

# Maintenance Rating Program

## Triangle Expressway

August 2022

2022 Second Quarter Report



## CONSULTANT CERTIFICATION OF COMPLETION

August 04, 2022

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

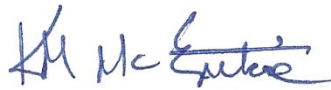
### NCTA Triangle Expressway Roadway Maintenance Performance Rating Program; Q2, FY 2022 Rating

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

A handwritten signature in blue ink, appearing to read "KM McEntire", is written over a horizontal line.

Ken M. McEntire, PE  
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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 Second Quarter Assessment of the Triangle Expressway.

The overall 2022 second quarter maintenance rating of the Triangle Expressway was **95.1**, 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 Second Quarter Assessment**

Element	MRP Rating	Target Rating
Road Surface	98.9	85.0
Unpaved Shoulders and Ditches	96.0	85.0
Drainage	94.2	85.0
Roadside	92.4	85.0
Traffic Control Devices	93.4	85.0
<b>Overall MRP Performance Rating</b>	<b>95.1</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 **93.7**.

**Table 2: MRP Rolling Element Results**

Element	Q3 2021 Rating	Q4 2021 Rating	Q1 2022 Rating	Q2 2022 Rating	Rolling Rating
Road Surface	100.0 <sup>1</sup>	98.4	95.7	98.9	98.3
Unpaved Shoulders and Ditches	96.8	98.9	98.7	96.0	97.6
Drainage	92.5	91.7	92.0	94.2	92.6
Roadside	91.6	92.4	94.0	92.4	92.6
Traffic Control Devices	86.5 <sup>1</sup>	87.8	92.1 <sup>2</sup>	93.4 <sup>2</sup>	89.5 <sup>3</sup>
<b>Overall MRP Performance Rating</b>	<b>93.0<sup>1</sup></b>	<b>93.3</b>	<b>94.2<sup>2</sup></b>	<b>95.1<sup>2</sup></b>	<b>93.7<sup>3</sup></b>

<sup>1</sup>Excludes asphalt surface pavement condition as well as markers, striping, and symbols on mainline NC-885 and all ramps/loops.

<sup>2</sup>Excludes concrete surface pavement markers, striping, and symbols on mainline NC-540 and asphalt surface markers on mainline NC-885.

<sup>3</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 one of 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.

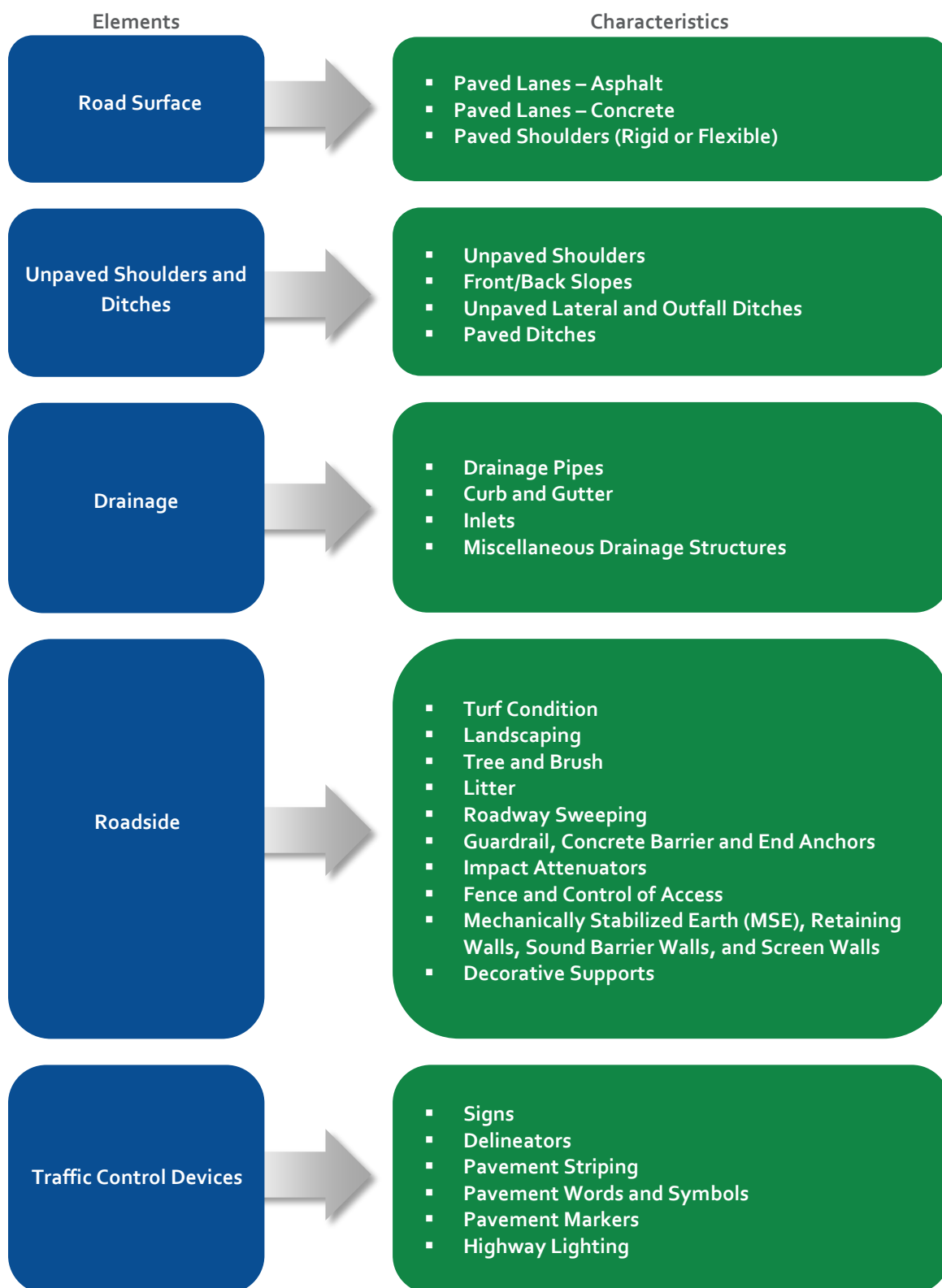
The NCTA performance standards, threshold criteria, and maintenance rating program were developed through a collaborative effort by NCTA managers, NCDOT maintenance staff, and consultants.

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 Second Quarter Assessment

### 6.1 Quarterly Results

The overall 2022 second quarter maintenance rating of the Triangle Expressway was 95.1, 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 second 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 second quarter MRP performance ratings for elements and characteristics are presented in **Table 4** and **Table 5**, respectively.

**Table 4: MRP Element Results for Q2 2022**

Element	MRP Rating
Road Surface	98.9
Unpaved Shoulders and Ditches	96.0
Drainage	94.2
Roadside	92.4
Traffic Control Devices	93.4
Overall MRP Performance Rating	95.1



Table 5: MRP Characteristics Results for Q2 2022

Road Surface	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q2 Rating
Paved Lanes Asphalt	15	15	9	135	135	100
Paved Lanes Concrete	16	16	9	144	144	100
Paved Shoulder	31	32	5	155	160	97
<b>Element Total</b>				<b>434</b>	<b>439</b>	<b>98.9</b>
Unpaved Shoulders and Ditches	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q2 Rating
Unpaved Shoulder	29	32	9	261	288	91
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>655</b>	<b>682</b>	<b>96.0</b>
Drainage	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q2 Rating
Drainage Pipes	35	36	7	245	252	97
Curb and Gutter	26	28	6	156	168	93
Inlets	31	33	7	217	231	94
Misc. Drainage Structure	28	31	4	112	124	90
<b>Element Total</b>				<b>730</b>	<b>775</b>	<b>94.2</b>
Roadside	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q2 Rating
Turf Condition	41	49	7	287	343	84
Landscaping	25	25	4	100	100	100
Trees and Brush	31	31	4	124	124	100
Litter	32	32	4	128	128	100
Roadway Sweeping	32	32	5	160	160	100
Guardrail, Concrete Barrier, and End Anchors	29	33	9	261	297	88
Impact Attenuators	9	9	9	81	81	100
Fence, Control Access	29	33	7	203	231	88
Retaining Walls and Sound Barrier Walls	12	16	5	60	80	75
Decorative Supports	26	26	5	130	130	100
Graffiti and Stain Removal	44	44	4	176	176	100
<b>Element Total</b>				<b>1710</b>	<b>1850</b>	<b>92.4</b>
Traffic Control Devices	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q2 Rating
Signs	33	34	7	231	238	97
Delineators	30	32	3	90	96	94
Pavement Striping/Marking	15	15	8	120	120	100
Words and Symbols	27	31	7	189	217	87
Pavement Markers	11	13	9	99	117	85
Highway Lighting	33	34	6	198	204	97
<b>Element Total</b>				<b>927</b>	<b>992</b>	<b>93.4</b>

Additionally, **Appendix A** includes maps that present the location of all assets assessed during the second 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 second quarter, all elements exceeded NCTA's quarter score threshold criteria of 85. Furthermore, all elements received a quarter score above 90.

Road Surface (98.9) experienced an increase in rolling rating 0.6 points higher than the previous quarter's rolling rating. Asphalt resurfacing was completed in September of 2021.

Unpaved Shoulders and Ditches (96.0) experienced a decrease in rolling rating. The rating for this element was 0.8 points lower than the previous quarter rolling rating. All characteristics within this element continued scoring above 90.

Drainage (94.2) rolling rating stayed consistent with the previous quarter rolling rating. Misc. Drainage Pipes (90) rolling rating increased from last quarter by 2.0 points, continuing to score above the target rating.

Roadside (92.4) decreased 0.8 points from the previous quarter's rolling rating. Turf Condition (84) experienced a decrease in rolling ratings from last quarter by 1.9 points. Retaining Walls and Sound Barrier Walls (75) experienced a decrease in rolling rating of 4.7 points.

Traffic Control Devices (93.4) experienced a decrease in rolling rating of 0.1 points from the previous quarter. Pavement Markers (88) and Pavement Striping/Marking (94) experienced a decrease in rolling rating of 2.5 and 1.3 points respectively. Repaving and subsequent striping of all asphalt lanes was completed in September 2021. Replacement of striping and markers for the remaining concrete sections is scheduled to start in 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): Three of the four wall sections that did not pass inspection had unsealed joints and scaling. 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

The rolling maintenance rating of the Triangle Expressway was **93.7**, exceeding NCTA’s target overall rating of **90**. All elements exceeded NCTA’s rolling rating threshold criteria of 85. All characteristic ratings met or exceeded the target rating of 80.

The 2021/2022 results are presented in **Exhibit 1** and **Table 6**. These results are a collection of the four quarterly inspections conducted in the last year.

