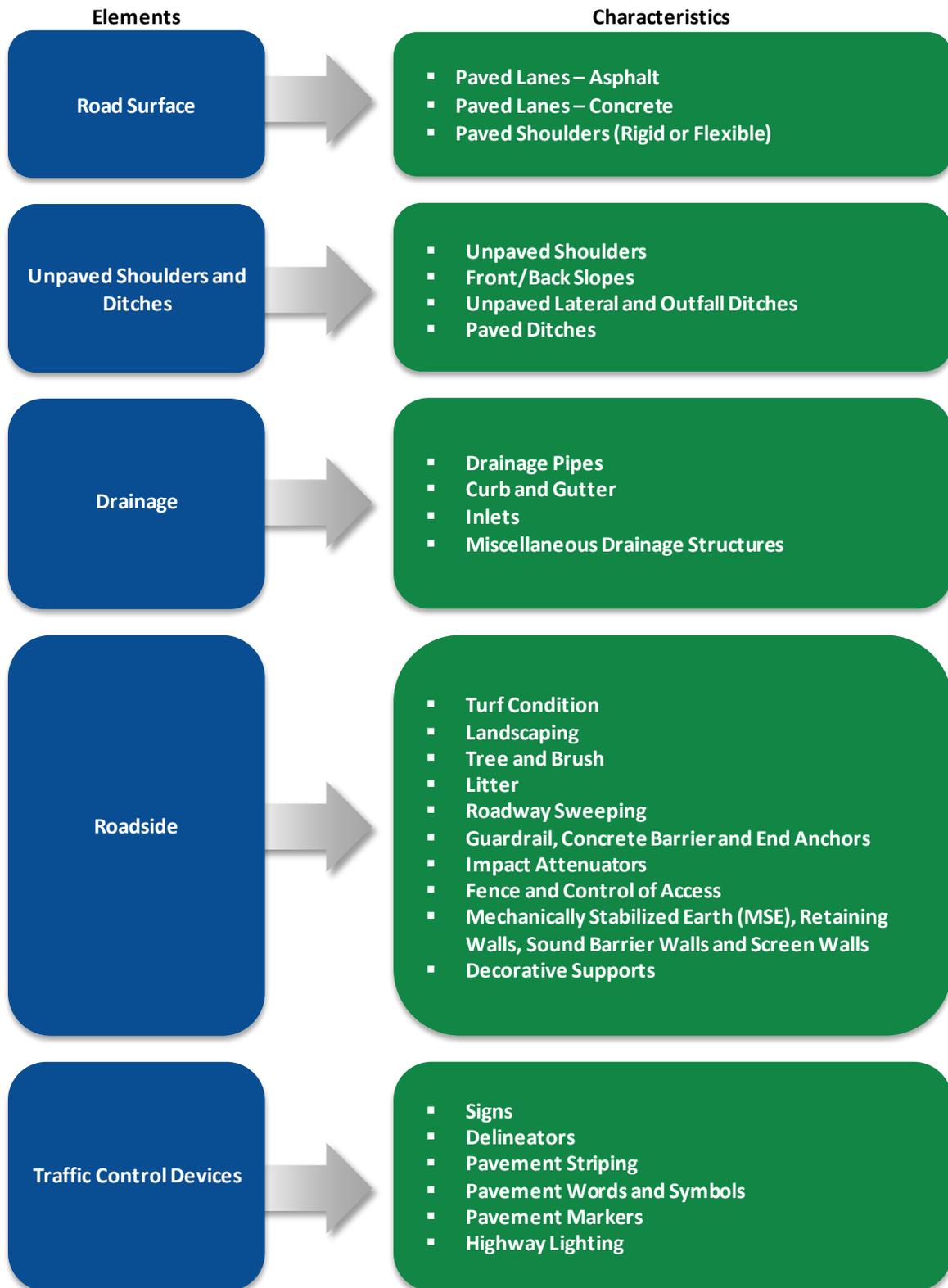
The NCTA performance standards, threshold criteria, and maintenance rating program were developed through a collaborative effort by NCTA managers, NCDOT maintenance staff, and consultants.

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 are shown in **Figure 1**:

Figure 1: Maintenance Elements and Characteristics



## Maintenance Rating Program for the Triangle Expressway

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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 sample 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.

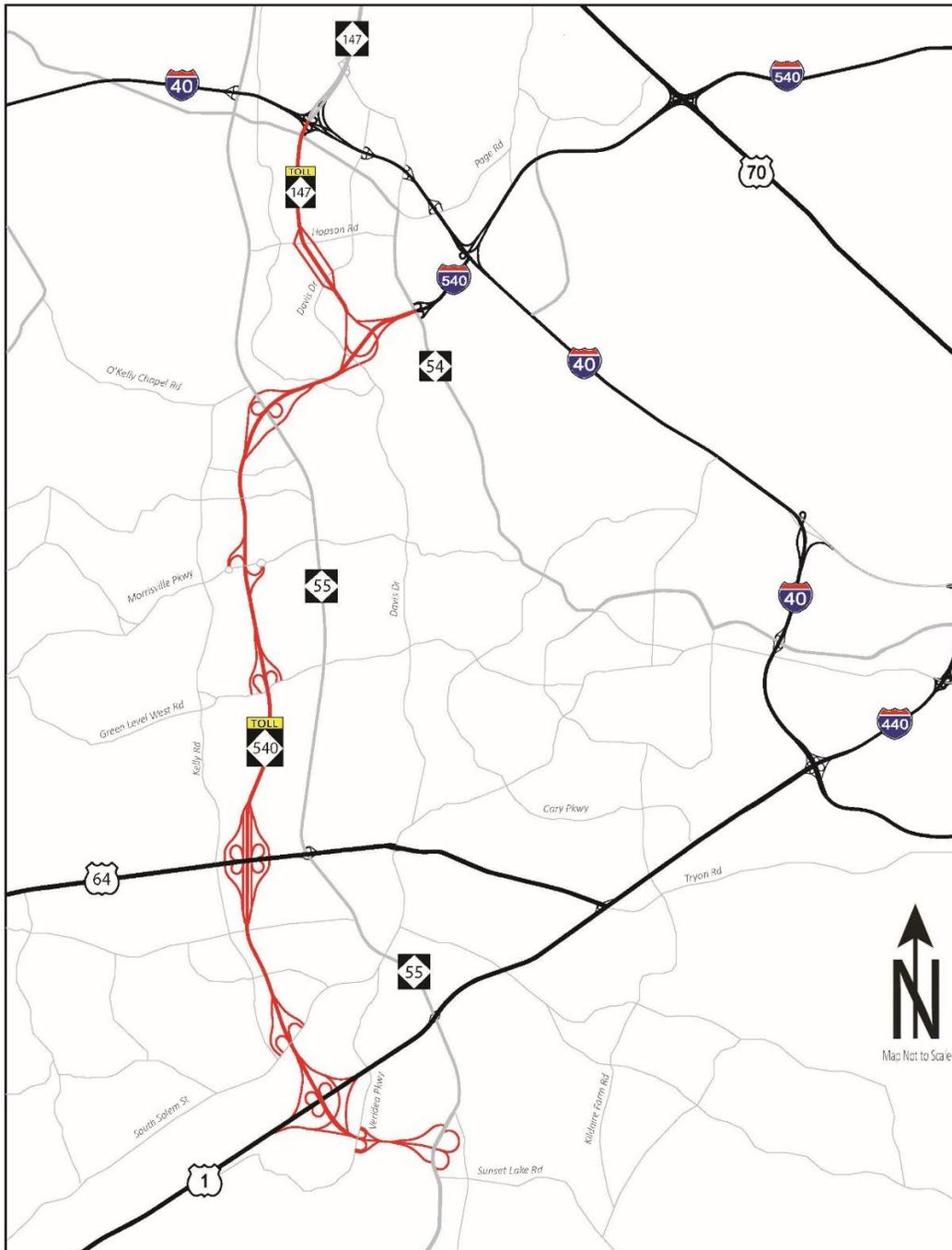
## Maintenance Rating Program for the Triangle Expressway

2021 First Quarter (January – March)

### 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 twelve interchanges and twenty-two all-electronic toll collection zones.

**Figure 2: Triangle Expressway Map**



## Maintenance Rating Program for the Triangle Expressway

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### 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 exit ramps to and from NC-55 Bypass were removed from the inventory due to the Complete 540 construction project. **Table 3** presents the updated number of assets that are currently available for inspections.

Table 3: Asset Inventory		
Assets	Total Inventory	2021 Eligible Inventory
Barriers	799	627
Curb and Gutter	428	397
Decorative Supports	305	298
Drainage	1179	1131
Misc. Drainage	211	200
Fences	508	484
Highway Lighting	435	431
Impact Attenuators	47	45
Inlets	1126	1080
Linear Segments	795	737
Plant Beds	266	261
Paved Ditches	2	2
Pavement Symbols	652	593
Signs	1221	1169
Tree and Brush	603	569
Turf	1074	978
Walls	88	84

## 6.0 MRP FIRST QUARTER ASSESSMENT

### 6.1 Quarterly Results

The overall 2021 first quarter maintenance rating of the Triangle Expressway was 88.9, below NCTA’s target overall rating of 90. All elements assessed apart from Traffic Control Devices (82.2) achieved quarter ratings above the target rating of 85 established for element groups. Miscellaneous Drainage Structures (75), Delineators (75), Pavement Striping/Markings (74), and Highway Lighting (78) are characteristics that scored below the target rating of 80.

Last year, NCTA let a resurfacing project to improve asphalt pavement condition as well as the condition of pavement striping, characters, symbols, and markers on mainline NC-147 and asphalt surface ramps/loops throughout Triangle Expressway. Due to this ongoing project, the Paved Lanes Asphalt, Paved Shoulder, Pavement Striping, Pavement Characters and Symbols, and Pavement Markers characteristics were only inspected on pavement surfaces not included in the resurfacing project contract. Once this project is completed, the characteristics rating for the entire facility will resume and will be included in the Road Surface element rating, Traffic Control Devices element rating and overall scoring.

It is important to note that these results are only representative of the first 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 first quarter MRP performance ratings for elements and characteristics are presented in **Table 4** and **Table 5**, respectively.

<b>Table 4: MRP Element Results for Q1 2021</b>	
<b>Element</b>	<b>Q1 2021 MRP Rating</b>
Road Surface	90.5 <sup>1</sup>
Unpaved Shoulders and Ditches	99.3
Drainage	88.6
Roadside	90.6
Traffic Control Devices	82.2 <sup>1</sup>
<b>Overall MRP Performance Rating</b>	<b>88.9<sup>1</sup></b>

<sup>1</sup>Excludes asphalt surface pavement condition as well as markers, striping, and symbols on mainline NC-147 and ramps/loops.

**Maintenance Rating Program for the Triangle Expressway**

**2021 First Quarter (January – March)**

<b>Table 5: MRP Characteristic Results for Q1 2021</b>						
<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>Q4 Rating</b>
Paved Lanes Asphalt	7	8	9	63	72	88 <sup>1</sup>
Paved Lanes Concrete	16	19	9	144	171	84
Paved Shoulder	27	27	5	135	135	100 <sup>1</sup>
<b>Element Total</b>				<b>342</b>	<b>378</b>	<b>90.5<sup>1</sup></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>Q4 Rating</b>
Unpaved Shoulder	40	40	9	360	360	100
Front/Back Slopes	39	40	6	234	240	98
Lateral and Outfall Ditches, Unpaved	40	40	6	240	240	100
Ditches, Paved	2	2	5	10	10	100
<b>Element Total</b>				<b>844</b>	<b>850</b>	<b>99.3</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>Q4 Rating</b>
Drainage Pipes	29	33	7	203	231	88
Curb and Gutter	26	28	6	156	168	93
Inlets	36	39	7	252	273	92
Misc. Drainage Structure	21	28	4	84	112	75
<b>Element Total</b>				<b>695</b>	<b>784</b>	<b>88.6</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>Q4 Rating</b>
Turf Condition	46	57	7	322	399	81
Landscaping	22	26	4	88	104	85
Trees and Brush	30	31	4	120	124	97
Litter	35	40	4	140	160	88
Roadway Sweeping	40	40	5	200	200	100
Guardrail, Concrete Barrier, and End Anchors	30	31	9	270	279	97
Impact Attenuators	8	8	9	72	72	100
Fence, Control Access	24	30	7	168	210	80
Retaining Walls and Sound Barrier Walls	15	16	5	75	80	94
Decorative Supports	26	26	5	130	130	100
Graffiti and Stain Removal	42	44	4	168	176	95
<b>Element Total</b>				<b>1753</b>	<b>1934</b>	<b>90.6</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>Q4 Rating</b>
Signs	31	35	7	217	245	89
Delineators	30	40	3	90	120	75
Pavement Striping/Marking	20	27	8	160	216	74 <sup>1</sup>
Words and Symbols	29	36	7	203	252	81 <sup>1</sup>
Pavement Markers	25	27	9	225	243	93 <sup>1</sup>
Highway Lighting	32	41	6	192	246	78
<b>Element Total</b>				<b>1087</b>	<b>1322</b>	<b>82.2<sup>1</sup></b>

<sup>1</sup>Excludes asphalt surface pavement condition as well as markers, striping, and symbols on mainline NC-147 and ramps/loops.

## Maintenance Rating Program for the Triangle Expressway

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### 2021 First Quarter (January – March)

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

#### 6.2 Quarter Analysis and Recommendations

##### Elements

During the first quarter, all elements apart from Traffic Control Devices (82.2) exceeded NCTA's threshold criteria of 85. Unpaved Shoulder/Ditches (99.3) achieved a score higher than 95 this quarter. Road Surface (90.5), Drainage (88.6), Roadside (90.6) experienced a decrease in rolling rating though continued to score above the target rating of 85.

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

##### Characteristics

This quarter, all but four characteristic, Miscellaneous Drainage Structures (75), Delineators (75), Pavement Striping/Markings (74), and Highway Lighting (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

2021 First Quarter (January – March)

Miscellaneous Drainage Structures (75 rating – 21 of the 28 assets passed): Out of the 7 structures that did not pass inspection, 2 were obstructed and 5 had a missing or damaged rodent screen at the outlet. Two of the miscellaneous drainage structures (shoulder underdrains) that did not pass inspection are presented in **Figure 3**.

**Figure 3: Miscellaneous Drainage Structure Inspection Results Sample**



In accordance with *NCTA Roadway and Facility Maintenance Standards V6*, referenced below, the maintenance provider shall plan annual cleaning of these drainage features to remove any debris or overgrown vegetation. It is also recommended that the maintenance provider continue to follow the routine patrol schedule and repair any erosion or soil buildup problems along the ditch line near the outlets. Given the subsurface Triassic soil conditions encountered on this project, the edge drain system is a critical component of maintaining the design life of pavements as it provides a conduit to channel water away from the subgrade and base.

Miscellaneous Drainage Maintenance Program Standards:

- 1) Miscellaneous Drainage Structures shall be inspected during routine patrols.
- 2) Clear all outlets to edge drains annually.
- 3) Schedule cleanouts and repairs during inspections.

Miscellaneous Drainage Evaluation Standards:

Miscellaneous Drainage Structures do not meet the maintenance standards when any of the following criteria is observed:

- 1) More than 50% of the structure (length and depth) is obstructed or blocked.
- 2) End protection has deteriorations, erosions, washouts or buildups adversely affecting the natural flow of water.

To avoid affecting the natural flow of water near the drainage features and reducing the design life of pavement performance, it is recommended that outlet elevations be checked against the outflow ditch elevations to ensure positive drainage. Appropriate grading of the ditch line may be necessary to provide positive flow.

## Maintenance Rating Program for the Triangle Expressway

### 2021 First Quarter (January – March)

Delineators (75 rating – 30 of the 40 assets passed): The delineator segments that did not pass inspection were identified as missing more than 10% of the required markers along guardrail segments or not reflecting during nighttime inspection. Two of the delineator segments that did not pass inspection are presented in **Figure 4**.

**Figure 4: Delineator Inspection Results Sample**



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

#### Maintenance Program:

- 1) Object markers and delineators are inspected by routine patrols and specifically after each mowing cycle for damage.
- 2) Missing and non-reflective object markers are replaced within the annual work program.
- 3) Missing and non-reflective delineators are replaced within 14 calendar days.

