

# Maintenance Rating Program

## Triangle Expressway

February 2023

2022 Fourth Quarter Report



## CONSULTANT CERTIFICATION OF COMPLETION

December 19, 2022

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


### NCTA Triangle Expressway Roadway Maintenance Performance Rating Program; Q4, CY 2022 Rating

This is to certify that I, Ken M. McEntire, PE am an authorized official representative of the company Mott MacDonald I&E, LLC, 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,

Mott MacDonald I&E, LLC



Ken M. McEntire, PE  
Principal Project Manager – Operations and Maintenance

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# 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 2022 Fourth Quarter Assessment of the Triangle Expressway.

The overall 2022 fourth quarter maintenance rating of the Triangle Expressway was **94.3**, above 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 2022 Fourth Quarter Assessment**

Element	MRP Rating	Target Rating
Road Surface	96.0	85.0
Unpaved Shoulders and Ditches	98.7	85.0
Drainage	94.8	85.0
Roadside	93.8	85.0
Traffic Control Devices	90.9	85.0
<b>Overall MRP Performance Rating</b>	<b>94.3</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 **94.6**.

**Table 2: MRP Rolling Element Results**

Element	Q1 2022 Rating	Q2 2022 Rating	Q3 2022 Rating	Q4 2022 Rating	Rolling Rating
Road Surface	95.7	98.9	100.0	96.0	97.7
Unpaved Shoulders and Ditches	98.7	96.0	94.7	98.7	97.0
Drainage	92.0	94.2	92.1	94.8	93.3
Roadside	94.0	92.4	93.3	93.8	93.4
Traffic Control Devices	92.1 <sup>1</sup>	93.4 <sup>1</sup>	92.5 <sup>1</sup>	90.9 <sup>1</sup>	92.2 <sup>2</sup>
<b>Overall MRP Performance Rating</b>	<b>94.2<sup>1</sup></b>	<b>95.1<sup>1</sup></b>	<b>94.7<sup>1</sup></b>	<b>94.3<sup>1</sup></b>	<b>94.6<sup>2</sup></b>

<sup>1</sup>Excludes concrete surface pavement markers, striping, and symbols on mainline NC-540 and asphalt surface markers on mainline NC-885.

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

In addition, the report provides findings of the Green Level Historic District signs inspection. This quarter, two signs were inspected. Both signs were found to be in good physical condition. The landscaped area around the two signs was 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 threshold 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.

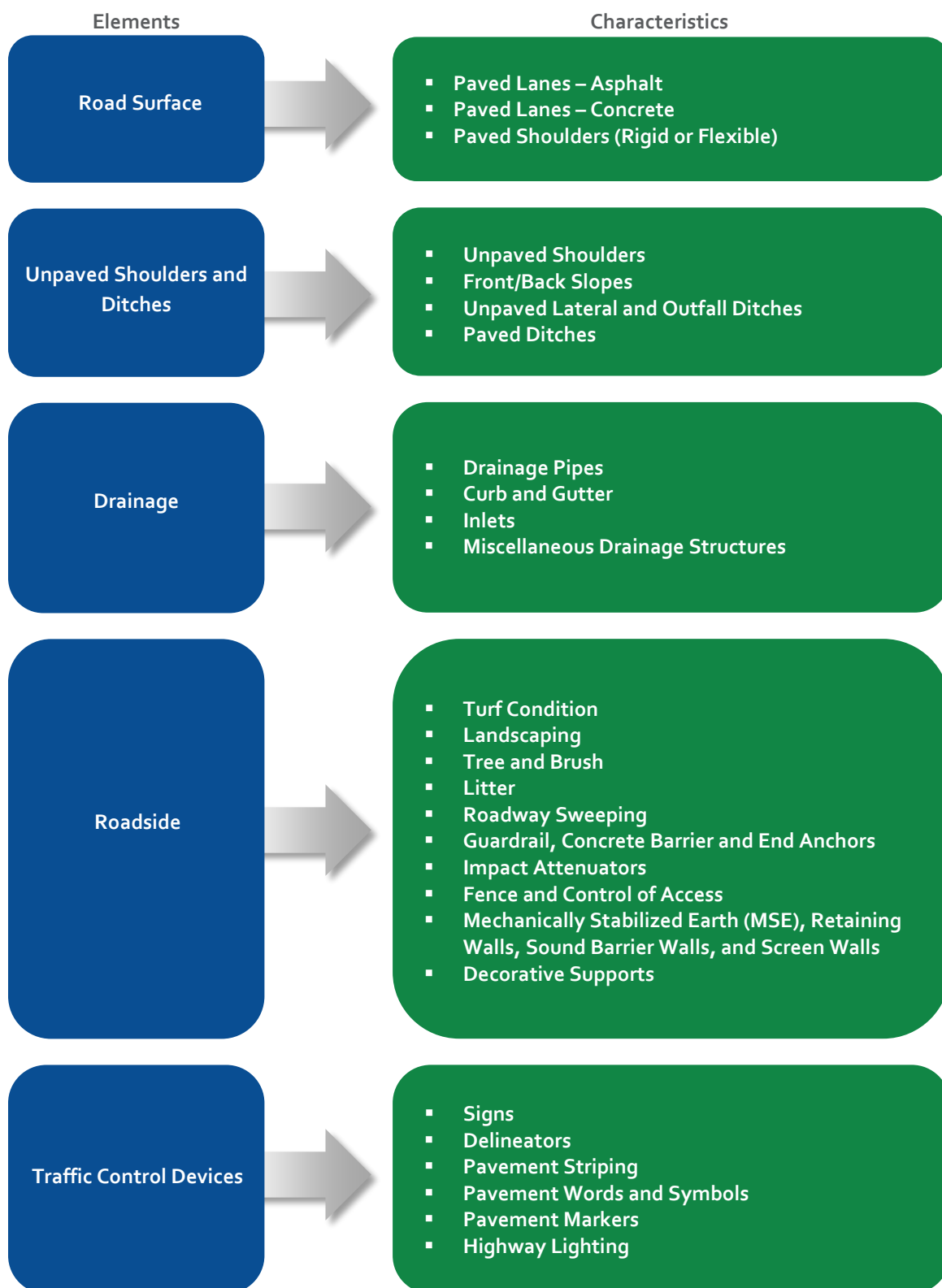
The NCTA performance standards, threshold criteria, and maintenance rating program were developed through a collaborative effort by NCTA managers, NCDOT maintenance staff, and consultants.

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 V7*, 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



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:

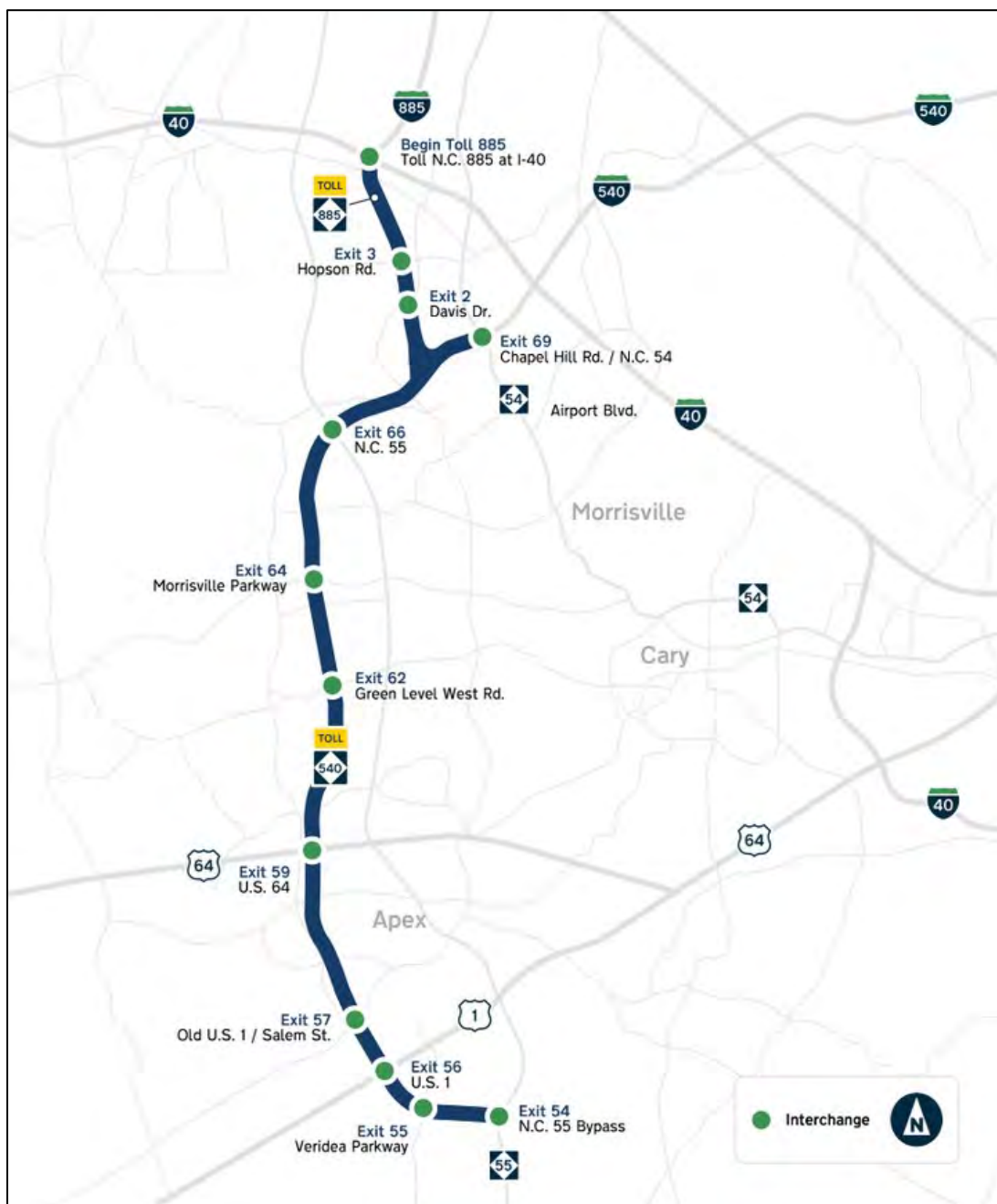
Road Surface =	25%
Unpaved Shoulders =	13%
Drainage =	15%
Roadside =	17%
Traffic Control Devices =	30%
<hr/>	
Total	100%

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.

## 4.0 Triangle Expressway Description

The Triangle Expressway extends for approximately 18.8 miles from the interchange of I-40 and Toll NC-885 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-885 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



## 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	2022 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 Fourth Quarter Assessment

### 6.1 Quarterly Results

The overall 2022 fourth quarter maintenance rating of the Triangle Expressway was 94.3, above NCTA's target overall rating of 90. All elements assessed achieved quarter ratings above the target rating of 85 established for element groups.

It is important to note that these results are only representative of the fourth 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 as the rolling rating, provide a 95% confidence level in statistical sampling. The fourth quarter MRP performance ratings for elements and characteristics are presented in *Table 4* and *Table 5*, respectively.

**Table 4: MRP Element Results for Q4 2022**

Element	MRP Rating
Road Surface	96.0
Unpaved Shoulders and Ditches	98.7
Drainage	94.8
Roadside	93.8
Traffic Control Devices	90.9
<b>Overall MRP Performance Rating</b>	<b>94.3</b>



Table 5: MRP Characteristics Results for Q4 2022

Road Surface	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q4 Rating
Paved Lanes Asphalt	15	15	9	135	135	100
Paved Lanes Concrete	15	17	9	135	153	88
Paved Shoulder	32	32	5	160	160	100
<b>Element Total</b>				<b>430</b>	<b>448</b>	<b>96.0</b>
Unpaved Shoulders and Ditches	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q4 Rating
Unpaved Shoulder	31	32	9	279	288	97
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>673</b>	<b>682</b>	<b>98.7</b>
Drainage	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q4 Rating
Drainage Pipes	31	33	7	217	231	94
Curb and Gutter	27	28	6	162	168	96
Inlets	33	34	7	231	238	97
Misc. Drainage Structure	25	28	4	100	112	89
<b>Element Total</b>				<b>710</b>	<b>749</b>	<b>94.8</b>
Roadside	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q4 Rating
Turf Condition	43	49	7	301	343	88
Landscaping	25	25	4	100	100	100
Trees and Brush	31	31	4	124	124	100
Litter	28	32	4	112	128	88
Roadway Sweeping	32	32	5	160	160	100
Guardrail, Concrete Barrier, and End Anchors	30	30	9	270	270	100
Impact Attenuators	9	9	9	81	81	100
Fence, Control Access	32	35	7	224	245	91
Retaining Walls and Sound Barrier Walls	12	16	5	60	80	75
Decorative Supports	24	26	5	120	130	92
Graffiti and Stain Removal	43	44	4	172	176	98
<b>Element Total</b>				<b>1724</b>	<b>1837</b>	<b>93.8</b>
Traffic Control Devices	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q4 Rating
Signs	31	34	7	217	238	91
Delineators	29	32	3	87	96	91
Pavement Striping/Marking	11	11	8	88	88	100
Words and Symbols	31	38	7	217	266	82
Pavement Markers	11	11	9	99	99	100
Highway Lighting	33	35	6	198	210	94
<b>Element Total</b>				<b>906</b>	<b>997</b>	<b>90.9</b>

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

## 6.2 Quarterly Analysis and Recommendations

### Elements

During the fourth quarter, all elements exceeded NCTA's quarter score threshold criteria of 85. All elements received a quarter score above 90.

Road Surface (96.0) experienced a 0.6 point decrease to the previous quarter's rolling rating. Asphalt resurfacing was completed in September of 2021. This quarter there were two concrete pavement linear sections that did not pass the joint material criteria. Paved Lanes Concrete (88) rolling rating decreased by 3.1 points.

Unpaved Shoulders and Ditches (98.7) experienced a slight decrease in rolling rating. The rating for this element was 0.2 points lower than the previous quarter rolling rating. All characteristics within this element continued scoring above 90.

Drainage (94.8) rolling rating increased by 0.8 points from the previous quarter rolling rating. Inlets (97) rolling rating increased the most from last quarter by 2.0 points.

Roadside (93.8) rolling rating increased by 0.4 points from the previous quarter rolling rating. Retaining Walls and Sound Barrier Walls (75) continued scoring below the threshold value, decreasing by 1.6 points from the previous quarter's rolling rating. Guardrail (100) and Impact Attenuators (100) increased the most from the previous quarter rolling rating, increasing by 1.5 and 2.8 points respectively.

Traffic Control Devices (90.9) experienced an increase in rolling rating of 1.2 points from the previous quarter. Pavement Striping/Marking (100) experienced an increase in rolling rating of 13.0 points. A portion of concrete striping replacement was performed in Summer 2022. Replacement of striping and markers for the remaining concrete sections is scheduled for Spring 2023.

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

### Characteristics

This quarter, all but one characteristic, Retaining Walls and Sound Barrier Walls (75), met the NCTA target threshold criteria of 80. A description of the characteristic's conditions and future work planning recommendations are provided below. Pictures of all characteristic failures are included in **Appendix B**.

Retaining Walls and Sound Barrier Walls (75 rating –12 of the 16 assets passed): The four wall sections that did not pass inspection had unsealed joints. Two of the sections that did not pass inspection are presented in *Figure 3*.

**Figure 3: Retaining Walls and Sound Barrier Walls Inspection Results Sample**



Maintenance Program:

- 1) Walls shall be inspected during daily patrols.
- 2) Unwanted vegetation and graffiti (see graffiti standard) shall be scheduled for removal.
- 3) Minor wall or column damage shall be scheduled for repair within the annual work program.
- 4) Staining damage shall be scheduled for repair within the annual work program.
- 5) Any structural damage that poses a safety risk shall be scheduled immediately upon observation. Mitigate any safety hazard upon observation.

Maintenance and Evaluation Standards: MSE/retaining walls, sound barrier walls, and screen walls do not meet the maintenance standards when any of the following criteria is observed:

- 1) More than 10% of exposed surface is covered with unwanted vegetation.
- 2) Any single spall 1 inch deep or greater or cumulative spalls covering an area over 5 SF on any single facing.
- 3) More than 25% of weep holes within the sample section are not functioning properly.
- 4) Unsealed cracks or joints greater than 0.25 inches in width.
- 5) Stained areas exhibit cumulative scaling in excess of 1 SF.

## 7.0 Current Rolling MRP Rating

### 7.1 Annual Results

The 2022 annual rolling maintenance rating of the Triangle Expressway was **94.6**, exceeding NCTA's target overall rating of 90. All elements exceeded NCTA's rolling rating threshold criteria of 85. Twenty-seven of the twenty-eight characteristic ratings met or exceeded the target rating of 80.

The 2022 results are presented in **Exhibit 1** and **Table 6**. These results are a collection of the four quarterly inspections conducted last year.