**Exhibit 1: MRP Element Results for 2021/2022**

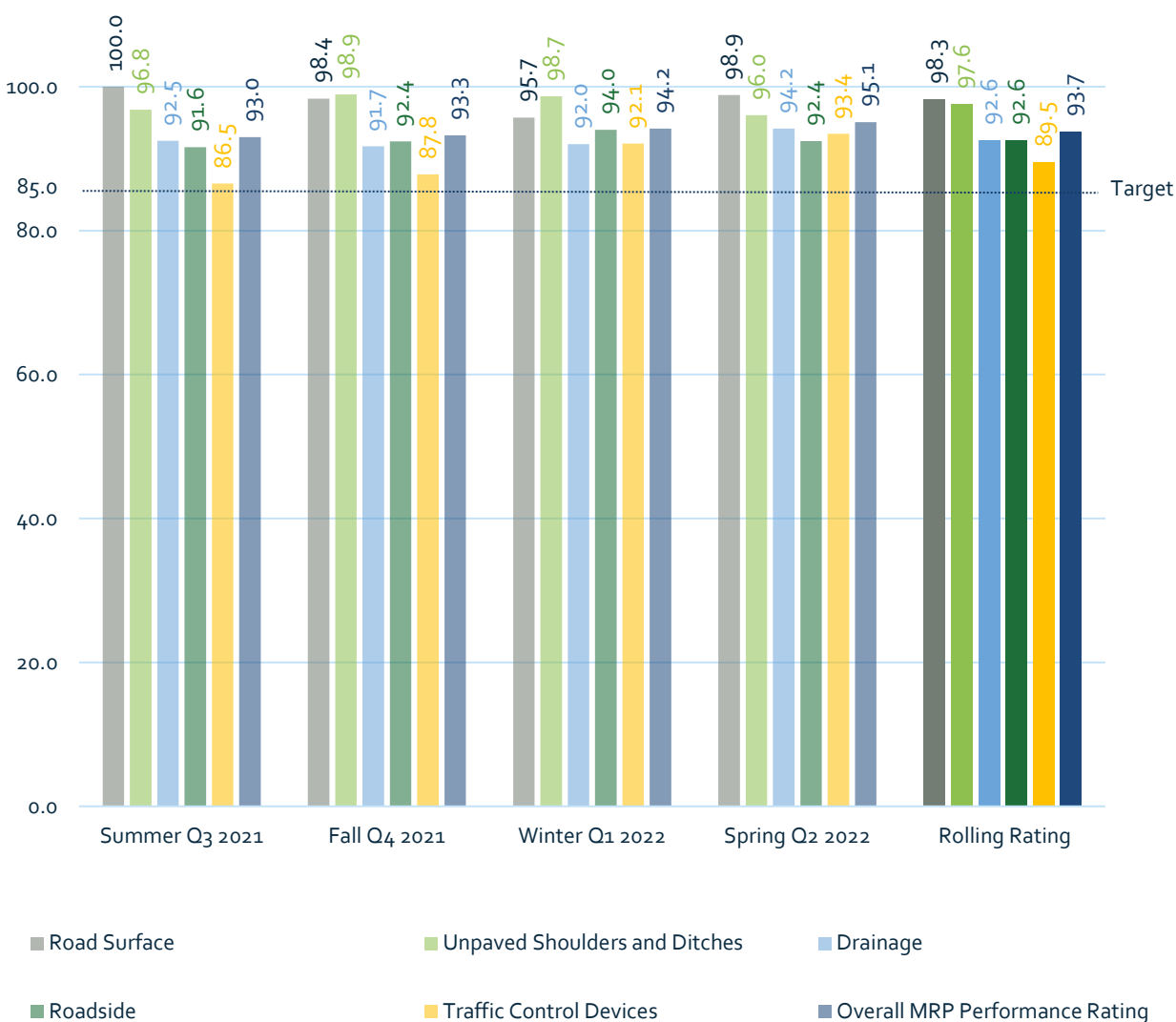


Table 6: MRP Rolling Element Results

Road Surface	Q3 2021 Rating	Q4 2021 Rating	Q1 2022 Rating	Q2 2022 Rating	Rolling Rating
Paved Lanes Asphalt	100 <sup>1</sup>	93	94	100	96
Paved Lanes Concrete	100	100	92	100	99
Paved Shoulder	100 <sup>1</sup>	100	100	97	99
Element Total	100.0 <sup>1</sup>	98.4	95.7	98.9	98.3
Unpaved Shoulders and Ditches	Q3 2021 Rating	Q4 2021 Rating	Q1 2022 Rating	Q2 2022 Rating	Rolling Rating
Unpaved Shoulder	93	97	97	91	94
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	96.8	98.9	98.7	96.0	97.6
Drainage	Q3 2021 Rating	Q4 2021 Rating	Q1 2022 Rating	Q2 2022 Rating	Rolling Rating
Drainage Pipes	91	91	88	97	92
Curb and Gutter	100	100	92	93	96
Inlets	95	89	97	94	94
Misc. Drainage Structure	80	86	90	90	87
Element Total	92.5	91.7	92.0	94.2	92.6
Roadside	Q3 2021 Rating	Q4 2021 Rating	Q1 2022 Rating	Q2 2022 Rating	Rolling Rating
Turf Condition	75	88	94	84	85
Landscaping	100	100	100	100	100
Trees and Brush	100	97	100	100	99
Litter	95	92	97	100	96
Roadway Sweeping	100	97	97	100	99
Guardrail, Concrete Barrier, and End Anchors	97	94	88	88	91
Impact Attenuators	100	89	100	100	97
Fence, Control Access	93	84	91	88	89
Retaining Walls and Sound Barrier Walls	69	81	75	75	75
Decorative Supports	100	100	100	100	100
Graffiti and Stain Removal	98	100	98	100	99
Element Total	91.6	92.4	94.0	92.4	92.6
Traffic Control Devices	Q3 2021 Rating	Q4 2021 Rating	Q1 2022 Rating	Q2 2022 Rating	Rolling Rating
Signs	88	97	91	97	93
Delineators	80	77	81	94	83
Pavement Striping/Marking	70 <sup>1</sup>	69	95 <sup>2</sup>	100 <sup>2</sup>	79 <sup>3</sup>
Words and Symbols	87 <sup>1</sup>	90	97 <sup>2</sup>	87 <sup>2</sup>	90 <sup>3</sup>
Pavement Markers	100 <sup>1</sup>	100	82 <sup>2</sup>	85 <sup>2</sup>	95 <sup>3</sup>
Highway Lighting	90	88	97	97	93
Element Total	86.5 <sup>1</sup>	87.8	92.1 <sup>2</sup>	93.4 <sup>2</sup>	89.5 <sup>3</sup>

<sup>1</sup> Excludes asphalt surface pavement condition as well as markers, striping, and symbols on mainline NC-885 and all ramps/loops.

<sup>2</sup> Excludes concrete surface pavement markers, striping, and symbols on mainline NC-540 and asphalt surface markers on mainline NC-885.

<sup>3</sup> Excludes the indicated quarter ratings for characteristics listed above.

## 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. Of the two landscaped areas, one was well maintained while the other was overgrown and partially obstructed the sign text. **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 second 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 second quarter 2022 overall rating was 95.1 and the rolling rating was 93.7, both ratings met the target rating of 90.

All element ratings were above the target ratings for the quarter and rolling assessment. During the second 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 to begin in 2023.

This quarter, the two Green Level Historic District signs inspected were found to be in good condition. The landscaped area surrounding one of the two signs was found to be overgrown and in need of maintenance. The landscape area around the other sign on Green Level Church Road was found to be well maintained.