#### Maintenance and Evaluation Standards:

Object Markers and delineators do not meet the maintenance standards when any of the following criteria is observed:

- 1) More than 10% of the post-mounted delineators are offset 4 feet plus or minus 3 inches from the shoulder break point and installed at a uniform height on interchange ramps.
- 2) More than 10% of the object markers or post-mounted delineators lean more than 1 inch per foot of post length.
- 3) More than 10% of the required markers and delineators are missing or unevenly spaced.
- 4) More than 10% of the required delineators are not visible during nighttime observation. (N)
- 5) More than 10% of the post-mounted delineators are installed facing the wrong way.
- 6) More than 10% of the object markers or post-mounted delineators are missing connecting hardware, nuts and bolts.

## Maintenance Rating Program for the Triangle Expressway

### 2021 First Quarter (January – March)

Pavement Striping (74 rating – 20 of the 27 assets passed): There were 7 pavement striping/markings segments that did not pass inspection, these segments were identified as missing more than 10% of any line segment in the sections, not meeting the required line width, or not reflecting during the nighttime inspection. Two of the pavement striping and marking segments that did not pass inspection are presented in **Figure 5**.

**Figure 5: 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:

- 4) Pavement striping is observed daily and inspected every 4 months for compliance to the standard.
- 5) Worn or missing markings are evaluated for compliance annually, and generally are scheduled on a 3 to 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. NCTA has let a contract for the replacement of pavement striping/markings following asphalt pavement resurfacing.

## Maintenance Rating Program for the Triangle Expressway

2021 First Quarter (January – March)

Highway Lighting (78 rating – 32 of the 41 assets failed). Out of the 9 highway lights that did not pass inspection, 7 had damaged or open electrical access and 2 had a missing rodent screen at the base. Two of these highway lights are presented in **Figure 6**.

**Figure 6: Highway Lighting Inspection Results Sample**



To increase future highway lighting ratings, it is recommended that all damaged highway lights noted during the inspection be repaired and/or replaced in accordance with the *NCTA Roadway and Facility Maintenance Standards V6*, referenced below. Additional care should be taken to ensure all access panels are properly secured to prevent rodent and other animal intrusion.

Highway Lighting Maintenance Program Standards:

- 1) Replace any light poles damaged by traffic within 5 days or within 14 days if any foundations need pouring.

Highway Lighting Maintenance and Evaluation Standards:

Highway and Sign Lighting do not meet the maintenance standards when any of the following criteria is observed:

- 1) Any electrical inspection plate, access panel cover, exposed electrical wire, or pull box cover are not properly secured in place.
- 2) More than 10% of the poles are damaged or missing.
- 3) Rodent screen protection is not in place.

## Maintenance Rating Program for the Triangle Expressway

2021 First Quarter (January – March)

### 7.0 CURRENT ROLLING MRP RATING

The rolling maintenance rating of the Triangle Expressway was 90.5, exceeding NCTA’s target overall rating of 90. All rolling element ratings apart from Traffic Control Devices exceeded the target rating of 85. Turf Condition (76) and Pavement Striping (76) were the only characteristics that did not meet the rolling rating threshold of 80.

The 2020/2021 results are presented in **Tables 6 and 7**. These results are a collection of the four quarterly inspections conducted in the last year.

Table 6: MRP Element Results for 2020/2021					
Element	Q2 2020 Rating	Q3 2020 Rating	Q4 2020 Rating	Q1 2021 Rating	Rolling Rating
Road Surface	93.8	96.3 <sup>1</sup>	96.2 <sup>1</sup>	90.5 <sup>1</sup>	94.1 <sup>2</sup>
Unpaved Shoulders and Ditches	92.5	96.5	98.8	99.3	96.9
Drainage	92.5	89.2	87.6	88.6	89.5
Roadside	91.7	91.1	89.1	90.6	90.6
Traffic Control Devices	87.0	84.0 <sup>1</sup>	85.2 <sup>1</sup>	82.2 <sup>1</sup>	84.6 <sup>2</sup>
<b>Overall MRP Performance Rating</b>	<b>91.0</b>	<b>90.7<sup>1</sup></b>	<b>90.7<sup>1</sup></b>	<b>88.9<sup>1</sup></b>	<b>90.3<sup>2</sup></b>

<sup>1</sup>Excludes asphalt surface pavement condition as well as markers, striping, and symbols on mainline NC-147 and ramps/loops.

<sup>2</sup>Excludes the indicated quarter ratings for characteristics listed above.

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<b>Table 7: MRP Rolling Element Results</b>					
<b>Road Surface</b>	<b>Q2 2020 RATING</b>	<b>Q3 2020 RATING</b>	<b>Q4 2020 RATING</b>	<b>Q1 2021 RATING</b>	<b>ROLLING RATING</b>
Paved Lanes Asphalt	91	100 <sup>1</sup>	100 <sup>1</sup>	88 <sup>1</sup>	93 <sup>2</sup>
Paved Lanes Concrete	95	94	96	84	93
Paved Shoulder	94	96 <sup>1</sup>	96 <sup>1</sup>	100 <sup>1</sup>	96 <sup>2</sup>
<b>Element Total</b>	<b>93.8</b>	<b>96.3<sup>1</sup></b>	<b>96.2<sup>1</sup></b>	<b>90.5<sup>1</sup></b>	<b>94.1<sup>2</sup></b>
<b>Unpaved Shoulders and Ditches</b>	<b>Q2 2020 RATING</b>	<b>Q3 2020 RATING</b>	<b>Q4 2020 RATING</b>	<b>Q1 2021 RATING</b>	<b>ROLLING RATING</b>
Unpaved Shoulder	84	94	97	100	94
Front/Back Slopes	100	100	100	98	99
Lateral and Outfall Ditches, Unpaved	97	97	100	100	99
Ditches, Paved	100	100	100	100	100
<b>Element Total</b>	<b>92.5</b>	<b>96.5</b>	<b>98.8</b>	<b>99.3</b>	<b>96.9</b>
<b>Drainage</b>	<b>Q2 2020 RATING</b>	<b>Q3 2020 RATING</b>	<b>Q4 2020 RATING</b>	<b>Q1 2021 RATING</b>	<b>ROLLING RATING</b>
Drainage Pipes	91	91	88	88	89
Curb and Gutter	100	100	93	93	96
Inlets	94	82	86	92	89
Misc. Drainage Structure	82	83	83	75	81
<b>Element Total</b>	<b>92.5</b>	<b>89.2</b>	<b>87.6</b>	<b>88.6</b>	<b>89.5</b>
<b>Roadside</b>	<b>Q2 2020 RATING</b>	<b>Q3 2020 RATING</b>	<b>Q4 2020 RATING</b>	<b>Q1 2021 RATING</b>	<b>ROLLING RATING</b>
Turf Condition	80	82	62	81	76
Landscaping	100	88	92	85	91
Trees and Brush	97	97	97	97	97
Litter	91	91	97	88	91
Roadway Sweeping	100	100	100	100	100
Guardrail, Concrete Barrier and End Anchors	91	100	97	97	96
Impact Attenuators	100	100	100	100	100
Fence, Control Access	90	88	90	80	87
Retaining Walls and Sound Barrier Walls	73	80	93	94	85
Decorative Supports	100	100	100	100	100
Graffiti and Stain Removal	100	82	93	95	93
<b>Element Total</b>	<b>91.7</b>	<b>91.1</b>	<b>89.1</b>	<b>90.6</b>	<b>90.6</b>
<b>Traffic Control Devices</b>	<b>Q2 2020 RATING</b>	<b>Q3 2020 RATING</b>	<b>Q4 2020 RATING</b>	<b>Q1 2021 RATING</b>	<b>ROLLING RATING</b>
Signs	97	86	94	89	91
Delineators	84	94	88	75	85
Pavement Striping/Marking	88	74 <sup>1</sup>	65 <sup>1</sup>	74 <sup>1</sup>	76 <sup>2</sup>
Words and Symbols	90	79 <sup>1</sup>	87 <sup>1</sup>	81 <sup>1</sup>	84 <sup>2</sup>
Pavement Markers	81	89 <sup>1</sup>	96 <sup>1</sup>	93 <sup>1</sup>	89 <sup>2</sup>
Highway Lighting	81	88	78	78	81
<b>Element Total</b>	<b>87.0</b>	<b>84.0<sup>1</sup></b>	<b>85.2<sup>1</sup></b>	<b>82.2<sup>1</sup></b>	<b>84.6<sup>2</sup></b>

<sup>1</sup>Excludes asphalt surface pavement condition as well as markers, striping, and symbols on mainline NC-147 and ramps/loops.

<sup>2</sup>Excludes the indicated quarter ratings for characteristics listed above.

## 8.0 GREEN LEVEL HISTORIC DISTRICT SIGNS

The 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 landscape area of the sign at intersection of Green Level West Road and Beaver Dam Road did partially obstruct the text of the sign. The third sign had been temporarily removed due to nearby construction activities. **Figure 7** shows the two signs assessed and the area of the third sign.

**Figure 7: Green Level West Historic District Signs, Landscape Areas**



## 9.0 CONCLUSION

This report presents the 2021 first quarter assessment of the Triangle Expressway. The NCTA's target ratings are 90 overall, 85 for elements, and 80 for characteristics. The first quarter 2021 overall rating was 88.9 and the rolling rating was 90.3.

Four of the five element ratings were above the target ratings for the quarter and rolling assessment. Unpaved Shoulders and Ditches (96.9) experienced an increase in rating compared to the previous rolling rating. Road Surface (94.1) rating decreased by 1.1 points, Drainage (89.5) rating decreased by 0.8 points, Roadside (90.6) rating decreased by 1.0 points, and Traffic Control Devices (84.6) rating decreased by 2.2 points.

During the first quarter assessment, all but four characteristics met or exceeded the target rating of 80. These characteristics were Miscellaneous Drainage Structures (75), Delineators (75), Pavement Striping (74), and Highway Lighting (78). All but two characteristics in the rolling rating assessment met or exceeded the rolling target rating of 80. These characteristics were Turf Condition (76) and Pavement Striping (76). Repaving of asphalt lanes began in 2020 and is scheduled to continue into 2021, which would include the replacement of Pavement Markers, Pavement Striping, and Words/Symbols on asphalt surfaces.

To continue to improve upon characteristic ratings that have scored a quarter rating below 80 this year, it is recommended that the maintenance provider perform routine patrols of highway lighting for open electrical panels. Also, bare areas seeding/fertilization program efforts should continue during the spring and summer seasons to promote new turf growth.

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**

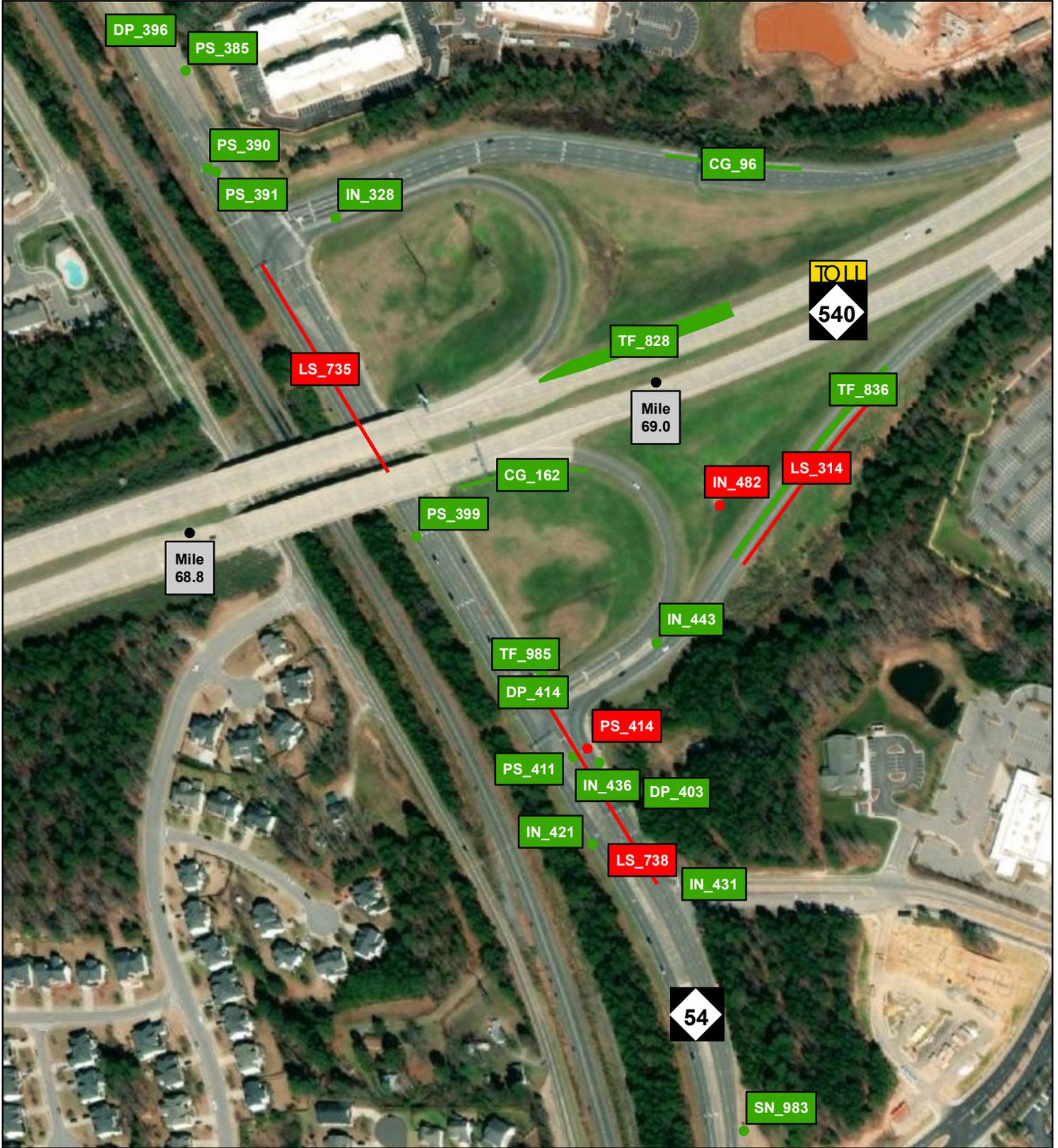
**Triangle Expressway 2021 First Quarter Asset Assessment Locations**

## Appendix A: Triangle Expressway 2021 First 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 2021 First Quarter Asset Assessment Locations

