



NORTH CAROLINA
Turnpike Authority

Maintenance Rating Program

Triangle Expressway

2020 Third Quarter Report

1 S. Wilmington Street
Raleigh, NC 27601



Last Updated:
November 12, 2020

Table of Contents

List of Figures ii

List of Tables ii

1.0 EXECUTIVE SUMMARY 1

2.0 INTRODUCTION 2

3.0 MRP PROCEDURE 2

4.0 TRIANGLE EXPRESSWAY DESCRIPTION 5

5.0 TRIANGLE EXPRESSWAY ASSET INVENTORY UPDATE 6

6.0 MRP THIRD QUARTER ASSESSMENT 7

 6.1 Quarterly Results 7

 6.2 Analysis and Recommendations 9

7.0 CURRENT ROLLING MRP RATING 12

8.0 GREEN LEVEL HISTORIC DISTRICT SIGNS 14

 8.1 Analysis and Recommendations 14

9.0 CONCLUSION 15

Maintenance Rating Program for the Triangle Expressway

2020 Third Quarter (July – September)

List of Figures

Figure 1: Maintenance Elements and Characteristics 3
Figure 2: Triangle Expressway Map 5
Figure 3: Pavement Striping Inspection Results Sample 10
Figure 4: Pavement Symbol Inspection Results Sample 11
Figure 5: Green Level West Historic District Signs, Landscape Areas 14

List of Tables

Table 1: MRP Element Results for the 2020 Third Quarter Assessment 1
Table 2: MRP Rolling Element Results 1
Table 3: Asset Inventory 6
Table 4: MRP Element Results for Q3 2020 7
Table 5: MRP Characteristic Results for Q3 2020 8
Table 6: MRP Element Results for 2020 12
Table 7: MRP Rolling Element Results 13

Appendices

- A. Triangle Expressway 2020 Third Quarter Asset Assessment Locations
- B. Triangle Expressway 2020 Third Quarter Table Results of Assets Failing MRP

Maintenance Rating Program for the Triangle Expressway

2020 Third Quarter (July – September)

1.0 EXECUTIVE SUMMARY

The North Carolina Turnpike Authority (NCTA) Maintenance Rating Program (MRP) is a maintenance evaluation program for roadway features and toll facilities on the NCTA system. This report presents results from the 2020 Third Quarter Assessment of the Triangle Expressway.

The overall 2020 third quarter maintenance rating of the Triangle Expressway was 90.7, above 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 2020 Third Quarter Assessment		
Element	MRP Rating	Target Rating
Road Surface	96.3 ¹	85.0
Unpaved Shoulders and Ditches	96.5	85.0
Drainage	89.2	85.0
Roadside	91.1	85.0
Traffic Control Devices	84.0 ¹	85.0
Overall MRP Performance Rating	90.7¹	90.0

¹Excludes 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 92.2.

Table 2: MRP Rolling Element Results					
Element	Q4 2019 RATING	Q1 2020 RATING	Q2 2020 RATING	Q3 2020 RATING	Rolling Rating
Road Surface	89.5	94.9	93.8	96.3 ¹	93.5 ²
Unpaved Shoulders and Ditches	99.1	98.7	92.5	96.5	96.7
Drainage	98.1	91.9	92.5	89.2	93.0
Roadside	96.2	94.7	91.7	91.1	93.4
Traffic Control Devices	90.9	90.4	87.0	84.0 ¹	88.2 ²
Overall MRP Performance Rating	93.6	93.6	91.0	90.7¹	92.2²

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

²Excludes the third 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.

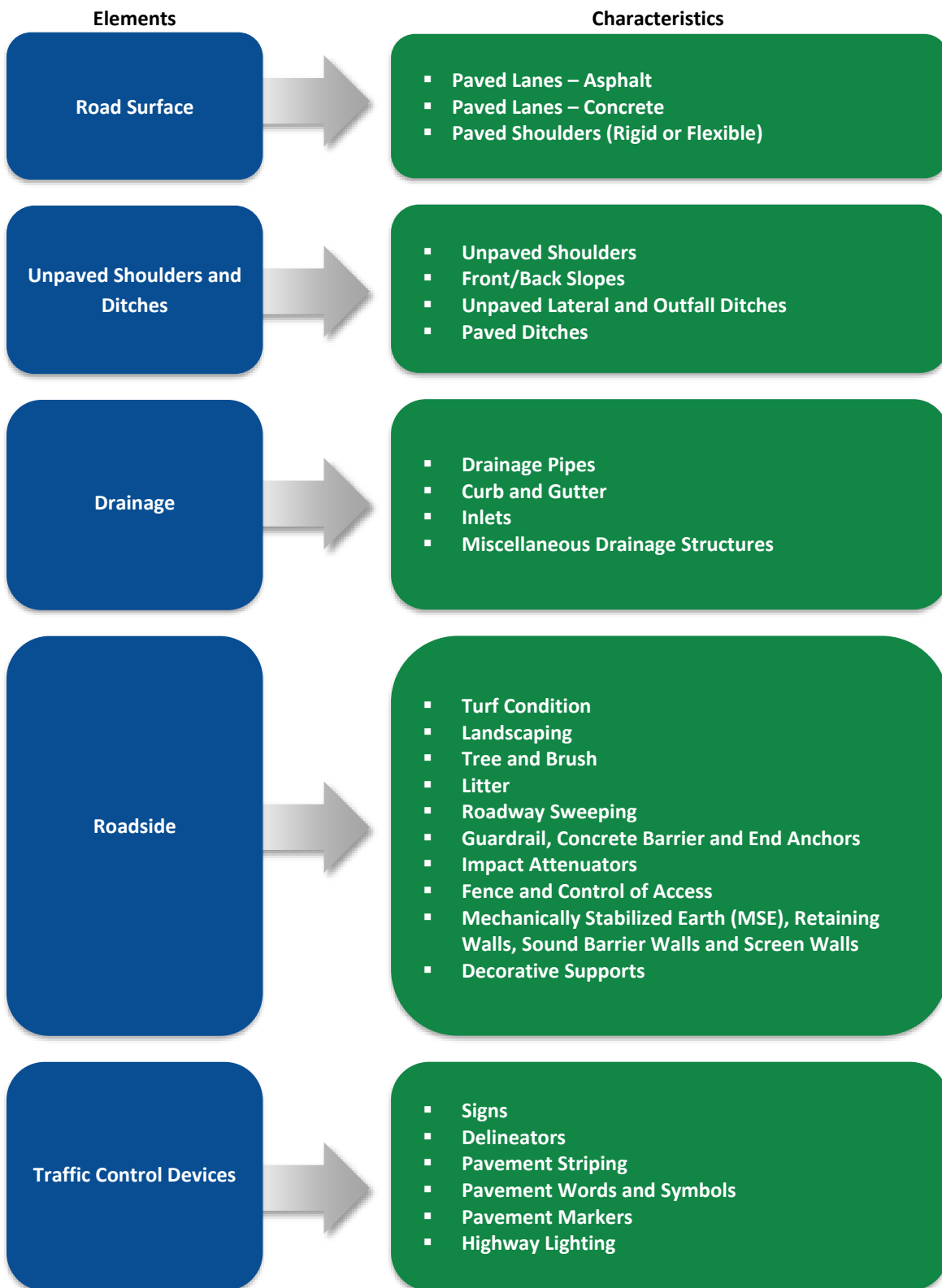
The NCTA performance standards, threshold criteria, and maintenance rating program were developed through a collaborative effort by NCTA managers, NCDOT maintenance staff, and consultants.

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 can be seen in **Figure 1**:

Figure 1: Maintenance Elements and Characteristics



Maintenance Rating Program for the Triangle Expressway

2020 Third Quarter (July – September)

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

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

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

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

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.