**Exhibit 1: MRP Element Results for 2022**

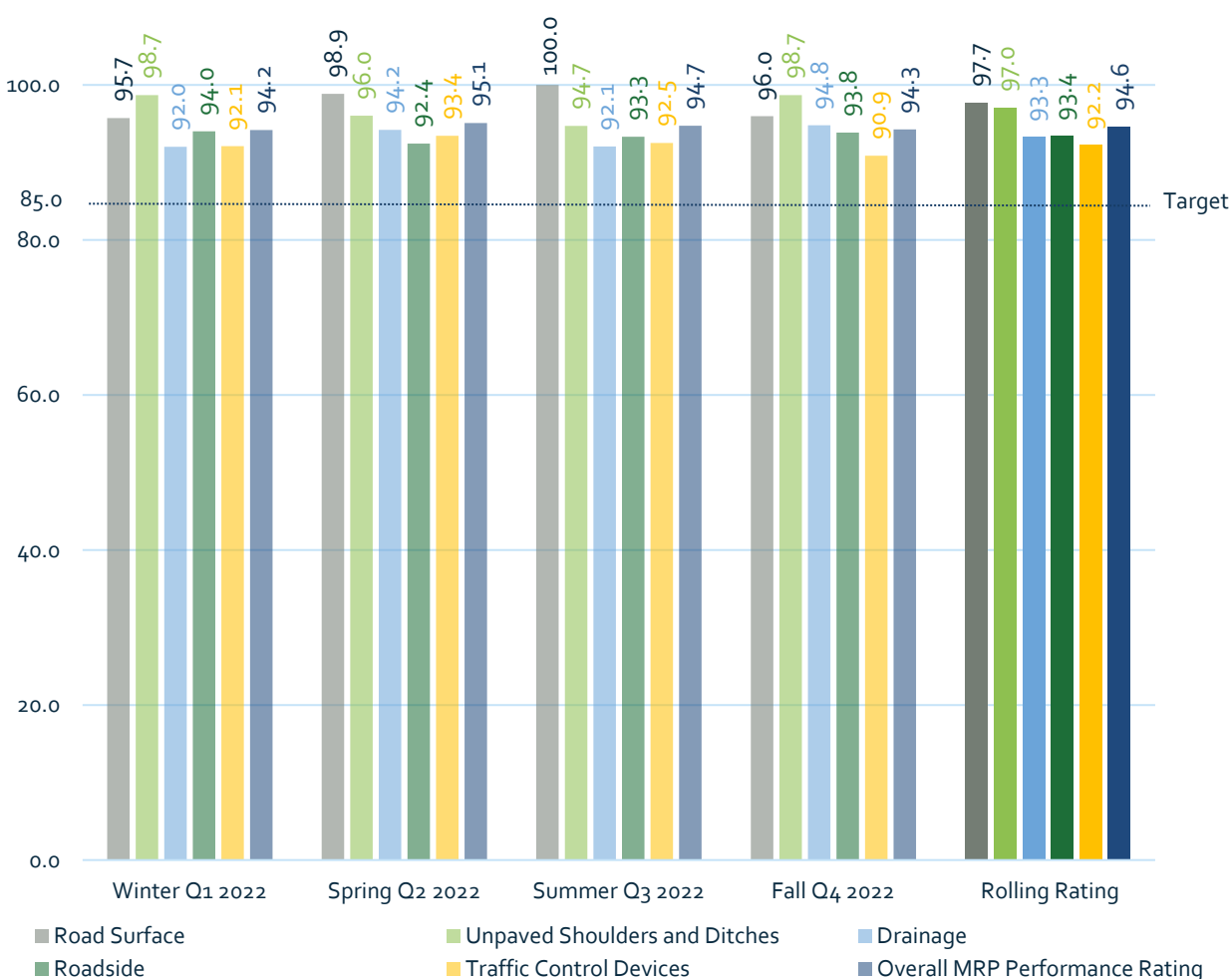


Table 6: MRP Rolling Element Results

Road Surface	Q1 2022 Rating	Q2 2022 Rating	Q3 2022 Rating	Q4 2022 Rating	Rolling Rating
Paved Lanes Asphalt	94	100	100	100	98
Paved Lanes Concrete	92	100	100	88	96
Paved Shoulder	100	97	100	100	99
Element Total	95.7	98.9	100.0	96.0	97.7
Unpaved Shoulders and Ditches	Q1 2022 Rating	Q2 2022 Rating	Q3 2022 Rating	Q4 2022 Rating	Rolling Rating
Unpaved Shoulder	97	91	88	97	93
Front/Back Slopes	100	100	100	100	100
Lateral and Outfall Ditches, Unpaved	100	100	100	100	100
Ditches, Paved	100	100	100	100	100
Element Total	98.7	96.0	94.7	98.7	97.0
Drainage	Q1 2022 Rating	Q2 2022 Rating	Q3 2022 Rating	Q4 2022 Rating	Rolling Rating
Drainage Pipes	88	97	100	94	95
Curb and Gutter	92	93	93	96	94
Inlets	97	94	88	97	94
Misc. Drainage Structure	90	90	82	89	88
Element Total	92.0	94.2	92.1	94.8	93.3
Roadside	Q1 2022 Rating	Q2 2022 Rating	Q3 2022 Rating	Q4 2022 Rating	Rolling Rating
Turf Condition	94	84	88	88	88
Landscaping	100	100	92	100	98
Trees and Brush	100	100	94	100	98
Litter	97	100	97	88	95
Roadway Sweeping	97	100	100	100	99
Guardrail, Concrete Barrier, and End Anchors	88	88	93	100	92
Impact Attenuators	100	100	89	100	97
Fence, Control Access	91	88	94	80	88
Retaining Walls and Sound Barrier Walls	75	75	75	75	75
Decorative Supports	100	100	100	92	98
Graffiti and Stain Removal	98	100	100	98	99
Element Total	94.0	92.4	93.3	92.3	93.0
Traffic Control Devices	Q1 2022 Rating	Q2 2022 Rating	Q3 2022 Rating	Q4 2022 Rating	Rolling Rating
Signs	91	97	91	91	93
Delineators	81	94	100	91	91
Pavement Striping/Marking	95 <sup>1</sup>	100 <sup>1</sup>	91 <sup>1</sup>	100 <sup>1</sup>	96 <sup>2</sup>
Words and Symbols	97 <sup>1</sup>	87 <sup>1</sup>	83 <sup>1</sup>	82 <sup>1</sup>	87 <sup>2</sup>
Pavement Markers	82 <sup>1</sup>	85 <sup>1</sup>	100 <sup>1</sup>	100 <sup>1</sup>	90 <sup>2</sup>
Highway Lighting	97	97	97	94	96
Element Total	92.1 <sup>1</sup>	93.4 <sup>1</sup>	92.5 <sup>1</sup>	90.9 <sup>1</sup>	92.2 <sup>2</sup>

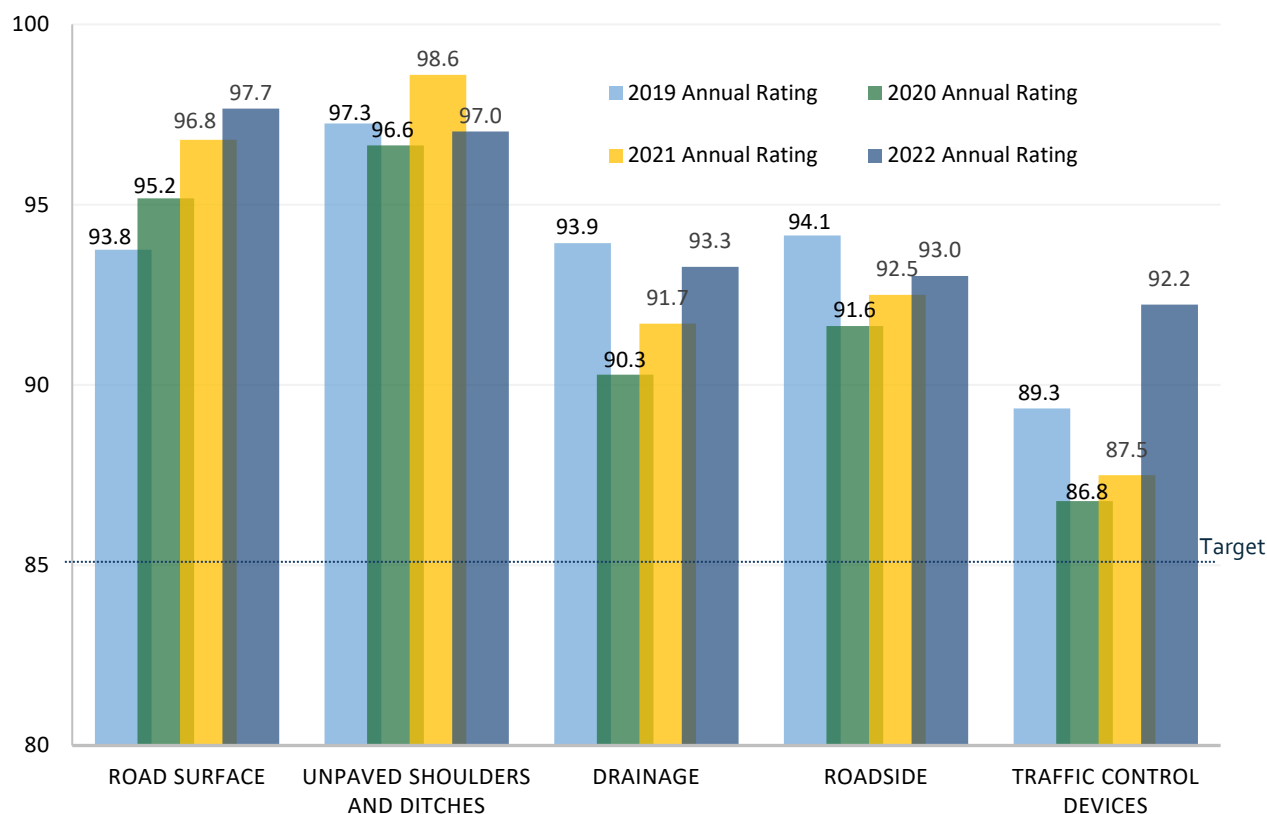
<sup>1</sup> Excludes concrete surface pavement markers, striping, and symbols on mainline NC-540 and asphalt surface markers on mainline NC-885.

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

## 7.2 Annual Analysis

Based on the combined results of all four quarterly inspections conducted in 2022, all elements exceeded NCTA's threshold criteria of 85. In addition, all characteristics, apart from Retaining Walls and Sound Barrier Wall (75), exceeded the target threshold criteria of 80. **Exhibit 2** shows the comparison in annual element ratings from 2019 to 2022, which shows four of five elements increasing in rating from 2021 to 2022.

**Exhibit 2: Annual Rating Comparison Chart**



## 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 two remaining Green Level Historic District signs to conduct a visual inspection of each sign and ensure they are in good standing. The two signs included in the inspection inventory were found to be in good condition. **Figure 4** shows the two signs assessed.

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



## 9.0 Conclusion

This report presents the 2022 fourth quarter assessment of the Triangle Expressway. The NCTA's target ratings are 90 for the rolling rating, 90 for the overall quarter rating, 85 for elements, and 80 for characteristics. The fourth quarter 2022 overall rating was 94.3 and the rolling rating was 94.6, both ratings met the target rating of 90.

All element ratings were above the target ratings for the quarter and rolling assessment. During the fourth quarter assessment, all but one characteristic met or exceeded the target rating of 80. The characteristic that received a quarter score less than 80 was Retaining Walls and Sound Barrier Walls (75).

To maintain/improve the condition ratings, it is recommended that the pavement striping/markings replacement cycles are completed as planned in the capital budget. Replacement of pavement striping, and marking is scheduled for Spring.

This quarter, the two Green Level Historic District signs inspected were found to be in good condition. Additionally, the landscaped areas surrounding the signs were found to be well maintained.



## **Appendix A**

**Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations**

## Appendix A: Triangle Expressway 2022 Fourth 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:

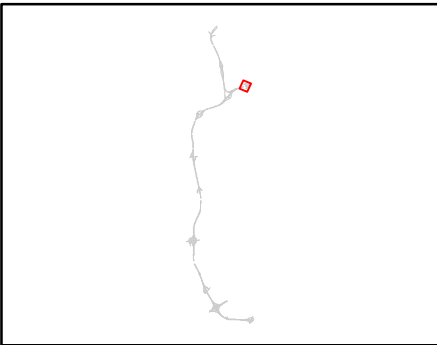
- Guardrail, Concrete Barrier and End Anchors – BR
- Curb and Gutter – CG
- Decorative Supports – DS
- Drainage Pipes – DP
- Misc. Drainage Structures – MDP
- Fence and Control of Access – FN
- Graffiti – GR
- Highway Lighting – HL
- Impact Attenuators – IA
- Inlets – IN
- Landscaping – PB
- Linear Samples – 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 2022 Fourth Quarter Asset Assessment Locations