## **Appendix A**

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



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



## Legend



Failing Asset

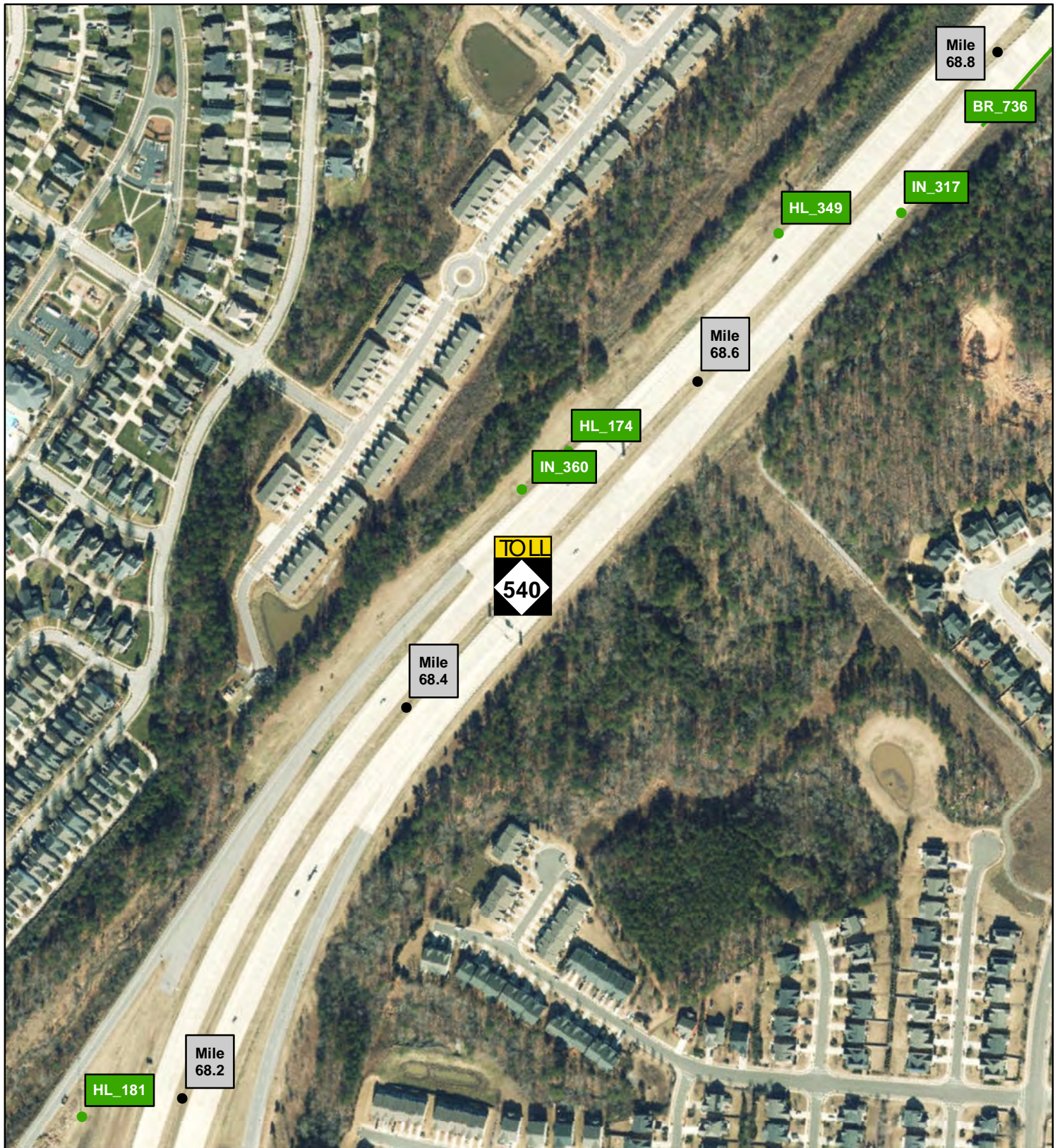


Passing Asset





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



## Legend



Failing Asset

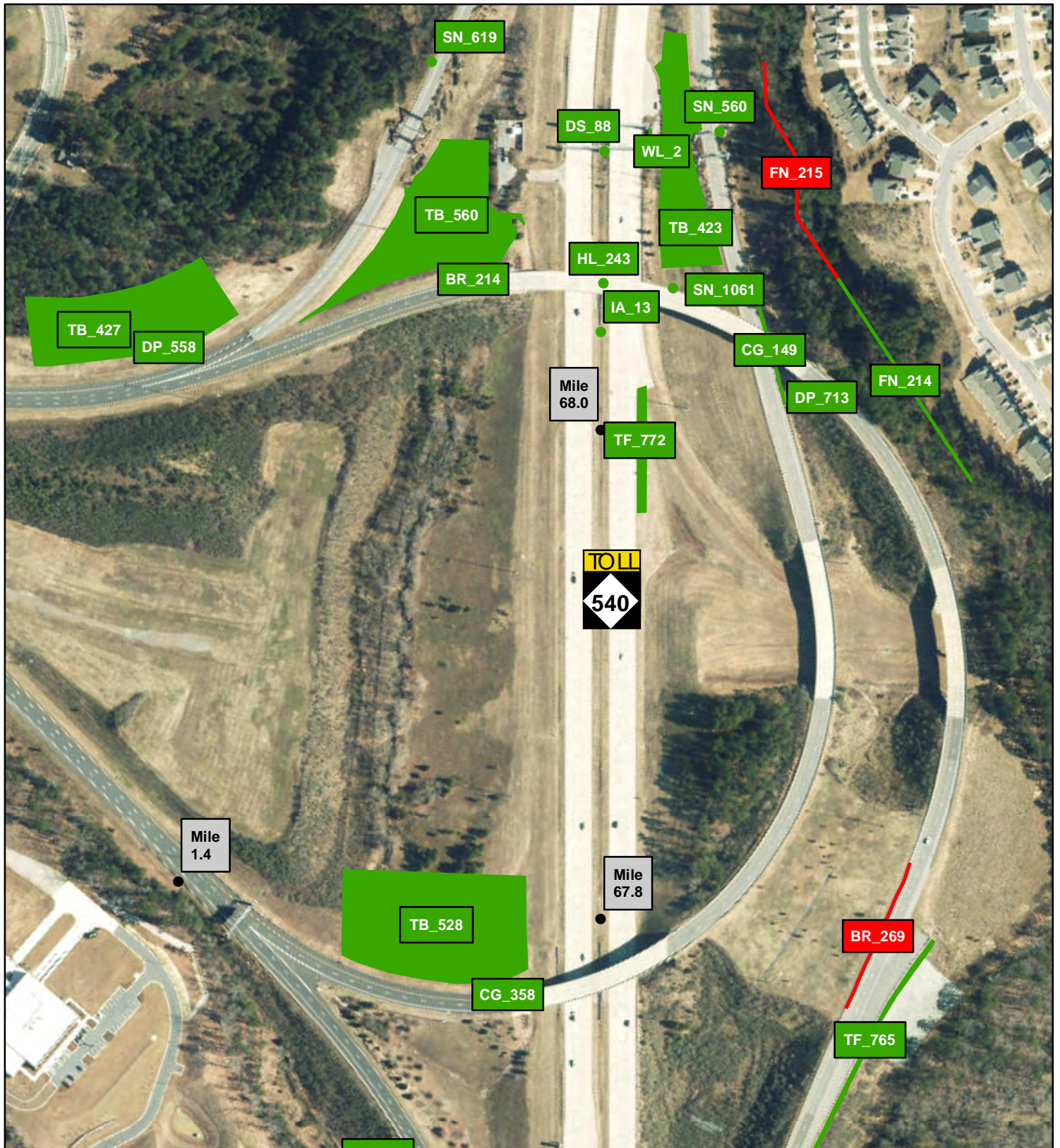


Passing Asset





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



## Legend



Failing Asset

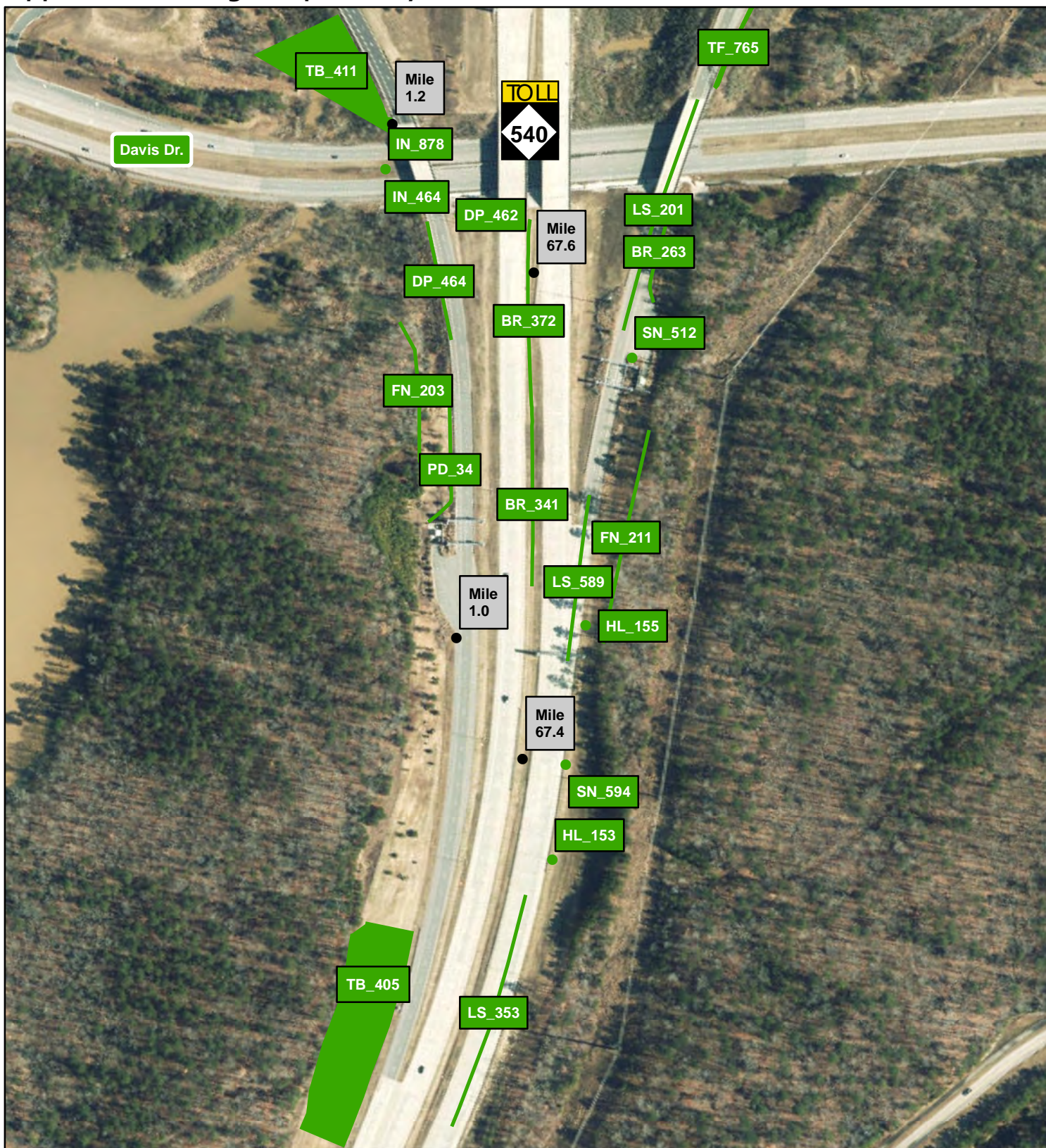


Passing Asset





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



## Legend

- Failing Asset
- Passing Asset







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



## Legend

-  Failing Asset
-  Passing Asset







Appendix A: Triangle Expressway 2022 Second Quarter Asset Assessment Locations



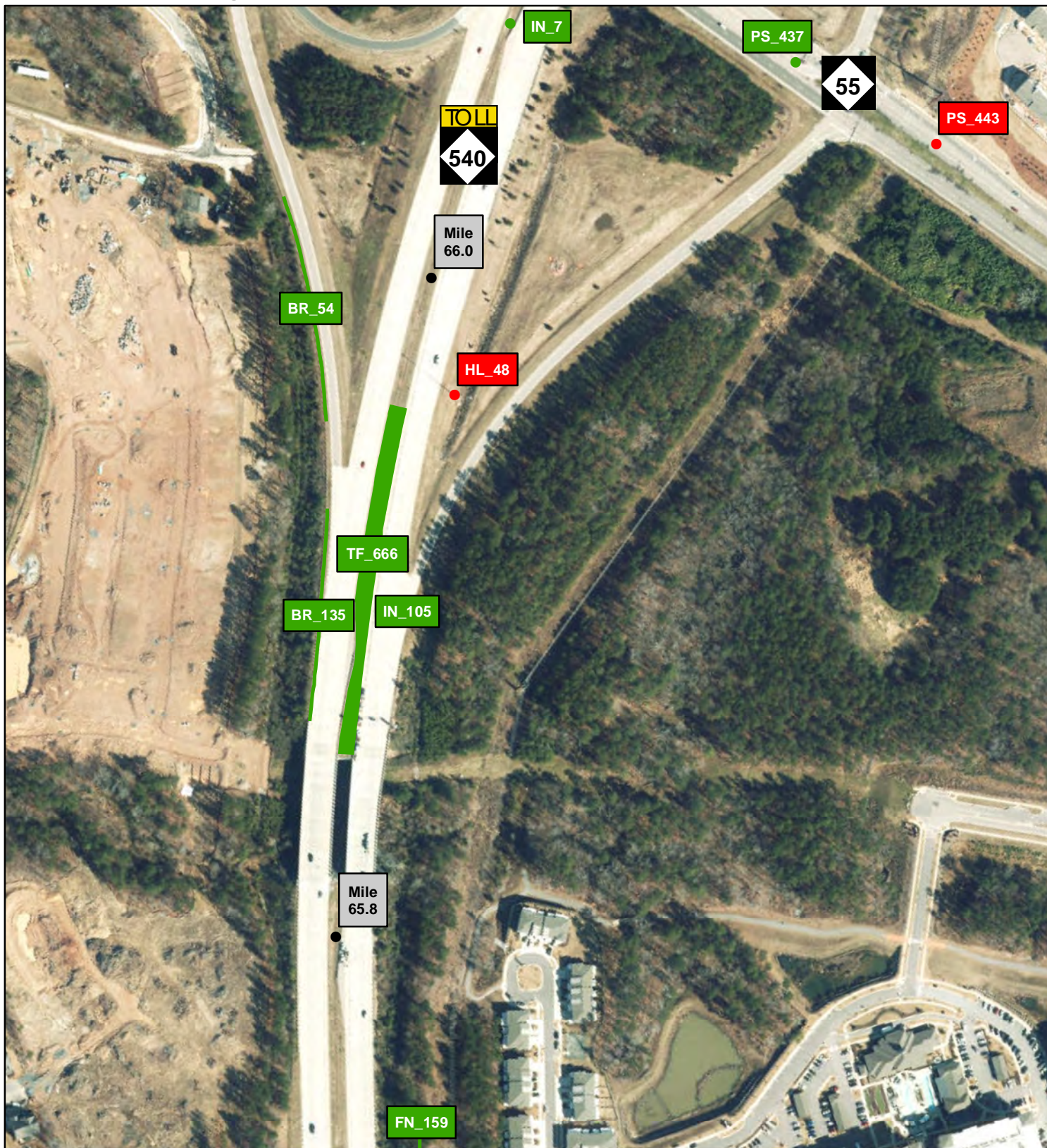
Legend

-  Failing Asset
-  Passing Asset





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



## Legend



Failing Asset

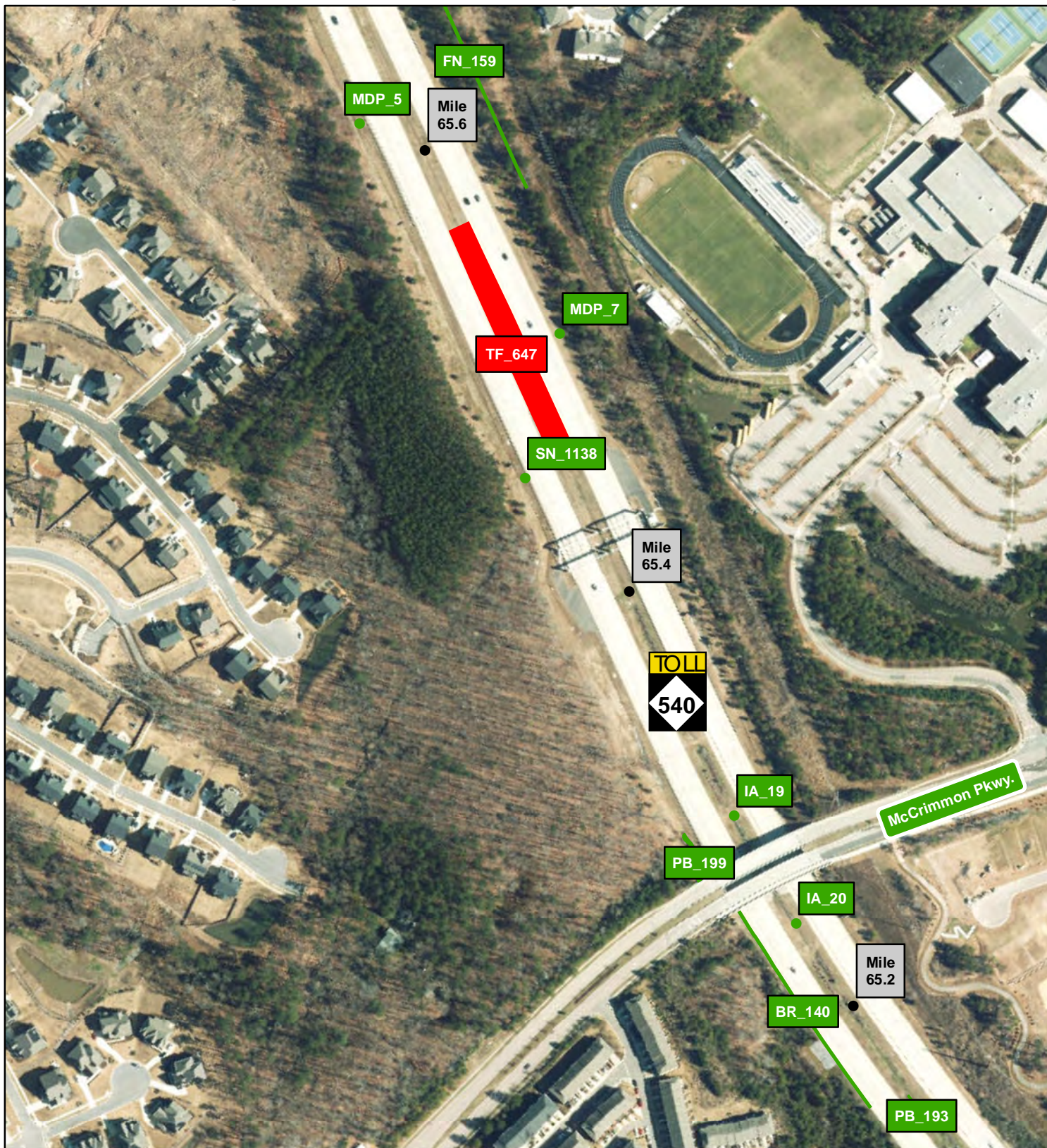


Passing Asset





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



## Legend



Failing Asset

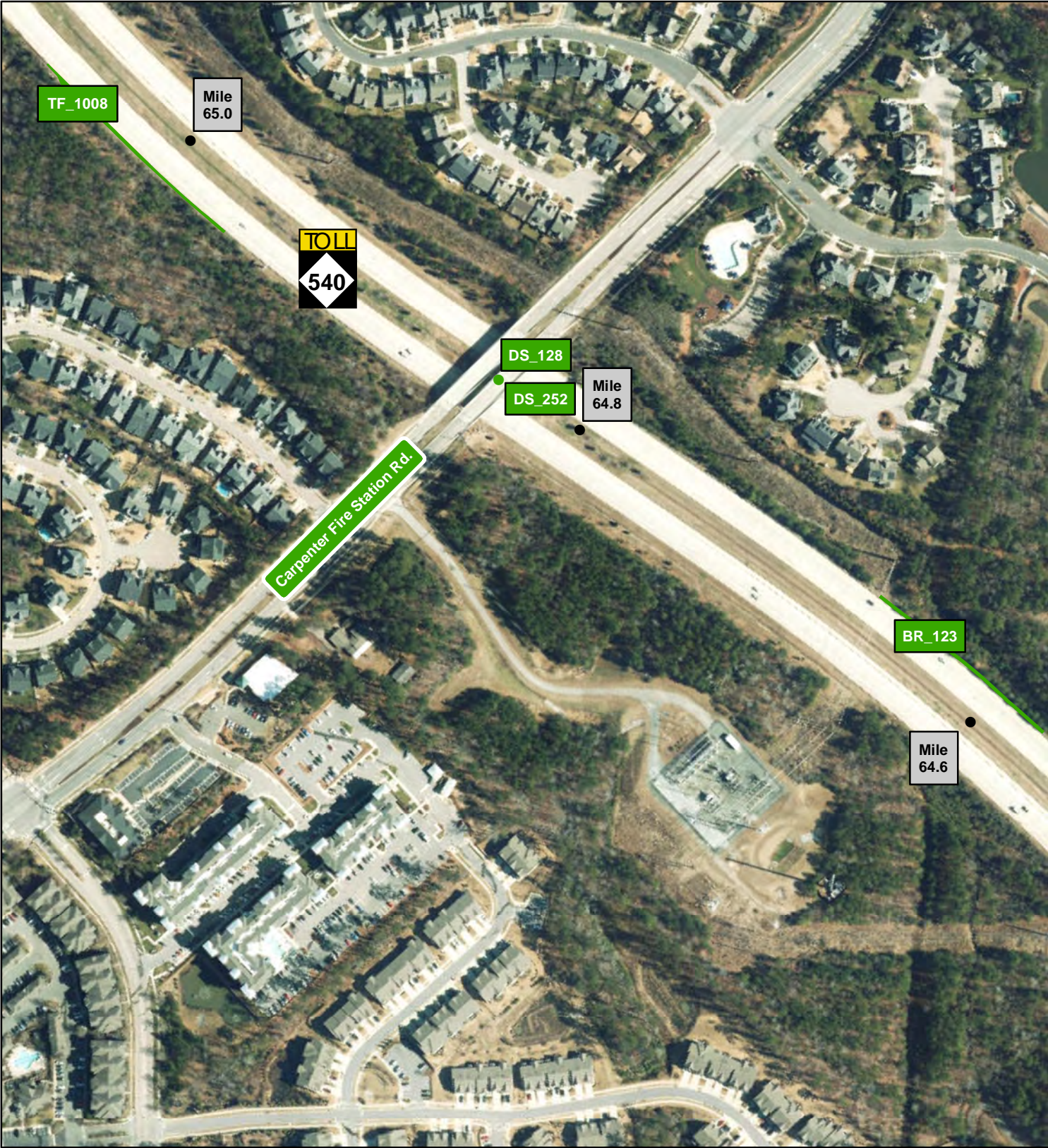






Passing Asset





Appendix A: Triangle Expressway 2022 Second Quarter Asset Assessment Locations



<p><b>Legend</b></p> <p> Failing Asset</p> <p> Passing Asset</p>		 <p>A9</p>
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# Appendix A: Triangle Expressway 2022 Second Quarter Asset Assessment Locations