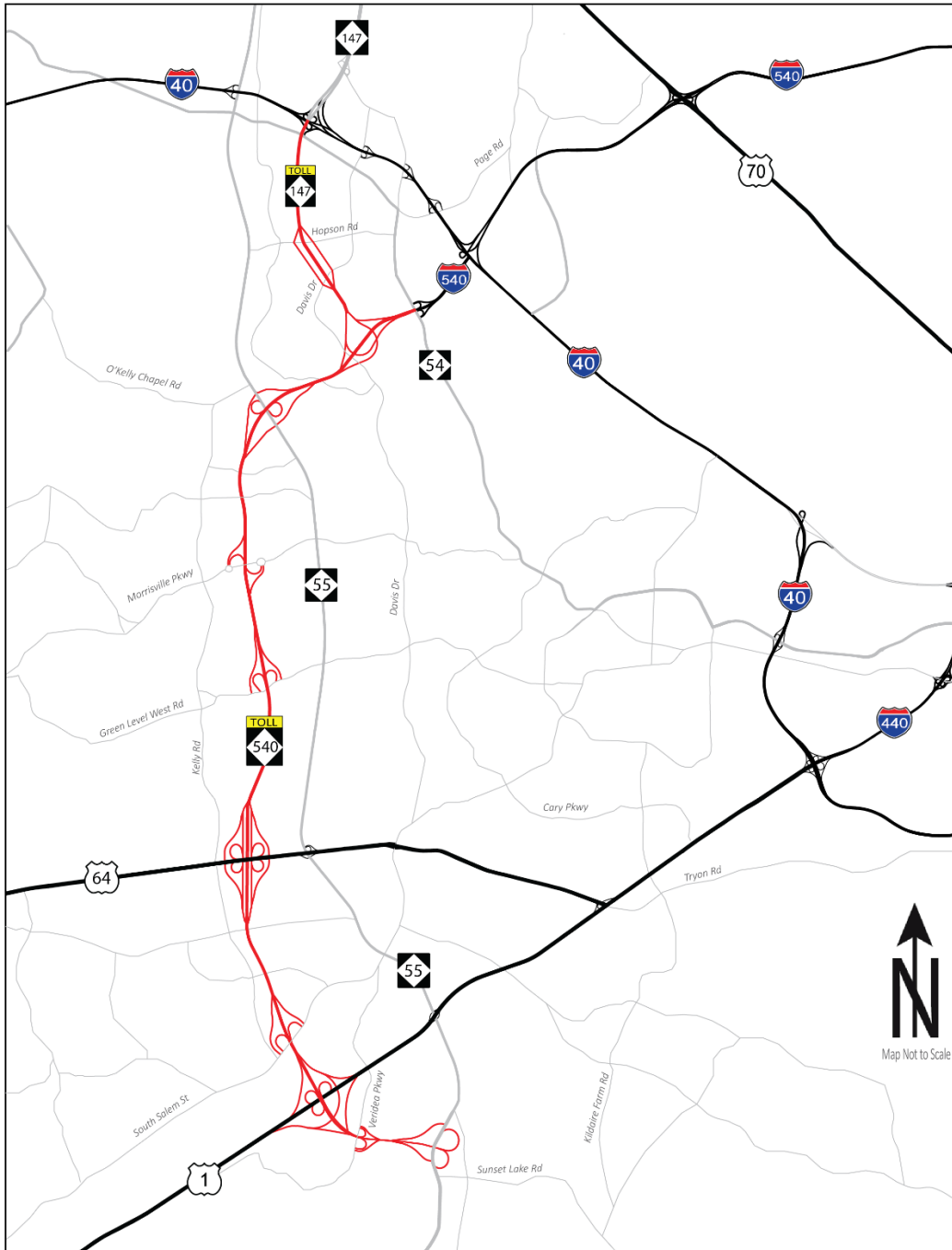
Maintenance Rating Program for the Triangle Expressway

2020 Third Quarter (July – September)

4.0 TRIANGLE EXPRESSWAY DESCRIPTION

The Triangle Expressway extends for approximately 18.8 miles from the interchange of I-40 and Toll NC-147 in Durham to the NC-55 Bypass near Holly Springs (**Figure 2**). It includes a one-mile segment on Toll NC-540 extending north from the Toll NC-540 / Toll NC-147 interchange to the NC-54 interchange. The Triangle Expressway consists of 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 near McCrimmon Parkway were removed from the inventory due to the Morrisville Parkway Interchange toll zone construction project. Also, 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	2020 Eligible Inventory
Barriers	801	743
Curb and Gutter	428	393
Decorative Supports	297	279
Drainage	1180	1105
Misc. Drainage	221	221
Fences	508	472
Highway Lighting	435	398
Impact Attenuators	47	45
Inlets	1126	1080
Linear Segments	795	767
Plant Beds	266	262
Paved Ditches	2	2
Pavement Symbols	638	602
Signs	1215	1096
Tree and Brush	603	539
Turf	1074	1039
Walls	88	85

6.0 MRP THIRD QUARTER ASSESSMENT

6.1 Quarterly Results

The overall 2020 third quarter maintenance rating of the Triangle Expressway was 90.7, meeting NCTA’s target overall rating of 90. Four of five elements assessed achieved ratings above the target rating of 85 established for element groups. Traffic Control Devices (84.0) is the only element that scored below the target element rating of 85. Pavement Striping (74) and Words and Symbols (79) are the characteristics that scored below the target characteristic rating of 80.

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

Table 4: MRP Element Results for Q3 2020	
Element	Q3 2020 MRP Rating
Road Surface	96.3 ¹
Unpaved Shoulders and Ditches	96.5
Drainage	89.2
Roadside	91.1
Traffic Control Devices	84.0 ¹
Overall MRP Performance Rating	90.7¹

¹Excludes 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

2020 Third Quarter (July – September)

Table 5: MRP Characteristic Results for Q3 2020

Road Surface	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q3 Rating
Paved Lanes Asphalt	9	9	9	81	81	100 ¹
Paved Lanes Concrete	17	18	9	153	162	94
Paved Shoulder	26	27	5	130	135	96 ¹
Element Total				364	378	96.3¹
8Unpaved Shoulders and Ditches	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q3 Rating
Unpaved Shoulder	30	32	9	270	288	94
Front/Back Slopes	32	32	6	192	192	100
Lateral and Outfall Ditches, Unpaved	31	32	6	186	192	97
Ditches, Paved	2	2	5	10	10	100
Element Total				658	682	96.5
Drainage	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q3 Rating
Drainage Pipes	32	35	7	224	245	91
Curb and Gutter	28	28	6	168	168	100
Inlets	28	34	7	196	238	82
Misc. Drainage Structure	25	30	4	100	120	83
Element Total				688	771	89.2
Roadside	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q3 Rating
Turf Condition	42	51	7	294	357	82
Landscaping	22	25	4	88	100	88
Trees and Brush	29	30	4	116	120	97
Litter	29	32	4	116	128	91
Roadway Sweeping	32	32	5	160	160	100
Guardrail, Concrete Barrier and End Anchors	32	32	9	288	288	100
Impact Attenuators	9	9	9	81	81	100
Fence, Control Access	29	33	7	203	231	88
Retaining Walls and Sound Barrier Walls	12	15	5	60	75	80
Decorative Supports	29	29	5	145	145	100
Graffiti and Stain Removal	36	44	4	144	176	82
Element Total				1695	1861	91.1
Traffic Control Devices	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q3 Rating
Signs	30	35	7	210	245	86
Delineators	30	32	3	90	96	94
Pavement Striping/Marking	20	27	8	160	216	74 ¹
Words and Symbols	22	28	7	154	196	79 ¹
Pavement Markers	24	27	9	216	243	89 ¹
Highway Lighting	28	32	6	168	192	88
Element Total				998	1188	84.0¹

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

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

6.2 Analysis and Recommendations

Elements

During the third quarter, four of five elements exceeded NCTA's threshold criteria of 85. All elements, apart from Traffic Control Devices (84.0), which experienced a decrease in rolling rating of 0.7 points since last report, continued exceeding a quarter score higher than 85. Both Pavement Striping (74) and Words and Symbols (79) experienced decreases in rolling rating and scored below the character threshold criteria of 80. Repaving and subsequent striping and marking of all asphalt lanes began during this quarter and is expected to be completed early next year.

Road Surface (96.3) experienced an increase in rolling rating compared to the previous quarter's rolling rating. The quarter rating for this element was 2.5 points higher than the second quarter ratings. The increase can be attributed to the exclusion of asphalt surface conditions under contract to be repaired in this quarter's inspection.

Unpaved Shoulders and Ditches (96.5) experienced an increase in rolling rating compared to the previous quarter. The rating for this element was 0.4 points higher than the second quarter rolling rating. The increase was predominately due to a higher quarter rating for Unpaved Shoulders (94).

Drainage (89.2) experienced a decrease in rolling rating of 0.7 points. Misc. Drainage Structures (83) continued to score above 80 for the third quarter this year, increasing the characteristics rolling rating by 0.4 points. Roadside (91.1) experienced a decrease of 0.6 points from the previous quarter. Retaining Walls and Sound Barrier Walls (80), Landscaping (88), and Fence (88) all experienced lower rolling ratings from last quarter's rolling rating.

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

Characteristics

This quarter, all but two characteristics, Pavement Striping (74) and Words and Symbols (79), 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

2020 Third Quarter (July – September)

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 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 3**.

Figure 3: Pavement Striping Inspection Results Sample



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

Maintenance Program:

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

Maintenance and Evaluation Standards:

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

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

Pavement striping/markings were installed along Toll NC-540 in the Summer of 2018. NCTA has let a contract in the Summer 2020 for the replacement of pavement striping/markings following asphalt pavement resurfacing.

Maintenance Rating Program for the Triangle Expressway

2020 Third Quarter (July – September)

Words and Symbols (79 rating – 22 of the 28 assets passed): There were 6 pavement symbols that did not pass inspection, these symbols were identified as missing sections and/or not reflecting during the nighttime inspection. Two of the pavement symbols that did not pass inspection are presented in **Figure 4**.

Figure 4: Pavement Symbol Inspection Results Sample



To improve inlet performance throughout the facility, it is recommended that the maintenance provider inspect inlets pursuant to the *NCTA Roadway and Facility Maintenance Standards V6*, referenced below.

Maintenance Program:

- 1) Words and symbols are observed daily and inspected every 4 months for compliance to the standard.
- 2) Worn or missing words or symbols are evaluated for compliance annually, and generally are scheduled on a 5 - 8 year replacement cycle depending on the material.

Maintenance and Evaluation Standards:

Pavement symbols do not meet the maintenance standards when any of the following criteria is observed:

- 1) More than 30% of the symbol area is worn, missing or not visible.
- 2) More than 30% of symbol area is not reflective for a distance of 160 feet using low beam headlights during nighttime observation. (N)

Pavement striping/markings were installed along Toll NC-540 in the Summer of 2018. Replacement of pavement symbols on asphalt pavement surfaces including Toll NC-147 mainline and asphalt pavement ramps and loops are included in the resurfacing contract let in Summer 2020.

Maintenance Rating Program for the Triangle Expressway

2020 Third Quarter (July – September)

7.0 CURRENT ROLLING MRP RATING

The rolling maintenance rating of the Triangle Expressway was 92.2, exceeding NCTA’s target overall rating of 90. Four of five elements exceeded NCTA’s rolling rating threshold criteria of 85. Also, all but two characteristics received quarter ratings at or above the target rating of 80. All characteristics received rolling ratings above the target rating of 80.