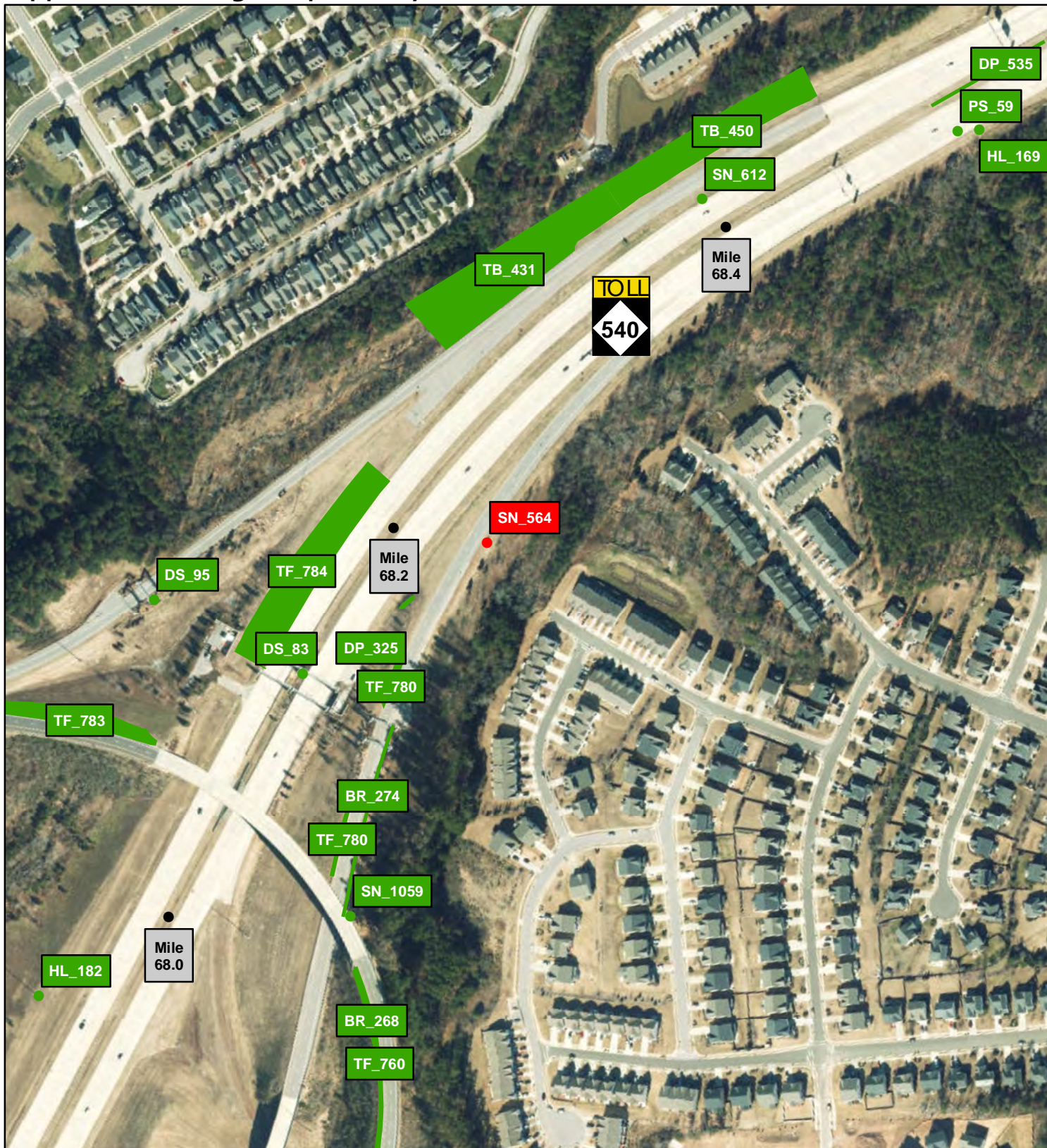
Legend

- Failing Asset
- Passing Asset





# Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



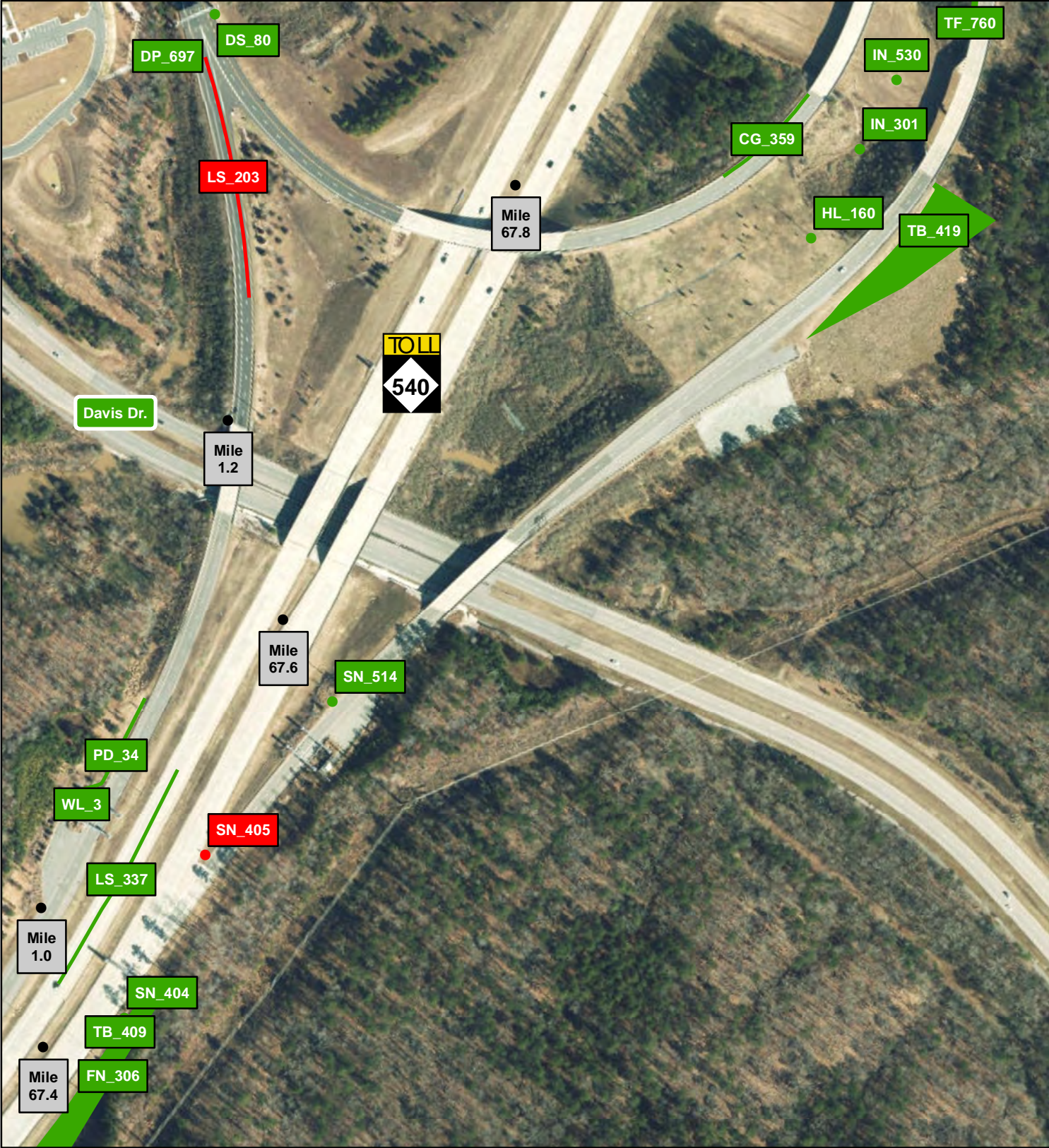
## Legend

- Failing Asset
- Passing Asset





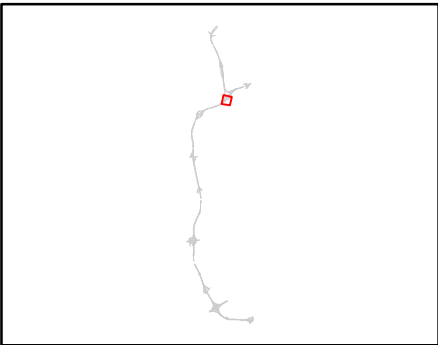


Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



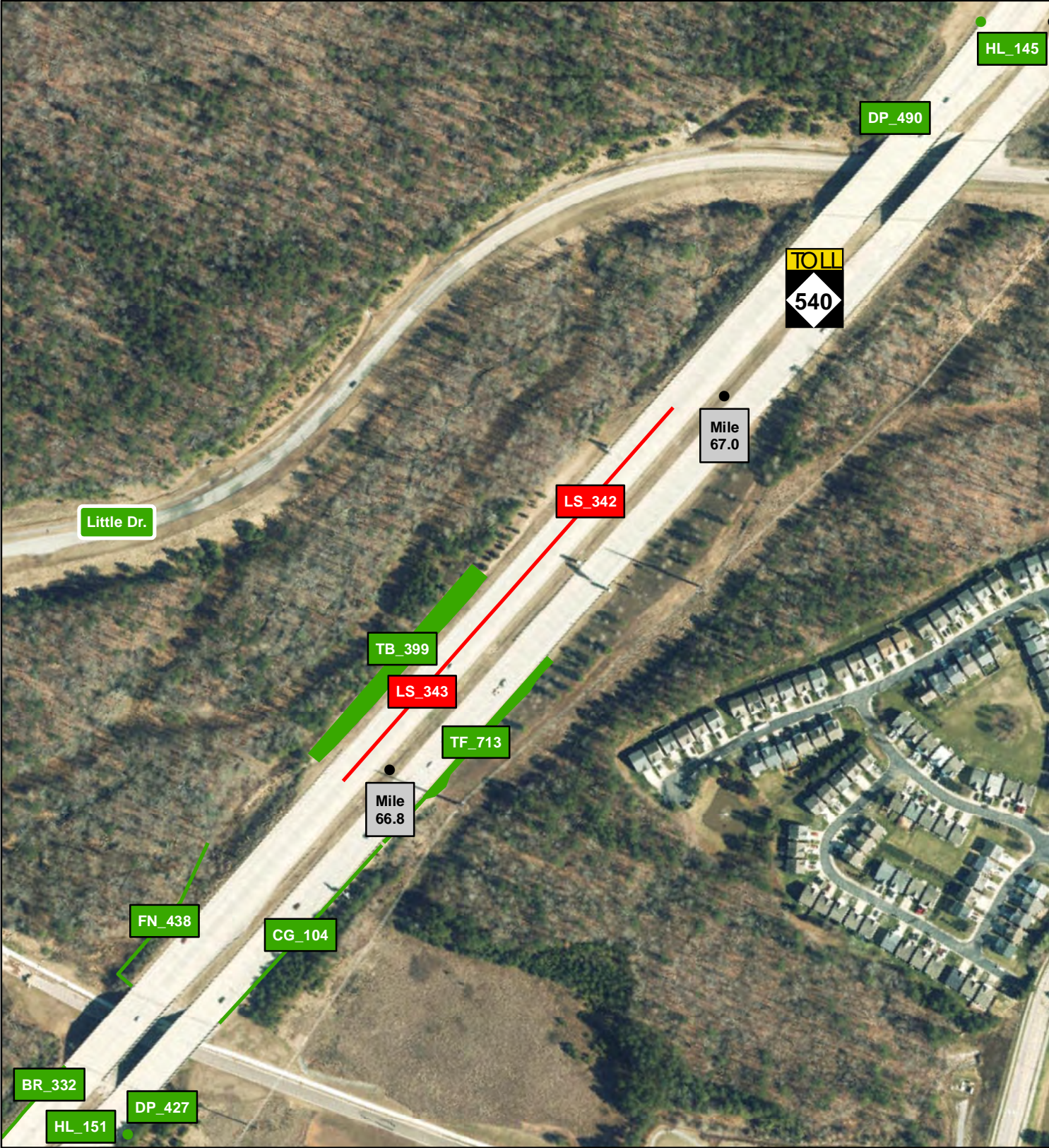
Legend

-  Failing Asset
-  Passing Asset





Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset





Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



Legend



Failing Asset



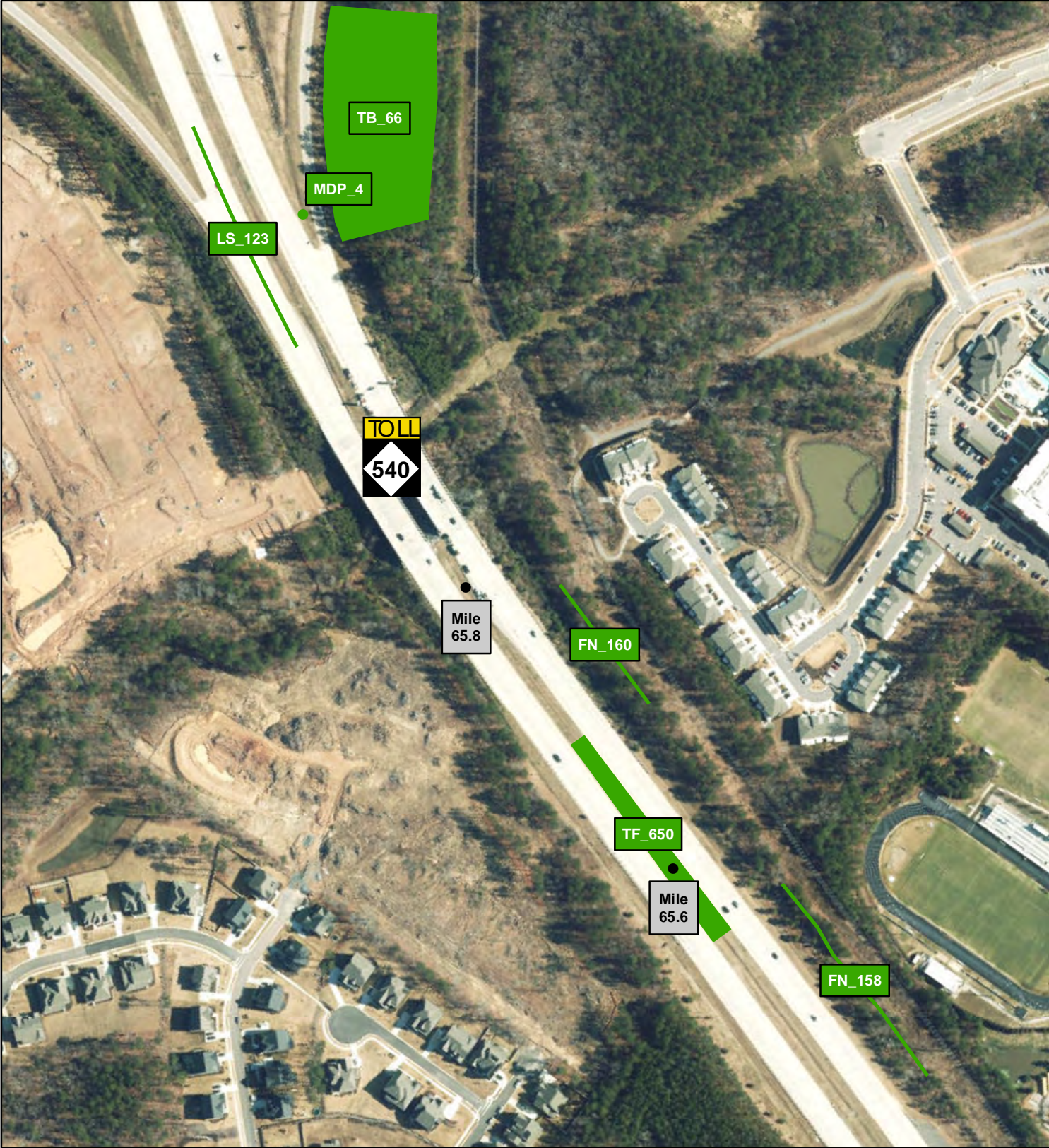
Passing Asset





NORTH CAROLINA  
Turnpike Authority

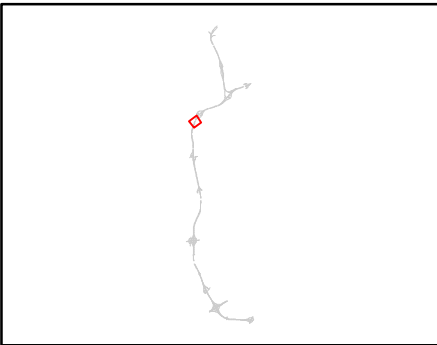


Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



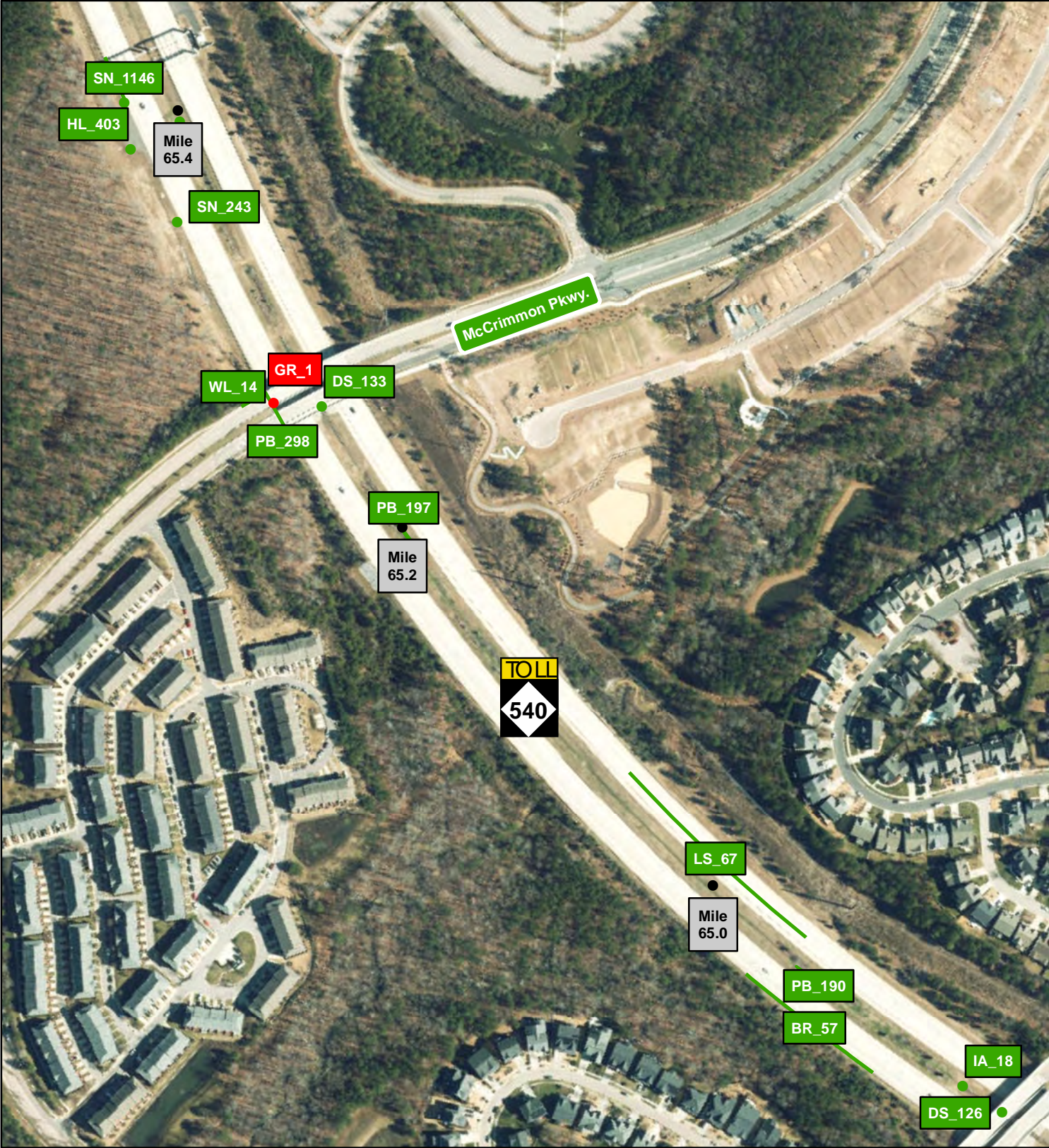
Legend

-  Failing Asset
-  Passing Asset



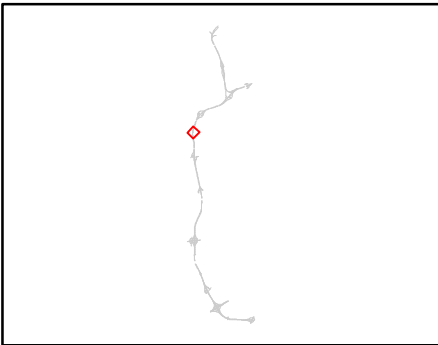


Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



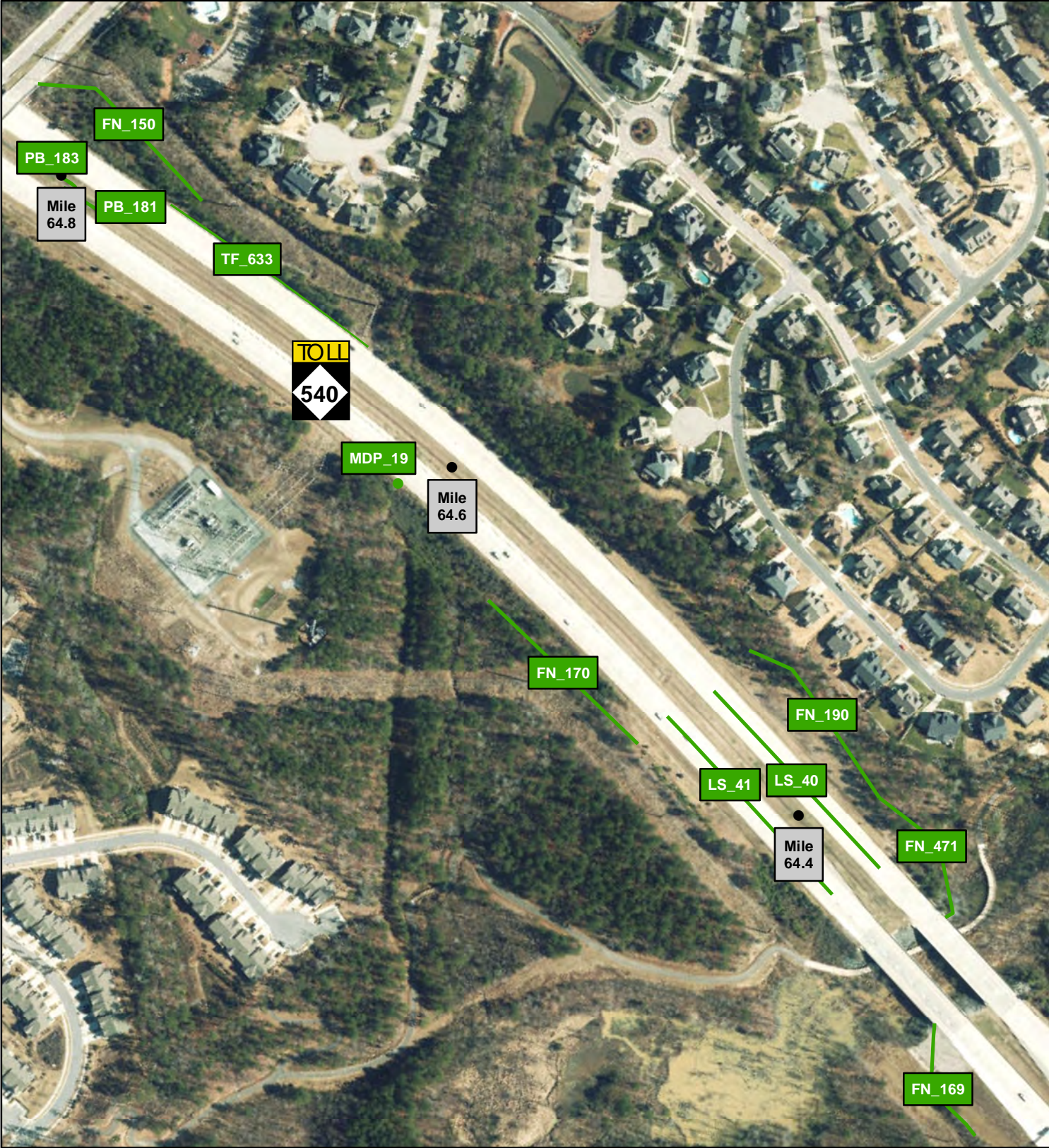
Legend

- Failing Asset
- Passing Asset





Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



Legend



Failing Asset

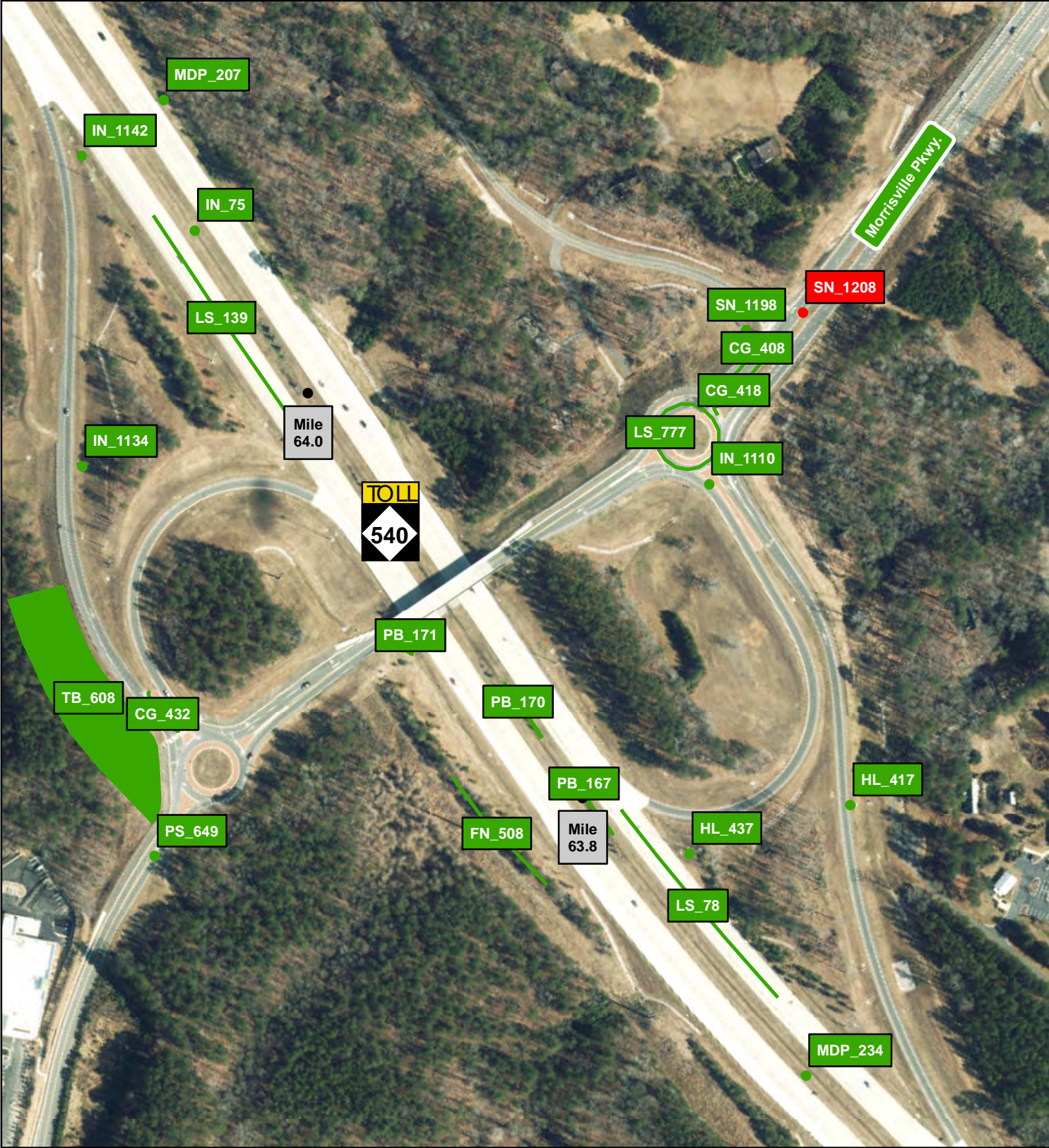


Passing Asset





Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset





Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



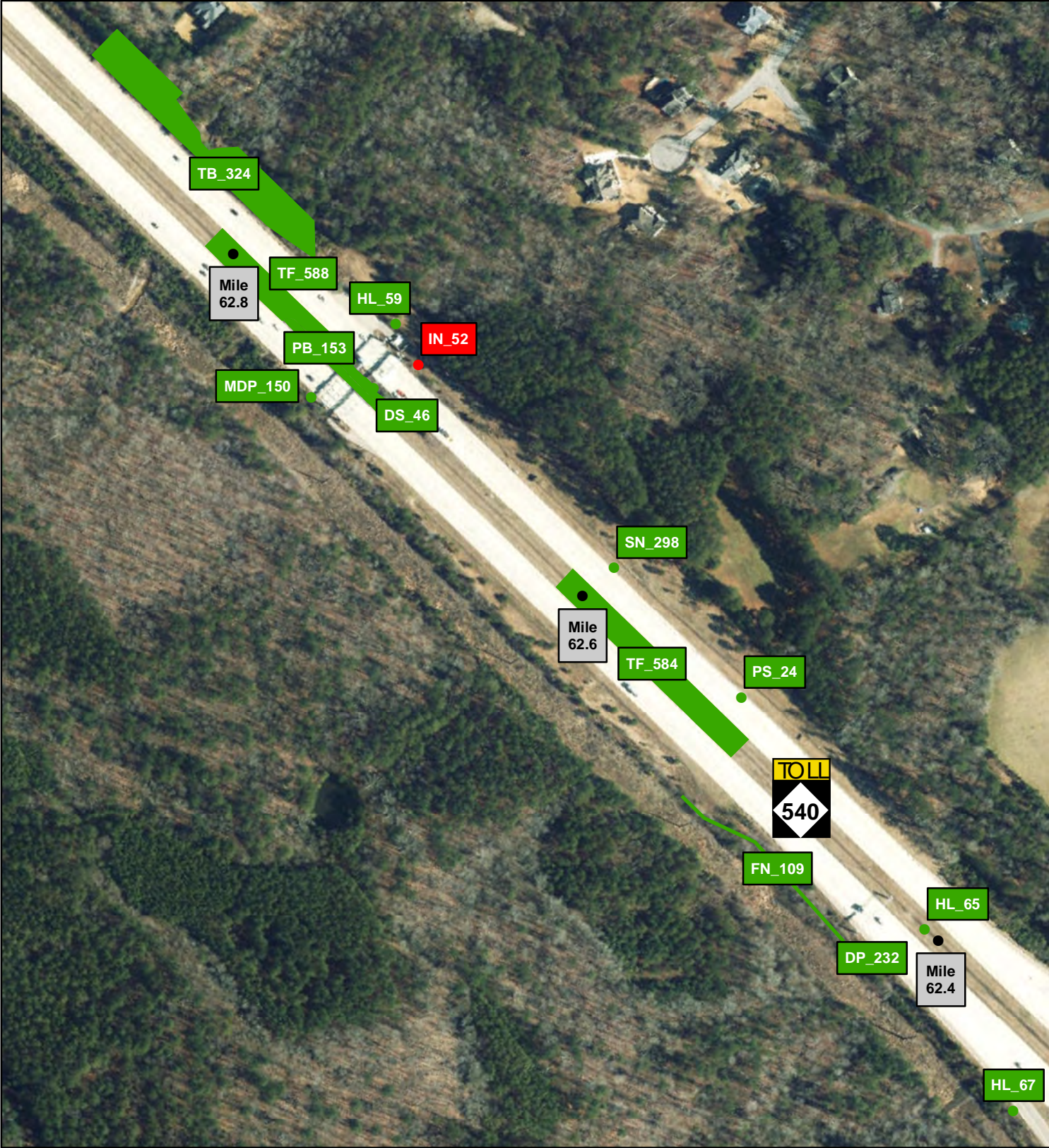
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-  Passing Asset



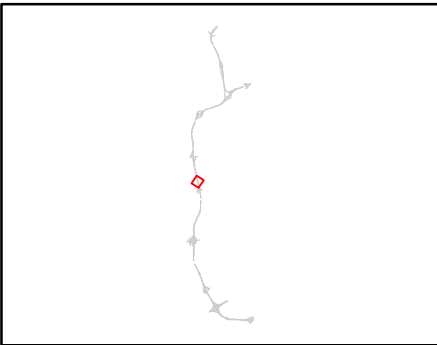


Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



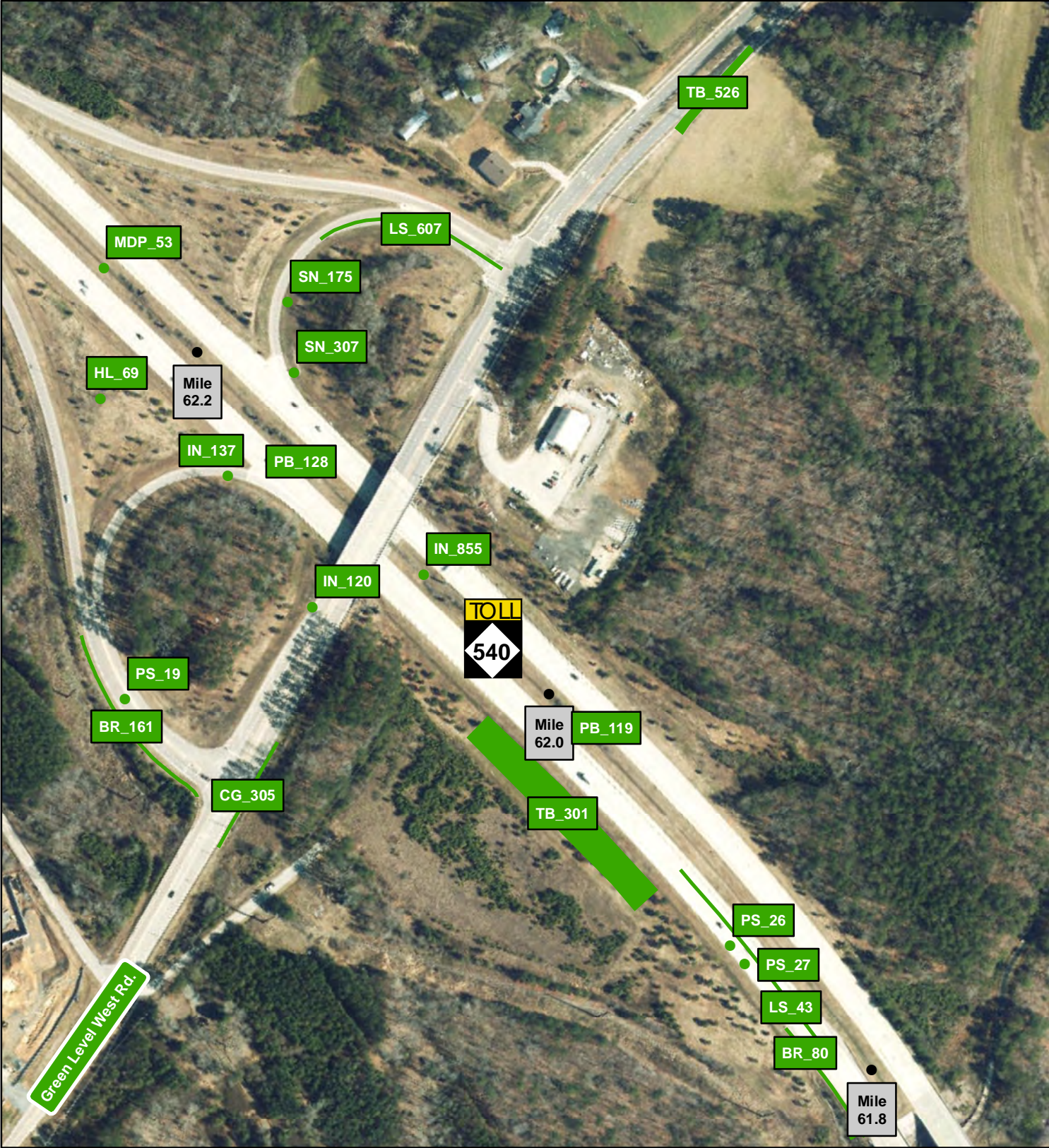
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-  Failing Asset
-  Passing Asset





Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



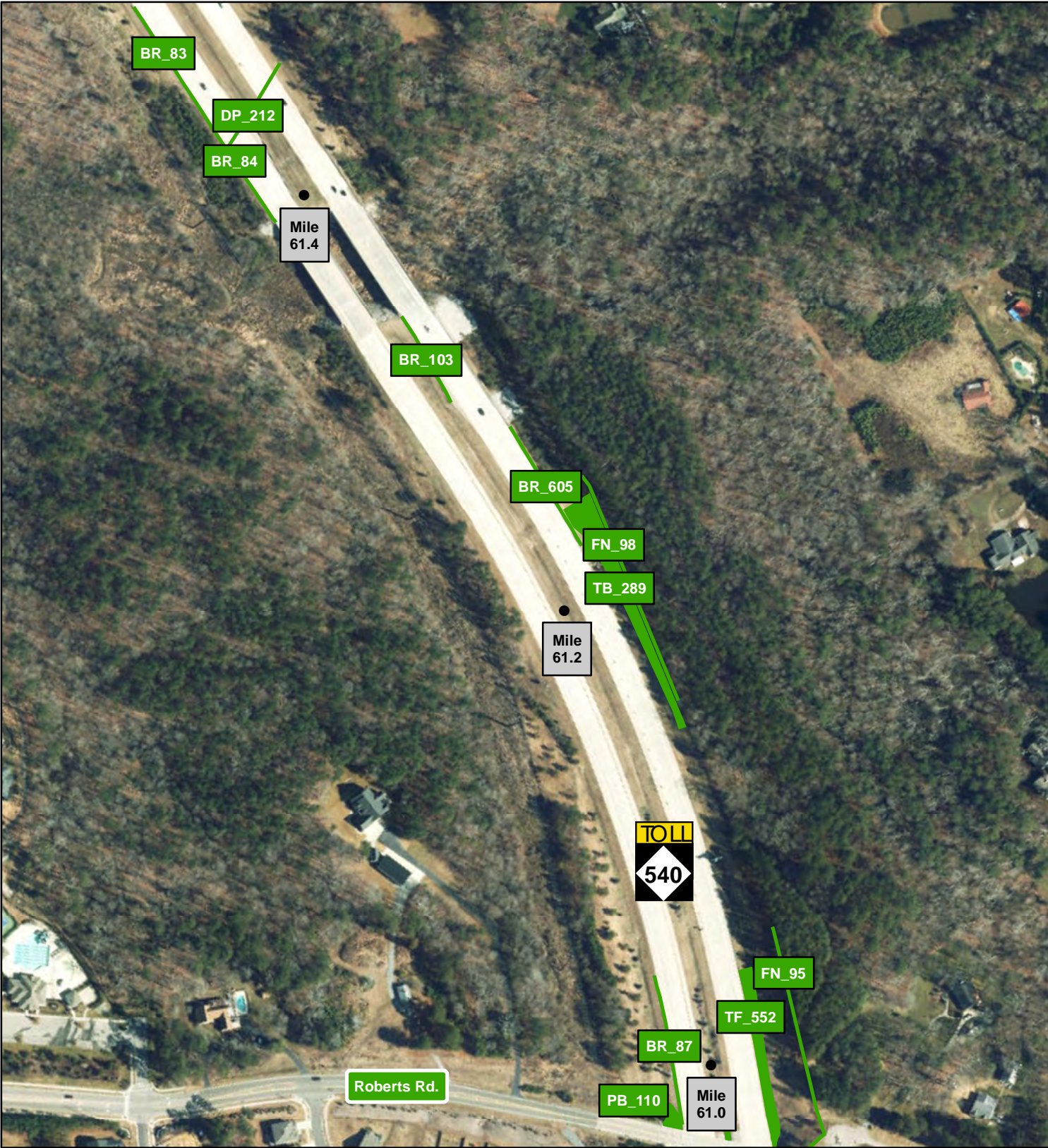
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- Failing Asset
- Passing Asset