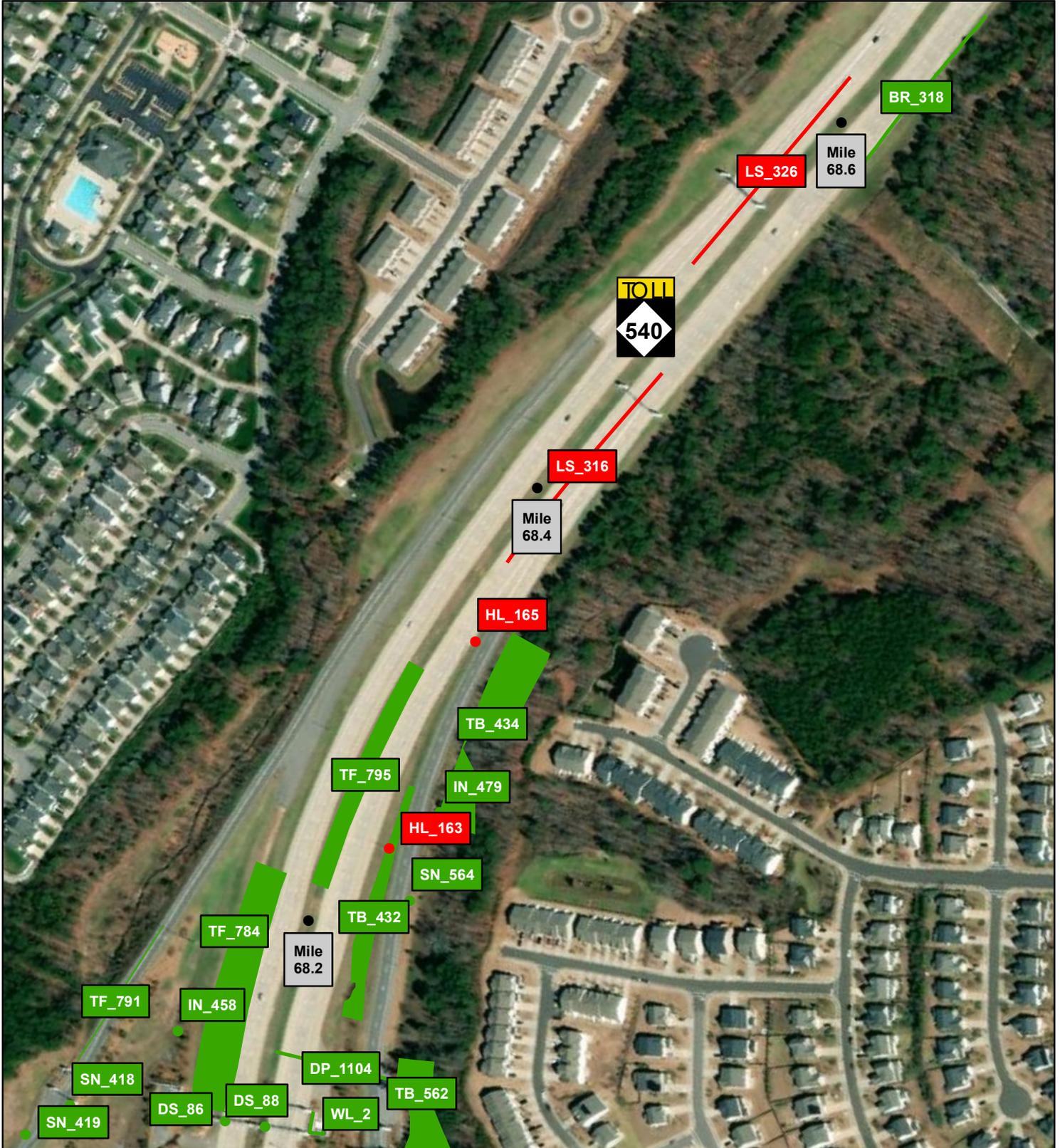


## Legend

- Failing Asset
- Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations

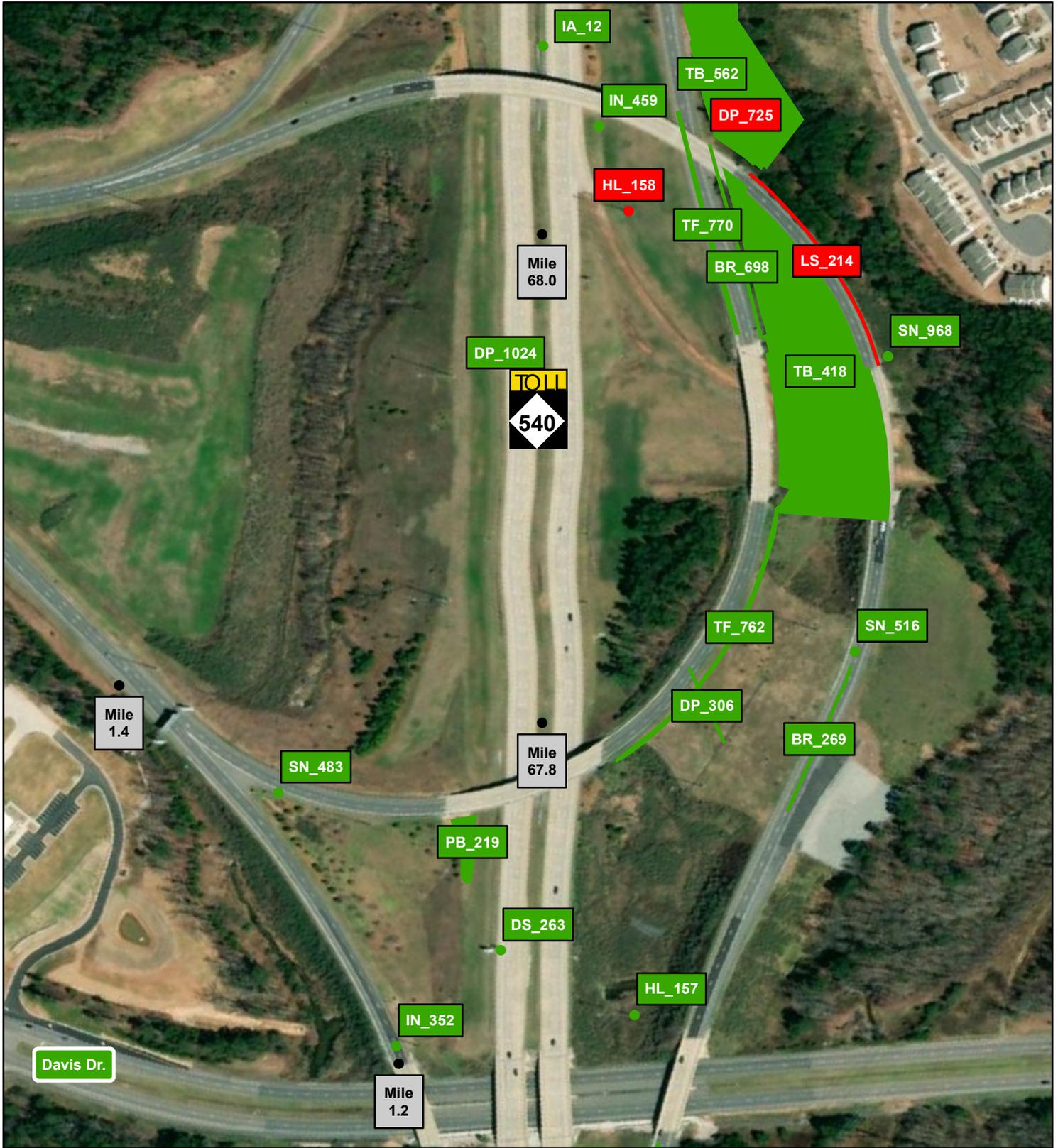


## Legend

- Failing Asset
- Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations

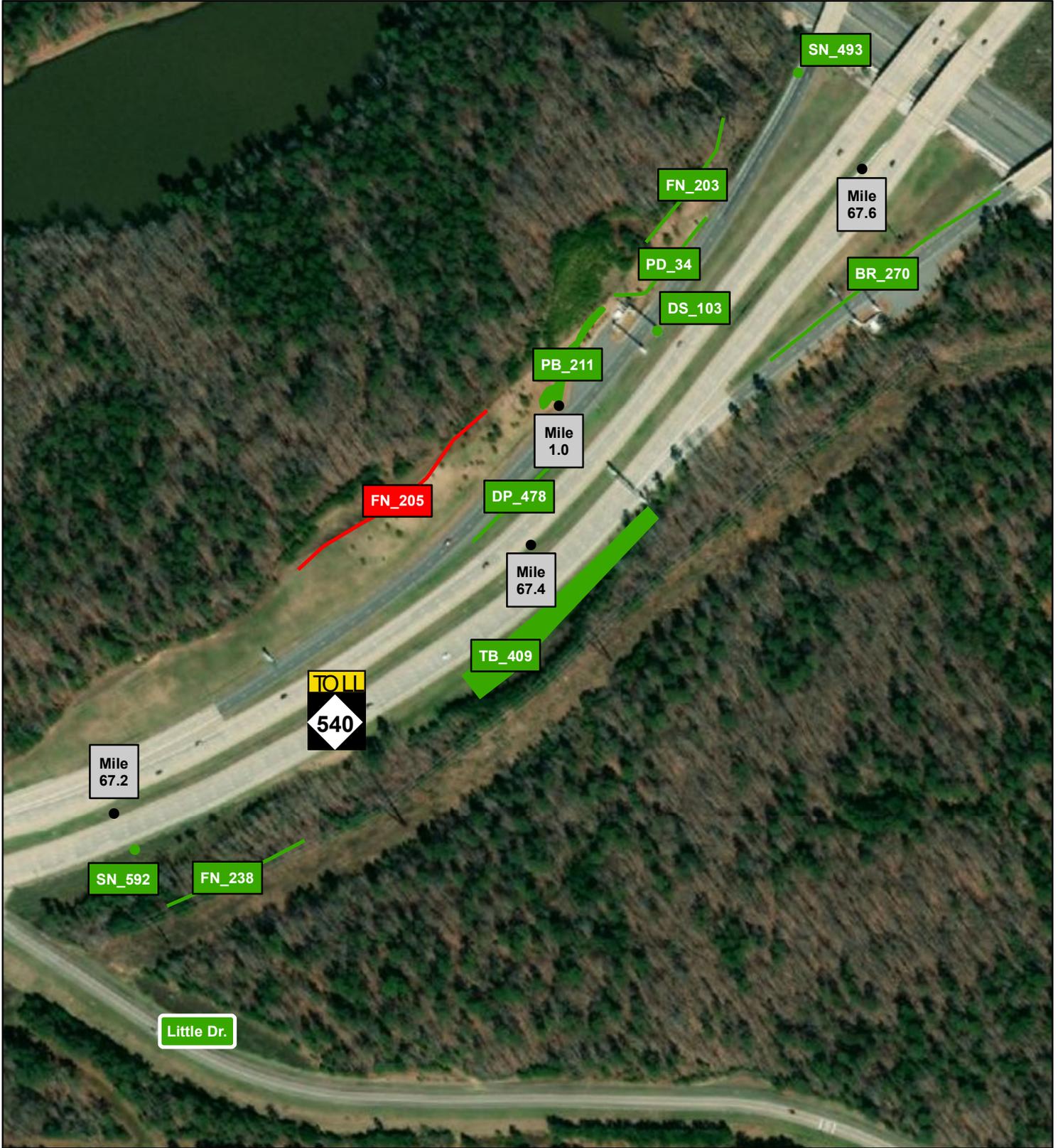


## Legend

- Failing Asset
- Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations

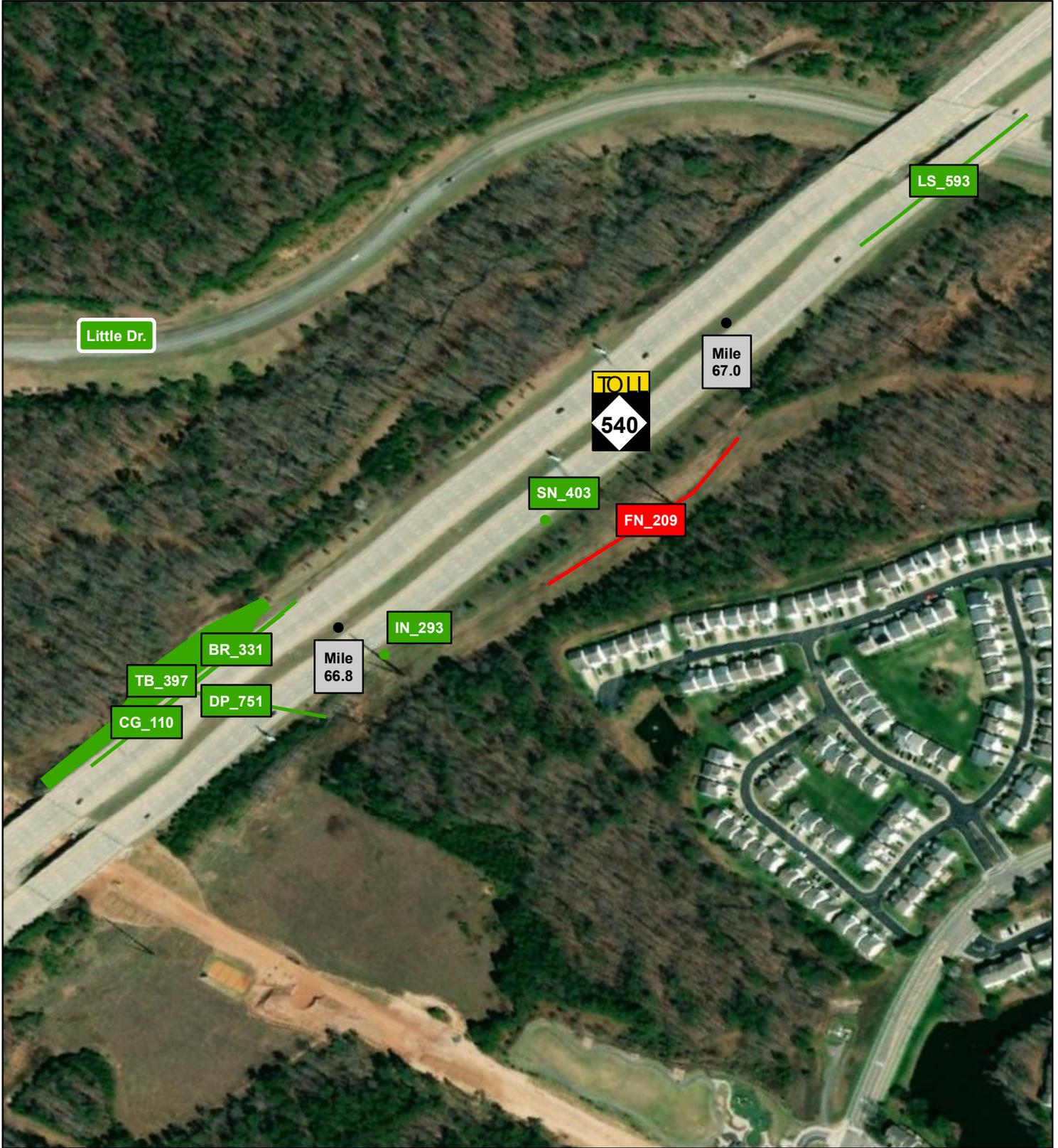


## Legend

- Failing Asset
- Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations

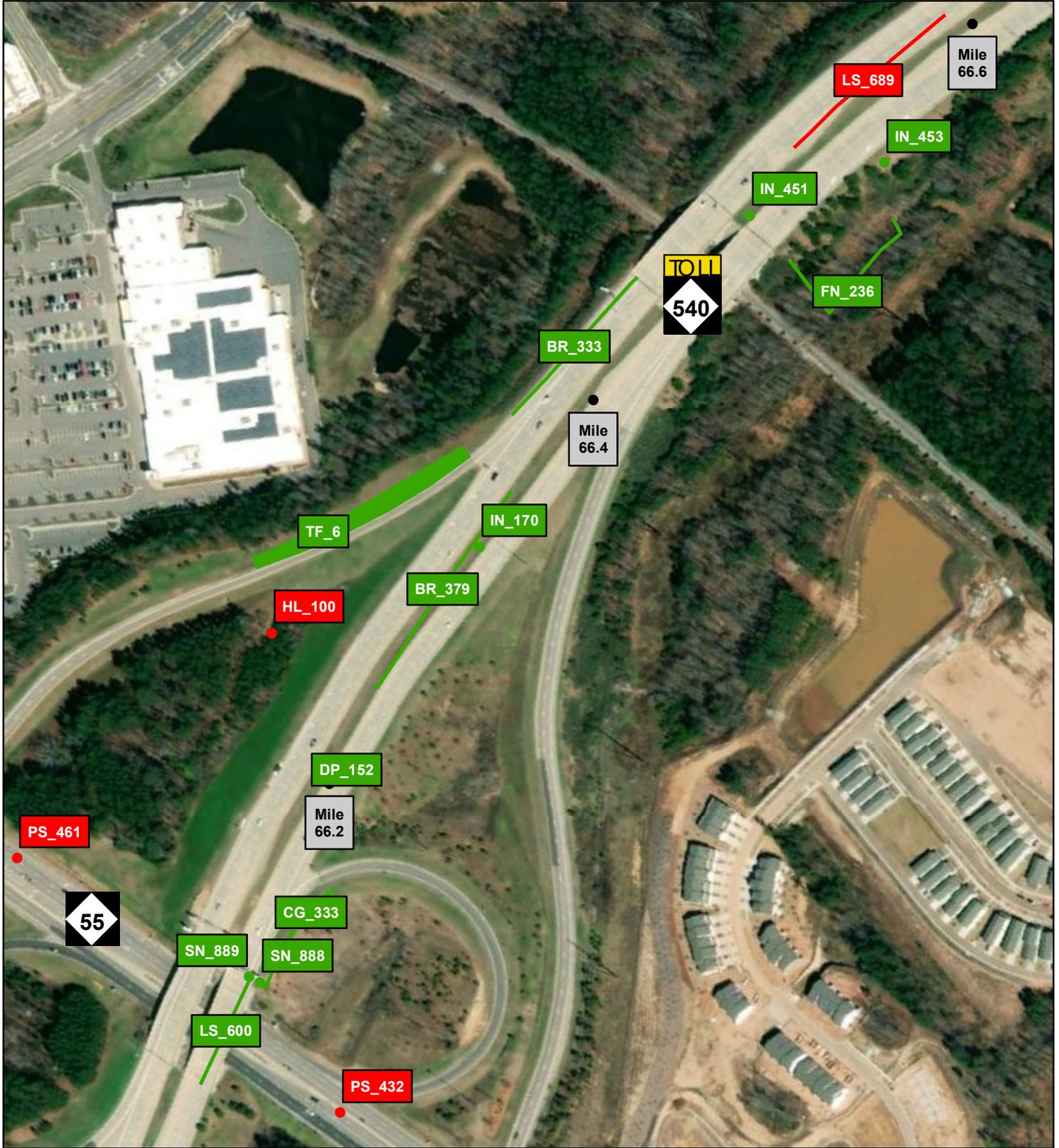


## Legend

-  Failing Asset
-  Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations

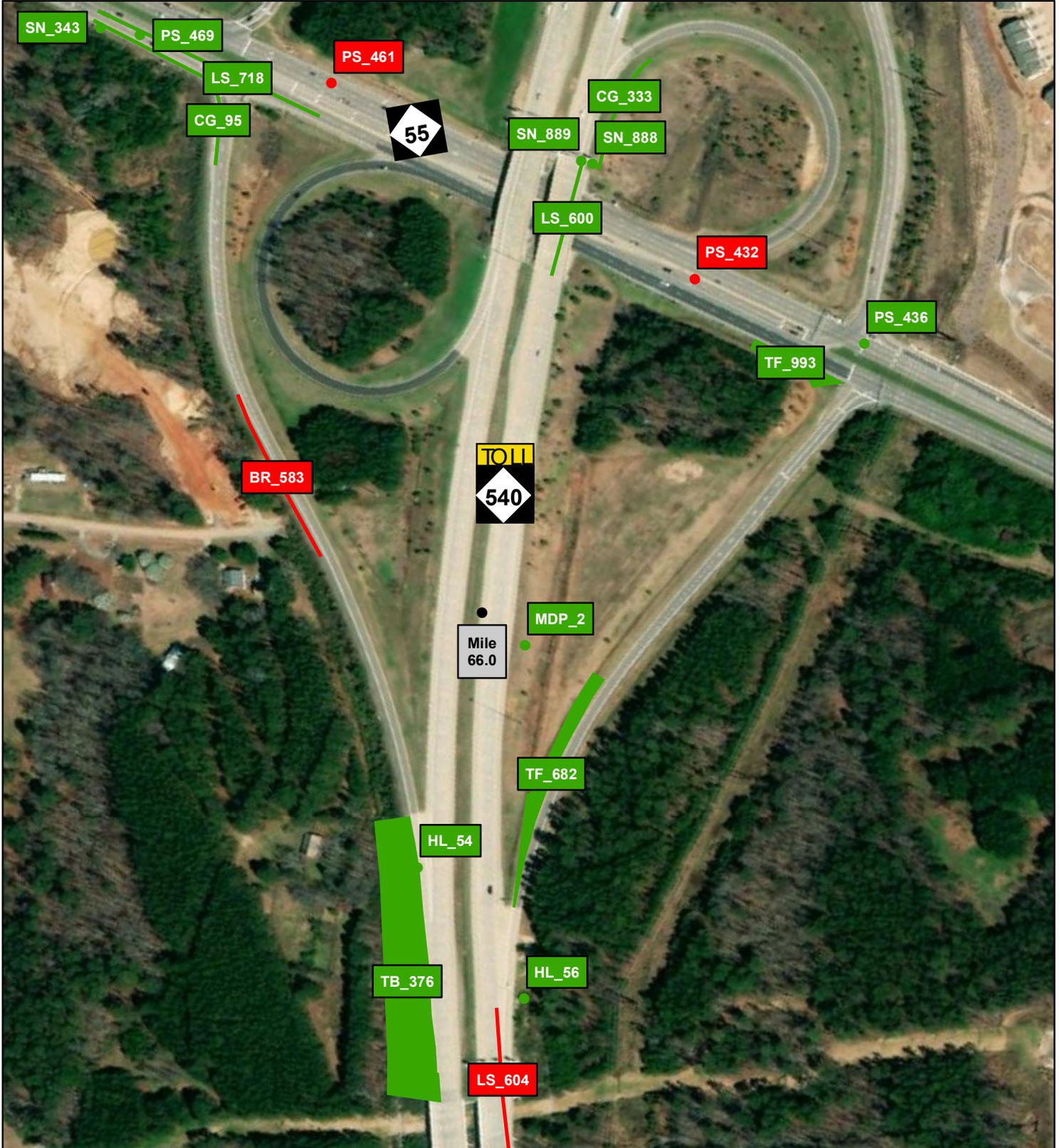


## Legend

- Failing Asset
- Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations

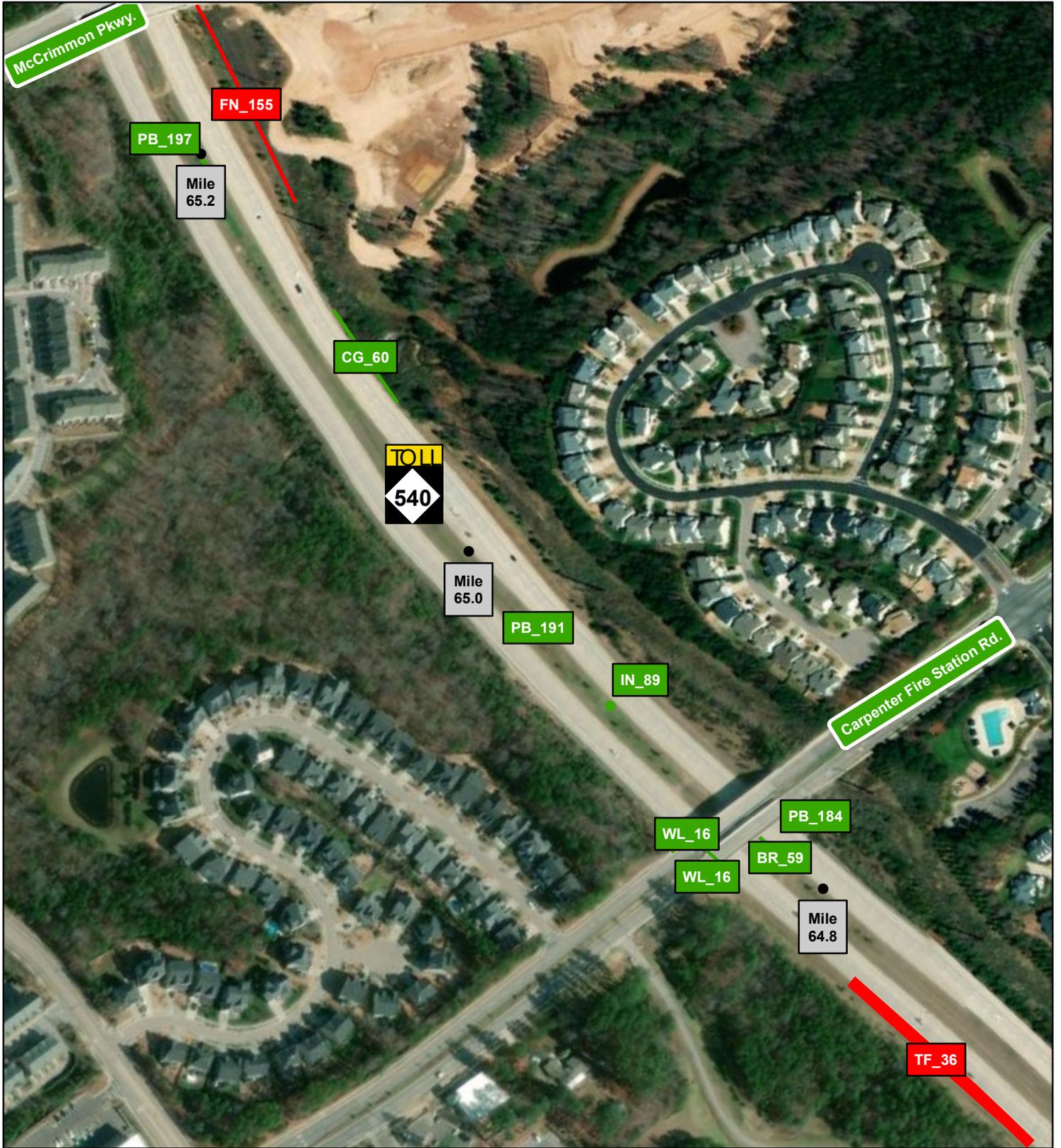


## Legend

-  Failing Asset
-  Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations



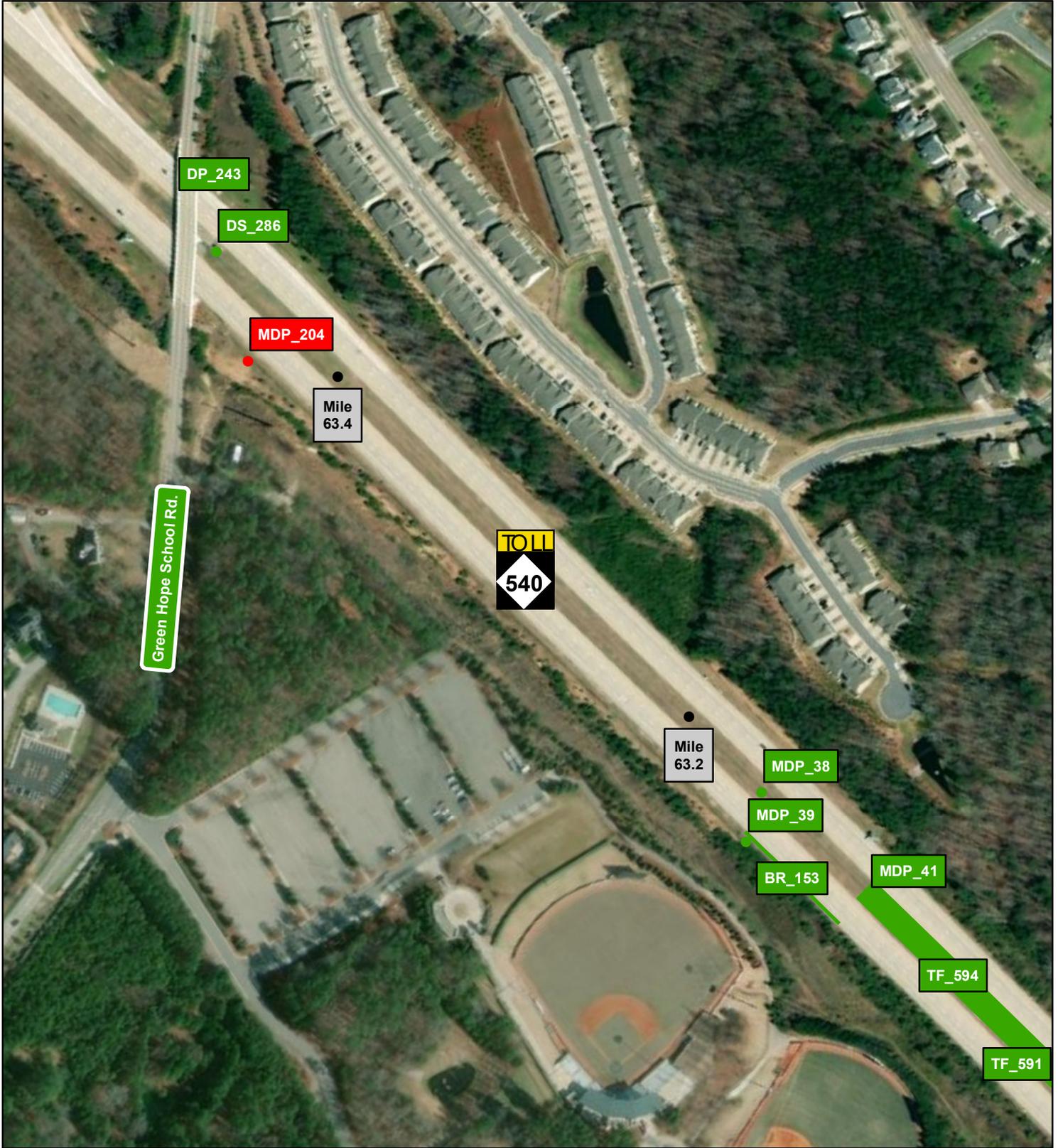
## Legend

-  Failing Asset
-  Passing Asset





# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations

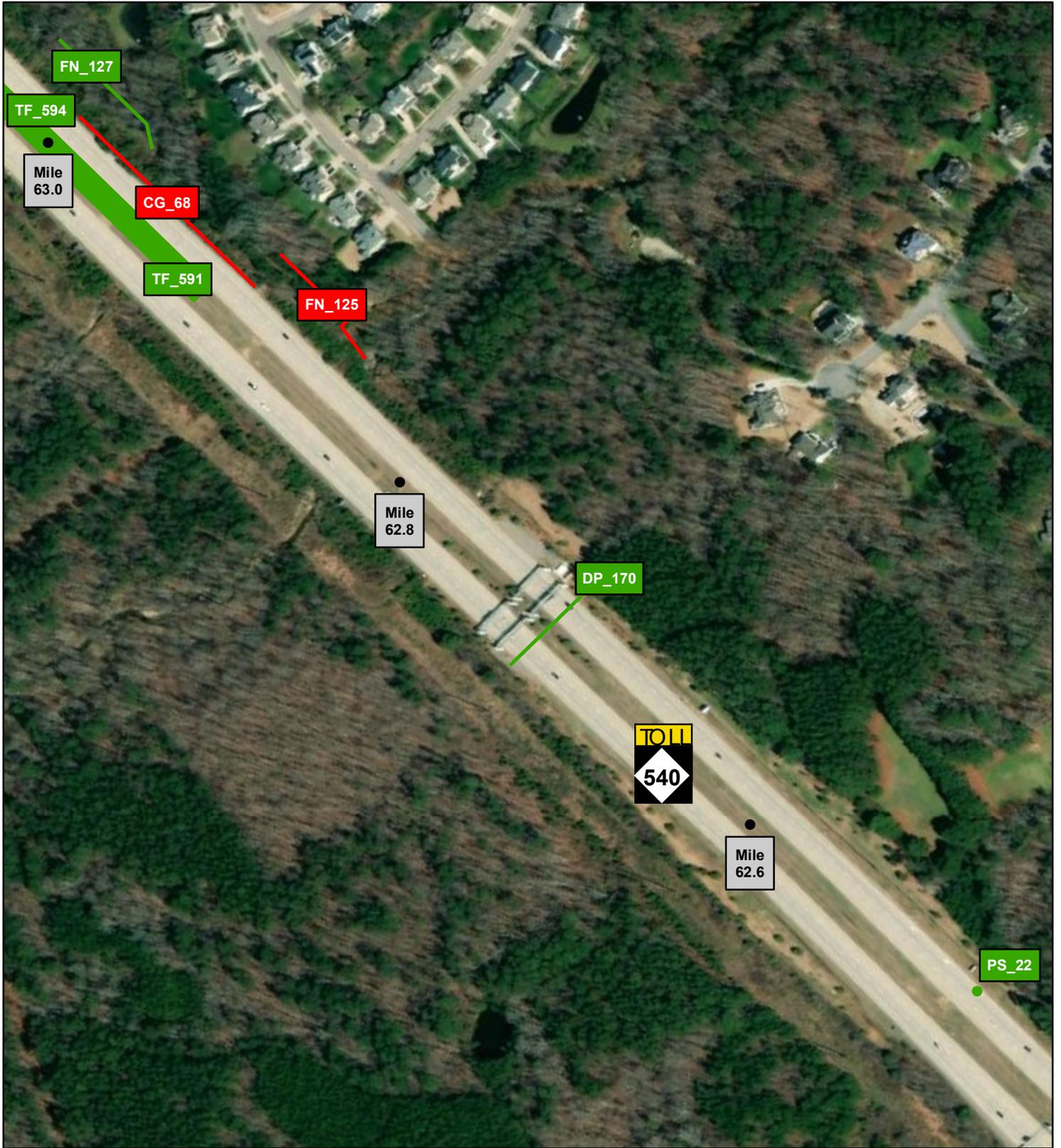


## Legend

-  Failing Asset
-  Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations

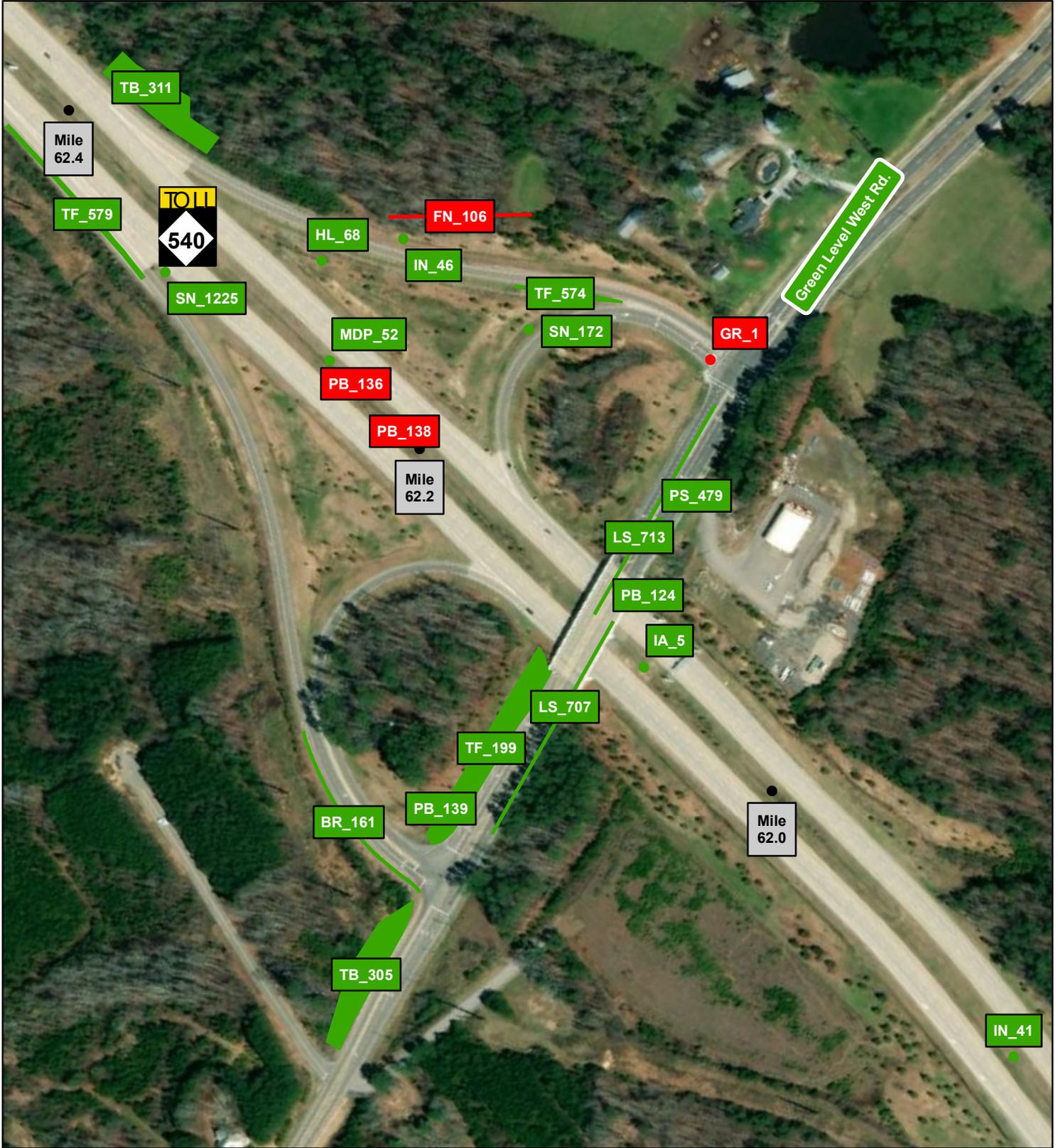


## Legend

-  Failing Asset
-  Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations

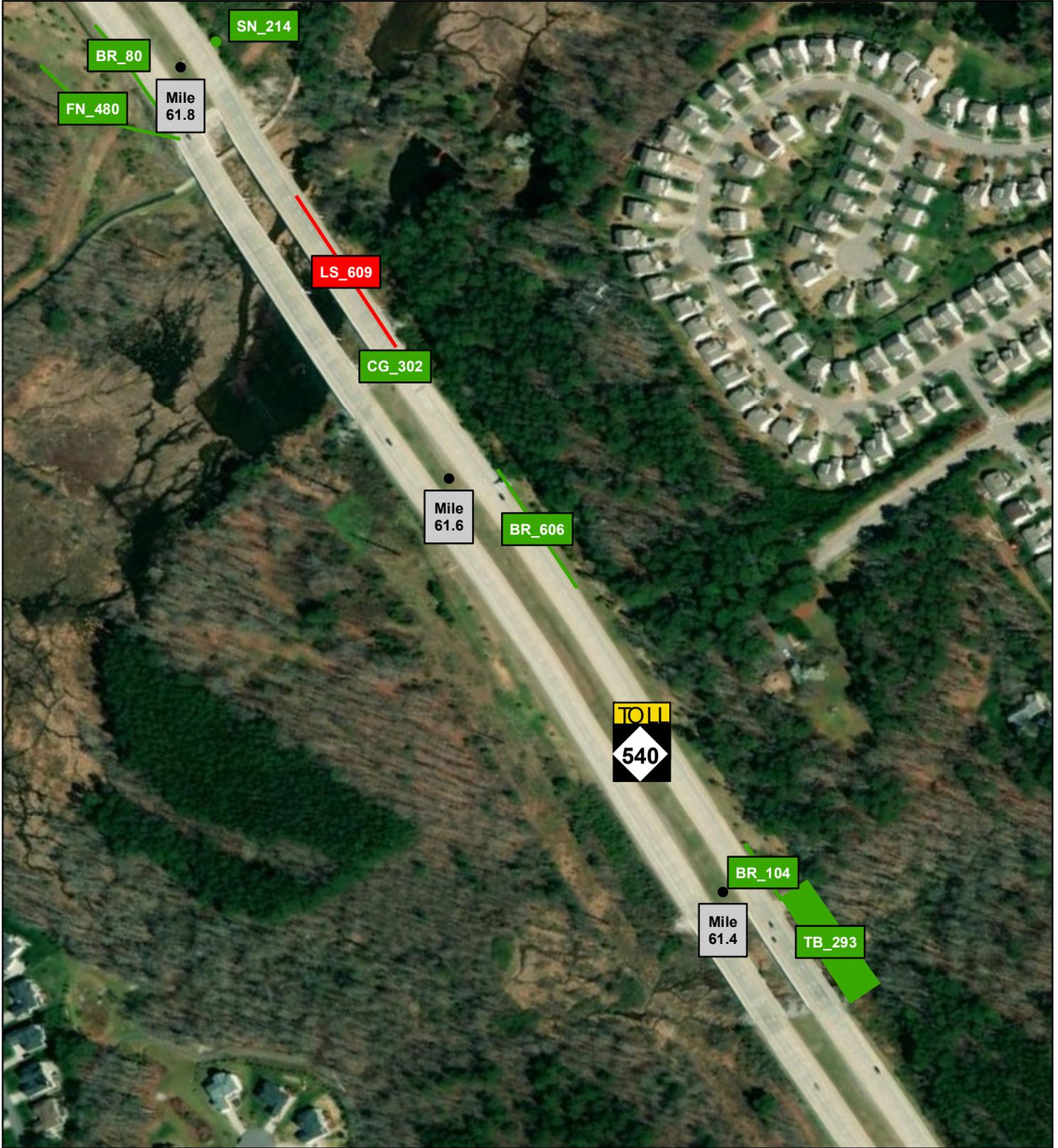


## Legend

- Failing Asset
- Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations

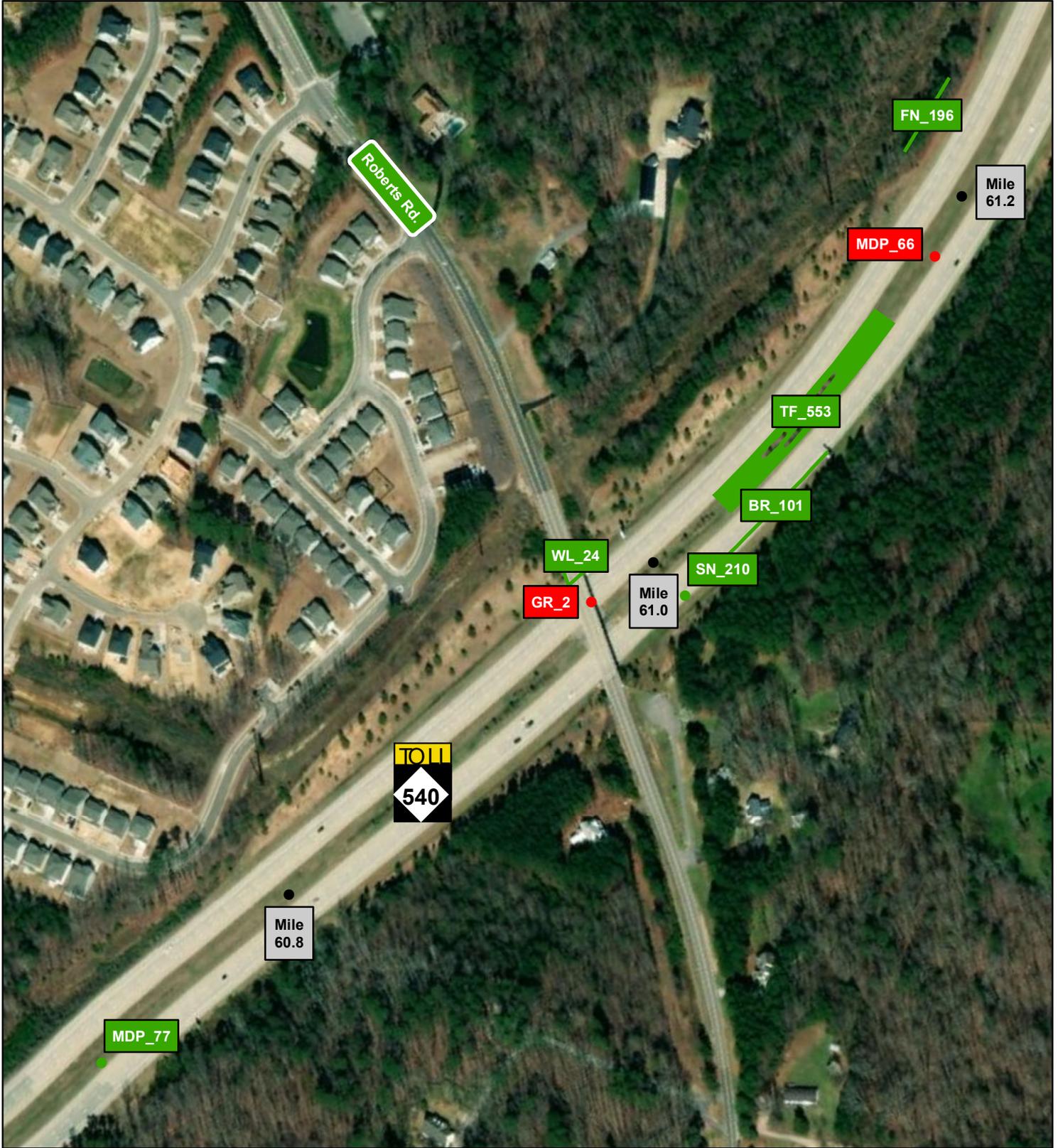


## Legend

-  Failing Asset
-  Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations

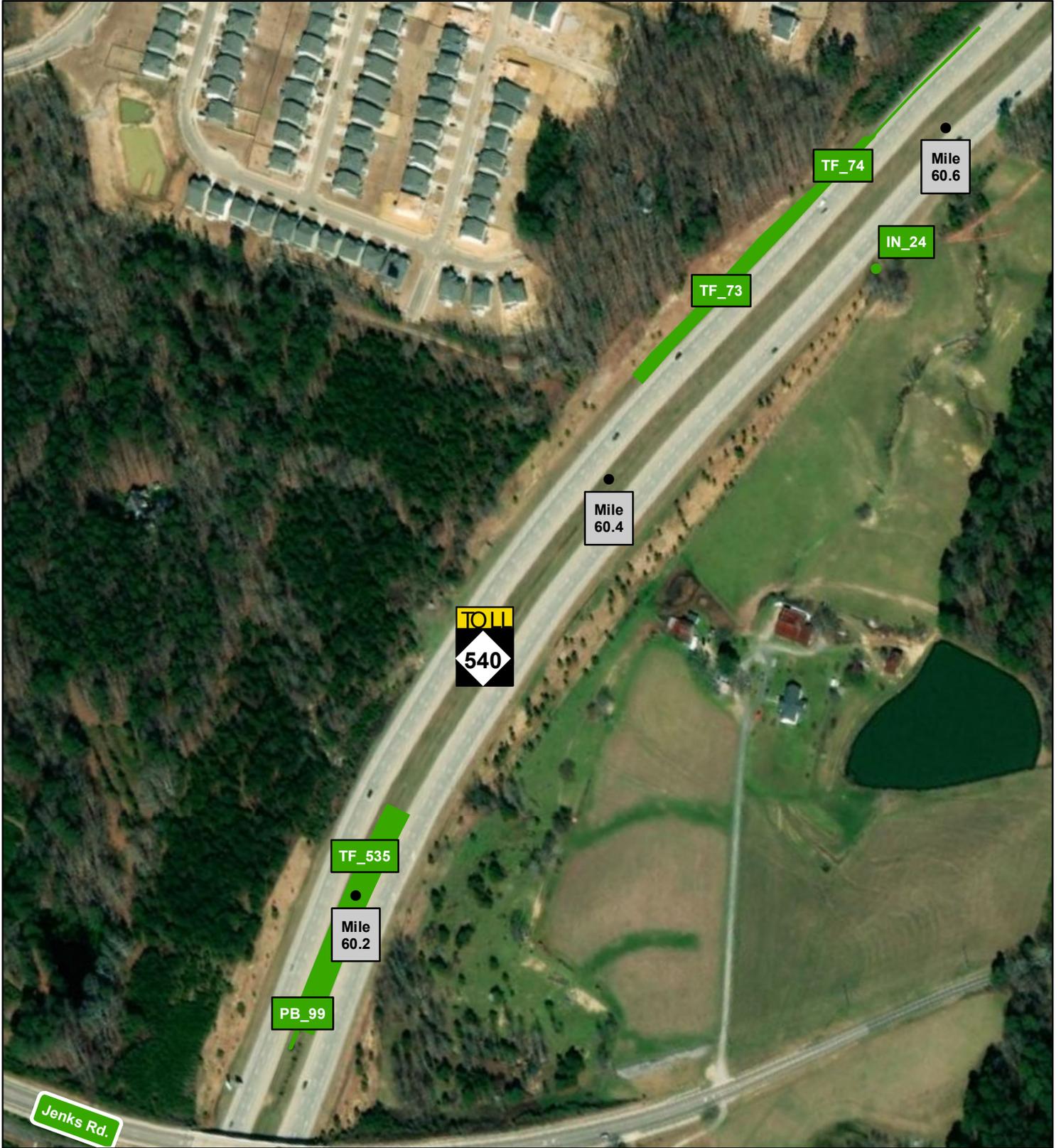