The 2019/2020 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					
Element	Q4 2019 RATING	Q1 2020 RATING	Q2 2020 RATING	Q3 2020 RATING	ROLLING RATING
Road Surface	89.5	94.9	93.8	96.3 ¹	93.5 ²
Unpaved Shoulders and Ditches	99.1	98.7	92.5	96.5	96.7
Drainage	98.1	91.9	92.5	89.2	93.0
Roadside	96.2	94.7	91.7	91.1	93.4
Traffic Control Devices	90.9	90.4	87.0	84.0 ¹	88.2 ²
Overall MRP Performance Rating	93.6	93.6	91.0	90.7¹	92.2²

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

²Excludes the third quarter ratings for characteristics listed above.

Maintenance Rating Program for the Triangle Expressway

2020 Third Quarter (July – September)

Table 7: MRP Rolling Element Results					
Road Surface	Q4 2019 RATING	Q1 2020 RATING	Q2 2020 RATING	Q3 2020 RATING	ROLLING RATING
Paved Lanes Asphalt	75	83	91	100 ¹	86 ²
Paved Lanes Concrete	100	100	95	94	97
Paved Shoulder	88	97	94	96 ¹	93 ²
Element Total	89.5	94.9	93.8	96.3¹	93.5²
Unpaved Shoulders and Ditches	Q4 2019 RATING	Q1 2020 RATING	Q2 2020 RATING	Q3 2020 RATING	ROLLING RATING
Unpaved Shoulder	100	97	84	94	94
Front/Back Slopes	97	100	100	100	99
Lateral and Outfall Ditches, Unpaved	100	100	97	97	98
Ditches, Paved	100	100	100	100	100
Element Total	99.1	98.7	92.5	96.5	96.7
Drainage	Q4 2019 RATING	Q1 2020 RATING	Q2 2020 RATING	Q3 2020 RATING	ROLLING RATING
Drainage Pipes	100	91	91	91	93
Curb and Gutter	100	100	100	100	100
Inlets	97	91	94	82	91
Misc. Drainage Structure	95	83	82	83	86
Element Total	98.1	91.9	92.5	89.2	93.0
Roadside	Q4 2019 RATING	Q1 2020 RATING	Q2 2020 RATING	Q3 2020 RATING	ROLLING RATING
Turf Condition	91	88	80	82	85
Landscaping	100	100	100	88	97
Trees and Brush	100	100	97	97	98
Litter	100	84	91	91	91
Roadway Sweeping	100	100	100	100	100
Guardrail, Concrete Barrier and End Anchors	97	97	91	100	96
Impact Attenuators	100	100	100	100	100
Fence, Control Access	93	90	90	88	90
Retaining Walls and Sound Barrier Walls	86	93	73	80	83
Decorative Supports	92	100	100	100	98
Graffiti and Stain Removal	100	100	100	82	95
Element Total	96.2	94.7	91.7	91.1	93.4
Traffic Control Devices	Q4 2019 RATING	Q1 2020 RATING	Q2 2020 RATING	Q3 2020 RATING	ROLLING RATING
Signs	100	94	97	86	94
Delineators	88	100	84	94	91
Pavement Striping/Marking	88	88	88	74 ¹	85 ²
Words and Symbols	90	90	90	79 ¹	88 ²
Pavement Markers	91	94	81	89 ¹	89 ²
Highway Lighting	86	81	81	88	84
Element Total	90.9	90.4	87.0	84.0¹	88.2²

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

²Excludes the third 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 three Green Level Historic District signs to conduct a visual inspection of each sign and ensure they are in good standing. Two of the three signs included in the inspection inventory were found to be in good condition, with the landscaped areas being well maintained. The third sign had been temporarily removed due to nearby construction activities. **Figure 5** shows the two signs assessed this quarter.

Figure 5: Green Level West Historic District Signs, Landscape Areas



9.0 CONCLUSION

This report presents the 2020 third quarter assessment of the Triangle Expressway. The NCTA's target ratings are 90 for the rolling rating, 90 overall, 85 for elements, and 80 for characteristics. The third quarter 2020 overall rating was 90.7 and the rolling rating was 92.2.

Traffic Control Devices (84.0) was the only element below the target ratings for the quarter. All elements rolling rating exceeded the target rating. During the third quarter assessment, all characteristics except Pavement Striping (74) and Words and Symbols (79) met or exceeded the quarter target rating of 80. All characteristics exceeded the rolling rating target of 80.

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

To continue to improve upon characteristic ratings that scored a rating below 80 in the last four quarters, continue a routine pattern of patrols and clearing of unwanted vegetation for MSE/Retaining Walls, Sound Barrier Walls, and Screen Walls. Additionally, to continue to meet/exceed NCTA's threshold criteria for graffiti, it is recommended to continue to follow the maintenance program and standards presented in the *NCTA Roadway and Facility Maintenance Standards V6*. The maintenance program calls for the removal of graffiti within 48 hours of observation or notification.

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 2020 Third Quarter Asset Assessment Locations

Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

Provided below are a series of maps outlining the assets that were a part of this quarter's sample and their corresponding result. Assets are defined by an Inventory ID, which is a unique identifier given to each individual asset. The components that make up the Inventory ID are an asset specific prefix along with a number, such as LS_1. All assets and their respective prefixes are listed below:

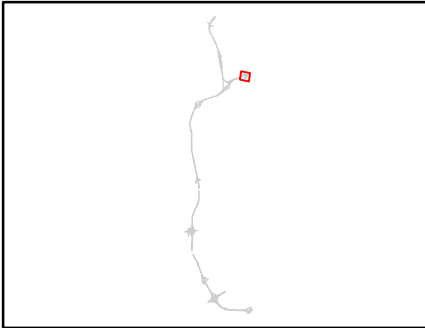
- Guardrail, Concrete Barrier and End Anchors – BR
- Curb and Gutter – CG
- Decorative Supports – DS
- Drainage Pipes – DP
- Misc. Drainage Structures – MDP
- Fence and Control of Access – FN
- Graffiti - GF
- Highway Lighting – HL
- Impact Attenuators – IA
- Inlets – IN
- Landscaping – PB
- Linear Samples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

Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

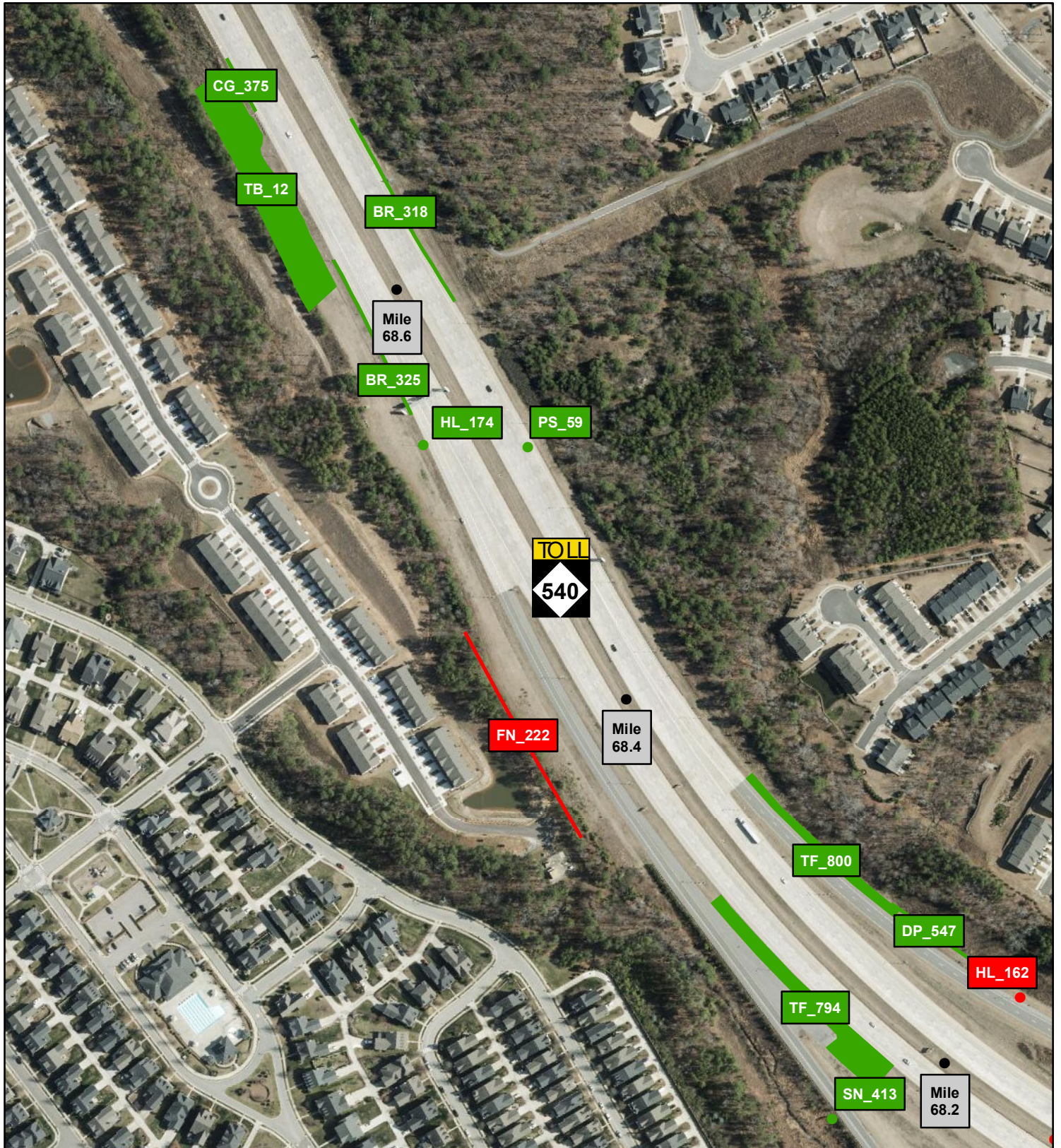


Legend



- Failing Asset
- Passing Asset

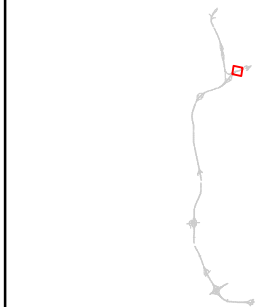


Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

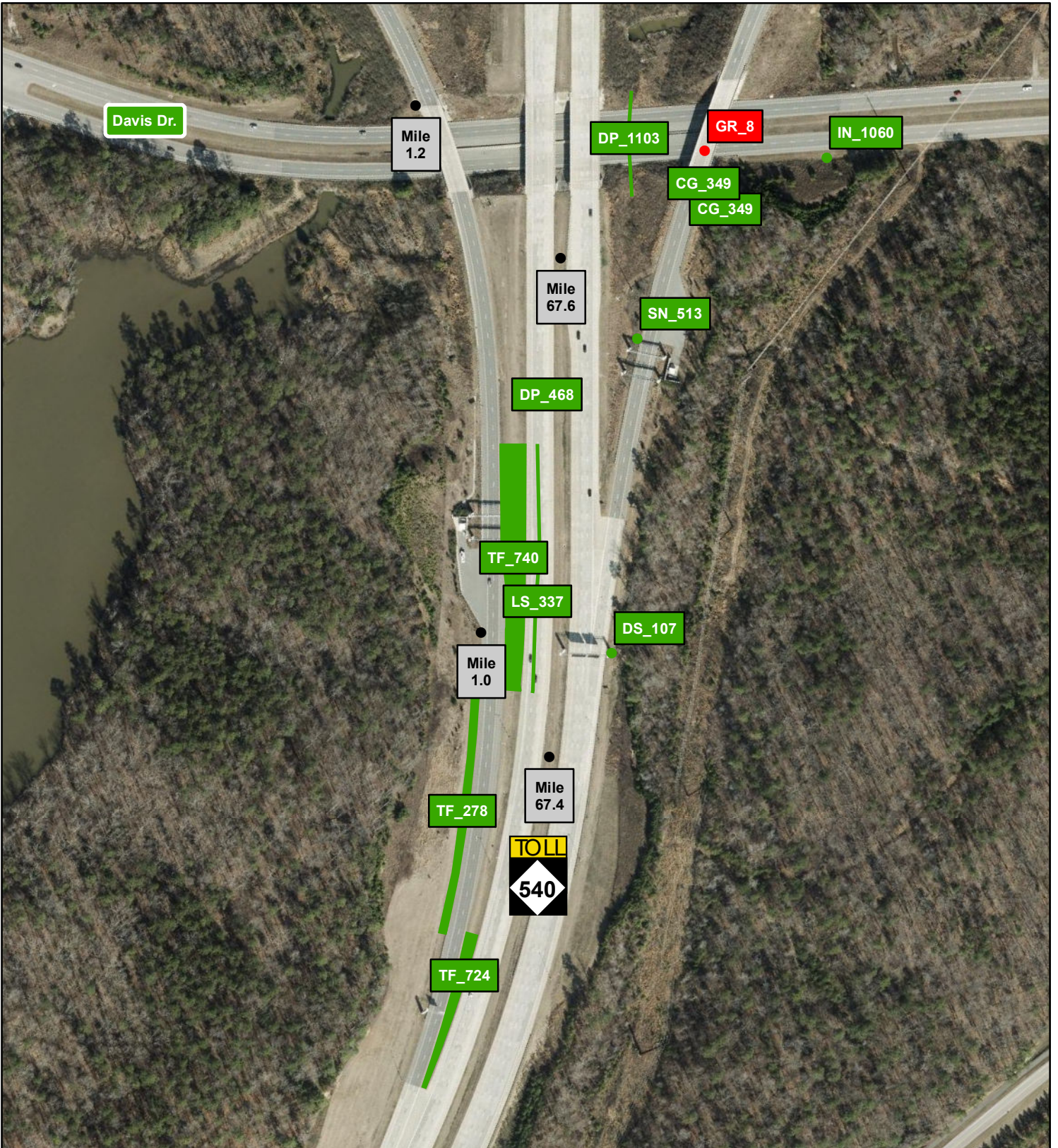


Legend

- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