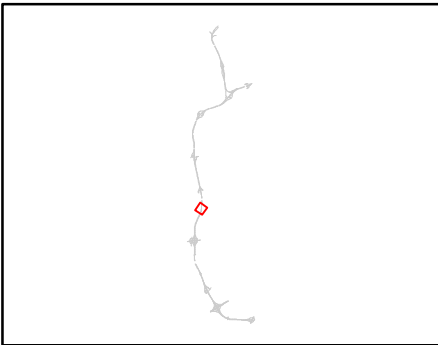


Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



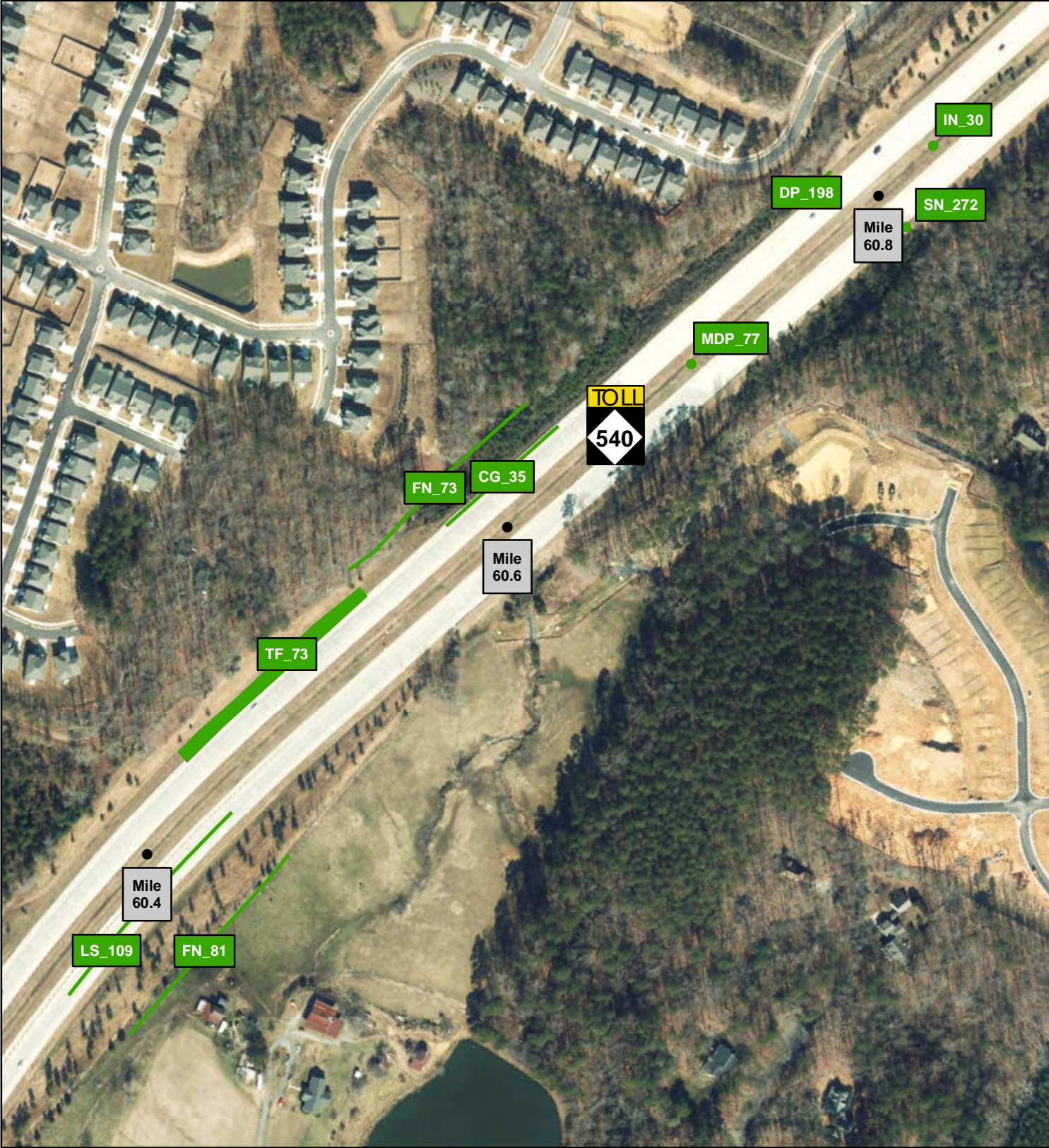
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-  Failing Asset
-  Passing Asset





Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



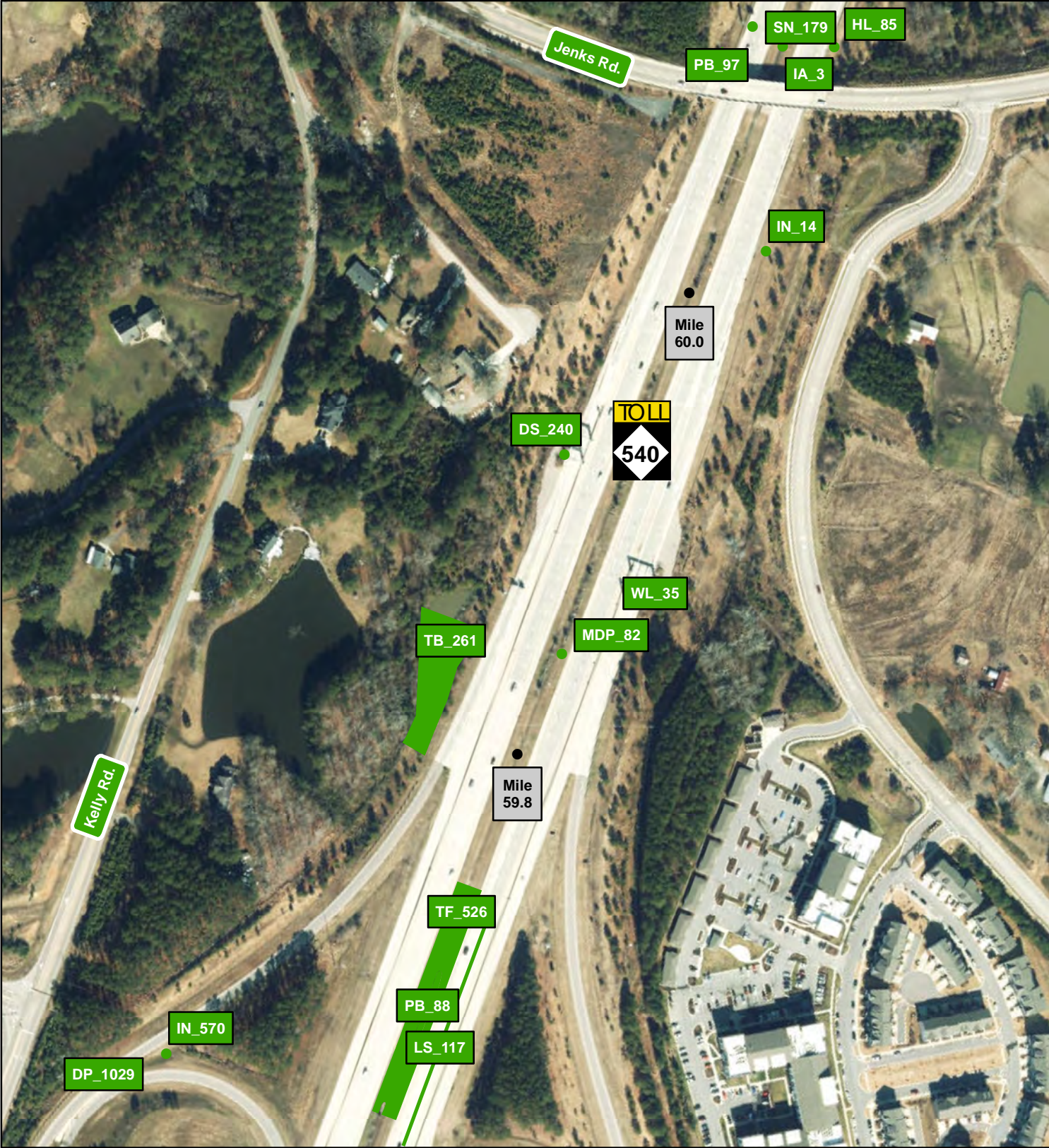
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-  Failing Asset
-  Passing Asset





Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



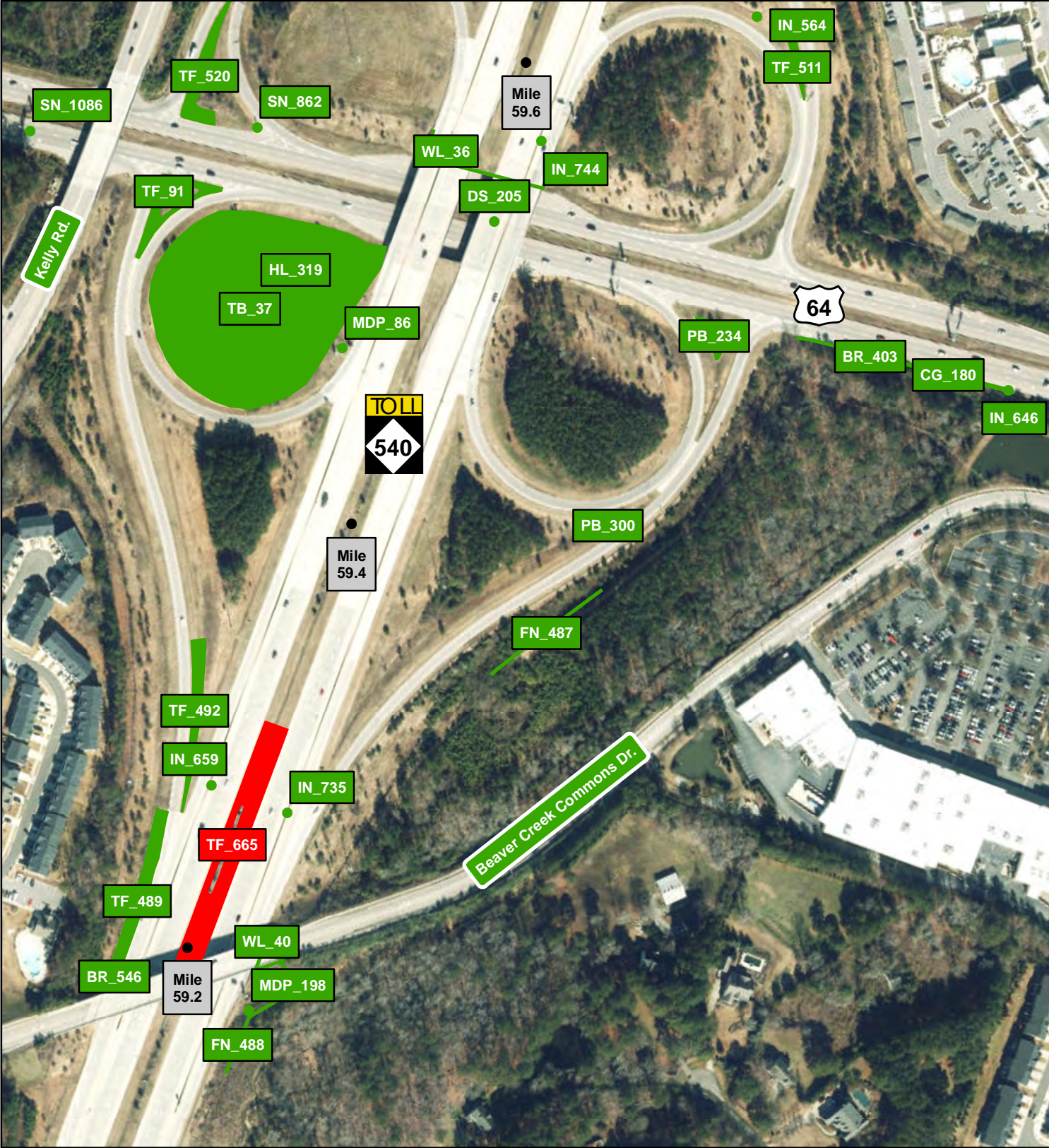
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- Failing Asset
- Passing Asset





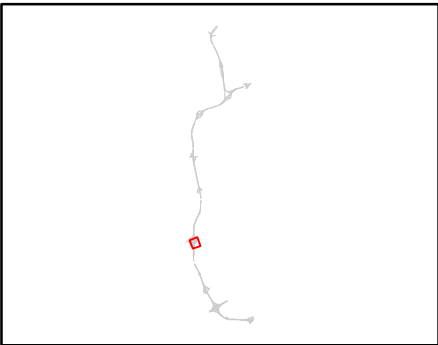


Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



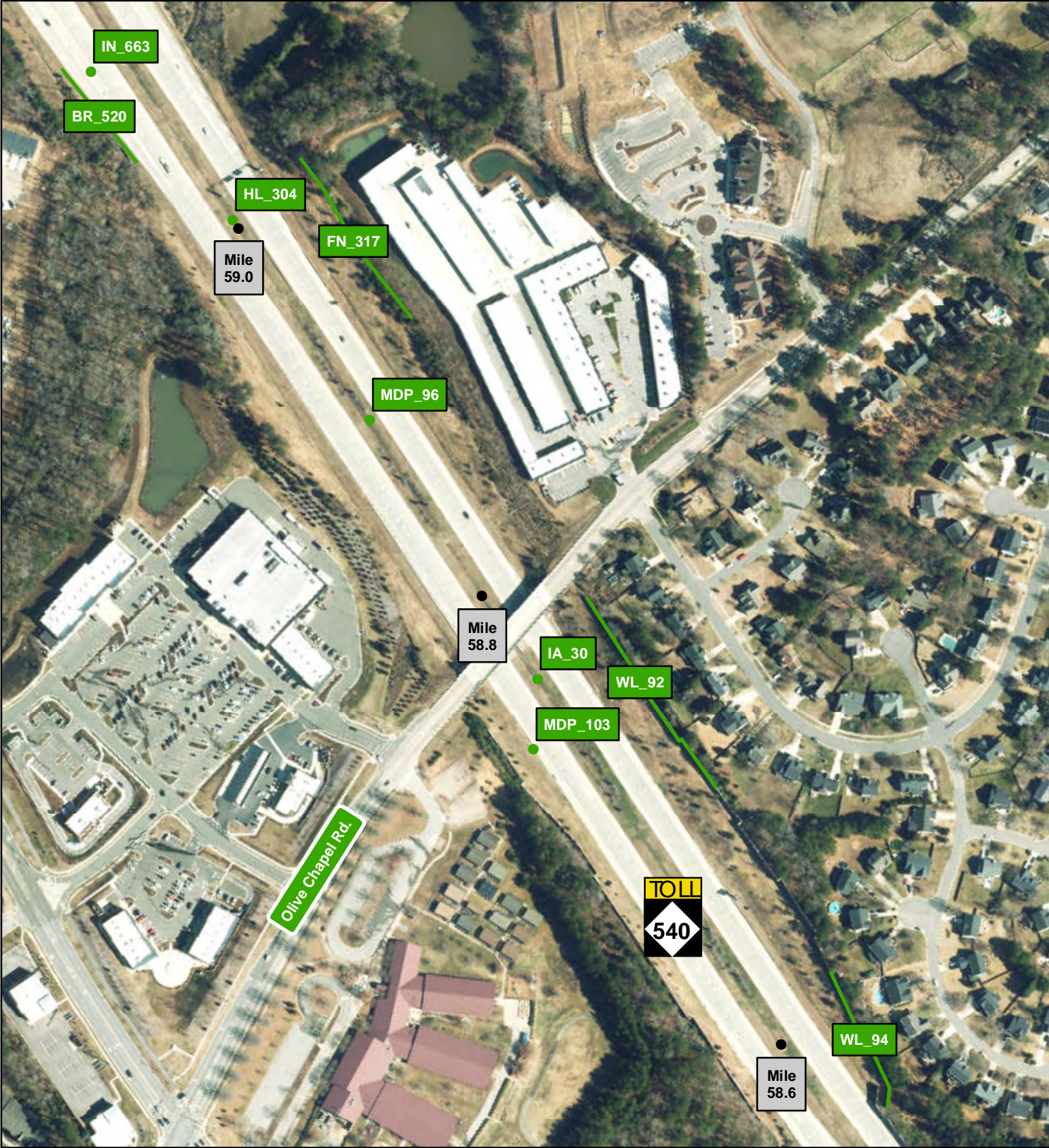
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-  Failing Asset
-  Passing Asset





Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



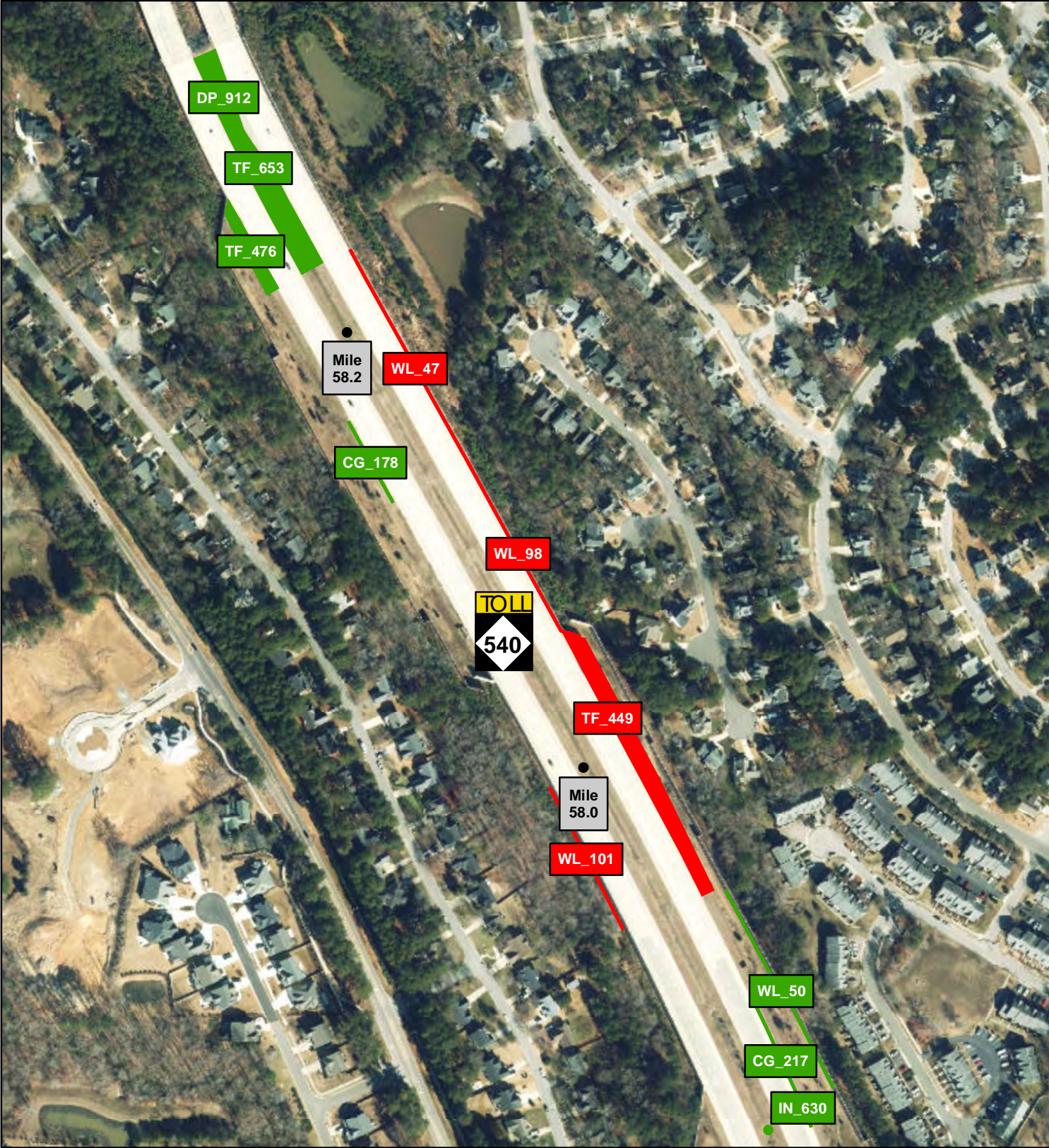
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- Failing Asset
- Passing Asset





Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



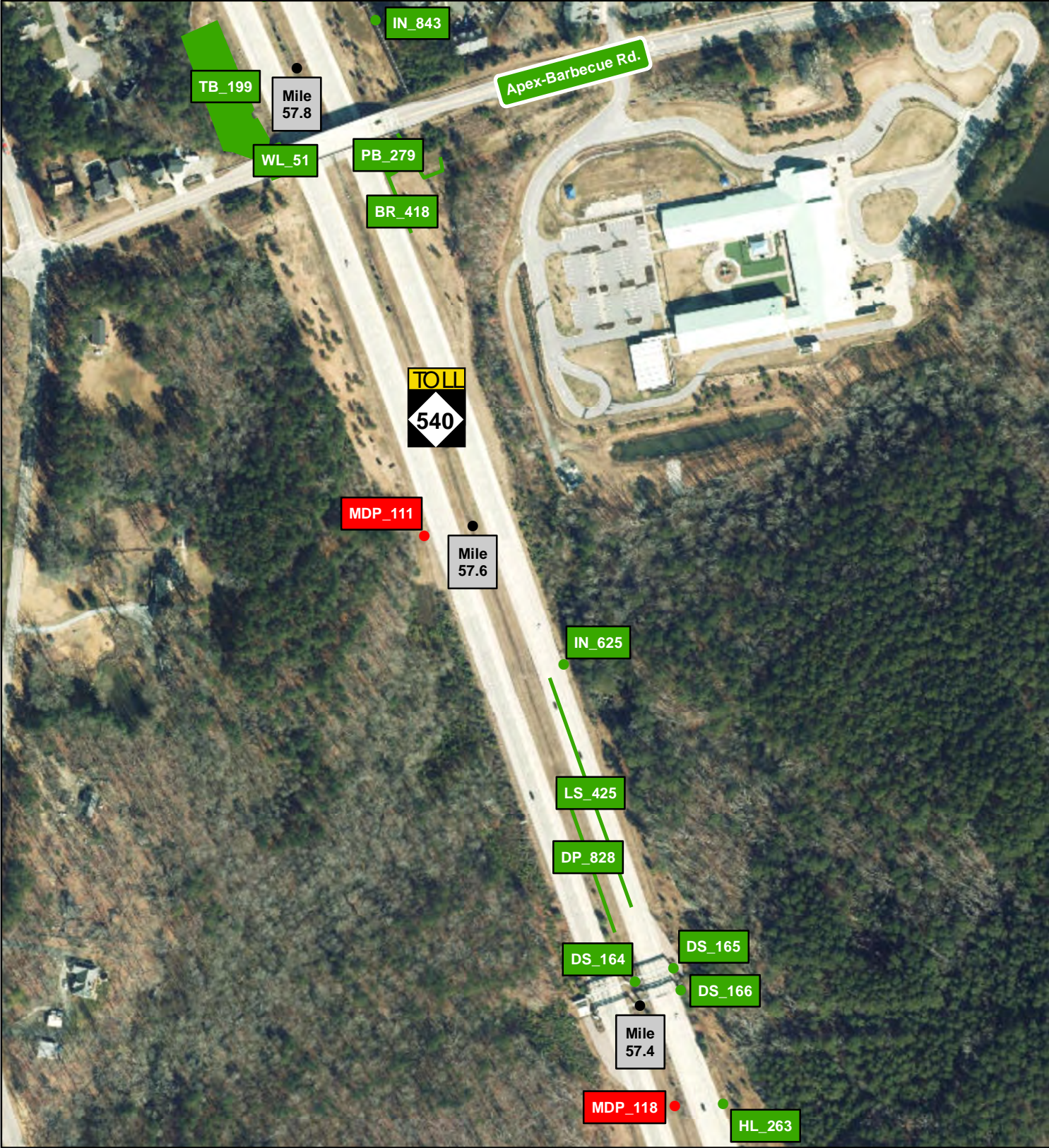
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-  Failing Asset
-  Passing Asset





Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



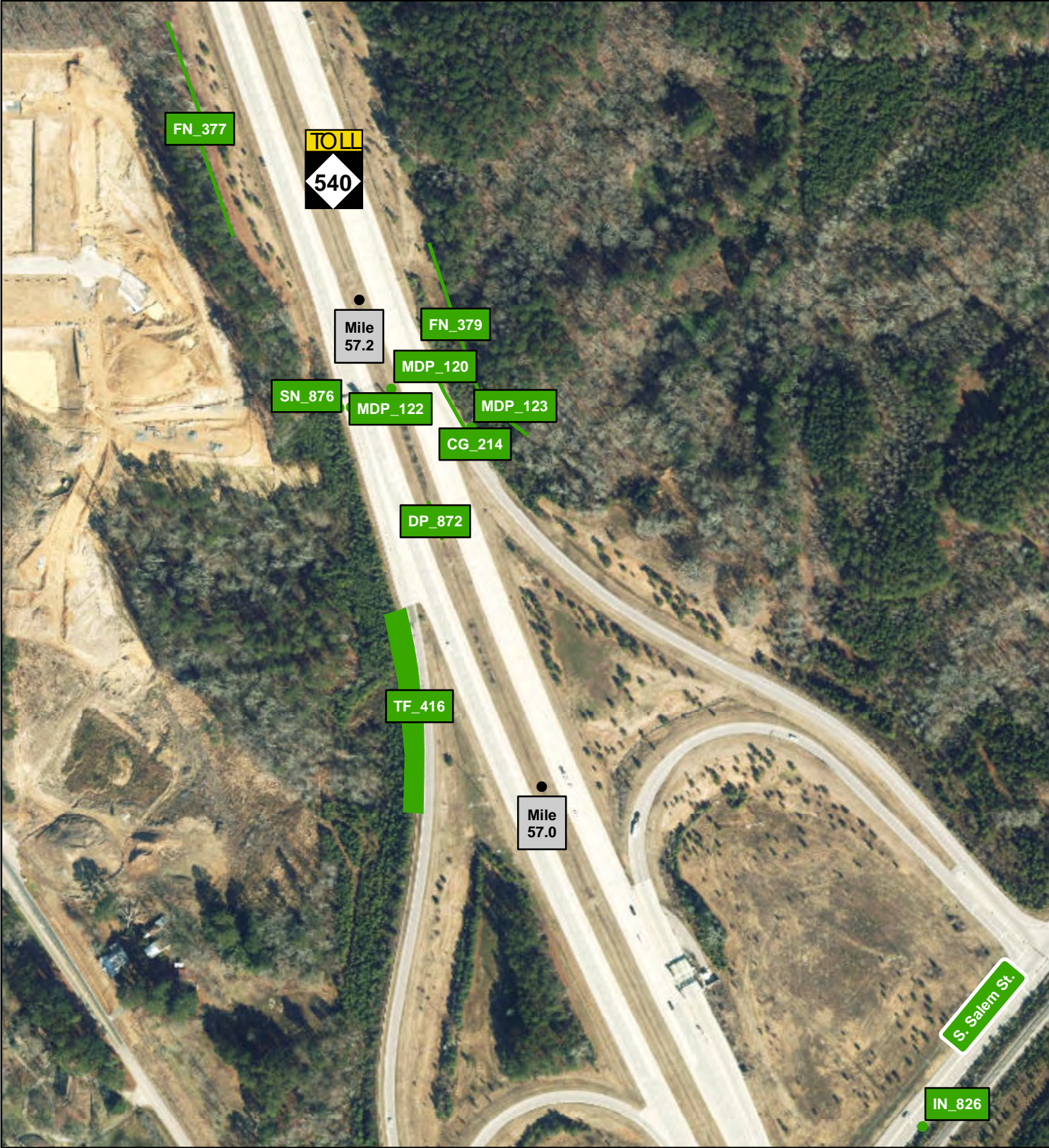
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- Failing Asset
- Passing Asset