## Legend

-  Failing Asset
-  Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations



## Legend

-  Failing Asset
-  Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations

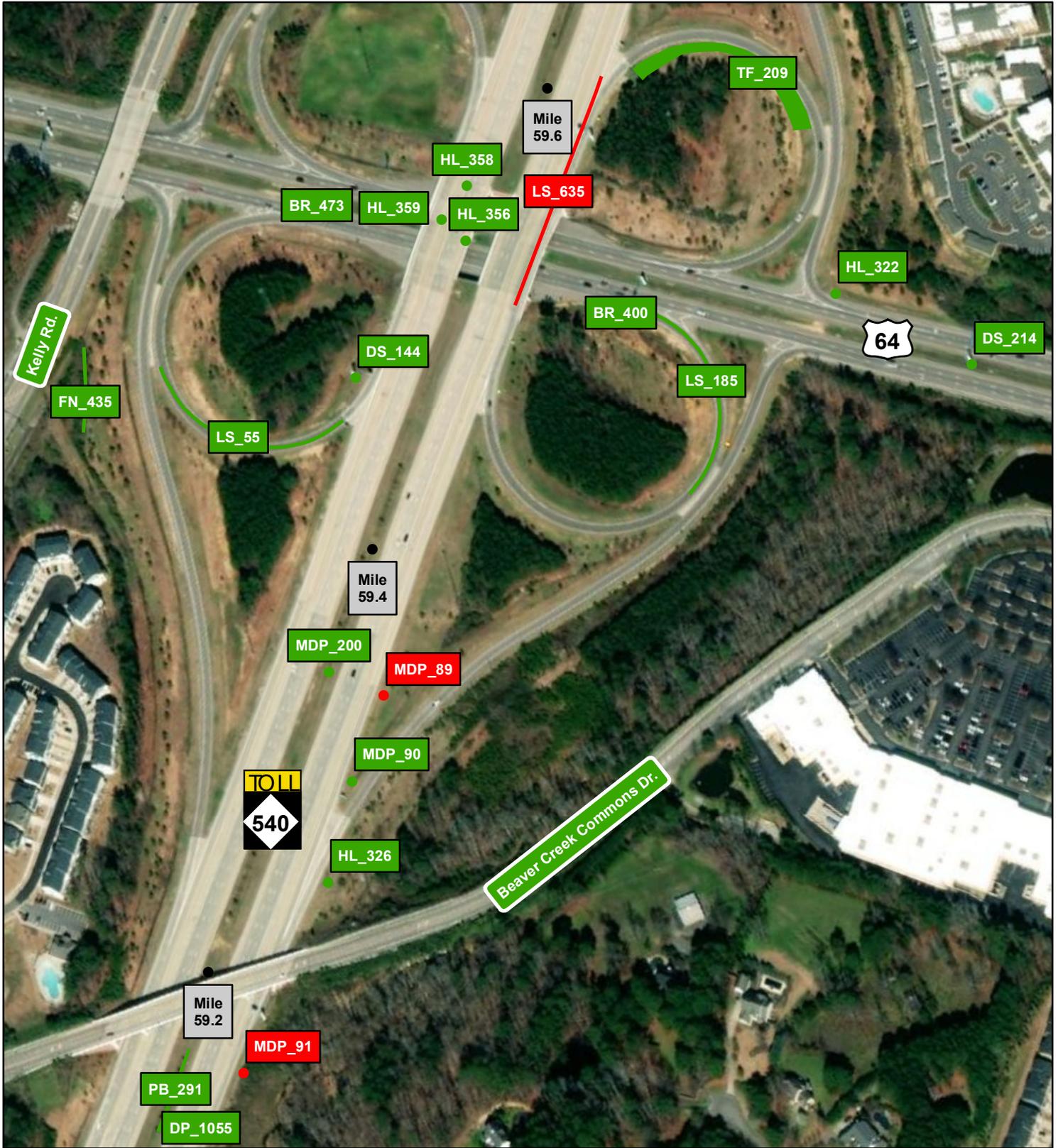


## Legend

- Failing Asset
- Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset

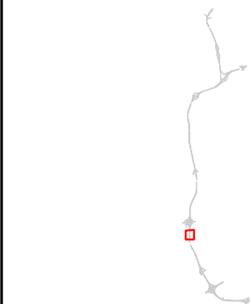


# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations

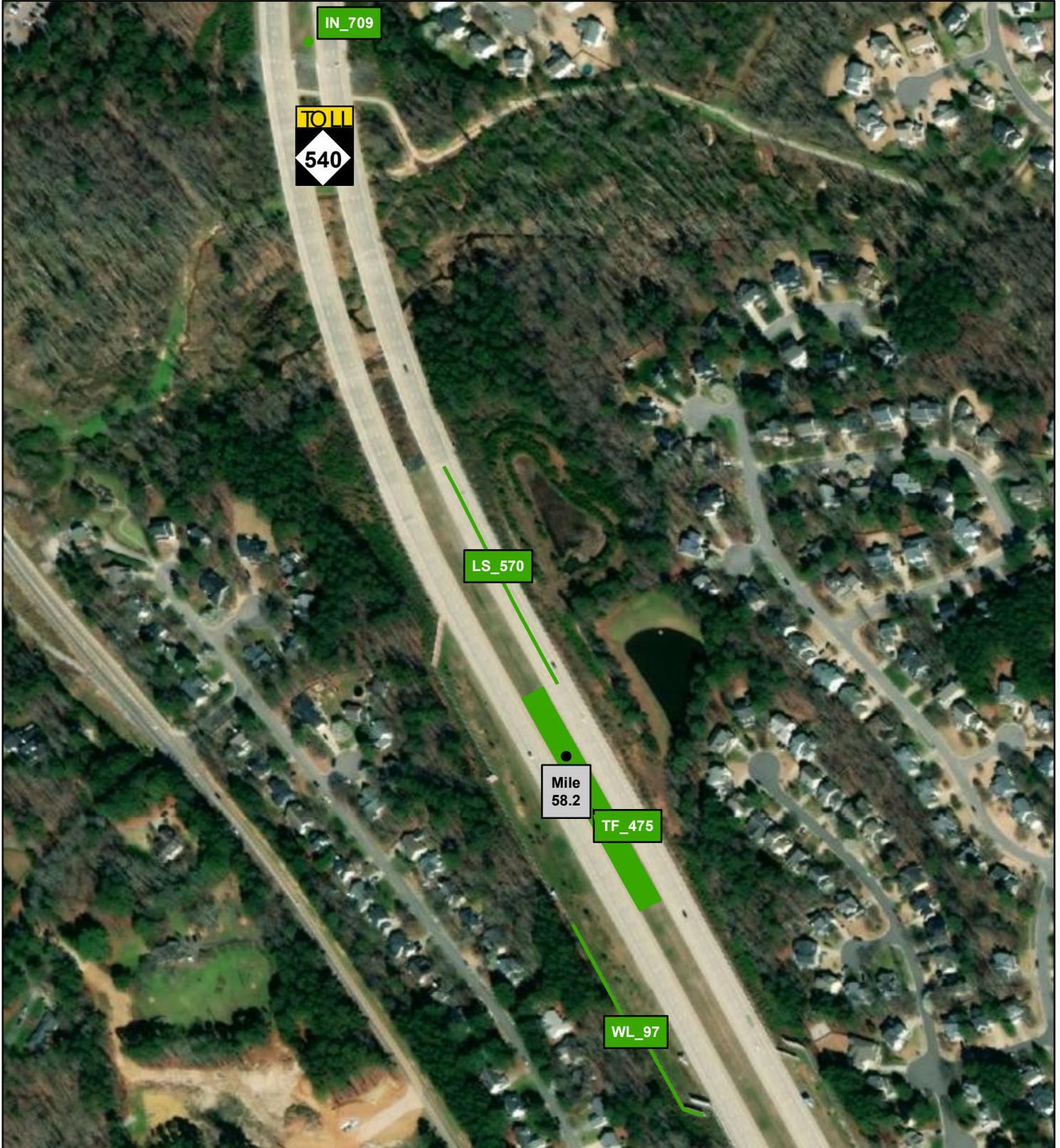


## Legend

- Failing Asset
- Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations