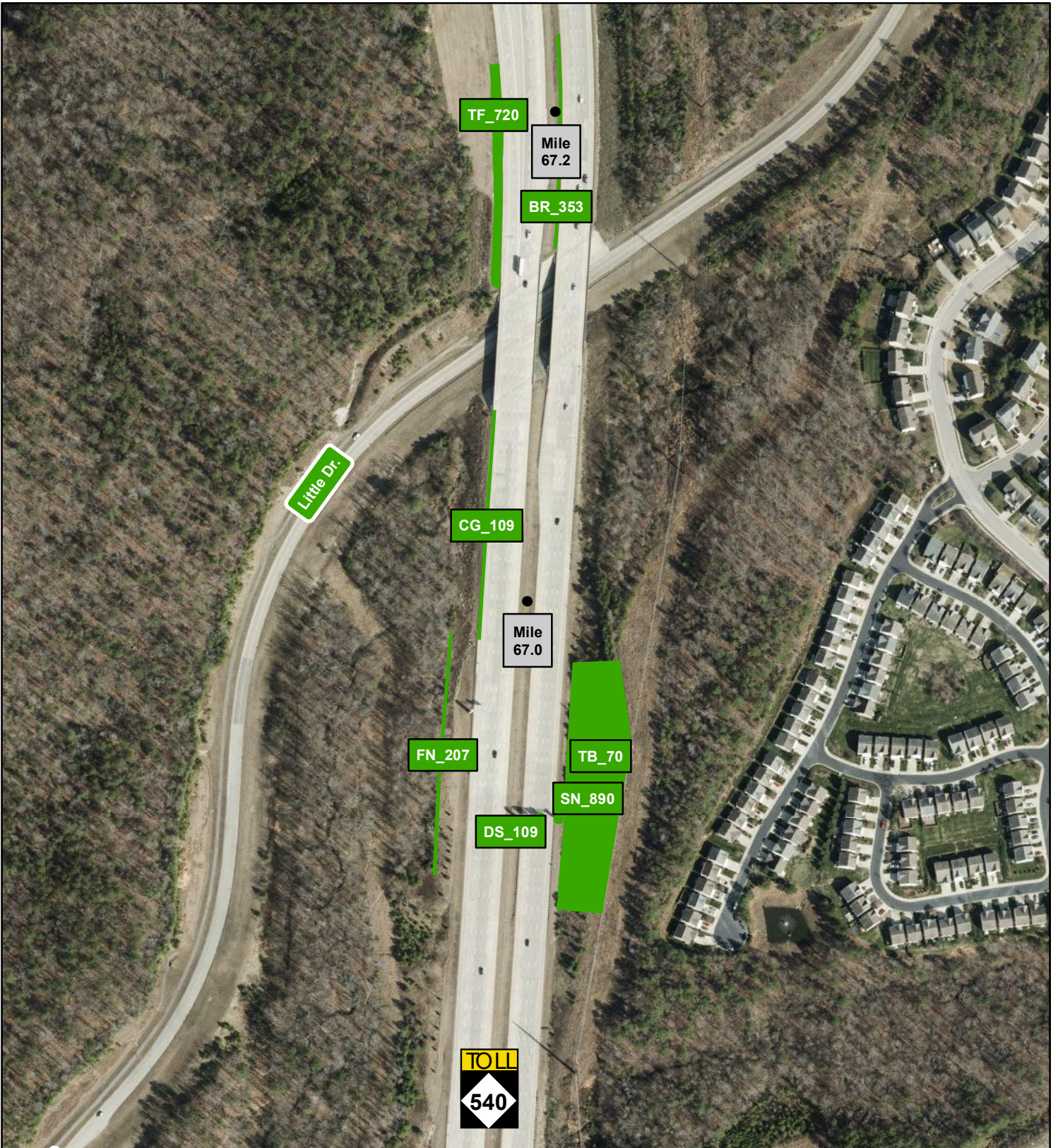


Legend



- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

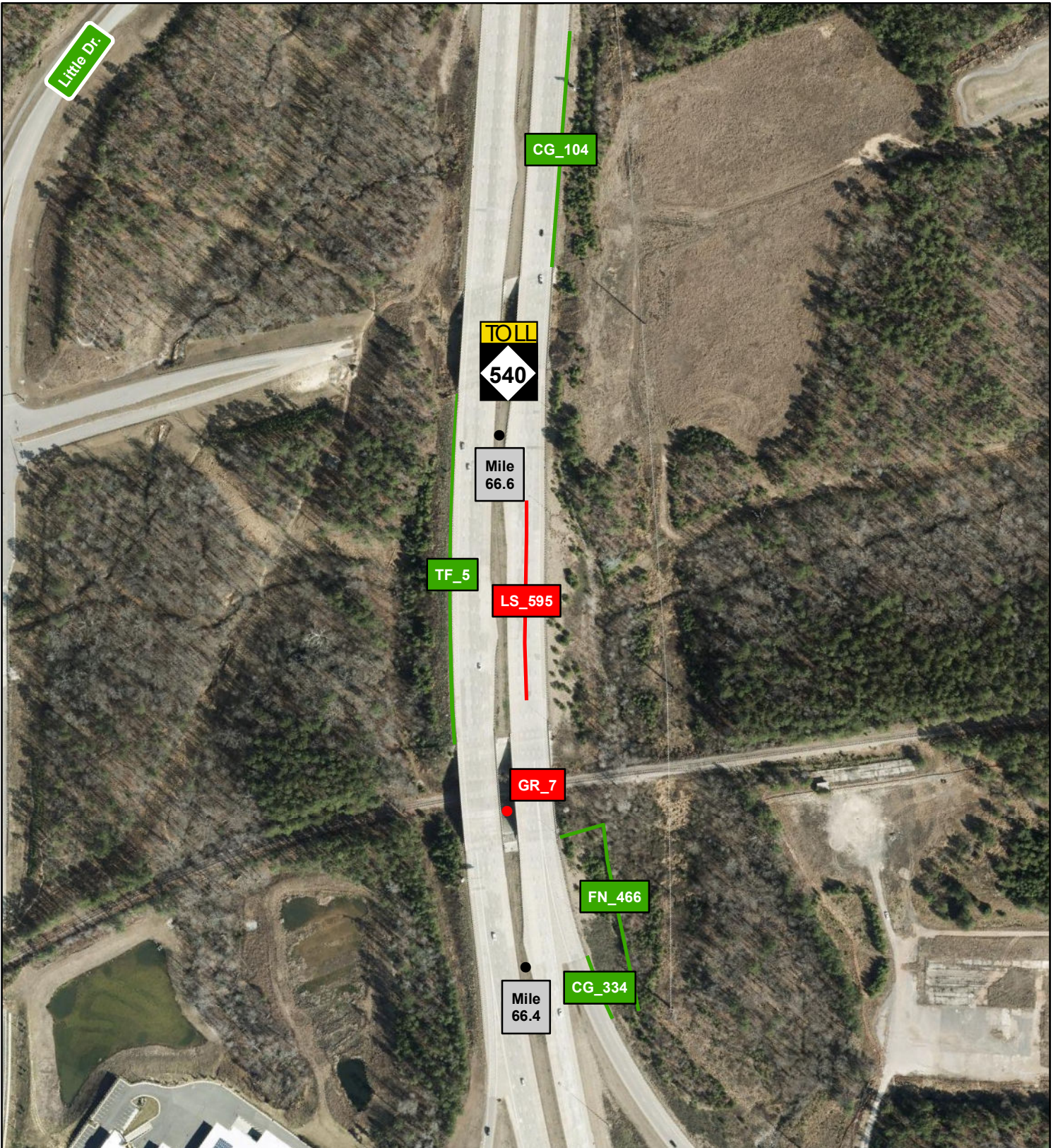


Legend



-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

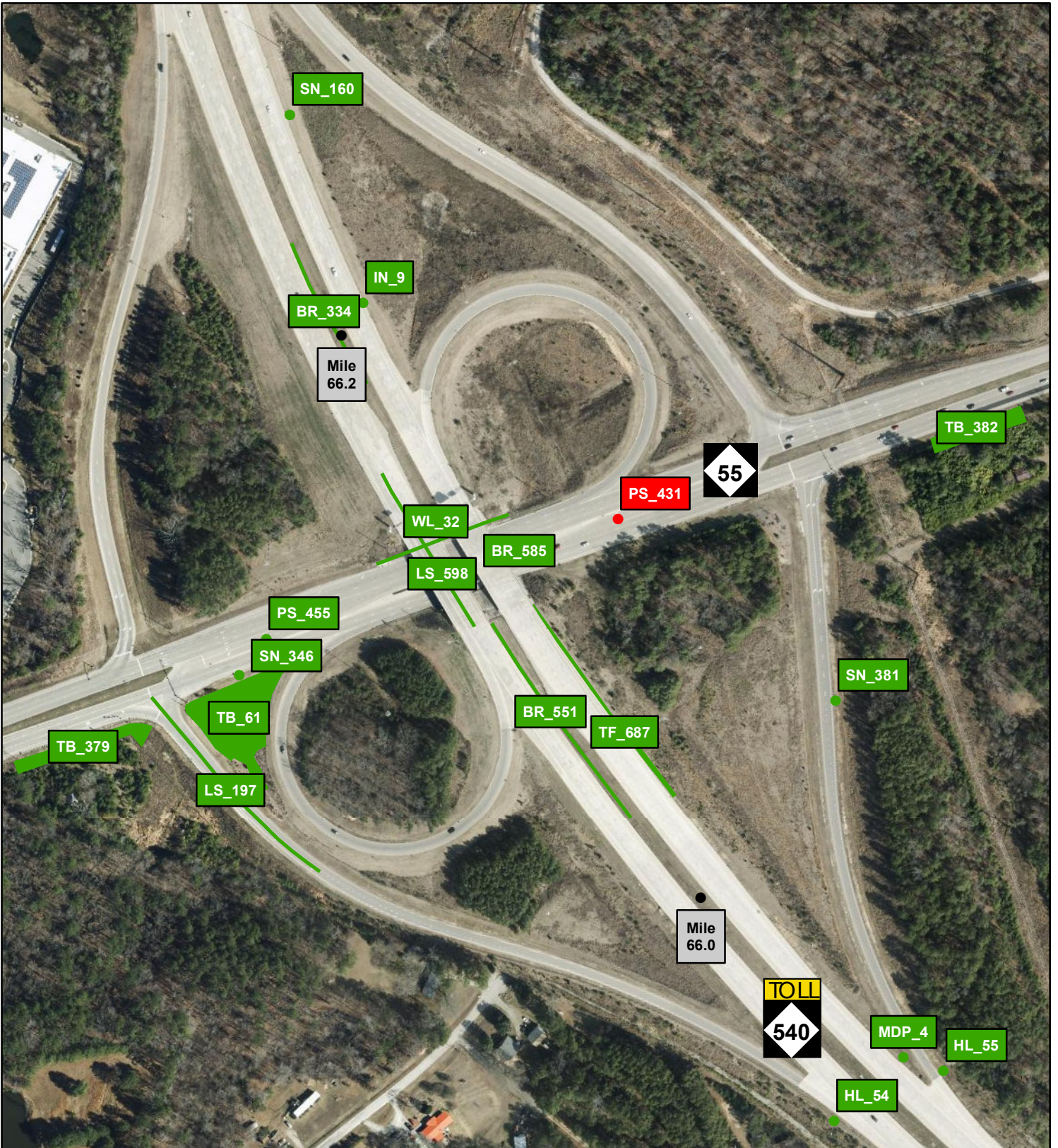


Legend

-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