## Legend



Failing Asset



Passing Asset





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



## Legend



Failing Asset

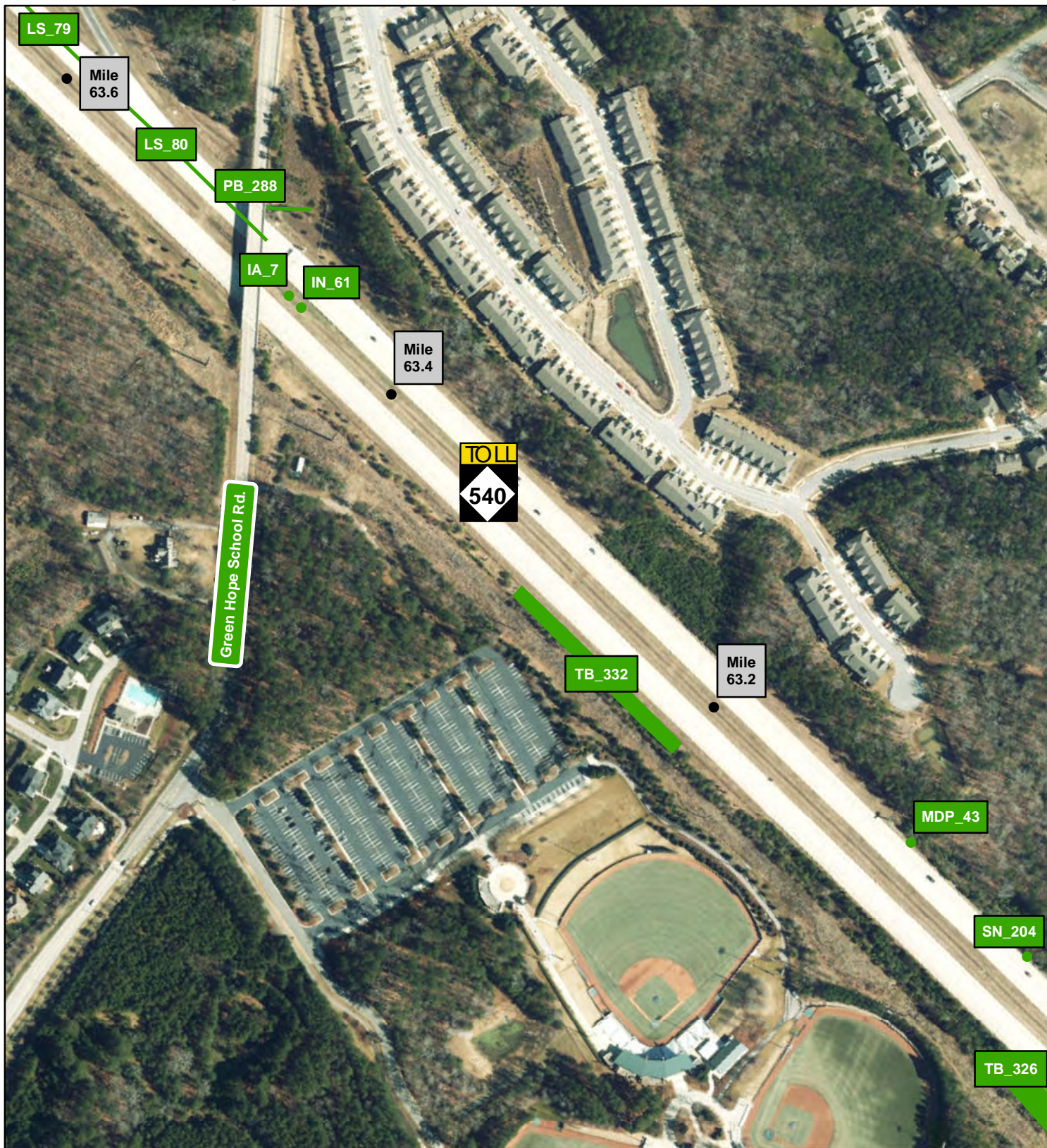


Passing Asset





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



## Legend



Failing Asset



Passing Asset





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



## Legend



Failing Asset



Passing Asset





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



## Legend



Failing Asset

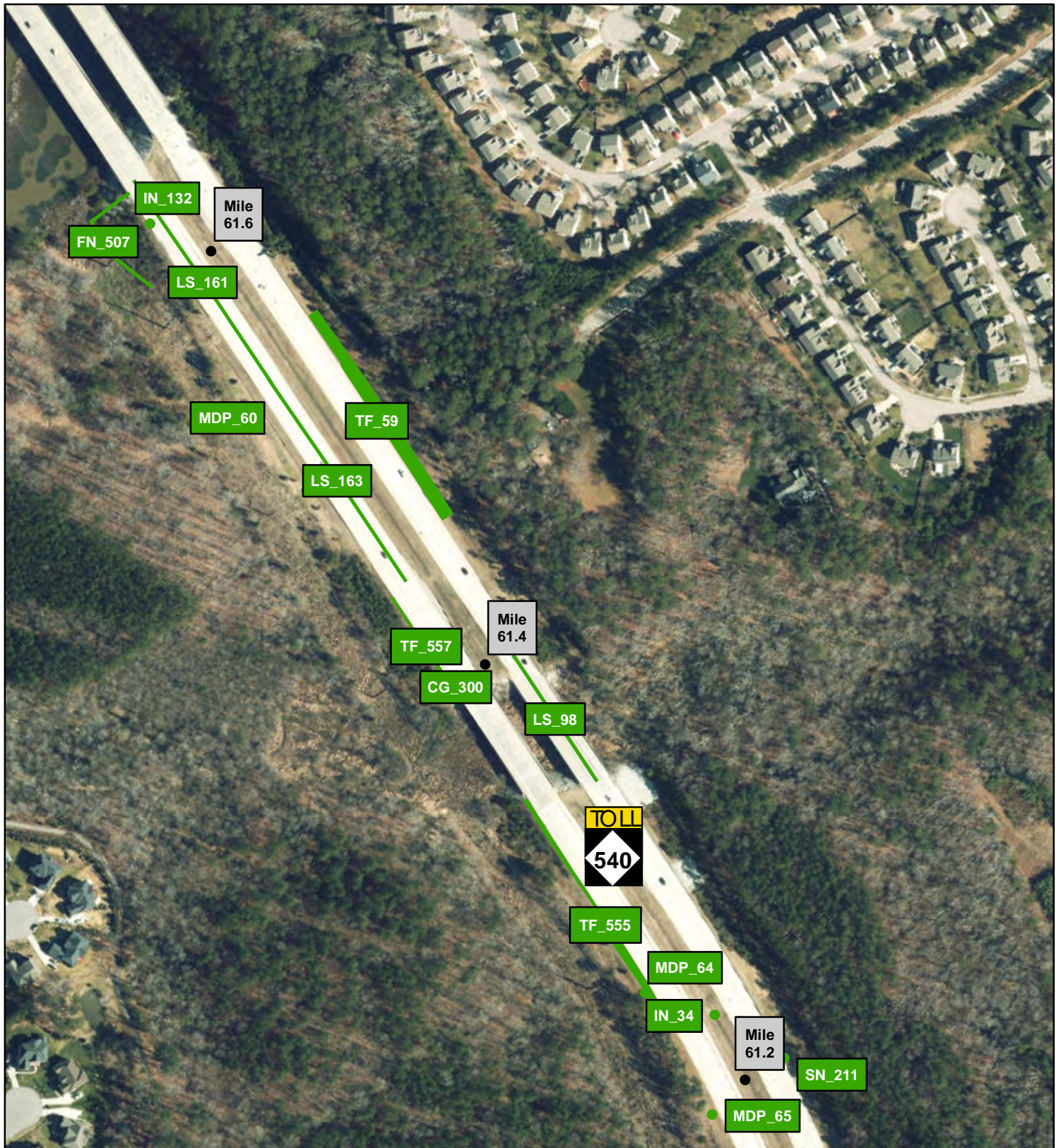


Passing Asset





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



## Legend



Failing Asset

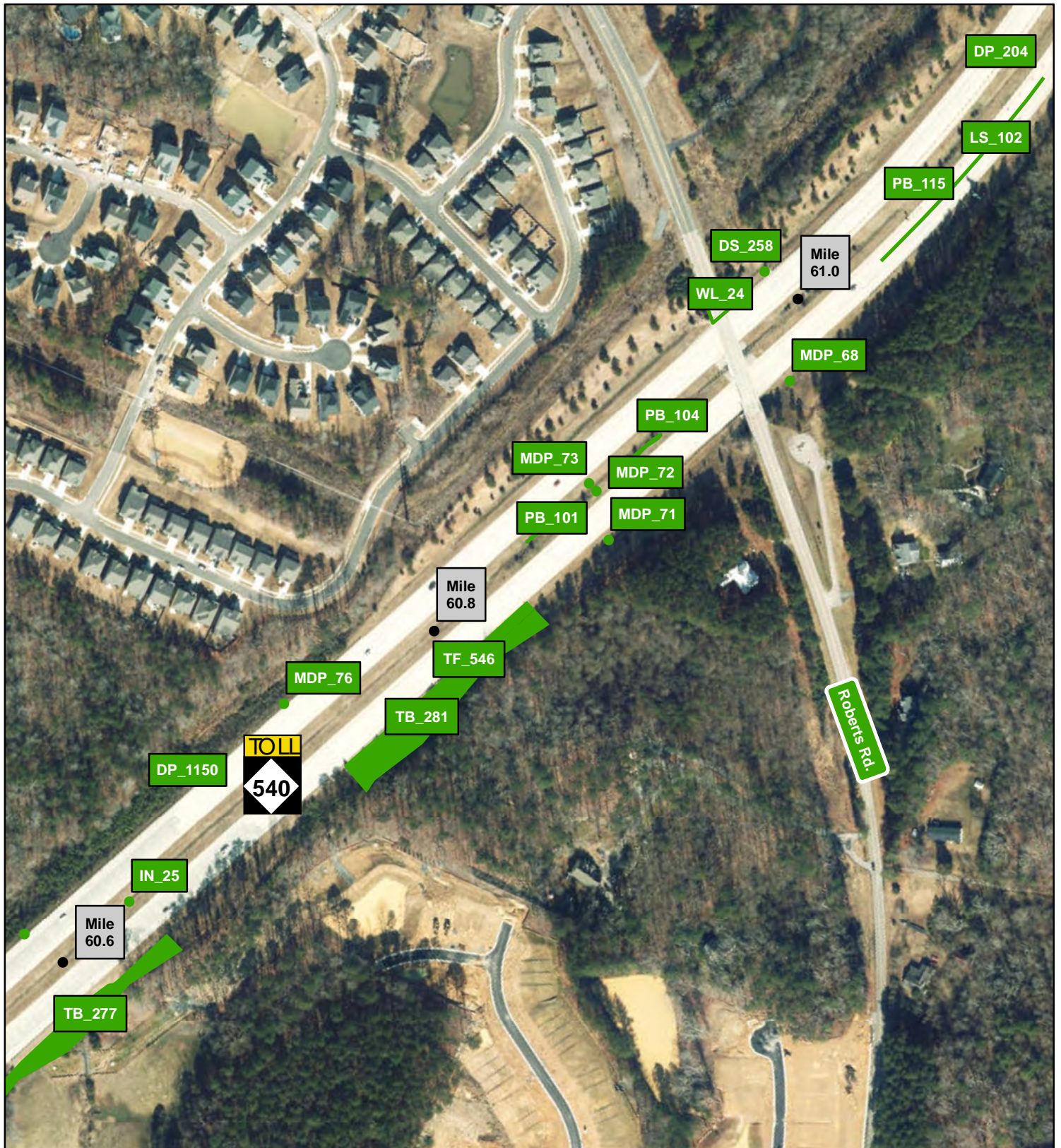


Passing Asset





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