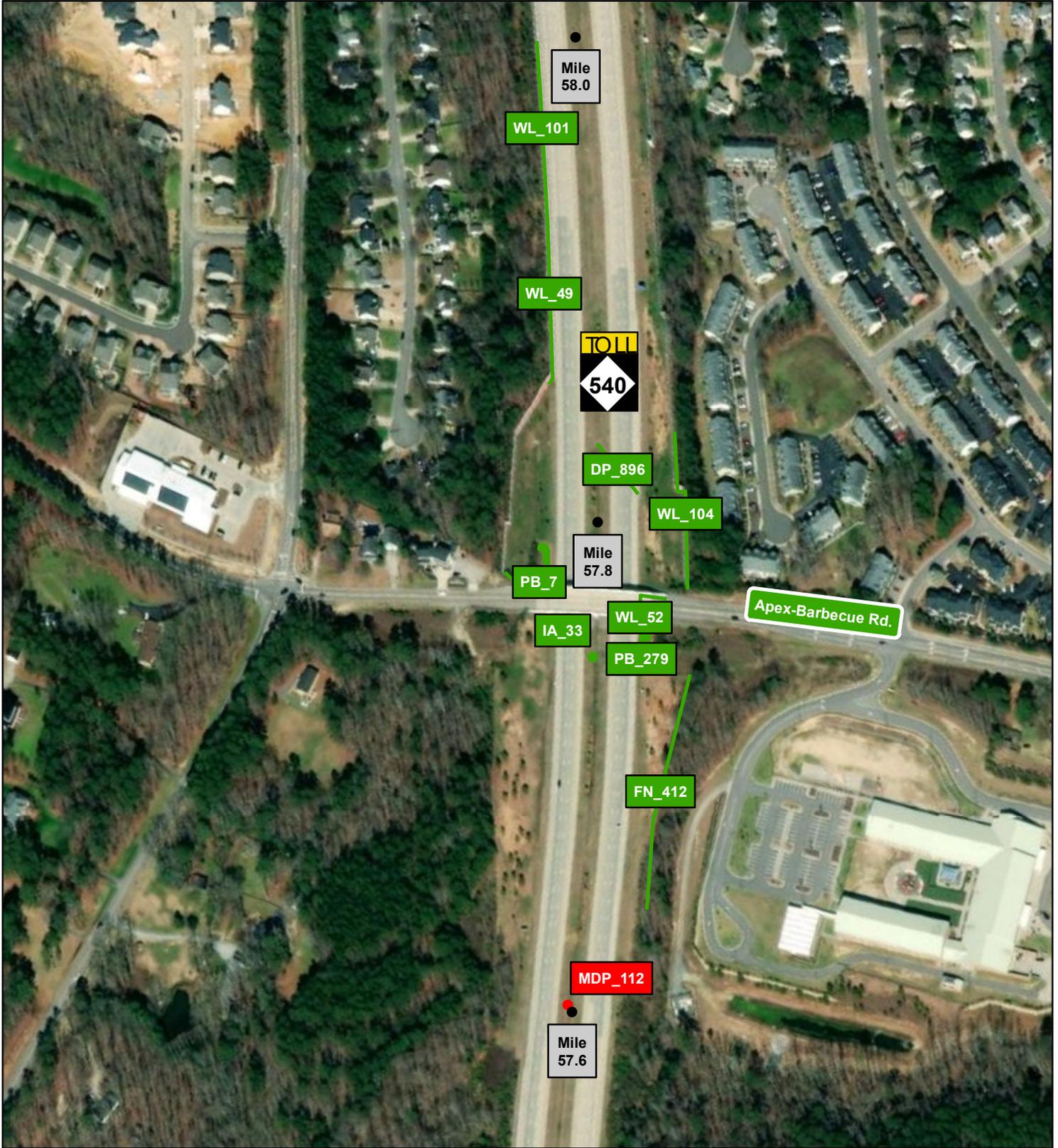


## Legend

-  Failing Asset
-  Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations

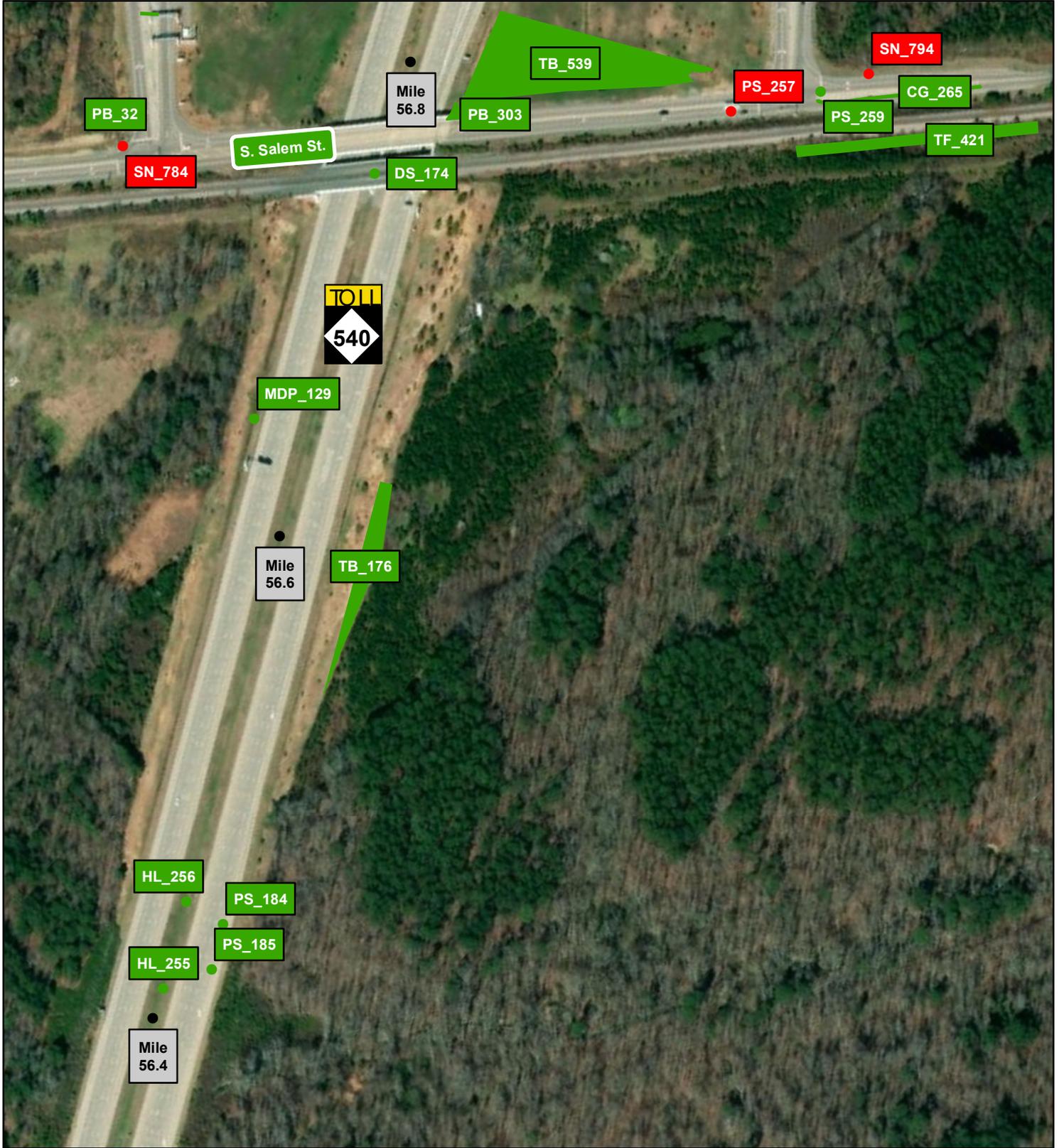


## Legend

- Failing Asset
- Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations

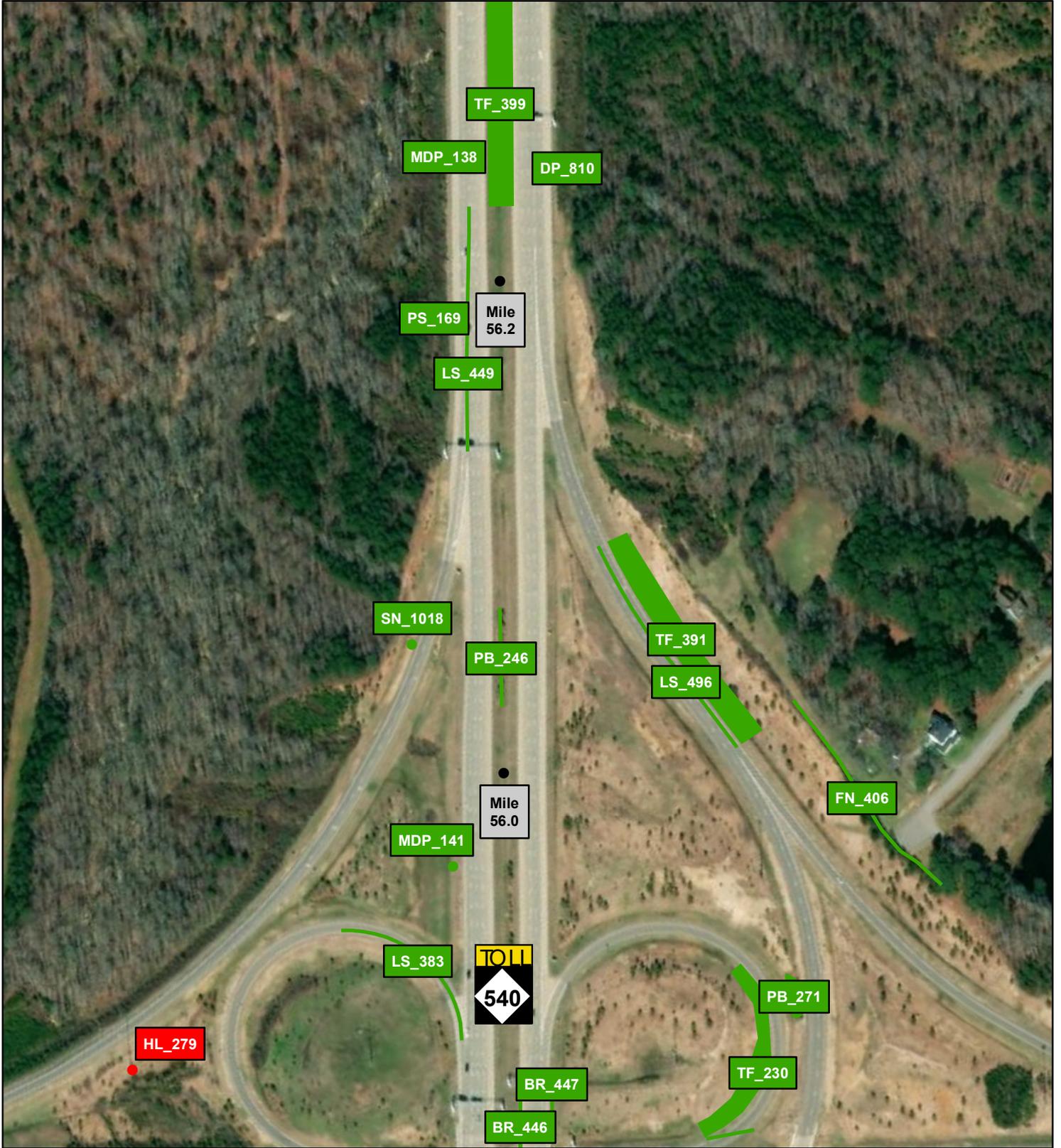


## Legend

- Failing Asset
- Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations

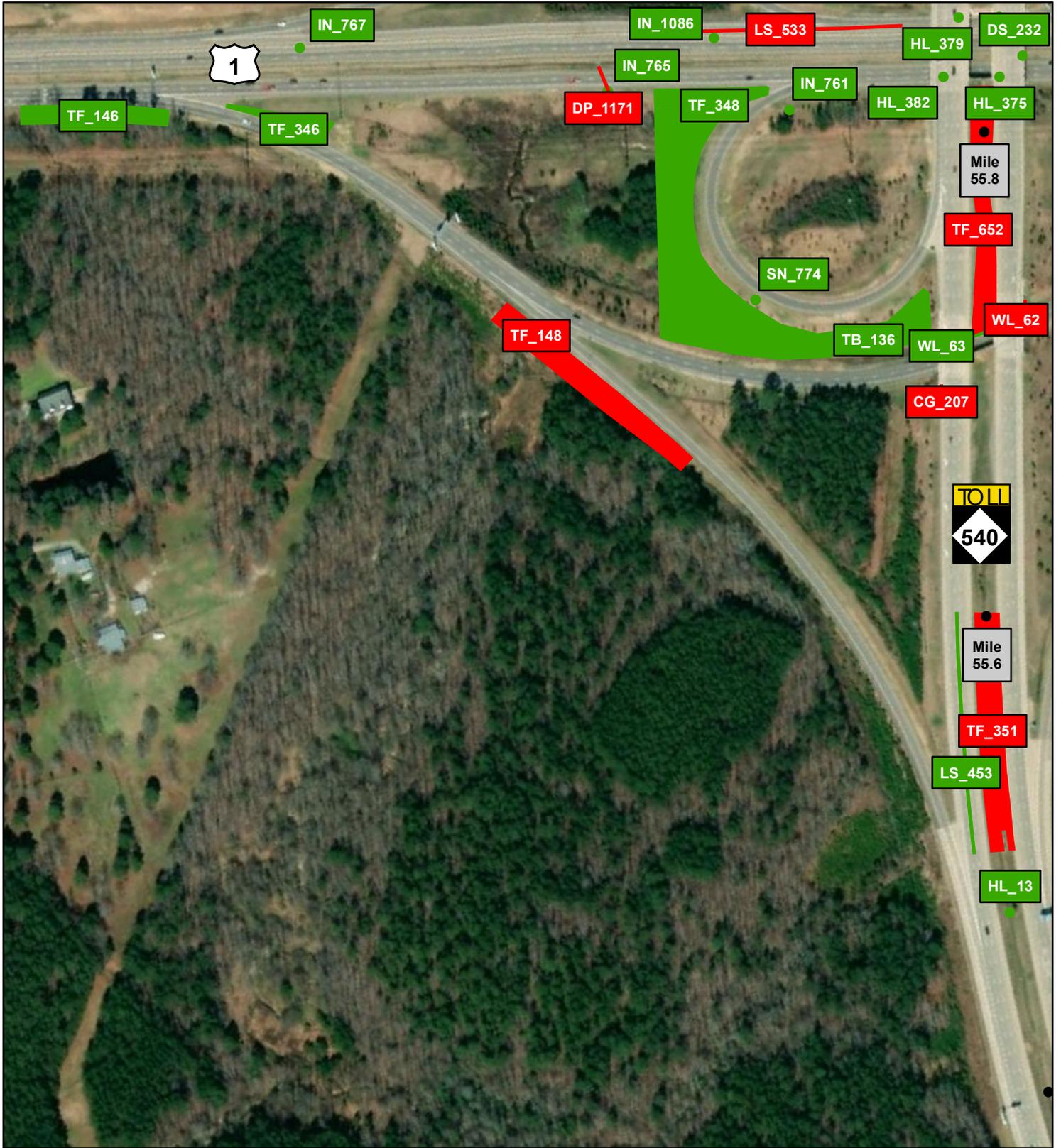


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-  Failing Asset
-  Passing Asset