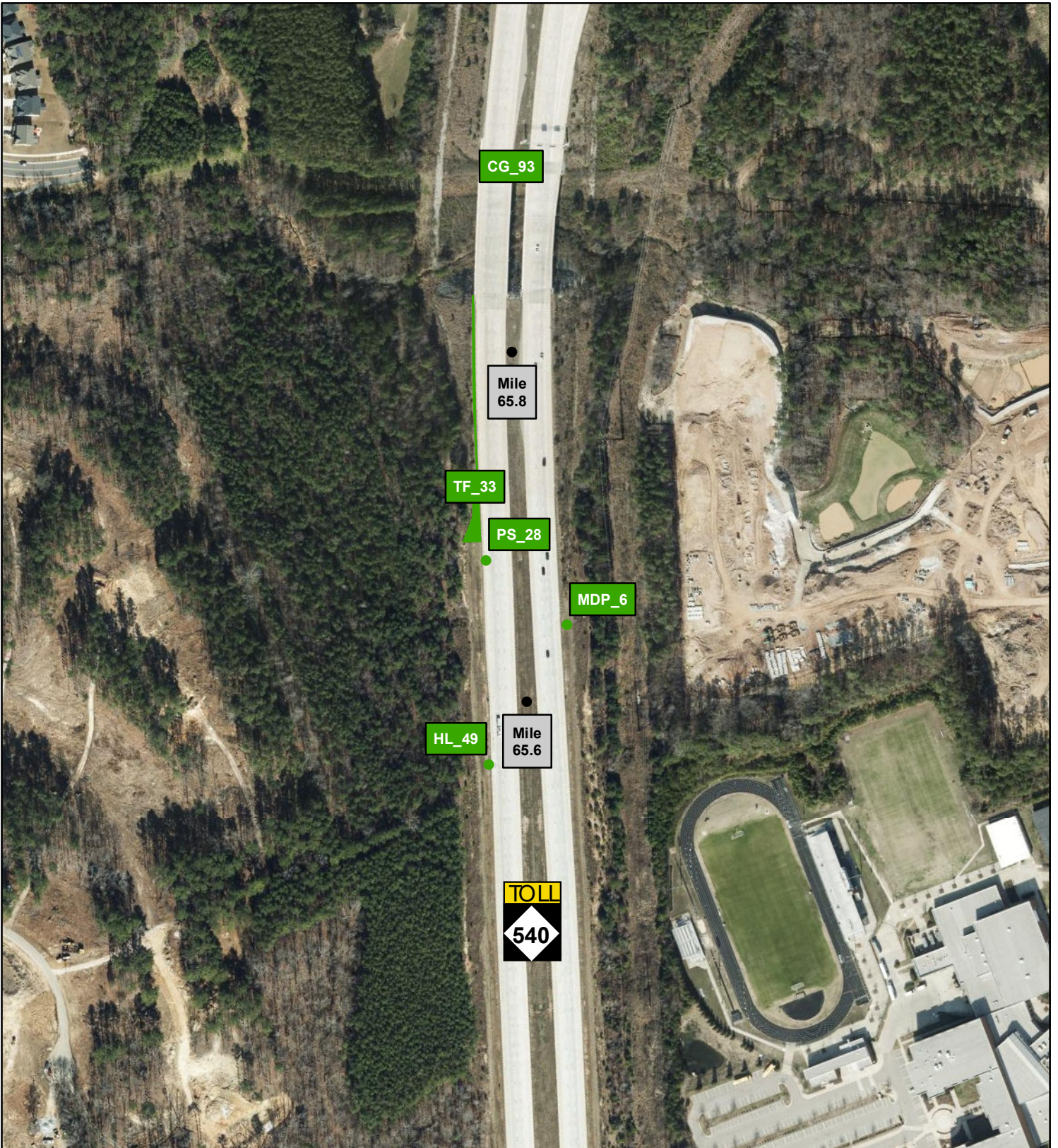


Legend



- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

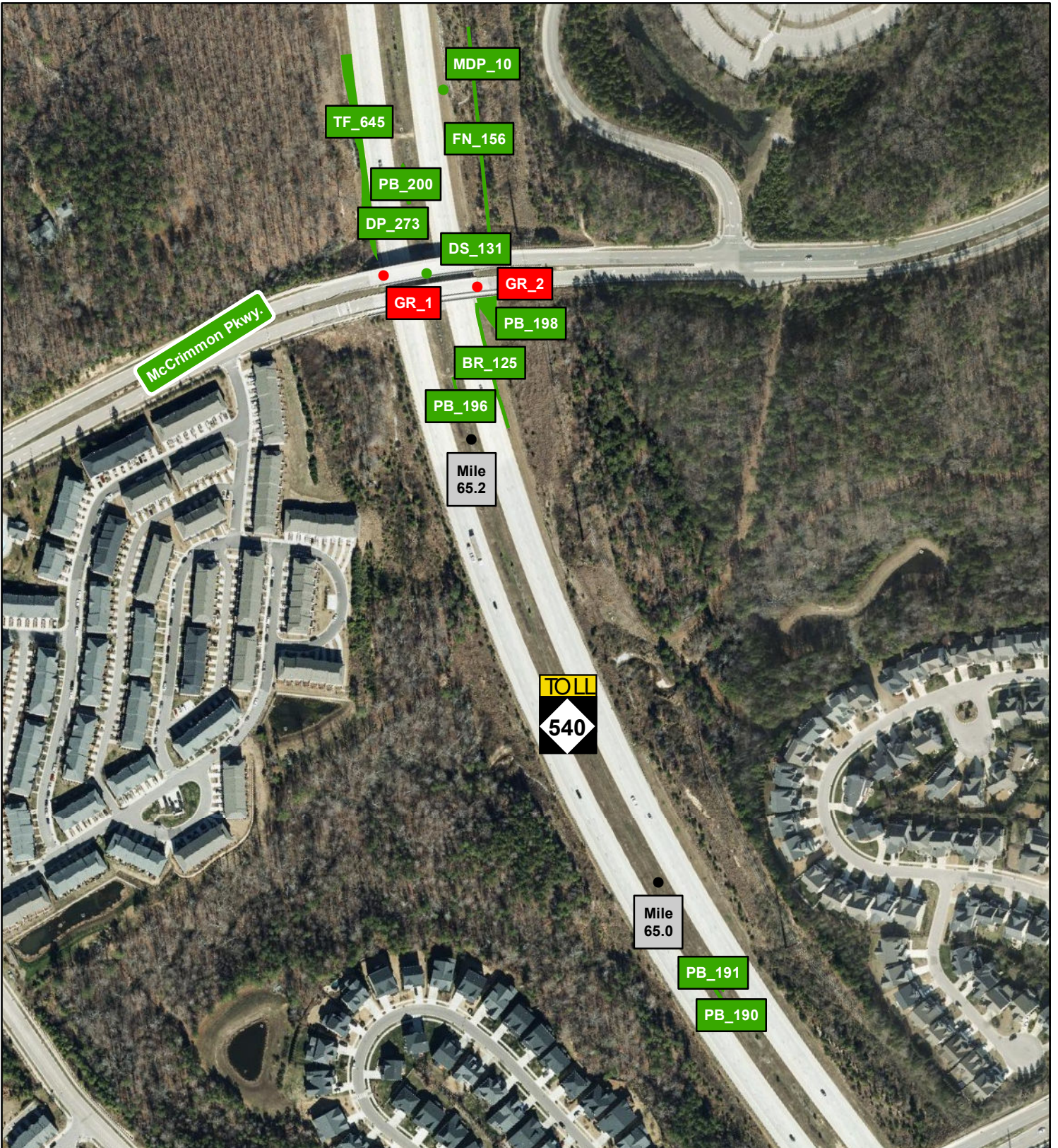


Legend

-  Failing Asset
-  Passing Asset

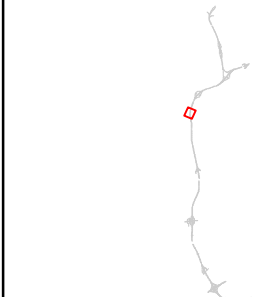


Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