## Legend



Failing Asset

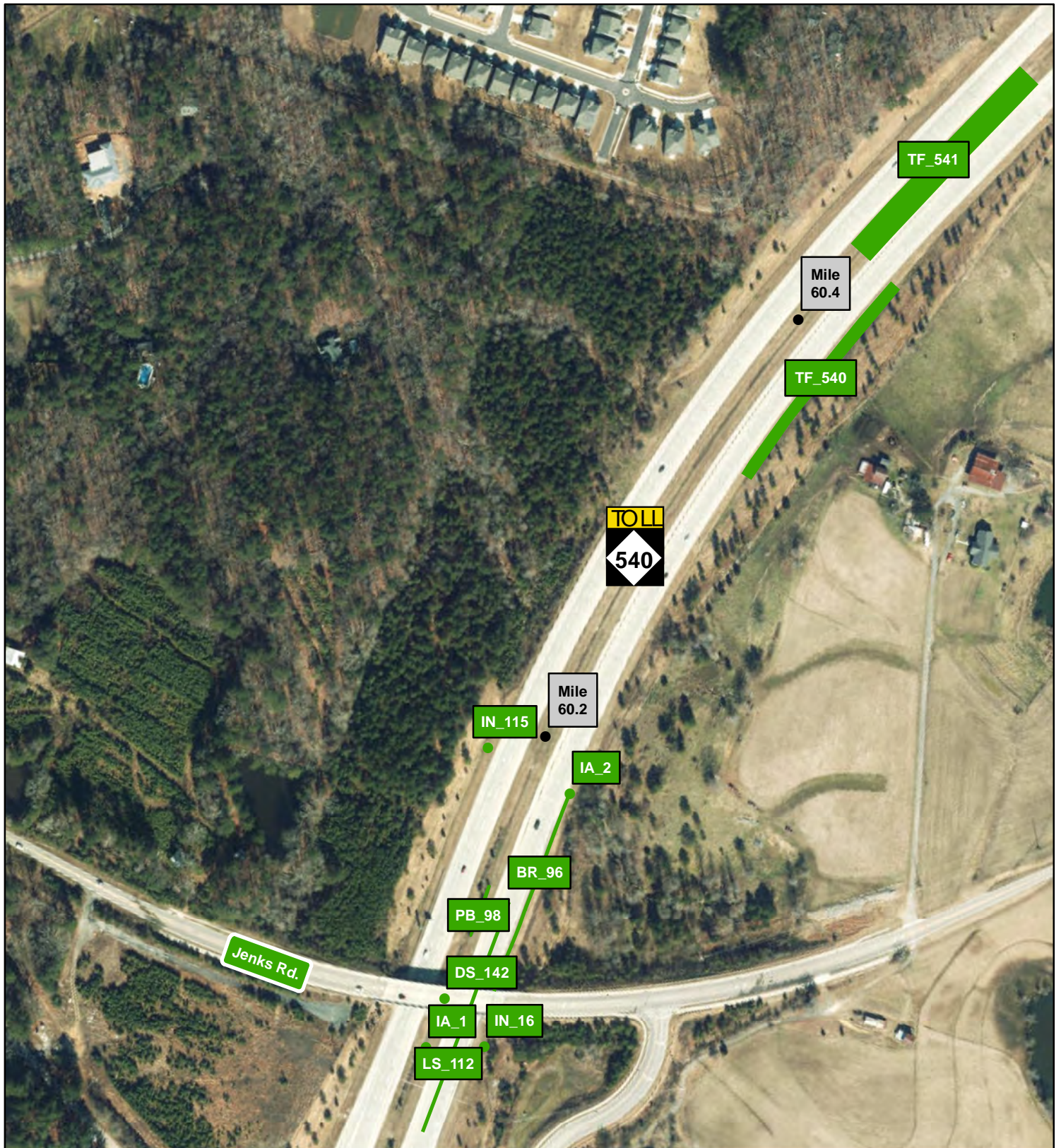


Passing Asset





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



## Legend



Failing Asset

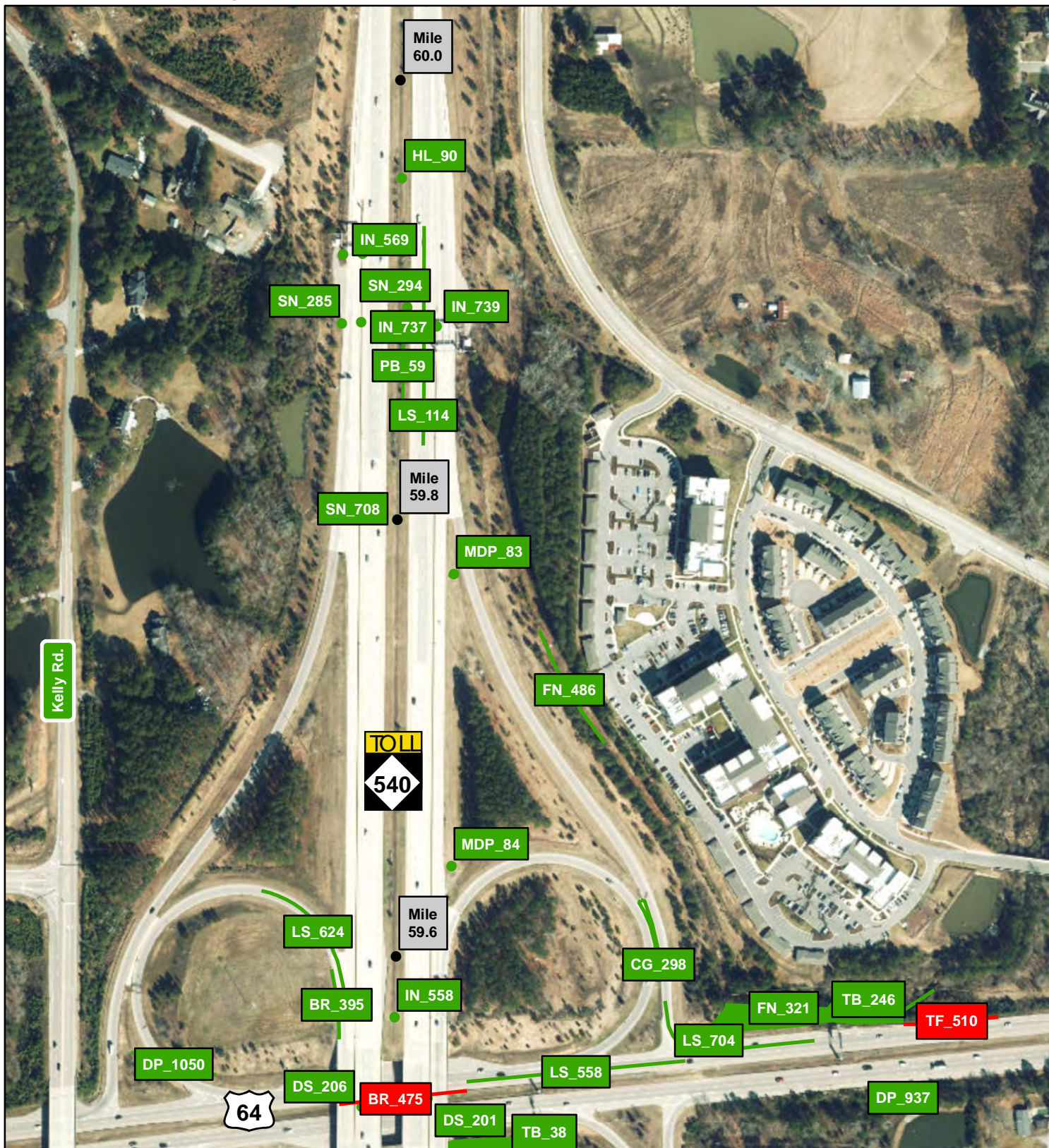


Passing Asset





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



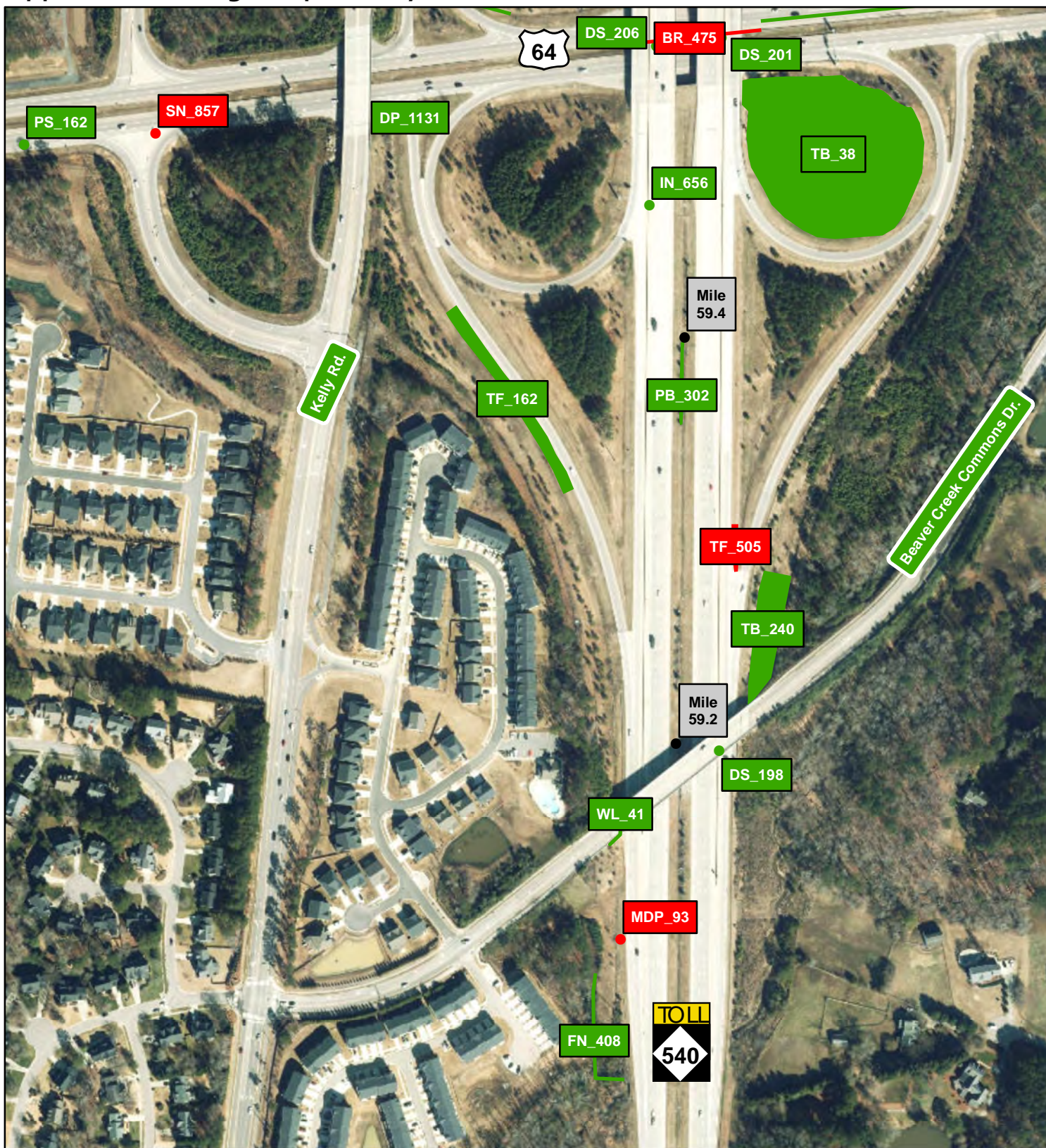
## Legend

- Failing Asset
- Passing Asset





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



## Legend



Failing Asset

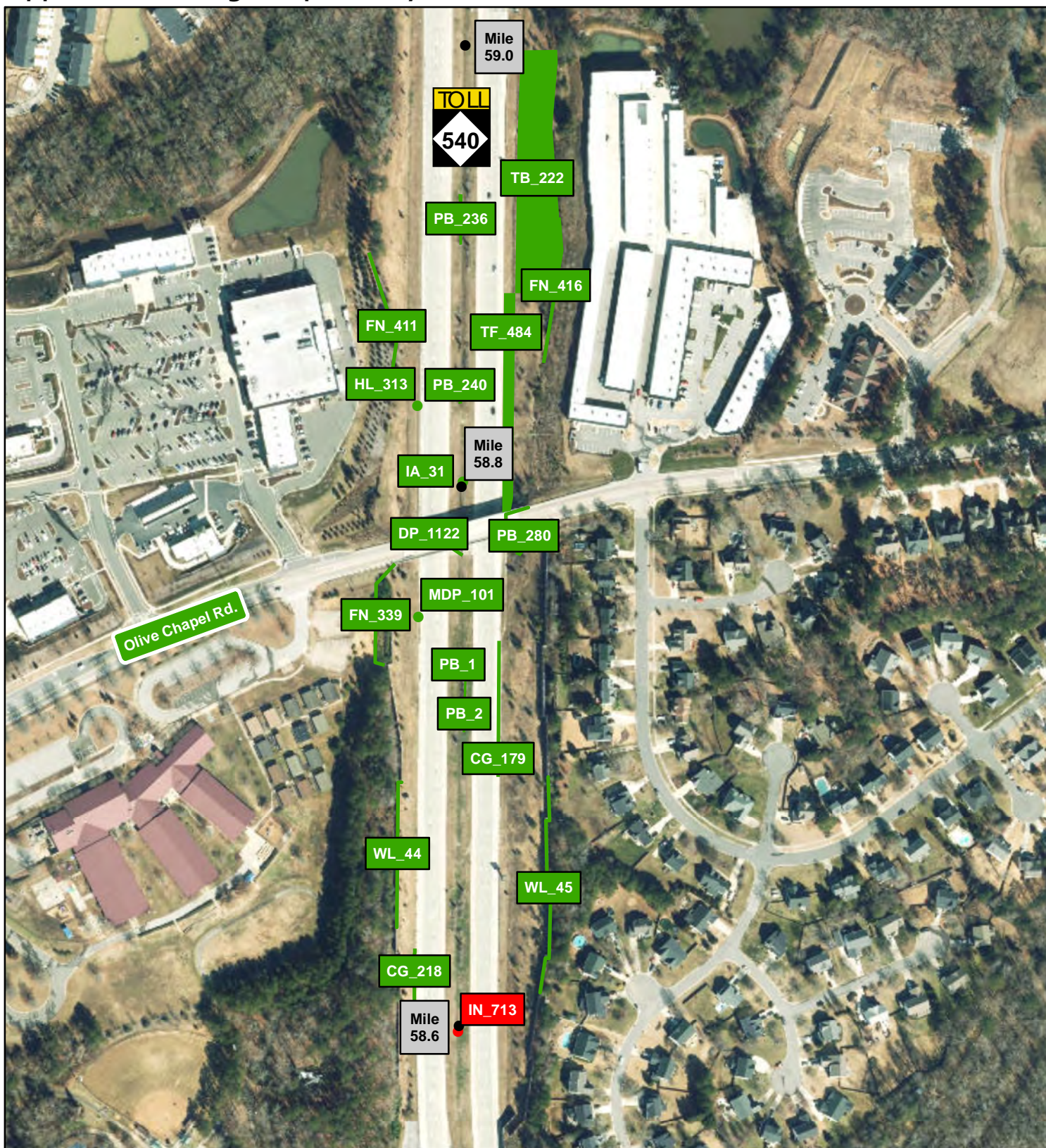


Passing Asset





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



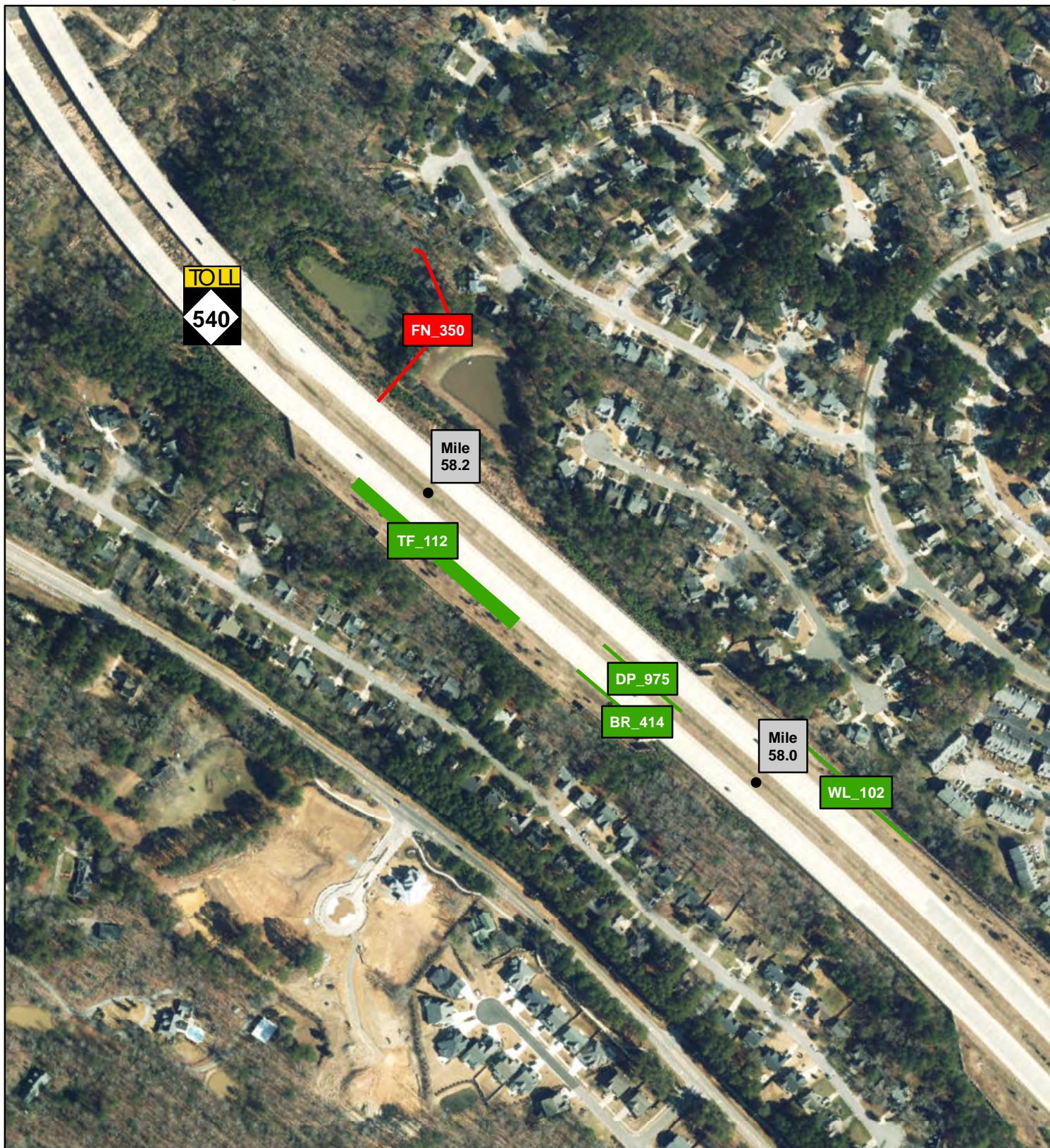
## Legend

- Failing Asset
- Passing Asset





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



## Legend



Failing Asset

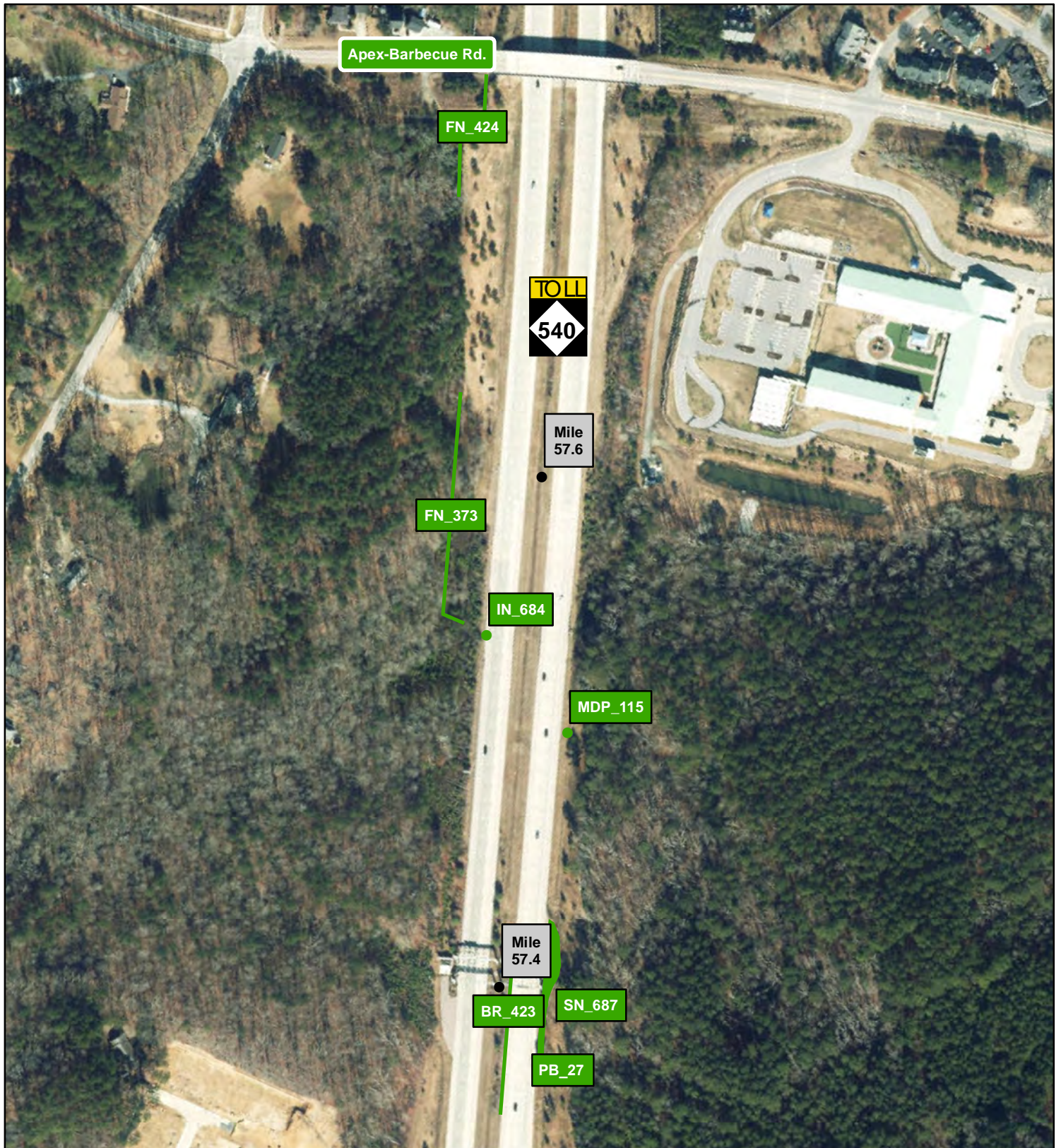