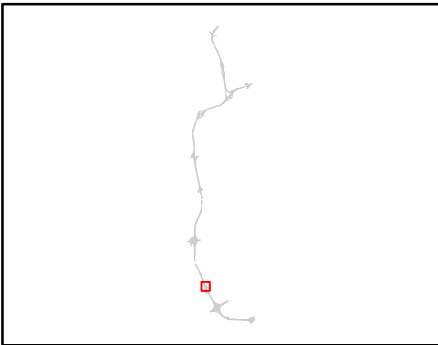


Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



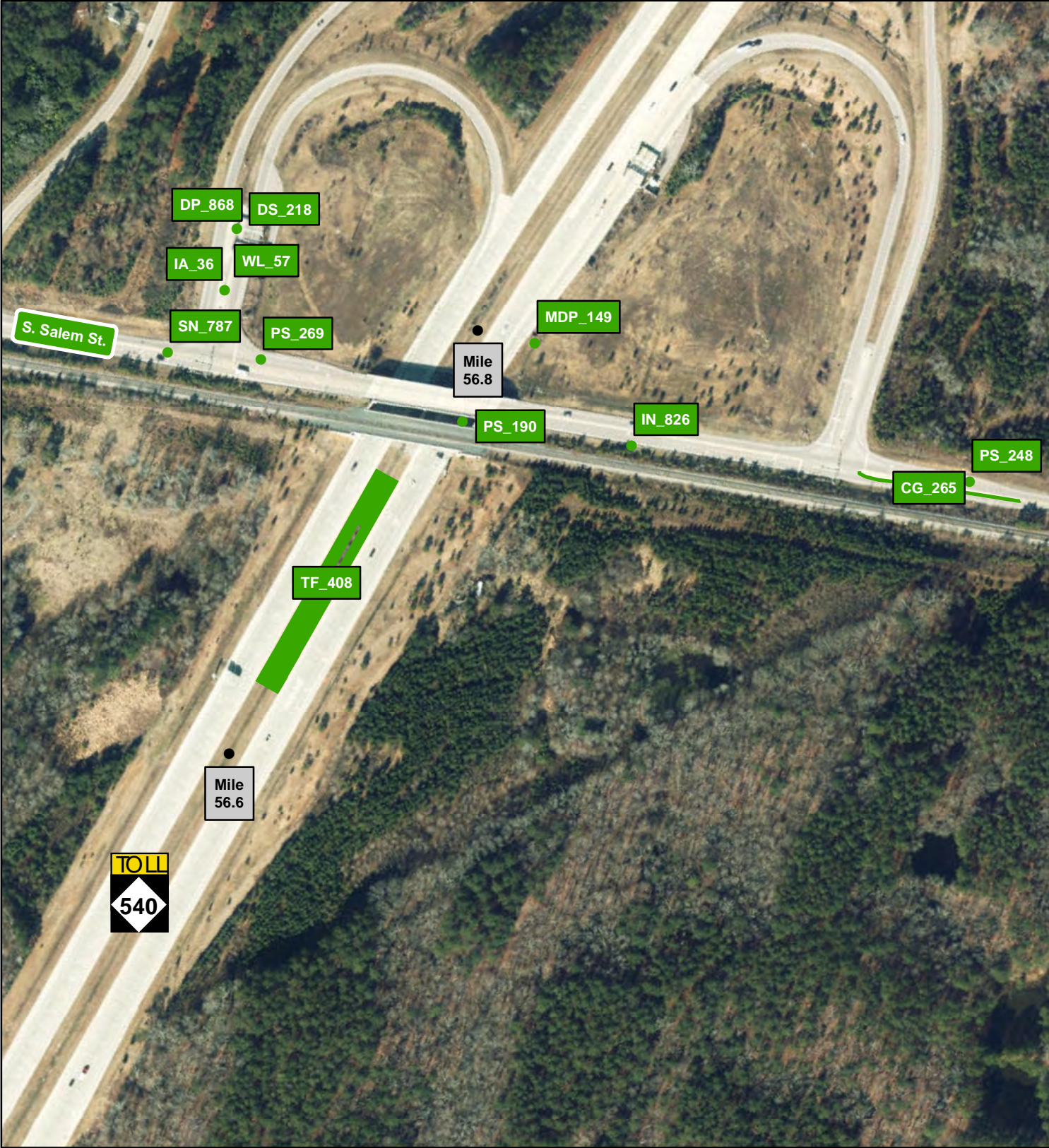
Legend

-  Failing Asset
-  Passing Asset





Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



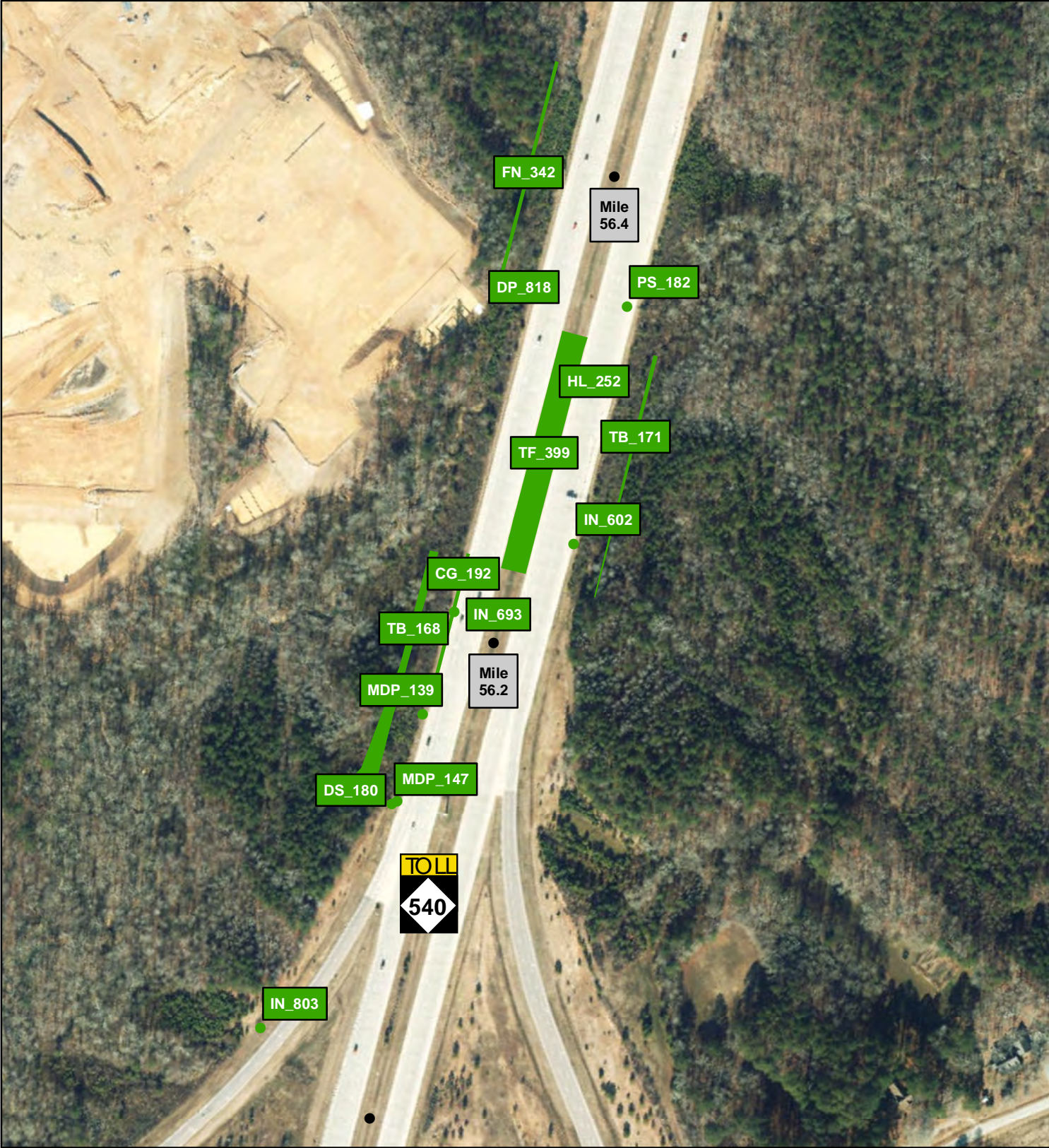
Legend

-  Failing Asset
-  Passing Asset







Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset





Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset





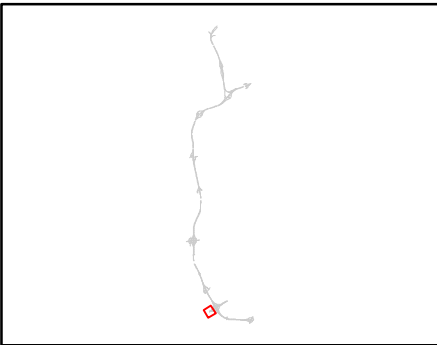


Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



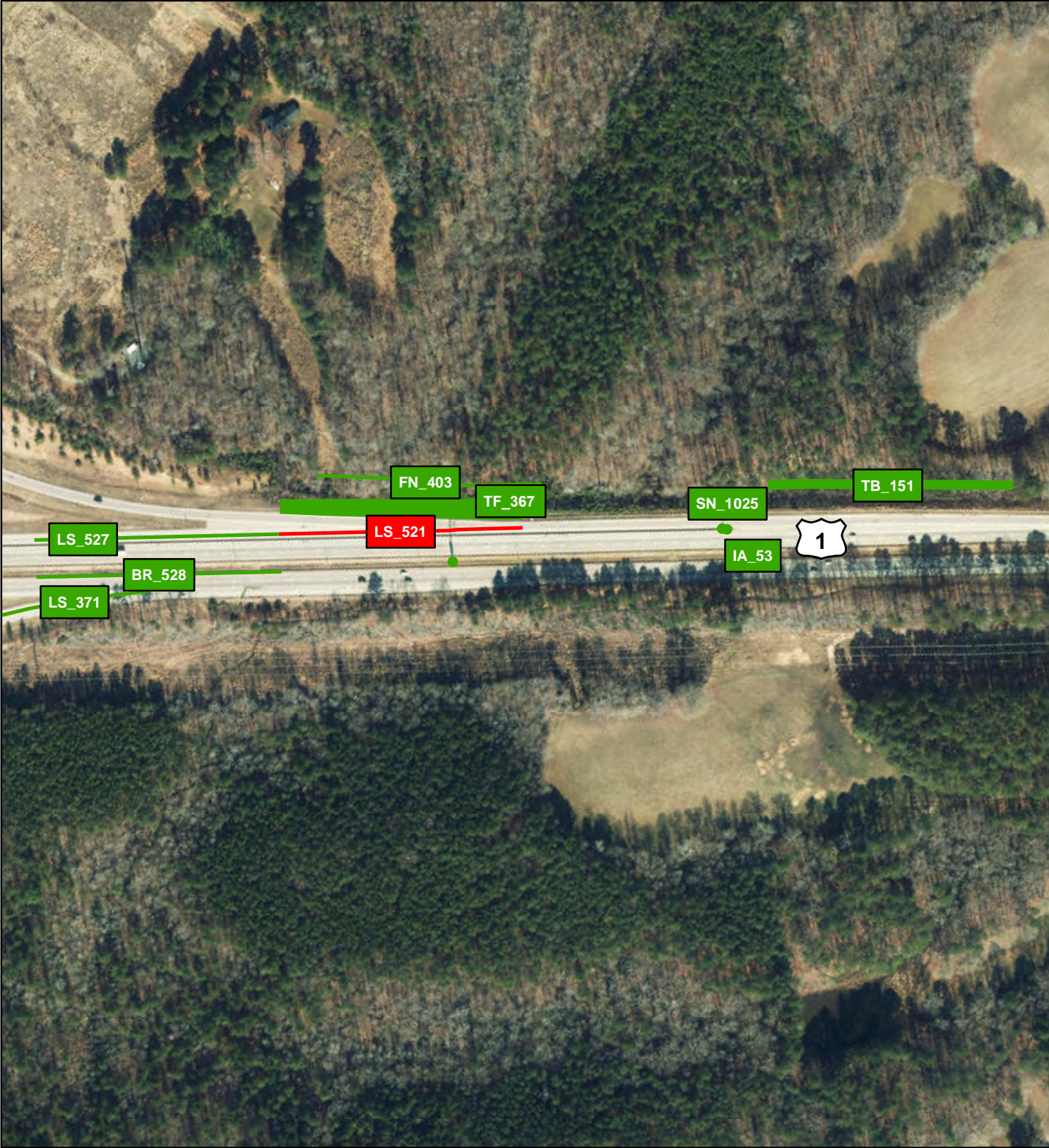
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-  Failing Asset
-  Passing Asset





Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



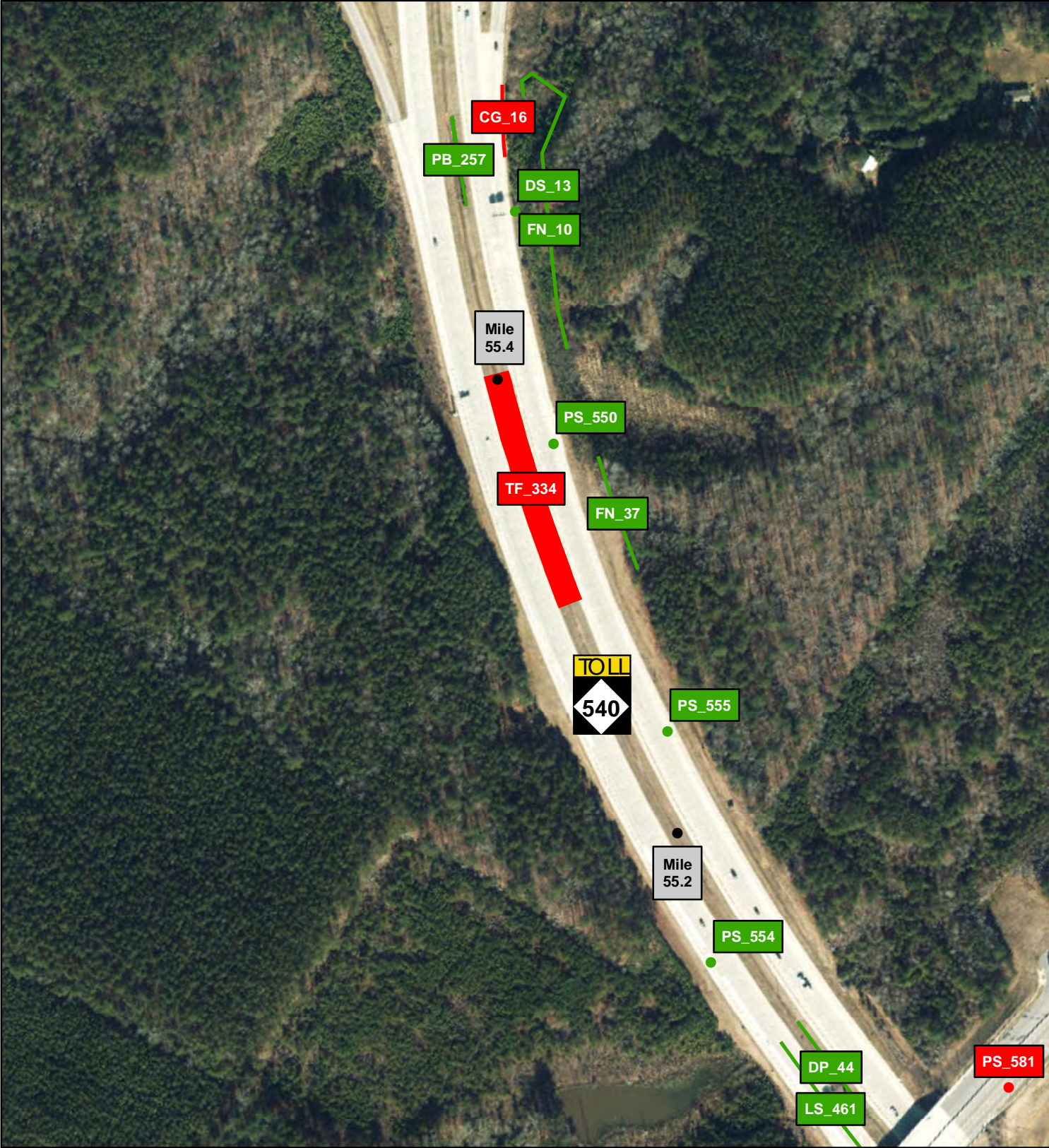
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-  Failing Asset
-  Passing Asset



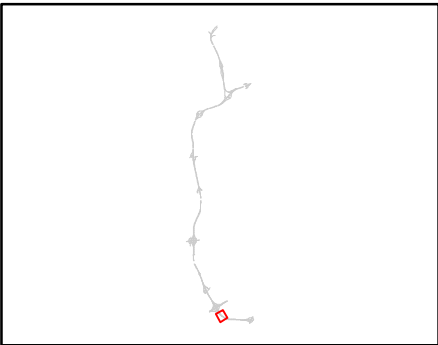


Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset





Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



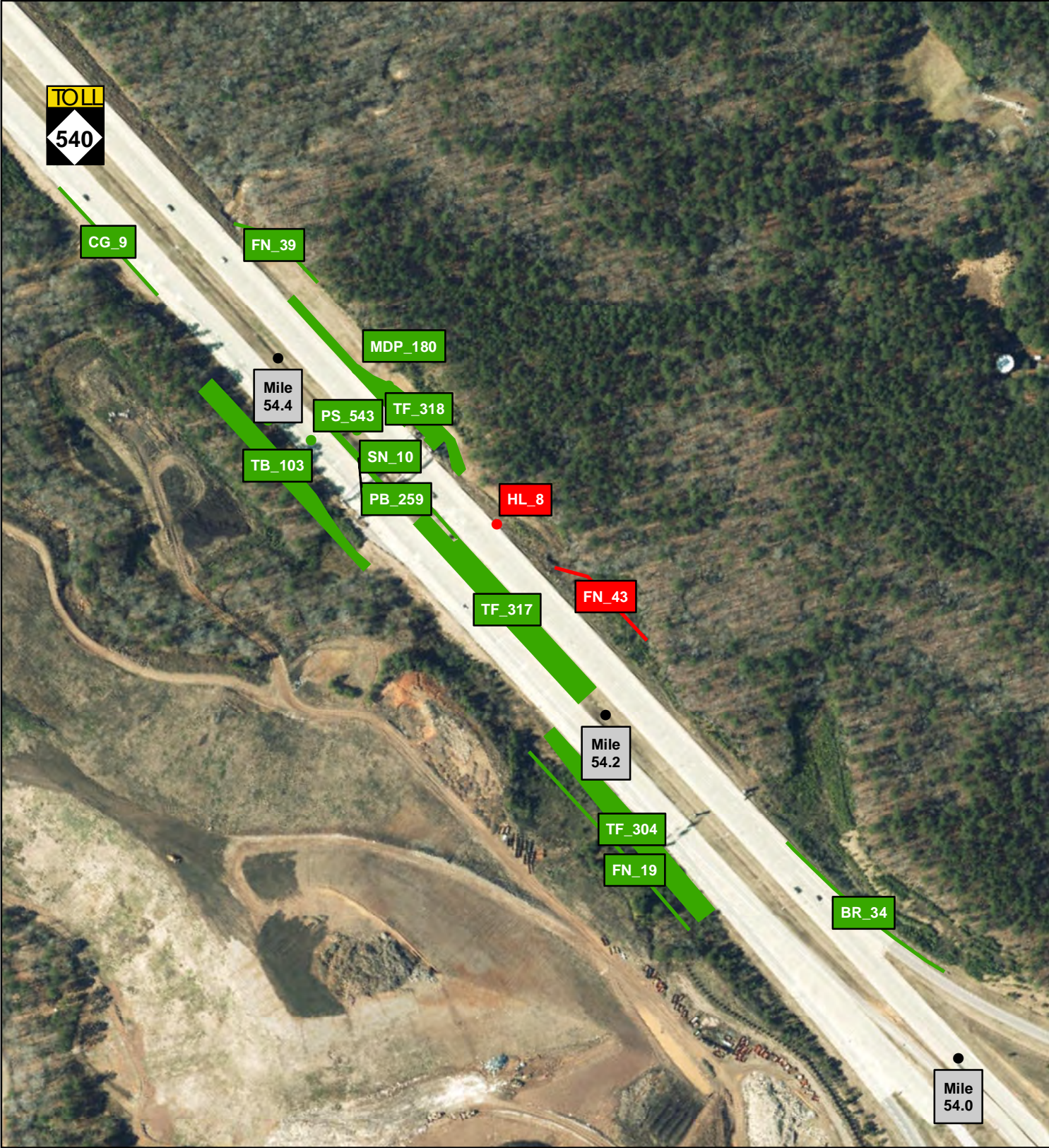
Legend

- Failing Asset
- Passing Asset





Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



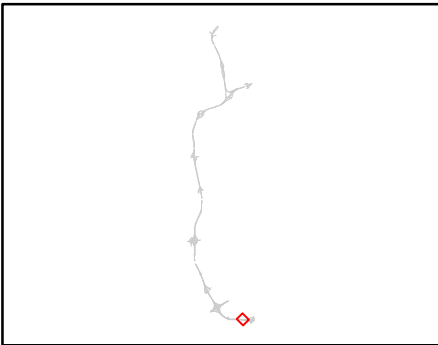
Legend



Failing Asset



Passing Asset





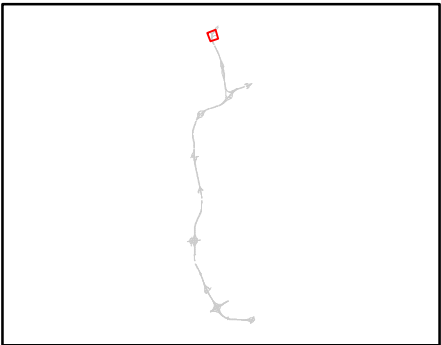


Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



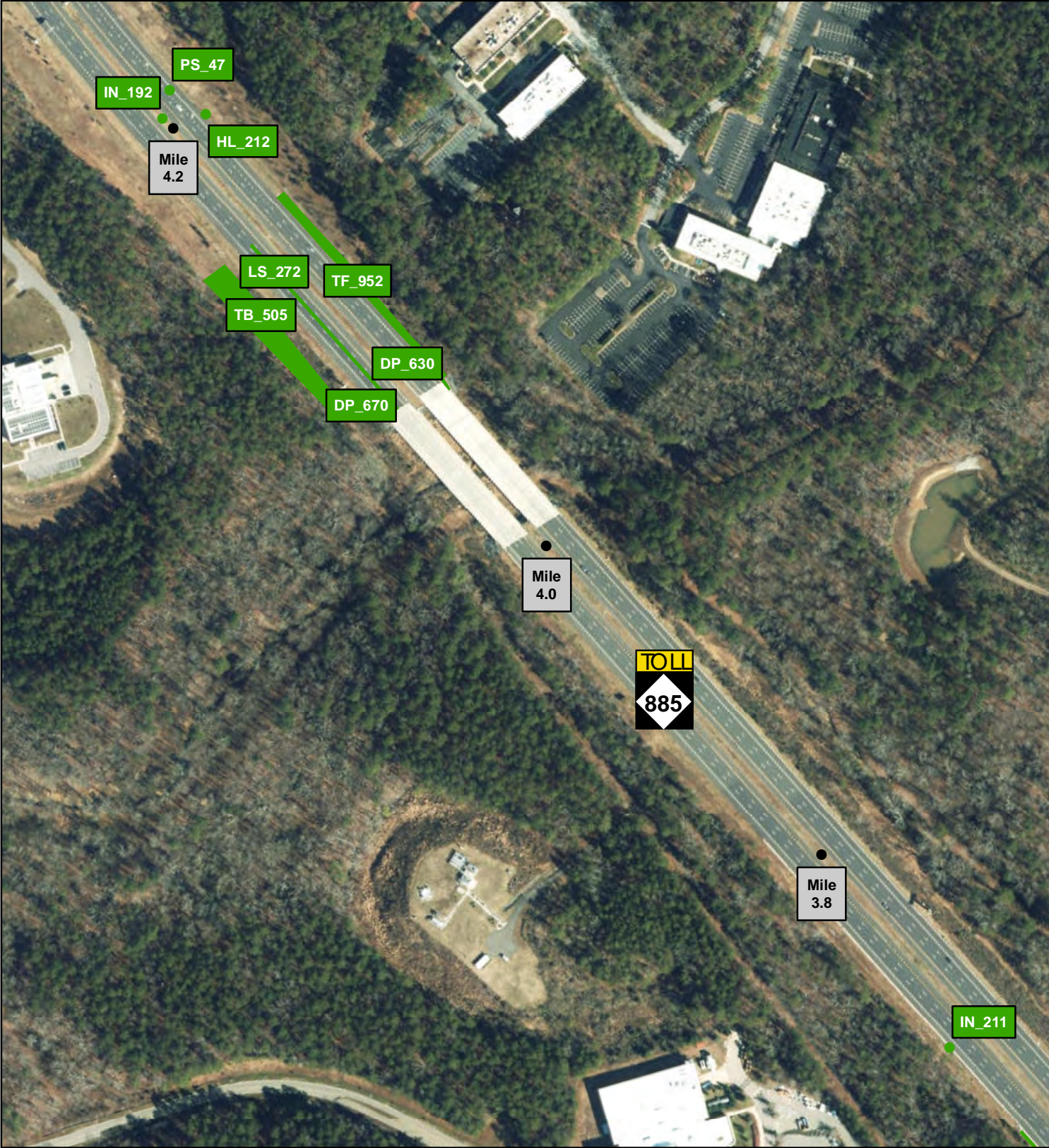
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-  Failing Asset
-  Passing Asset





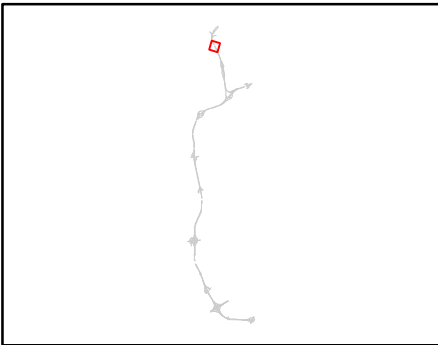
Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