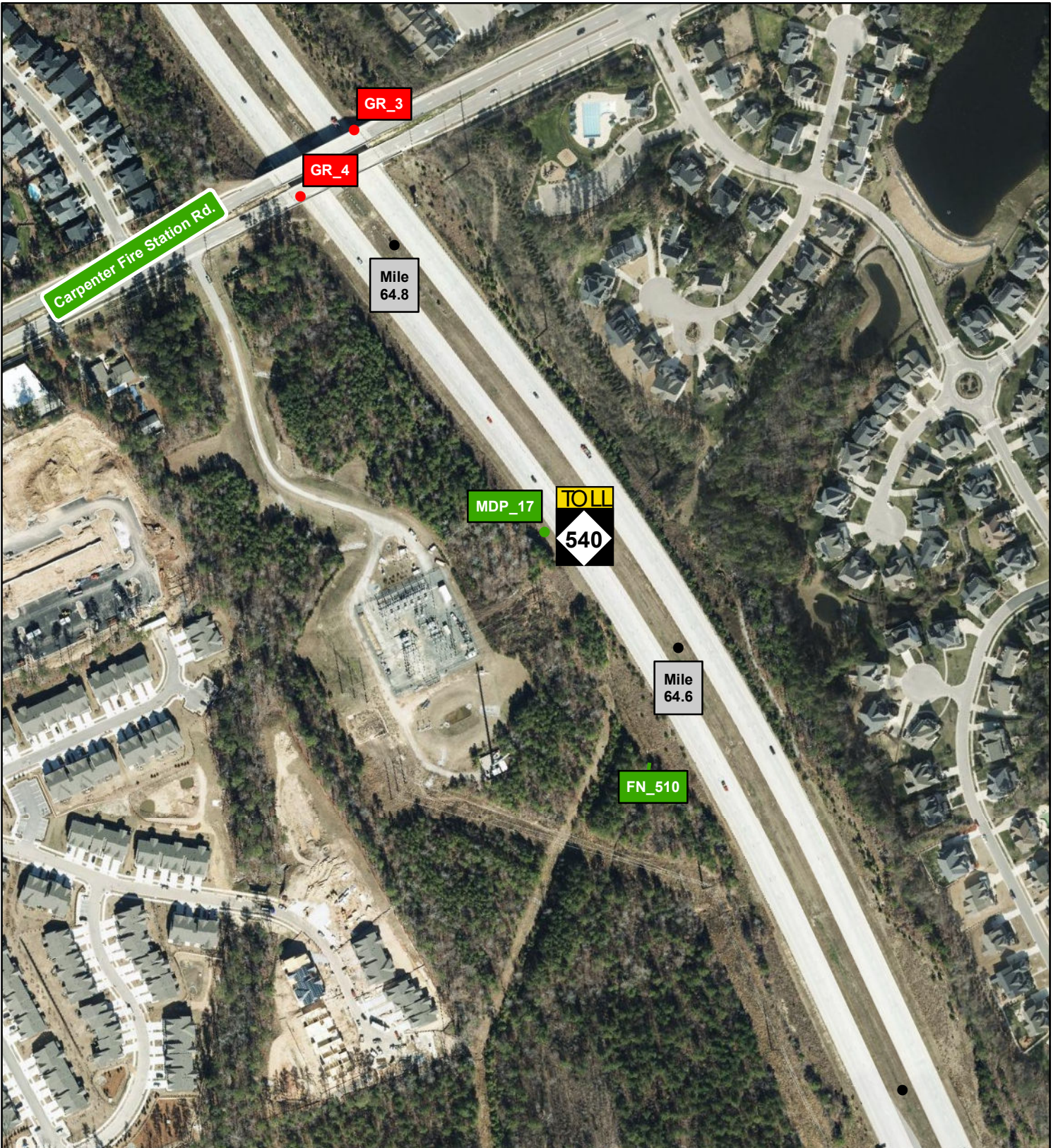


Legend



- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

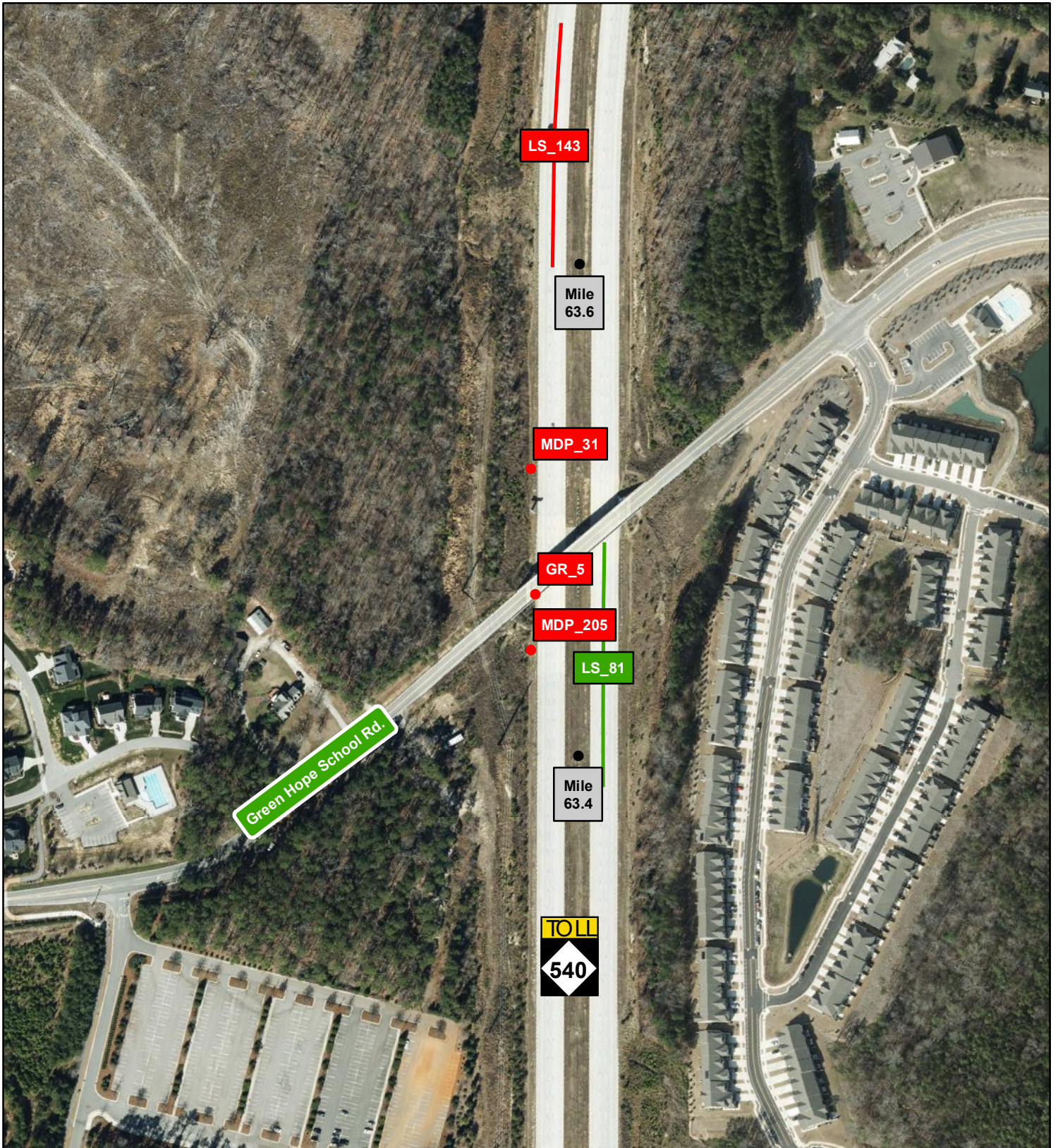


Legend



-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

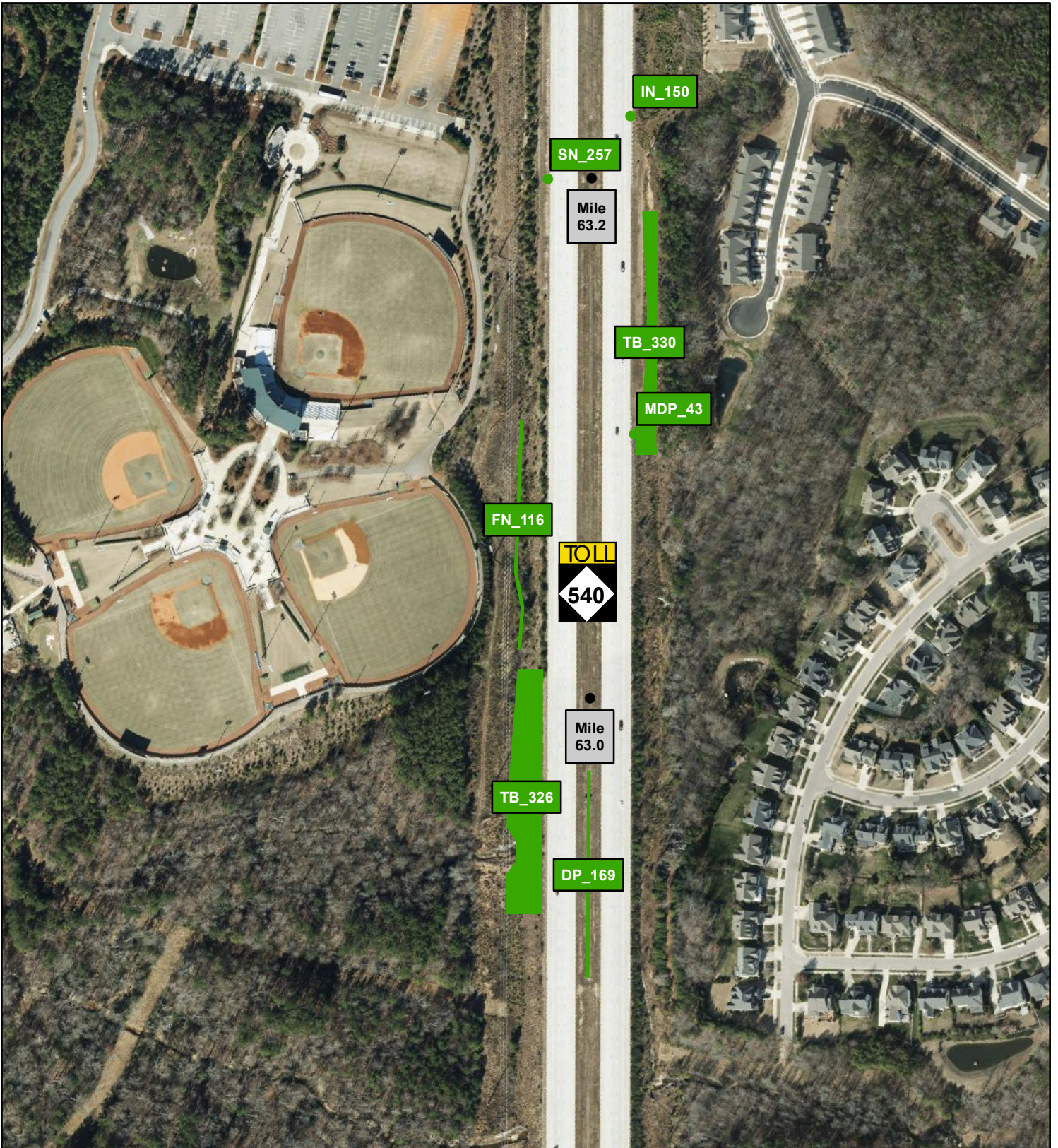


Legend

-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