Passing Asset





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



## Legend



Failing Asset



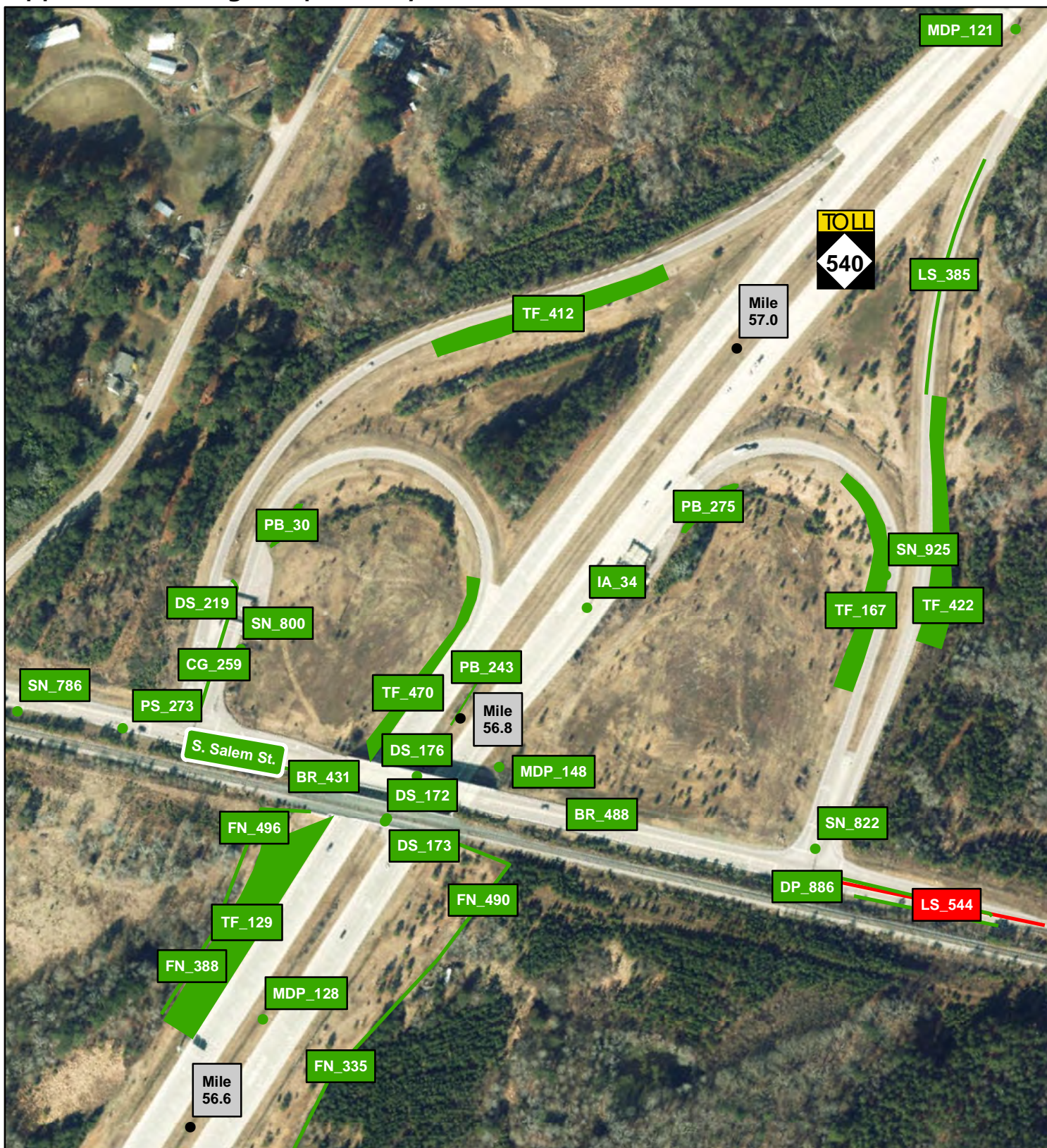
Passing Asset



NORTH CAROLINA  
Turnpike Authority



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



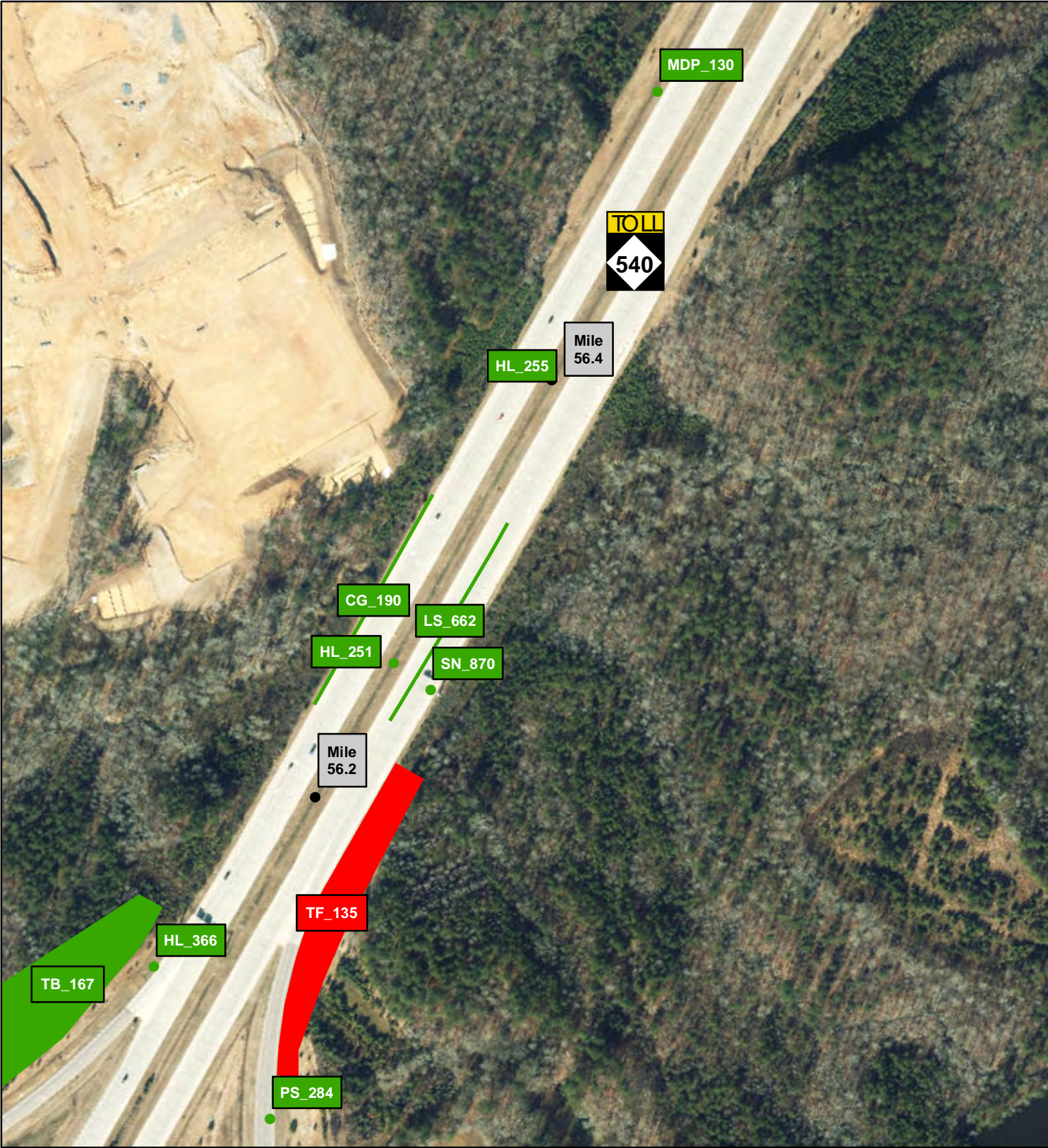
## Legend

- Failing Asset
- Passing Asset





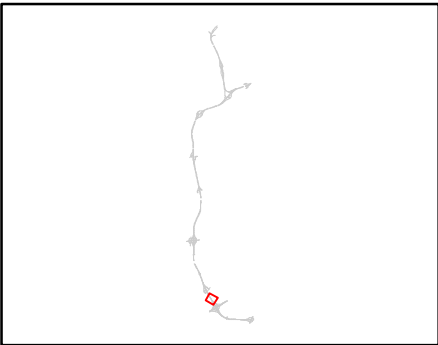


Appendix A: Triangle Expressway 2022 Second Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset





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



## Legend



Failing Asset



Passing Asset





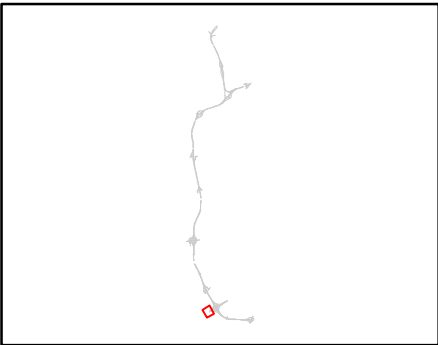


Appendix A: Triangle Expressway 2022 Second Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset





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



### Legend



Failing Asset

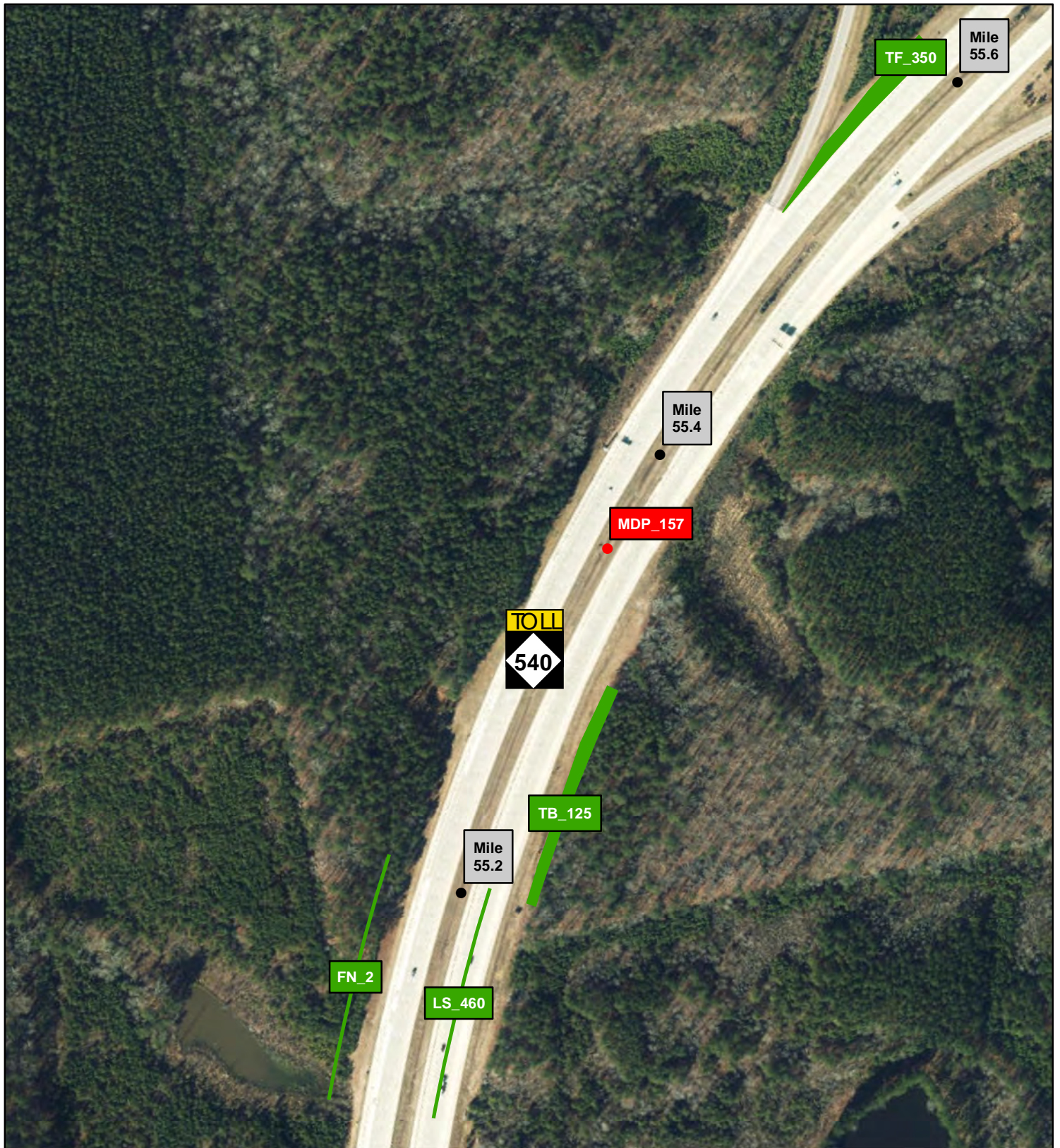


Passing Asset





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



## Legend



Failing Asset

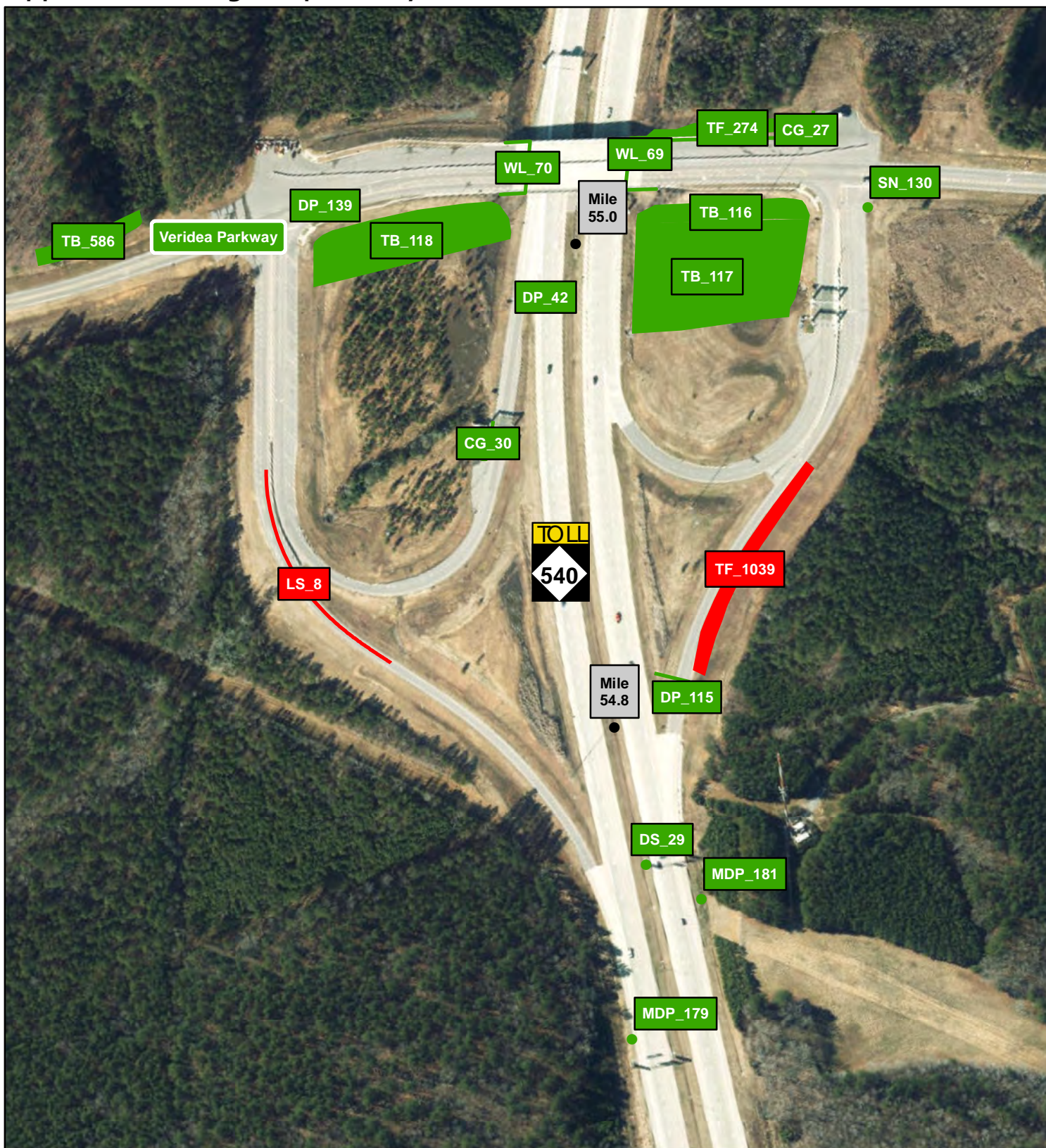


Passing Asset





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



## Legend



Failing Asset

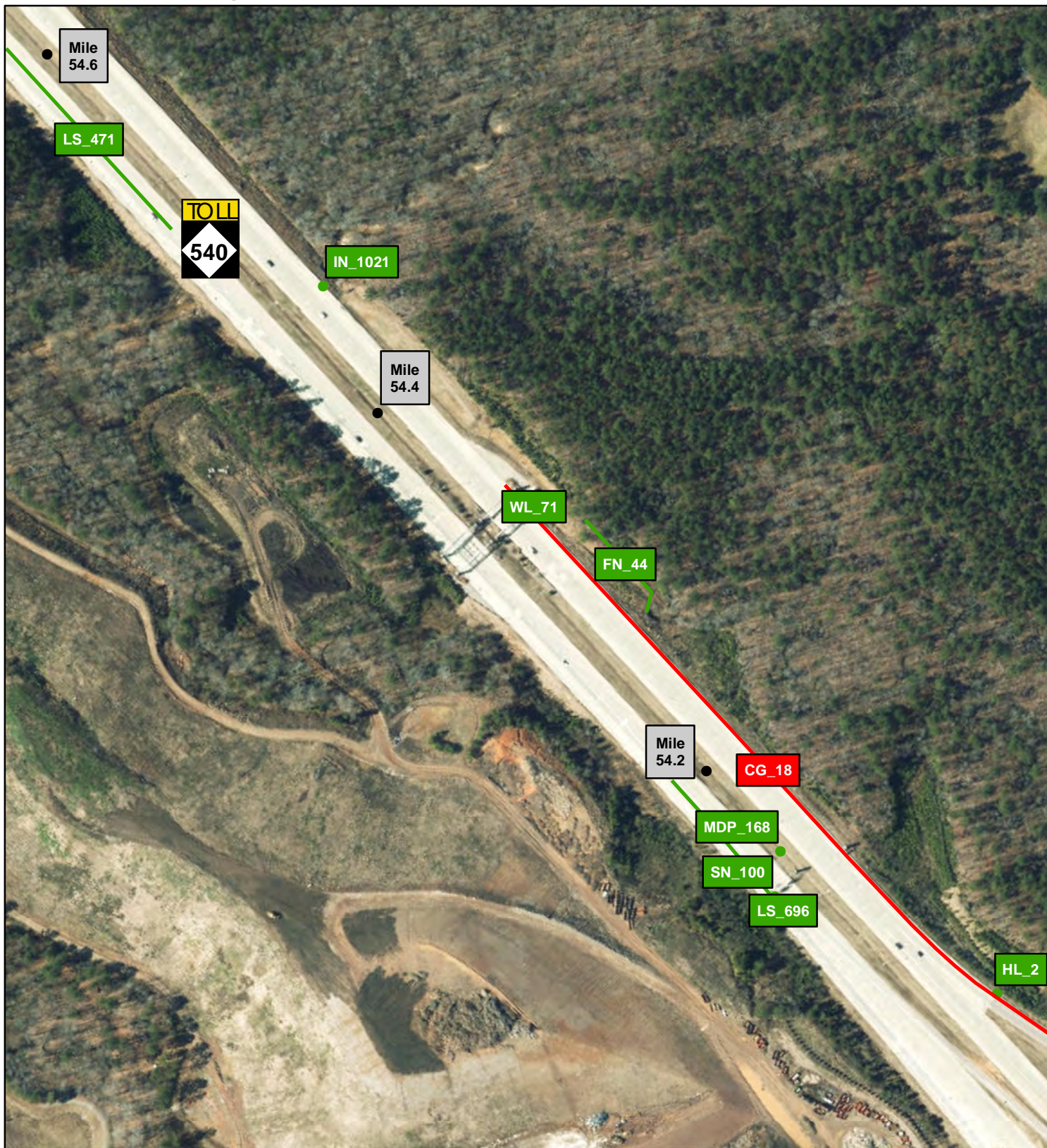


Passing Asset





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



## Legend



Failing Asset

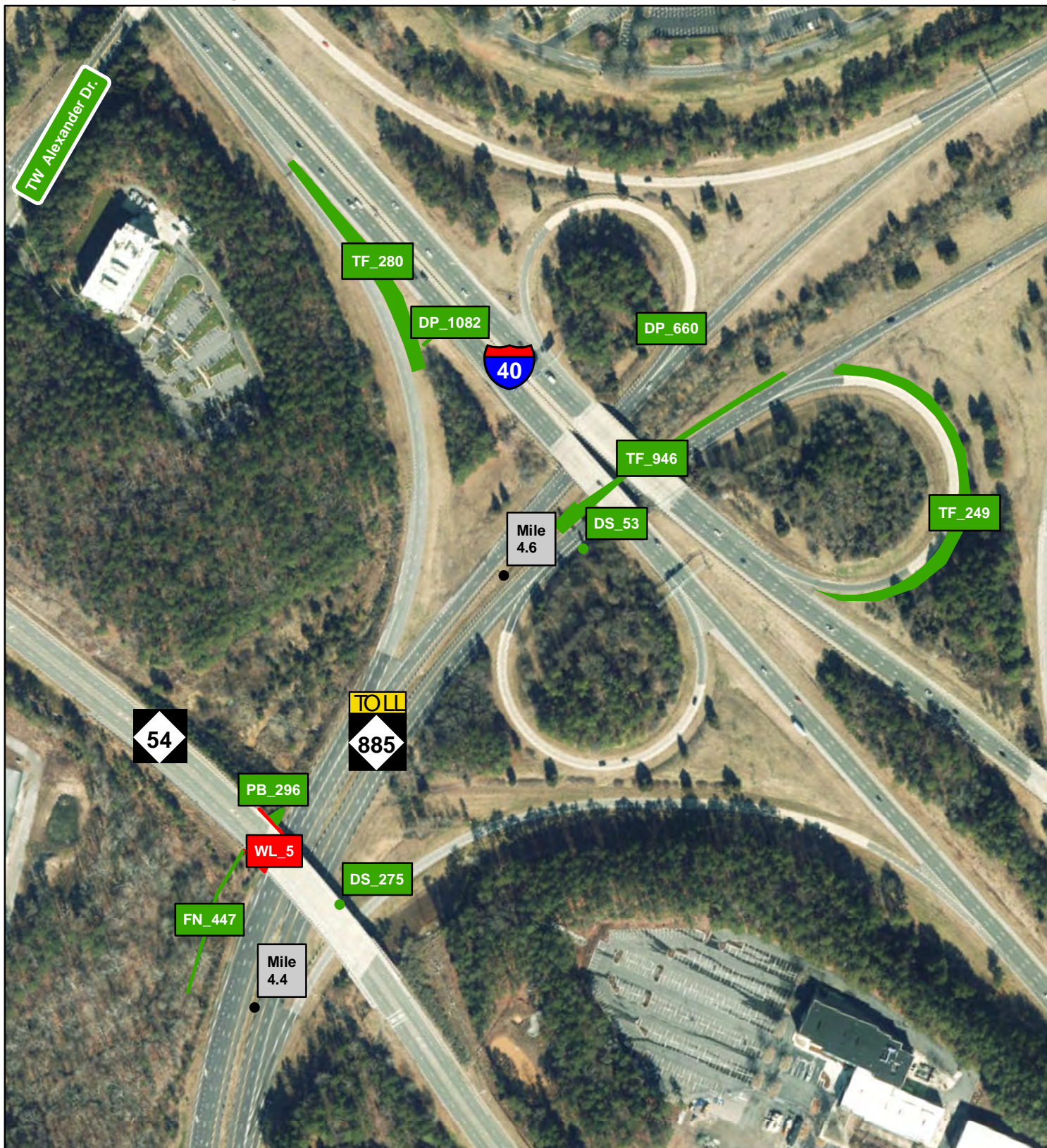


Passing Asset





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



## Legend



Failing Asset



Passing Asset





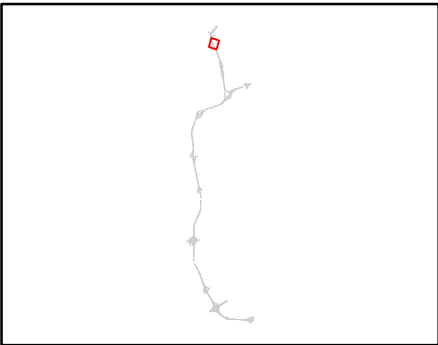


Appendix A: Triangle Expressway 2022 Second Quarter Asset Assessment Locations



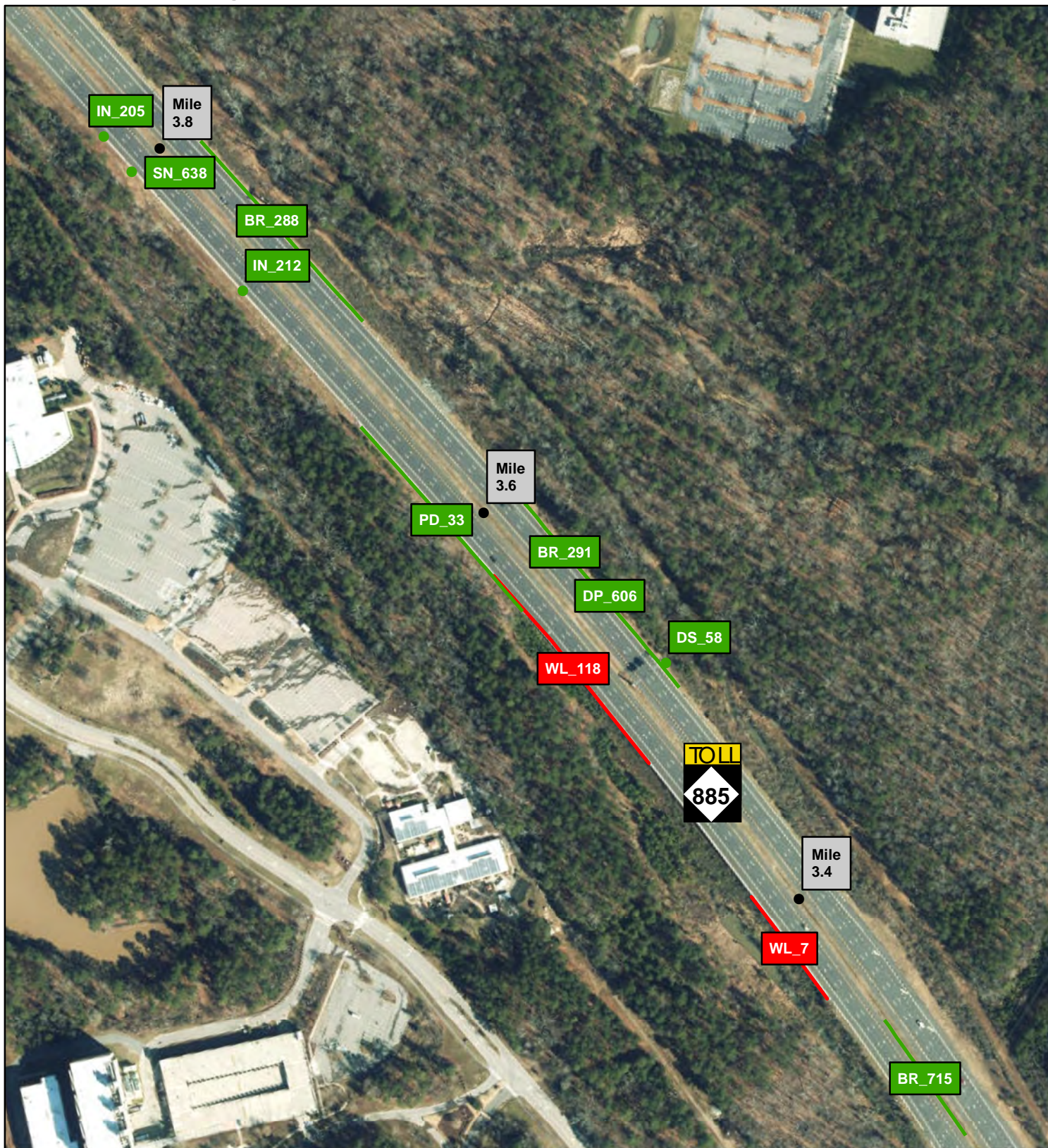
Legend

-  Failing Asset
-  Passing Asset





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



## Legend



Failing Asset

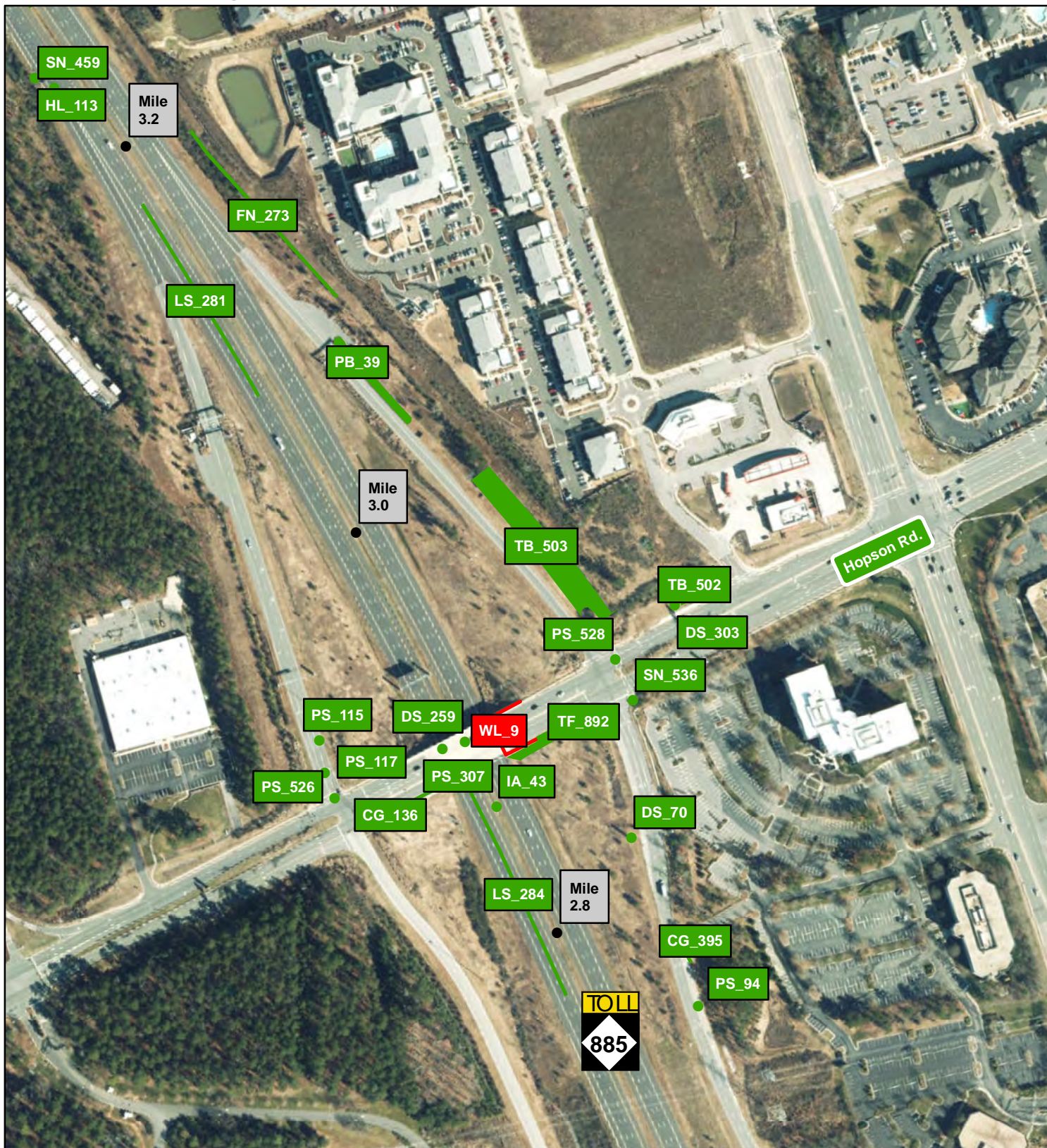


Passing Asset





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



## Legend

- Failing Asset
- Passing Asset





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



## Legend



Failing Asset

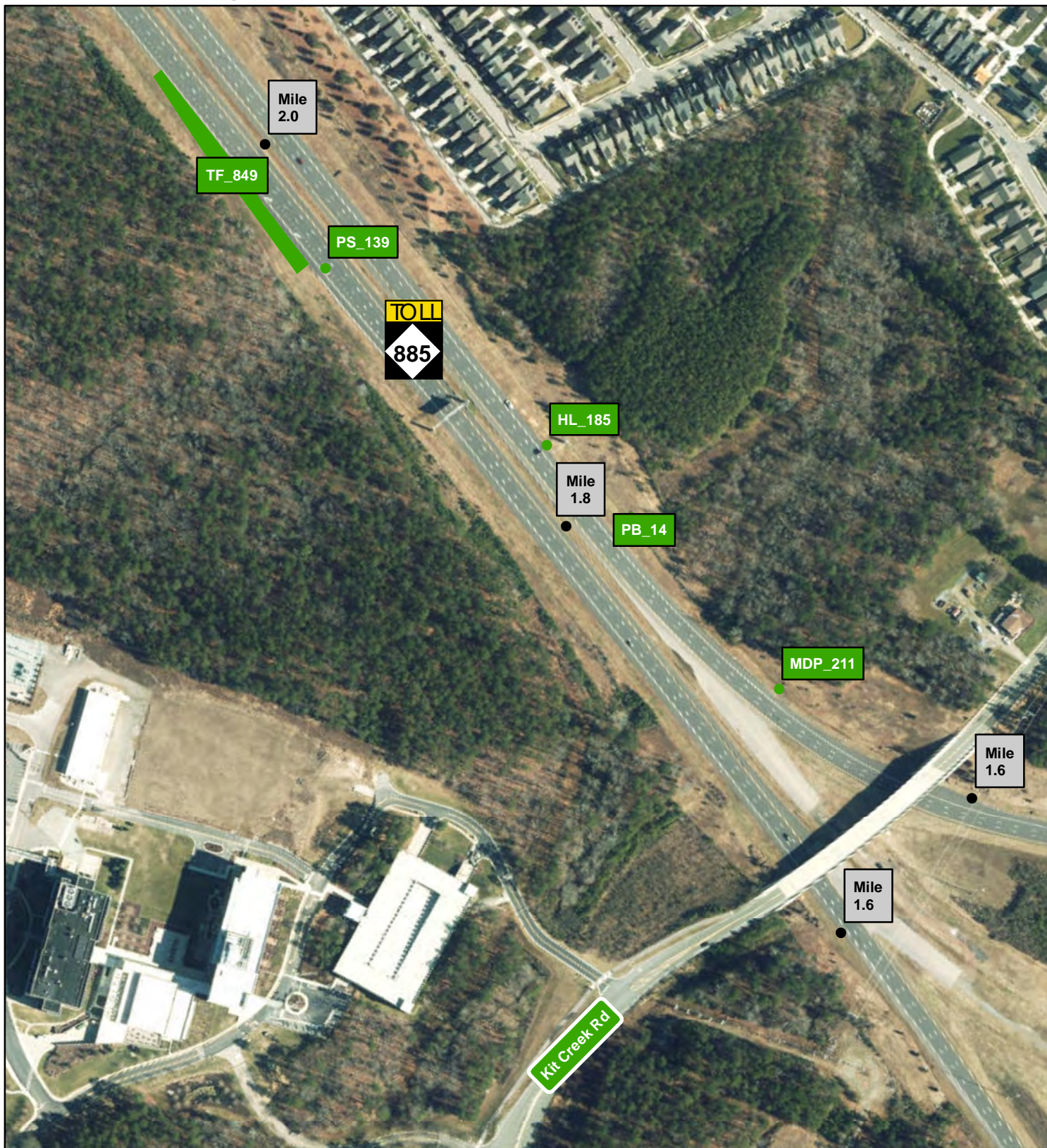


Passing Asset





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



## Legend



Failing Asset



Passing Asset





## **Appendix B**

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



## Appendix B: Triangle Expressway 2022 Second Quarter Table Results of Assets Failing MRP



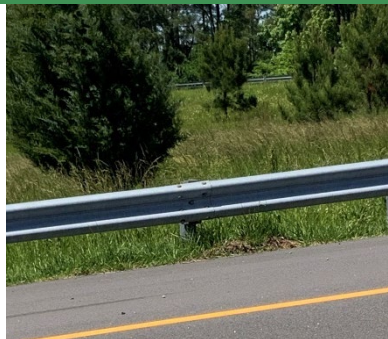

Provided below are a series of tables outlining the existing failures that occurred throughout the facility. Assets are defined by an Inventory ID, which is a unique identifier given to each individual asset. The components that make up the Inventory ID are an asset specific prefix along with a number, 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).....	B15
Pavement Striping (LS) .....	B16
Pavement Markers (LS).....	B17
Delineators (LS) .....	B18
Paved Ditches (PD).....	B19
Pavement Words and Symbols (PS) .....	B20
Signs (SN) .....	B21
Tree and Brush (TB).....	B22
Turf Condition (TF) .....	B23
MSE/Retaining Walls, Sound Barrier Walls, and Screen Walls (WL) .....	B25





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

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Guardrail	BR_109	Missing Parts		A14
2	Guardrail	BR_248	Twisted Blocks		A5
3	Guardrail	BR_269	Missing Parts		A3
4	Guardrail	BR_475	Functional Damage		A18



## Curb and Gutter (CG)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Shoulder Berm Gutter	CG_18	Misalignment		A30
2	Shoulder Berm Gutter	CG_57	Separation		A10




## Decorative Supports (DS)

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