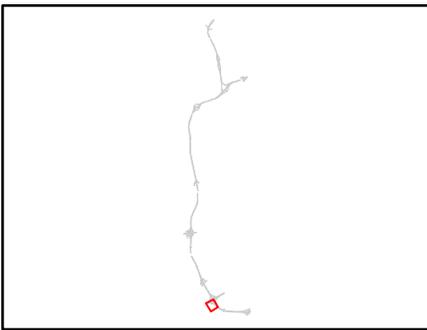


# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset







A26

# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations



## Legend

-  Failing Asset
-  Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations

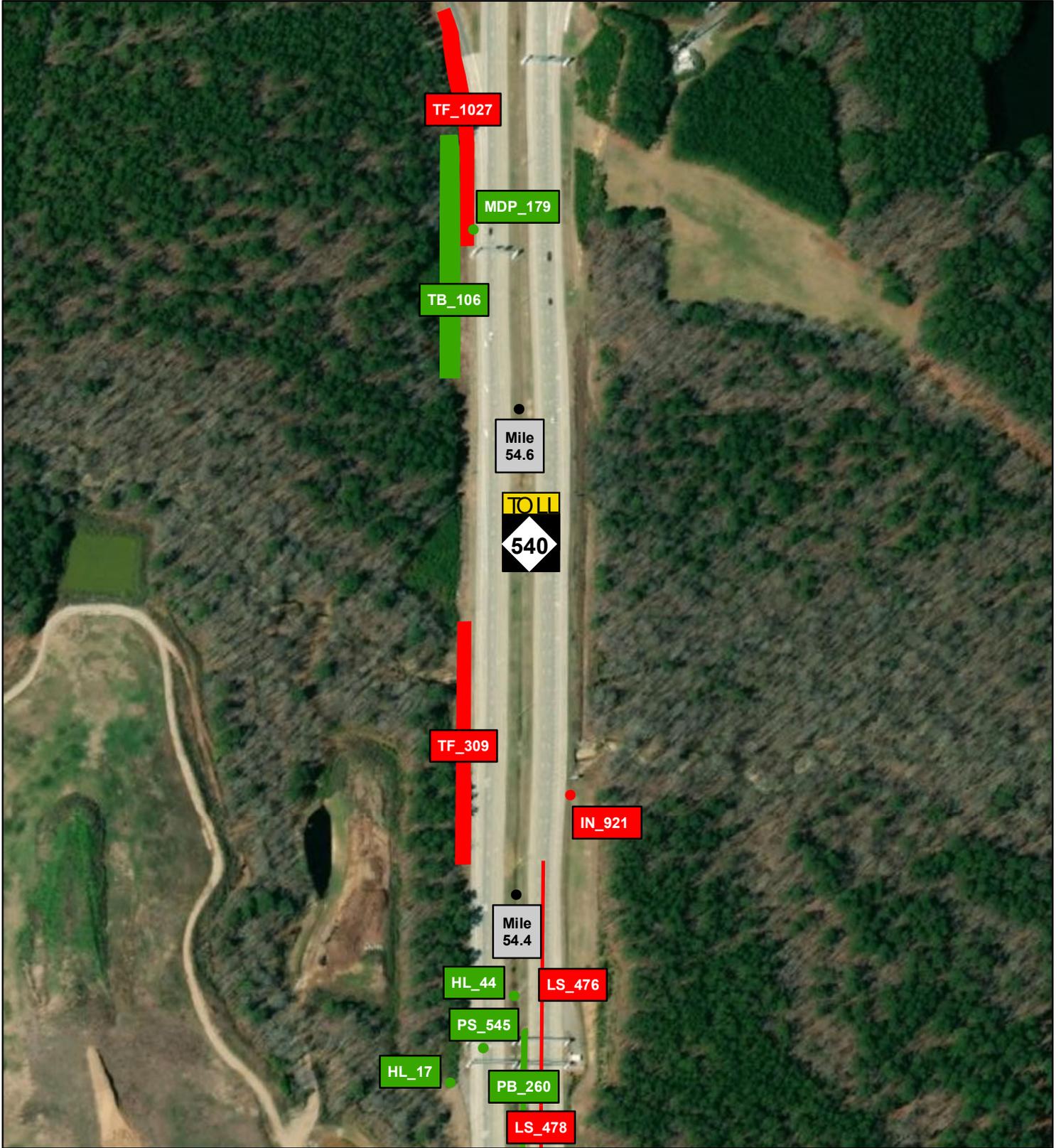


## Legend

- Failing Asset
- Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations



## Legend

-  Failing Asset
-  Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations



## Legend

-  Failing Asset
-  Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations

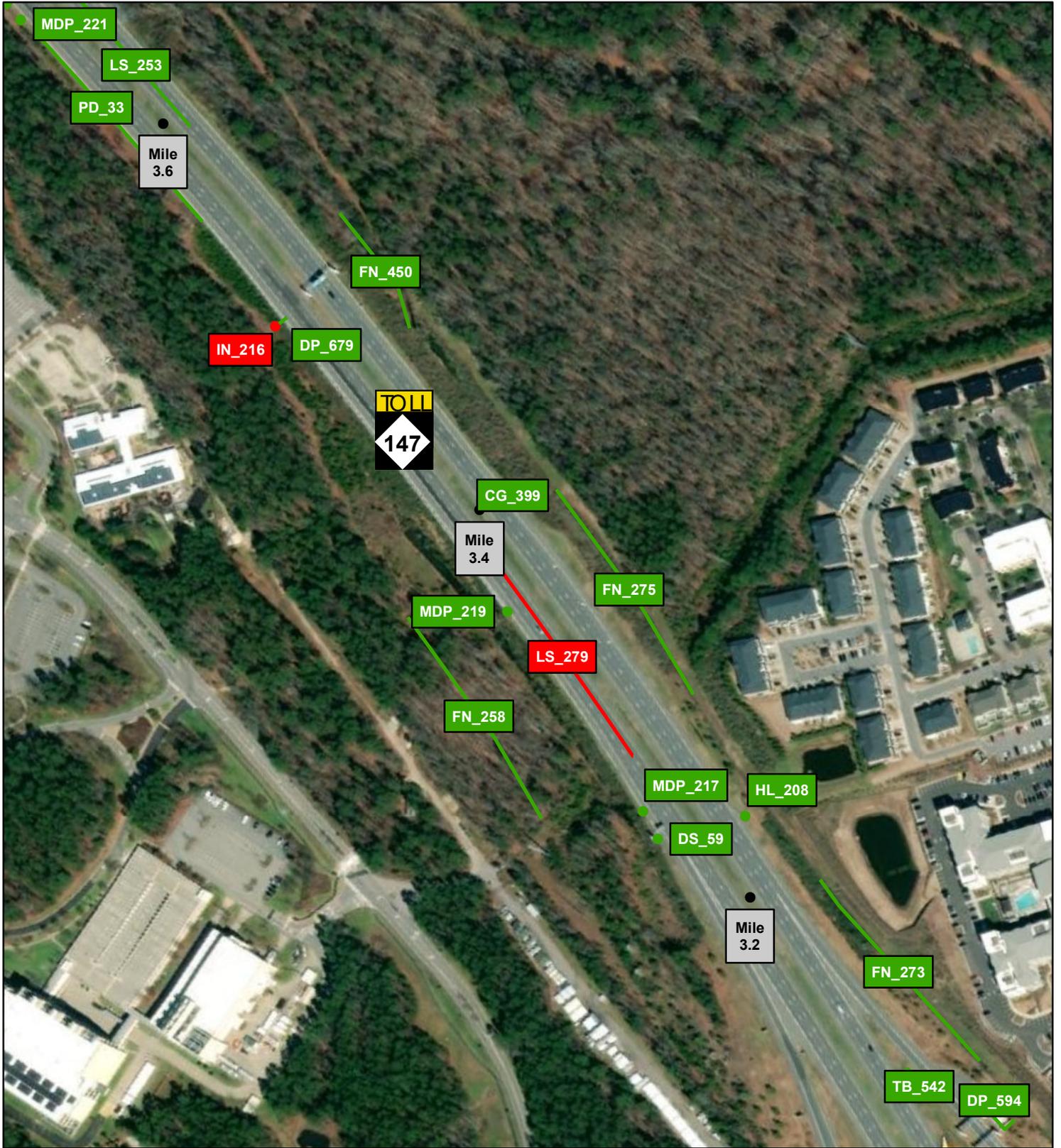


## Legend

- Failing Asset
- Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset



# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations

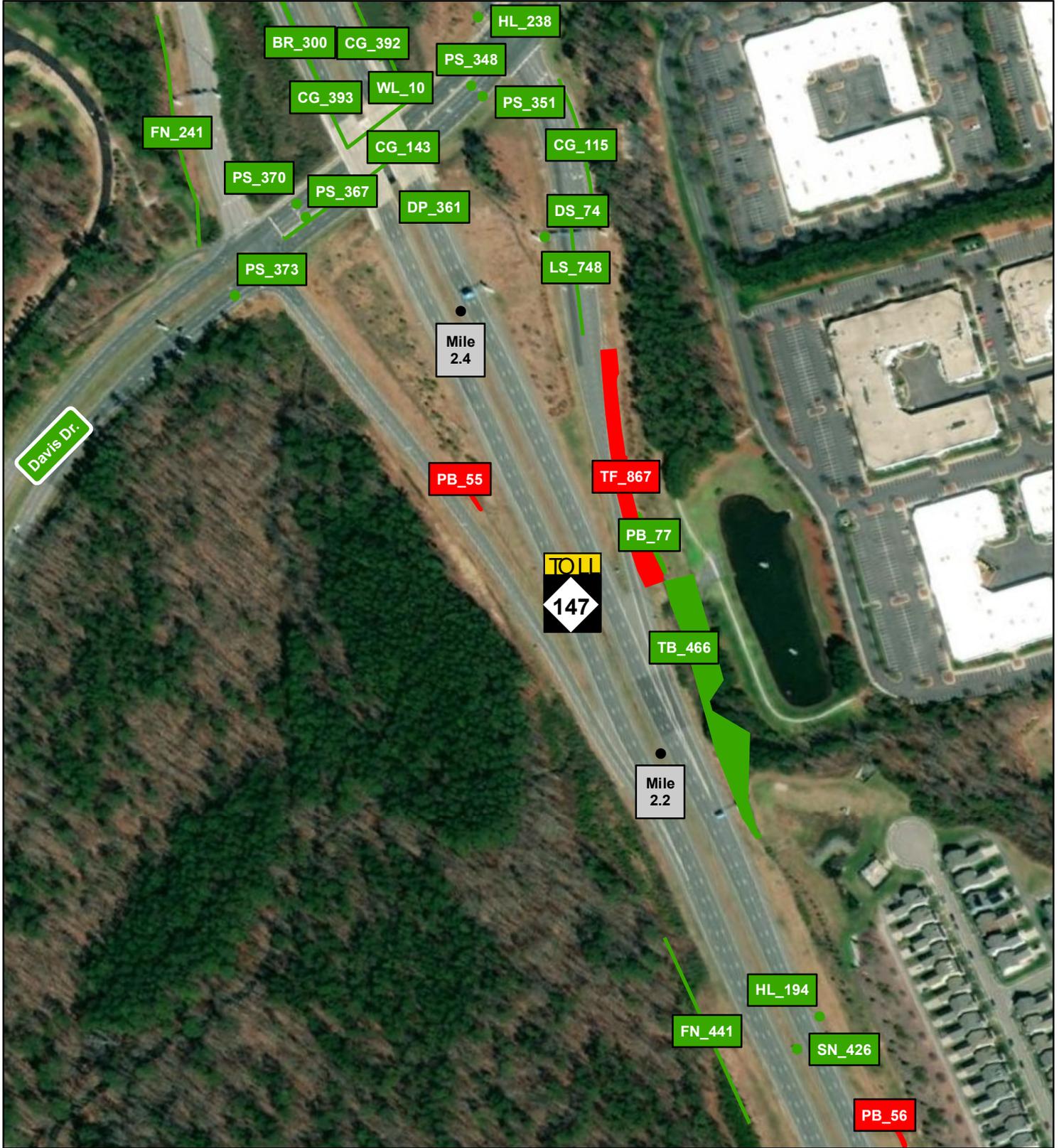


## Legend

- Failing Asset
- Passing Asset

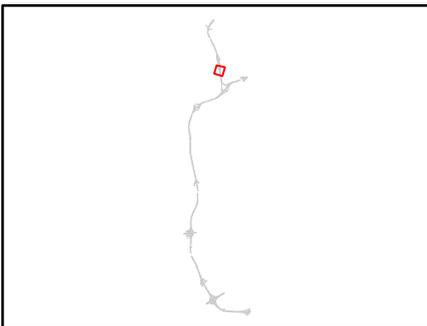


# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset

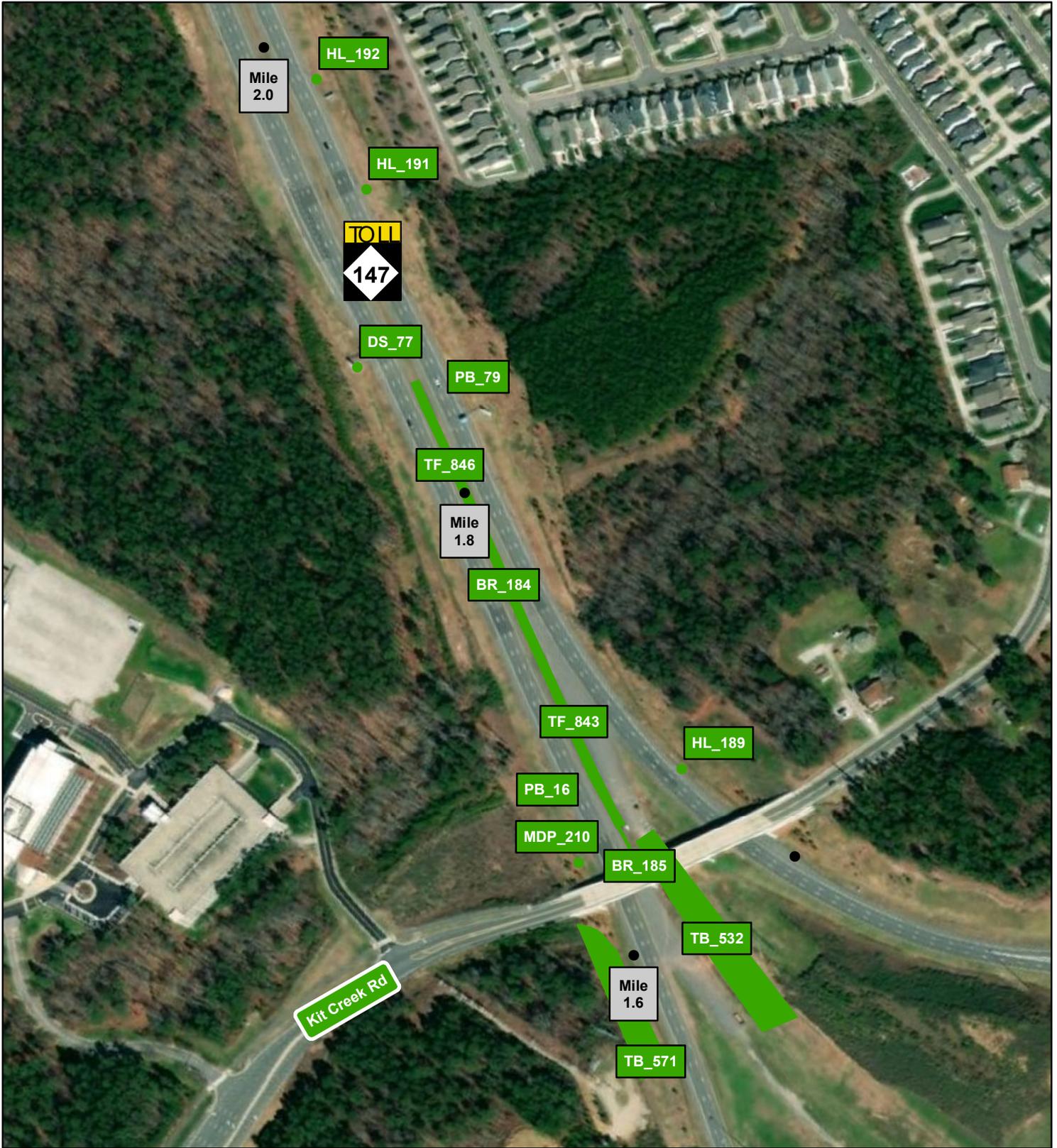






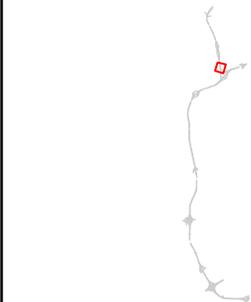
A35

# Appendix A: Triangle Expressway 2021 First Quarter Asset Assessment Locations



## Legend

- Failing Asset
- Passing Asset



## **Appendix B**

**Triangle Expressway 2021 First Quarter Table Results of Assets Failing MRP**

## Appendix B: Triangle Expressway 2021 First 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. 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.

All assets and their respective prefixes are listed below:

Guardrail, Concrete Barrier and End Anchors (BR) .....	1
Curb and Gutter (CG).....	2
Decorative Supports (DS) .....	3
Drainage Pipes (DP).....	4
Misc. Drainage Structure (MDP).....	5
Fence and Control of Access (FN) .....	7
Graffiti (GR) .....	9
Highway Lighting (HL).....	10
Impact Attenuators (IA).....	13
Inlets (IN).....	14
Landscaping (PB) .....	15
Paved Lanes – Asphalt (LS) .....	16
Paved Lanes – Concrete (LS).....	16
Paved Shoulders (LS) .....	17
Unpaved Shoulders (LS) .....	17
Front/Back Slopes (LS) .....	18
Unpaved Lateral and Outfall Ditches (LS).....	18
Litter (LS).....	19
Roadway Sweeping (LS) .....	20
Pavement Striping (LS).....	21
Pavement Markers (LS).....	23
Delineators (LS) .....	24
Paved Ditches (PD).....	27
Pavement Words and Symbols (PS) .....	28
Signs (SN) .....	30
Tree and Brush (TB).....	31
Turf Condition (TF) .....	32
MSE/Retaining Walls, Sound Barrier Walls and Screen Walls (WL).....	35

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

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Guardrail	BR_583	Twisted Blocks		A7

## Curb and Gutter (CG)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Curb and Gutter	CG_68	Misalignment		A13
2	Curb and Gutter	CG_207	Settlement		A26

**Decorative Supports (DS)**

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

## Drainage Pipes (DP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Drain	DP_634	Obstruction		A32
2	Drain	DP_778	Obstruction		A27
3	Drain	DP_786	Erosion, Water Infiltration		A27
4	Drain	DP_1171	Obstruction		A26

### Misc. Drainage Structure (MDP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Shoulder Drain	MDP_66	Rodent Screen		A16
2	Shoulder Drain	MDP_89	Rodent Screen		A19
3	Shoulder Drain	MDP_91	Rodent Screen		A19
4	Shoulder Drain	MDP_112	Rodent Screen		A22

### Misc. Drainage Structure (MDP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Shoulder Drain	MDP_117	Obstruction		A23
6	Shoulder Drain	MDP_123	Obstruction		A23
7	Shoulder Drain	MDP_204	Rodent Screen, End Damage		A12

## Fence and Control of Access (FN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Woven	FN_106	Fence Height		A14
2	Woven	FN_125	Fence Height		A13
3	Woven	FN_155	Fence Hole		A9
4	Woven	FN_205	Fence Hole		A4

## Fence and Control of Access (FN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Woven	FN_209	Fence Hole		A5
6	Chain Link	FN_443	Fence Hole		A34

## Graffiti (GR)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Signal Cabinet	GR_1	Graffiti		A14
2	Bridge Barrier	GR_2	Graffiti		A16

## Highway Lighting (HL)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	High Mast	HL_1	Part Damage		A30
2	High Mast	HL_100	Part Damage		A6
3	High Mast	HL_158	Rodent Screen		A3
4	Double Roadway	HL_163	Part Damage		A2

## Highway Lighting (HL)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Double Roadway	HL_165	Part Damage		A2
6	High Mast	HL_279	Rodent Screen		A25
7	Single Roadway	HL_311	Part Damage		A20
8	Single Roadway	HL_336	Part Damage		A31

**Highway Lighting (HL)**

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
9	Single Roadway	HL_409	Part Damage		A10

**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	Inlet	IN_216	Eroded Area		A33
2	Inlet	IN_482	Surface Damage		A1
3	Inlet	IN_921	Eroded Area		A29

## Landscaping (PB)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Plant Bed	PB_55	Weeds		A35
2	Plant Bed	PB_56	Health		A35
3	Plant Bed	PB_136	Health		A14
4	Plant Bed	PB_138	Health		A14

### Paved Lanes – Asphalt (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_735	Pothole		A1

### Paved Lanes – Concrete (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_316	Joint Malfunction		A2
2	Concrete	LS_458	Pothole		A28
3	Concrete	LS_478	Spalling		A29, A30

### Paved Shoulders (LS)

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

### Unpaved Shoulders (LS)

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

### Front/Back Slopes (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_476	Slope Deviation		A29

### 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_71	Litter – 3CF		A10
2	Asphalt	LS_275	Litter – 3CF		A32
3	Asphalt	LS_279	Litter – 3CF		A33
4	Asphalt	LS_285	Litter – 3CF		A34

### Litter (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Concrete	LS_480	Litter – 3CF		A30

### 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_71	Line Missing		A10
2	Concrete	LS_137	Line Missing		A10
3	Concrete	LS_140	Line Missing		A11
4	Concrete	LS_604	Line Missing		A7, A8

## Pavement Striping (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Concrete	LS_635	Line Missing		A19
6	Asphalt	LS_735	Line Missing		A1
7	Asphalt	LS_738	Line Missing		A1

## Pavement Markers (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_609	Marker Missing		A15
2	Asphalt	LS_738	Nighttime Reflectivity		A1

## Delineators (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_71	Missing & Nighttime Reflectivity		A10
2	Asphalt	LS_214	Missing & Nighttime Reflectivity		A3
3	Asphalt	LS_314	Missing & Nighttime Reflectivity		A1
4	Concrete	LS_316	Missing & Nighttime Reflectivity		A2

## Delineators (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Concrete	LS_326	Missing & Nighttime Reflectivity		A2
6	Concrete	LS_476	Missing & Nighttime Reflectivity		A29
7	Concrete	LS_478	Missing & Nighttime Reflectivity		A29, A30
8	Concrete	LS_480	Missing & Nighttime Reflectivity		A30

## Delineators (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
9	Asphalt	LS_533	Missing & Nighttime Reflectivity		A26
10	Concrete	LS_689	Missing & Nighttime Reflectivity		A6

**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)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Right Turn	PS_414	Daytime Assessment		A1
2	Left Turn	PS_432	Daytime Assessment		A6
3	Thru Lane	PS_461	Daytime Assessment		A6
4	Thru Lane	PS_568	Nighttime Reflectivity		A28

## Pavement Words and Symbols (PS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Merge Left	PS_628	Daytime Assessment		A11
6	Merge Left	PS_651	Daytime Assessment		A11

## Signs (SN)

#	Sign Type	Object ID	Failure Type	Photo	GIS Reference Page
1	NC Route	SN_114	Slip Base		A28
2	Do Not Enter	SN_784	Leaning		A24
3	NC Route	SN_794	Missing Parts		A24
4	Chevron	SN_1049	Leaning, Sign Support		A31

**Tree and Brush (TB)**

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Tree and Brush	TB_152	Barrier Clearance		A27

## Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Turf	TF_36	Bare Ground		A9
2	Turf	TF_148	Bare Ground		A26
3	Turf	TF_226	Bare Ground		A23
4	Turf	TF_280	Bare Ground		A31

### Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Turf	TF_309	Bare Ground		A29
6	Turf	TF_351	Bare Ground		A26
7	Turf	TF_647	Bare Ground		A8
8	Turf	TF_652	Bare Ground		A26

**Turf Condition (TF)**

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
9	Turf	TF_867	Bare Ground		A35
10	Turf	TF_1027	Bare Ground		A29
11	Turf	TF_1041	Bare Ground		A28

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

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Bridge Wall	WL_62	Vegetation	 A photograph showing a close-up of a red brick retaining wall. The wall is covered with bare, brown vines growing up its side. The top of the wall is white, and the background shows a clear blue sky and a grassy slope.	A26