**Legend**

Failing Asset

Passing Asset

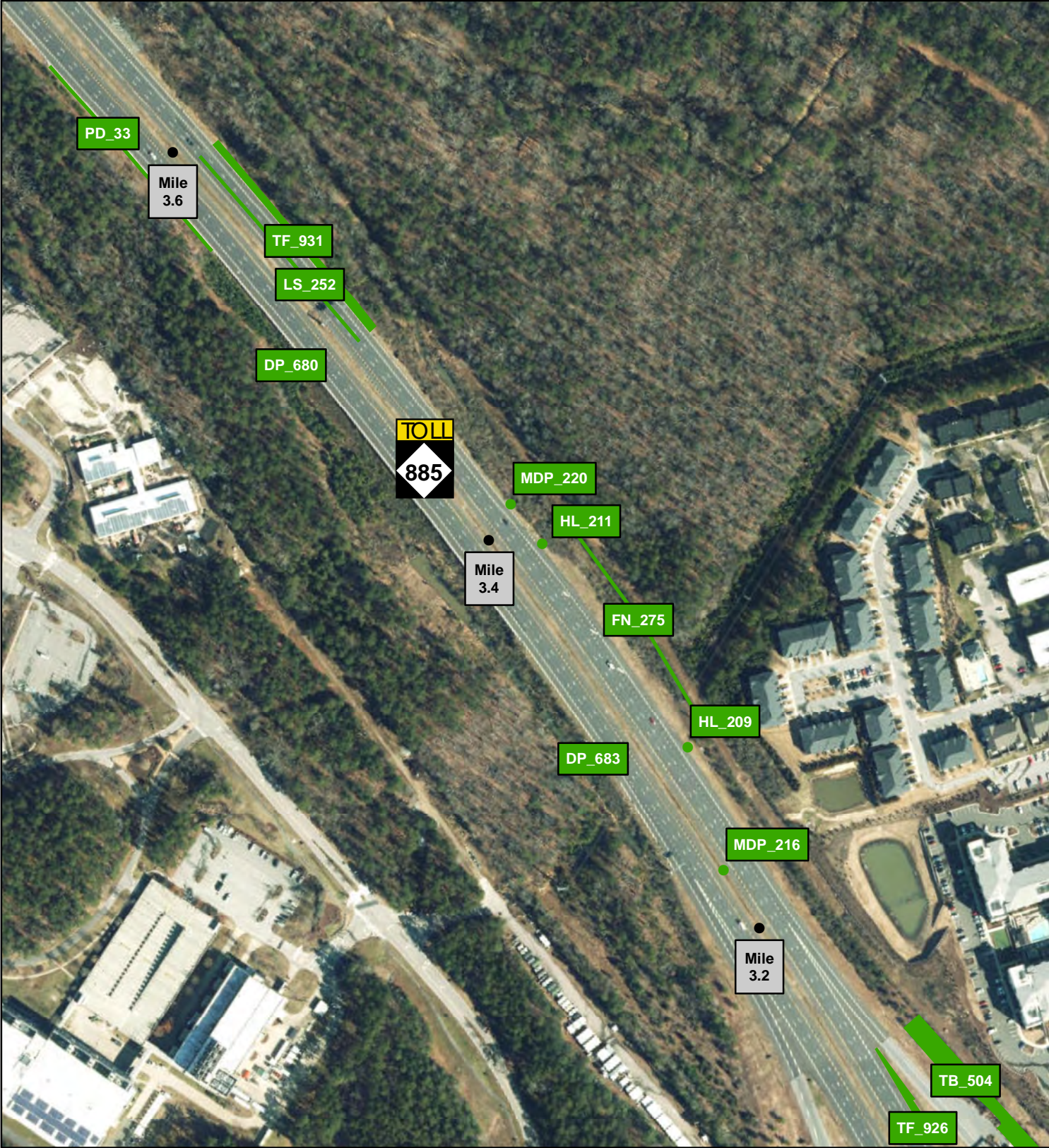


NORTH CAROLINA  
Turnpike Authority

A30



Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



Legend



Failing Asset



Passing Asset





# Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



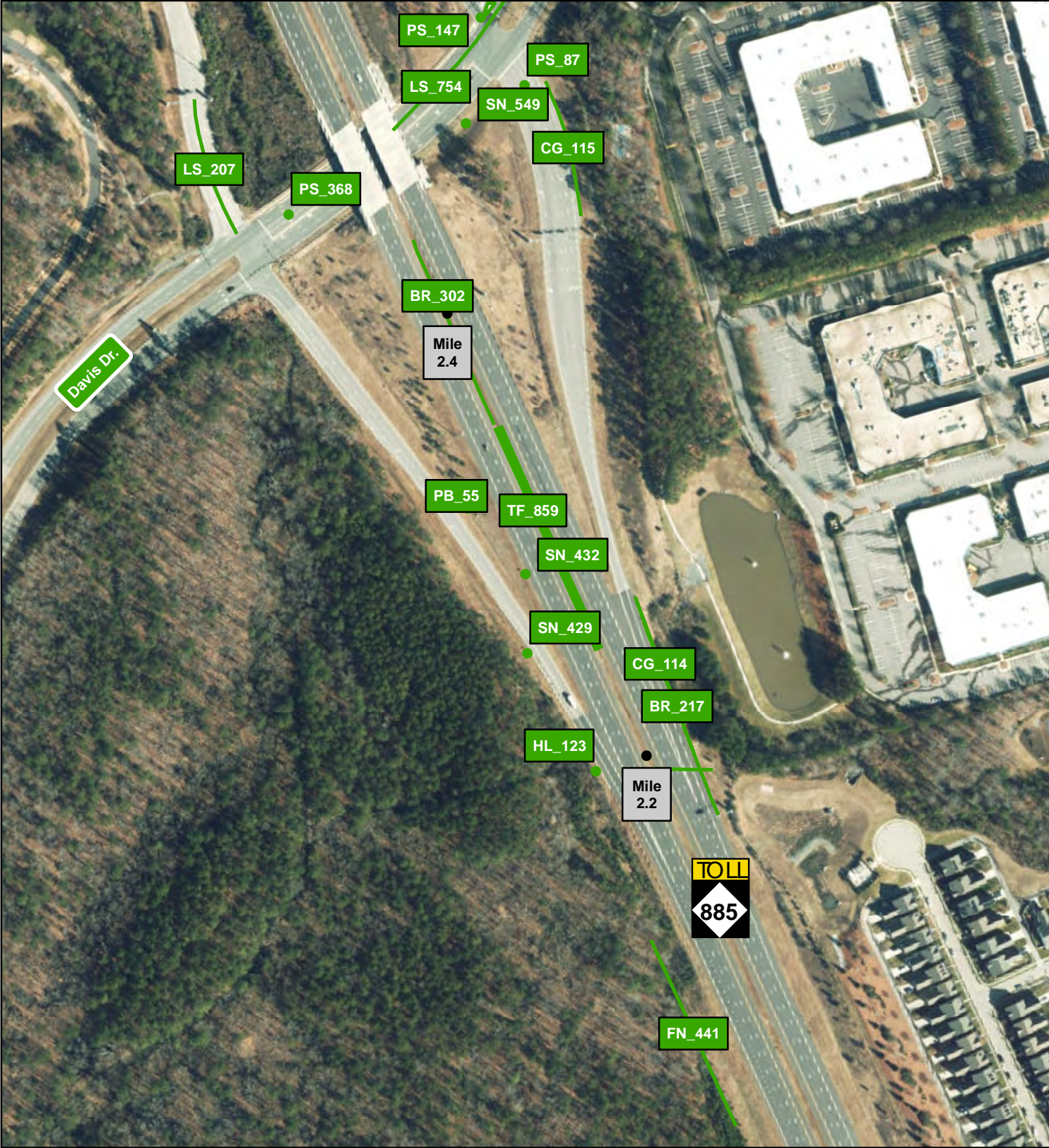
## Legend

- Failing Asset
- Passing Asset







Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



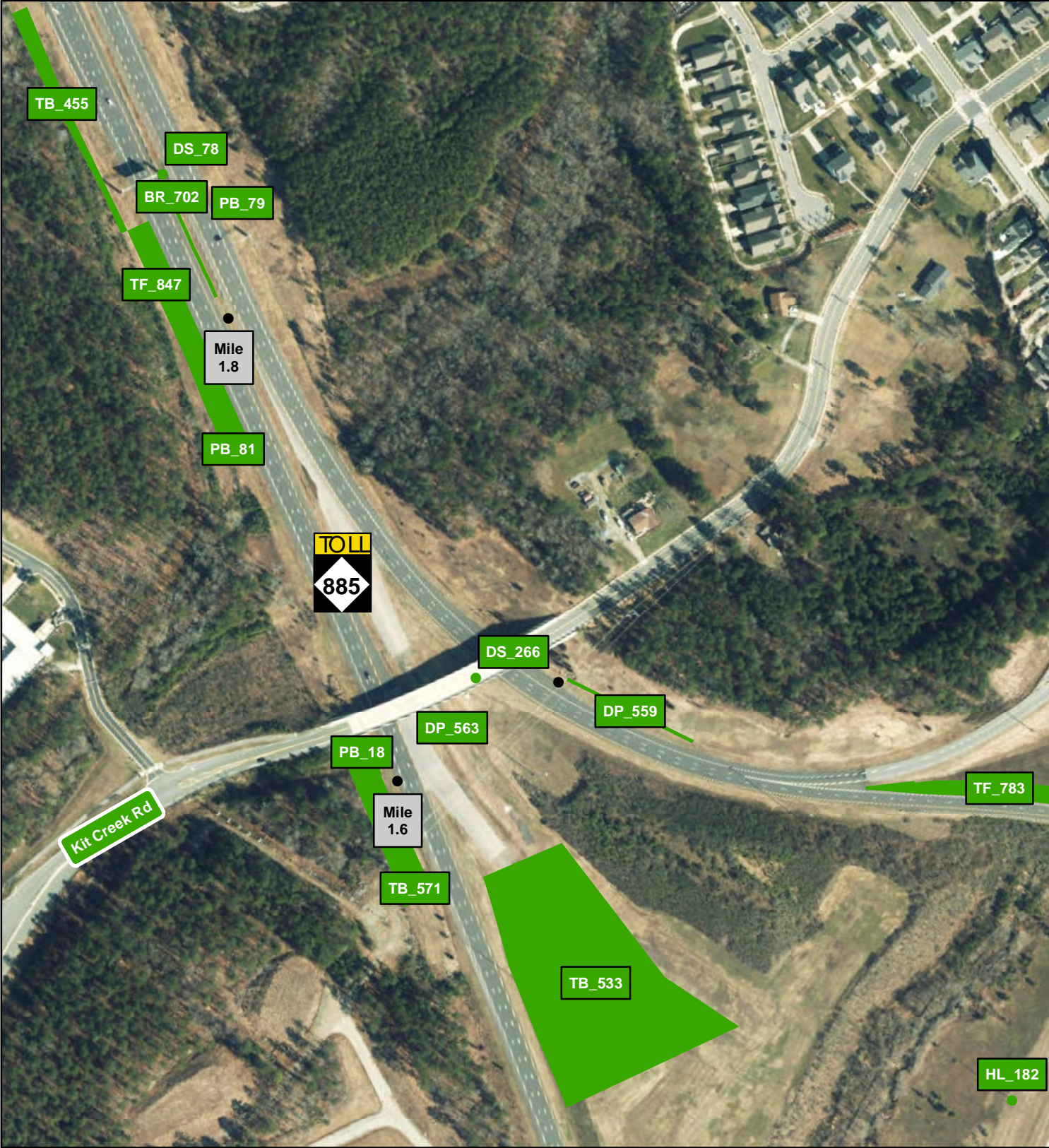
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-  Failing Asset
-  Passing Asset





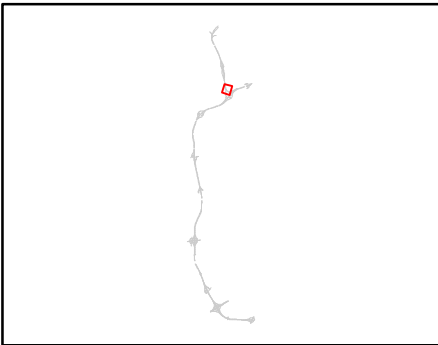


Appendix A: Triangle Expressway 2022 Fourth Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset





## **Appendix B**

**Triangle Expressway 2022 Fourth Quarter Table Results of Assets Failing MRP**

## Appendix B: Triangle Expressway 2022 Fourth 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).....	B1
Curb and Gutter (CG).....	B2
Decorative Supports (DS).....	B3
Drainage Pipes (DP).....	B4
Misc. Drainage Structure (MDP) .....	B5
Fence and Control of Access (FN) .....	B6
Graffiti (GR).....	B7
Highway Lighting (HL) .....	B8
Impact Attenuators (IA).....	B9
Inlets (IN).....	B10
Landscaping (PB).....	B11
Paved Lanes – Asphalt (LS) .....	B12
Paved Lanes – Concrete (LS).....	B12
Paved Shoulders (LS) .....	B12
Unpaved Shoulders (LS) .....	B13
Front/Back Slopes (LS) .....	B14
Unpaved Lateral and Outfall Ditches (LS) .....	B14
Litter (LS).....	B15
Roadway Sweeping (LS).....	B16
Pavement Striping (LS) .....	B17
Pavement Markers (LS) .....	B18
Delineators (LS) .....	B19
Paved Ditches (PD).....	B20
Pavement Words and Symbols (PS) .....	B21
Signs (SN) .....	B22
Tree and Brush (TB).....	B23
Turf Condition (TF) .....	B24
MSE/Retaining Walls, Sound Barrier Walls, and Screen Walls (WL) .....	B26



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

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

## Curb and Gutter (CG)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Shoulder Berm Gutter	CG_16	Misalignment		A26





## Decorative Supports (DS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Overpass Support	DS_277	Unsealed Cracks/Joints		A29
2	Overpass Support	DS_281	Unsealed Cracks/Joints		A32






## Drainage Pipes (DP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Cross Pipe	DP_380	End Protection Damage		A1
2	Drain	DP_408	Obstruction		A1



## Misc. Drainage Structure (MDP)


#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Shoulder Drain	MDP_111	Obstruction		A19
2	Shoulder Drain	MDP_118	Rodent Screen, Obstruction		A19
3	Shoulder Drain	MDP_141	Obstruction		A23



## Fence and Control of Access (FN)



#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Woven	FN_43	Fence Hole		A28
2	Woven	FN_63	Height		A5
3	Woven	FN_302	Height		A1

## Graffiti (GR)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Bridge Wall	GR_1	Graffiti		A7



## Highway Lighting (HL)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Single Roadway	HL_8	Missing Part		A28
2	High Mast	HL_203	Rodent Screen		A32


## Impact Attenuators (IA)

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



## Inlets (IN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Inlet	IN_52	Obstruction		A11

## Landscaping (PB)

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





### Paved Lanes – Asphalt (LS)

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

### Paved Lanes – Concrete (LS)


#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_342	Joint Malfunction		A4
2	Concrete	LS_343	Joint Malfunction		A4

### Paved Shoulders (LS)

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

## Unpaved Shoulders (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_521	Drop-Off		A25



### Front/Back Slopes (LS)

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

### Unpaved Lateral and Outfall Ditches (LS)

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

## Litter (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_206	Litter		A32
2	Concrete	LS_342	Litter		A4
3	Concrete	LS_343	Litter		A4
4	Asphalt	LS_768	Litter		A29



## Roadway Sweeping (LS)

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

## Pavement Striping (LS)

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





## Pavement Markers (LS)

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

## Delineators (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_203	Nighttime Reflectivity	Not Available for Nighttime Failures	A3
2	Asphalt	LS_269	Missing		A29
3	Asphalt	LS_725	Missing		A5





## Paved Ditches (PD)

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

## Pavement Words and Symbols (PS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Left Turn	PS_423	Nighttime Reflectivity	Not Available for Nighttime Failures	A1
2	Left Turn	PS_432	Nighttime Reflectivity	Not Available for Nighttime Failures	A5
3	Only	PS_509	Nighttime Reflectivity, Daytime Assessment		A5
4	Thru and Right	PS_558	Nighttime Reflectivity	Not Available for Nighttime Failures	A27
5	Thru Lane	PS_568	Nighttime Reflectivity, Daytime Assessment		A27
6	Thru and Right	PS_581	Nighttime Reflectivity	Not Available for Nighttime Failures	A27
7	Stop Bar	PS_624	Nighttime Reflectivity	Not Available for Nighttime Failures	A1



## Signs (SN)

#	Sign Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Exit	SN_405	Slip Base		A3
2	Right Lane Ends	SN_564	Night Reflectivity	Not Available for Nighttime Failures	A2
3	One Way	SN_1208	Height		A9

Tree and Brush (TB)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
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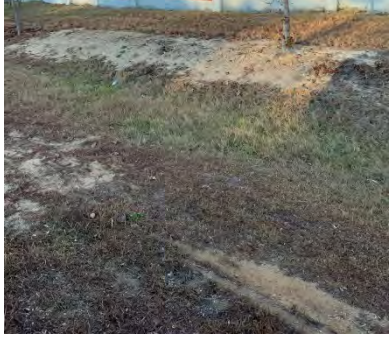

This asset did not produce any failures.



## Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Turf	TF_232	Bare Ground		A23
2	Turf	TF_240	Bare Ground		A23
3	Turf	TF_334	Bare Ground		A26
4	Turf	TF_354	Bare Ground		A23

## Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Turf	TF_449	Bare Ground		A18
6	Turf	TF_665	Bare Ground		A16



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

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Sound Wall	WL_47	Unsealed Cracks/Joints		A18
2	Bridge Wall	WL_64	Unsealed Cracks/Joints		A23
3	Sound Wall	WL_98	Unsealed Cracks/Joints		A18
4	Sound Wall	WL_101	Unsealed Cracks/Joints		A18