## Drainage Pipes (DP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Drain	DP_227	End Protection		A14







## Misc. Drainage Structure (MDP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Shoulder Drain	MDP_55	Rodent Screen		A14
2	Shoulder Drain	MDP_93	Obstruction		A19
3	Shoulder Drain	MDP_157	Obstruction		A28



## Fence and Control of Access (FN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Woven	FN_58	Fence Hole		A6
2	Woven	FN_215	Hole Height		A3
3	Woven	FN_286	Fence Hole		A35
4	Woven	FN_350	Fence Hole		A21




## Graffiti (GR)

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



## Highway Lighting (HL)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	High Mast	HL_48	Rodent Screen		A7





## 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_713	Obstruction		A20
2	Inlet	IN_1122	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
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This asset did not produce any failures.

### Paved Shoulders (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_136	Paved Shoulder Cracking		A10

## Unpaved Shoulders (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_8	Drop Off		A29
2	Asphalt	LS_238	Drop Off		A35
3	Asphalt	LS_544	Drop Off		A23



### 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
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This asset did not produce any failures.

## 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
1	Asphalt	LS_529	Nighttime Visibility	Not Available for Nighttime Failure	A25
2	Asphalt	LS_778	Marker Missing		A11



## Delineators (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_8	Nighttime Visibility	Not Available for Nighttime Failure	A29
2	Concrete	LS_155	Missing		A13



## 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	Thru Lane	PS_412	Nighttime Reflectivity		A1
2	Left Turn	PS_421	Nighttime Reflectivity		A1
3	Left Turn	PS_431	Nighttime Reflectivity, Daytime Assessment		A6
4	Thru Lane	PS_443	Nighttime Reflectivity, Daytime Assessment		A7

## Signs (SN)

#	Sign Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Merge	SN_857	Sign Support		A19



## 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_135	Bare Ground		A24
2	Turf	TF_276	Bare Ground		A6
3	Turf	TF_384	Bare Ground		A25
4	Turf	TF_505	Bare Ground		A19



## Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Turf	TF_510	Bare Ground		A18
6	Turf	TF_565	Bare Ground		A14
7	Turf	TF_647	Bare Ground		A8
8	Turf	TF_1039	Bare Ground		A29

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

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Bridge Wall	WL_5	Unsealed Cracks/Joints		A31
2	Sound Wall	WL_7	Unsealed Cracks/Joints		A33
3	Bridge Wall	WL_9	Unsealed Cracks/Joints		A34
4	Sound Wall	WL_118	Unsealed Cracks/Joints		A33