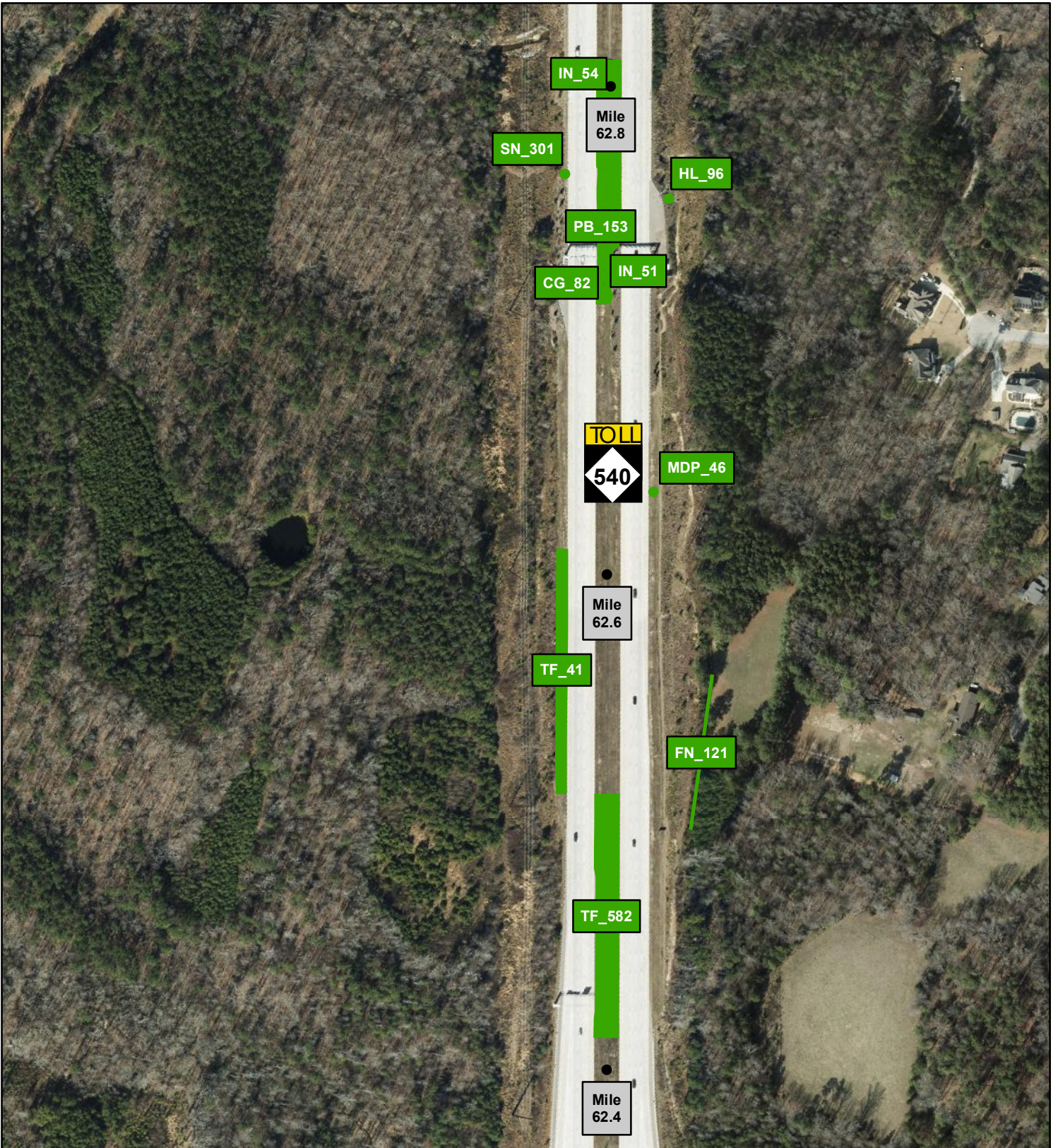


Legend



- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

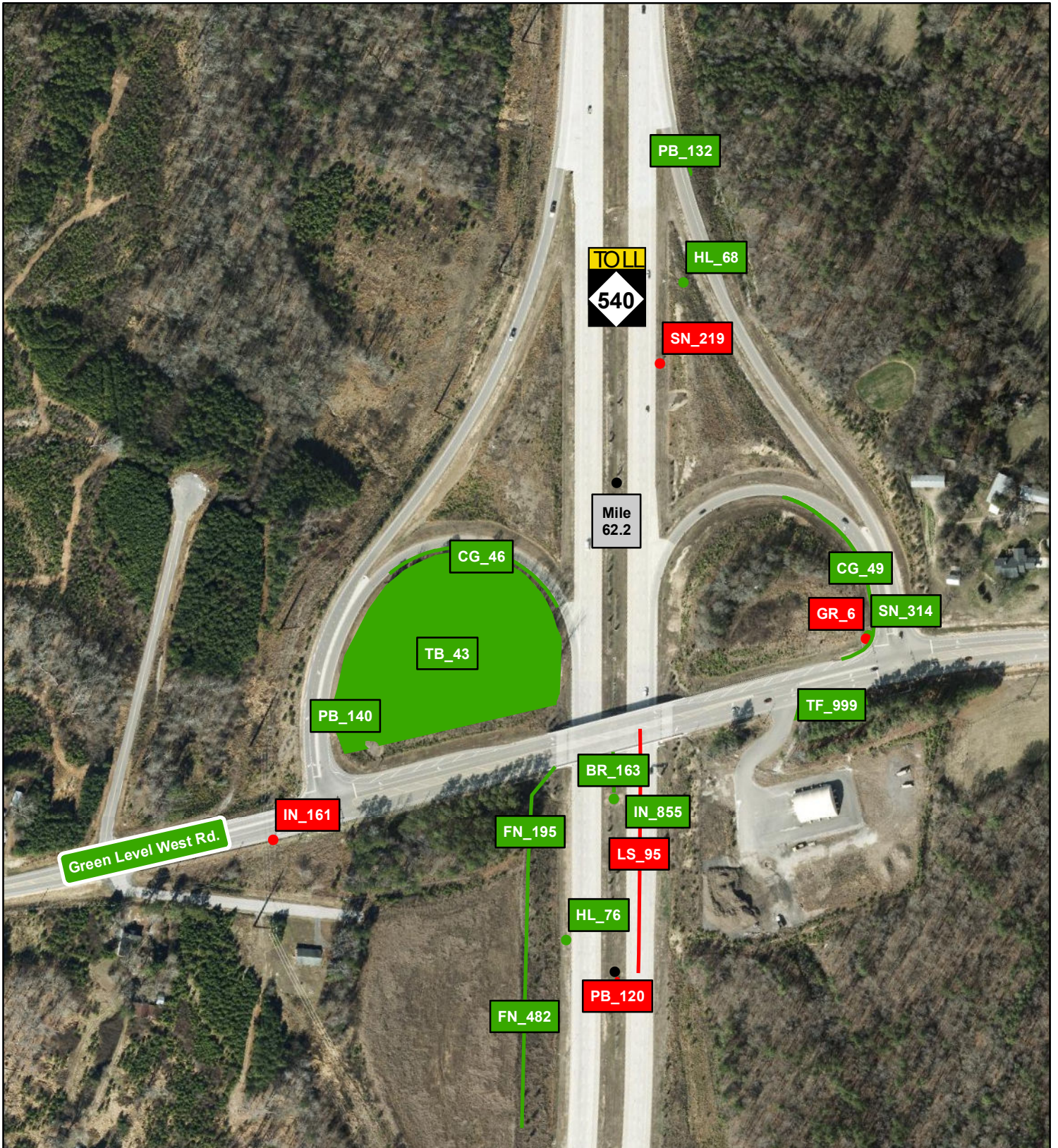


Legend

-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

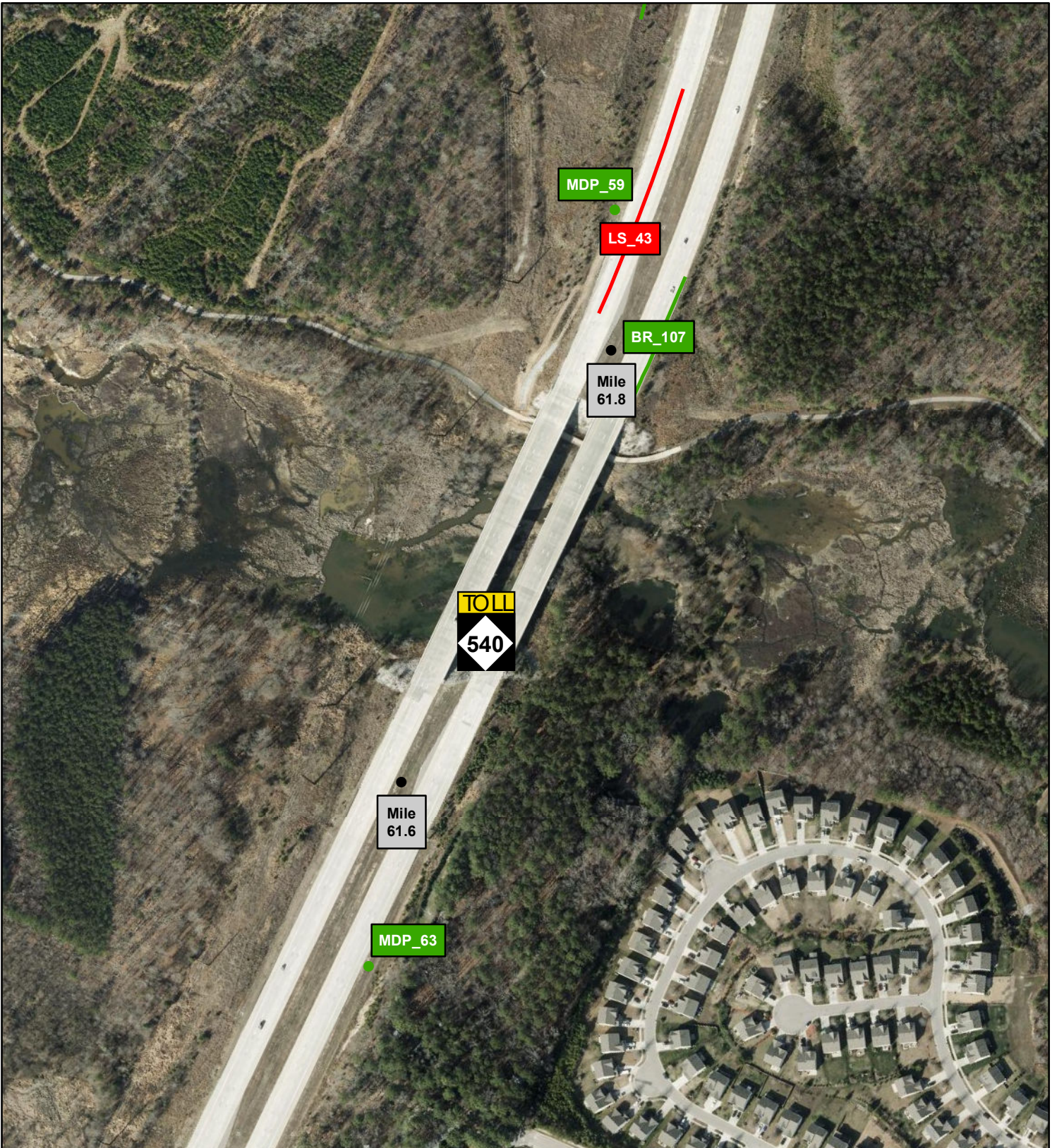


Legend



- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

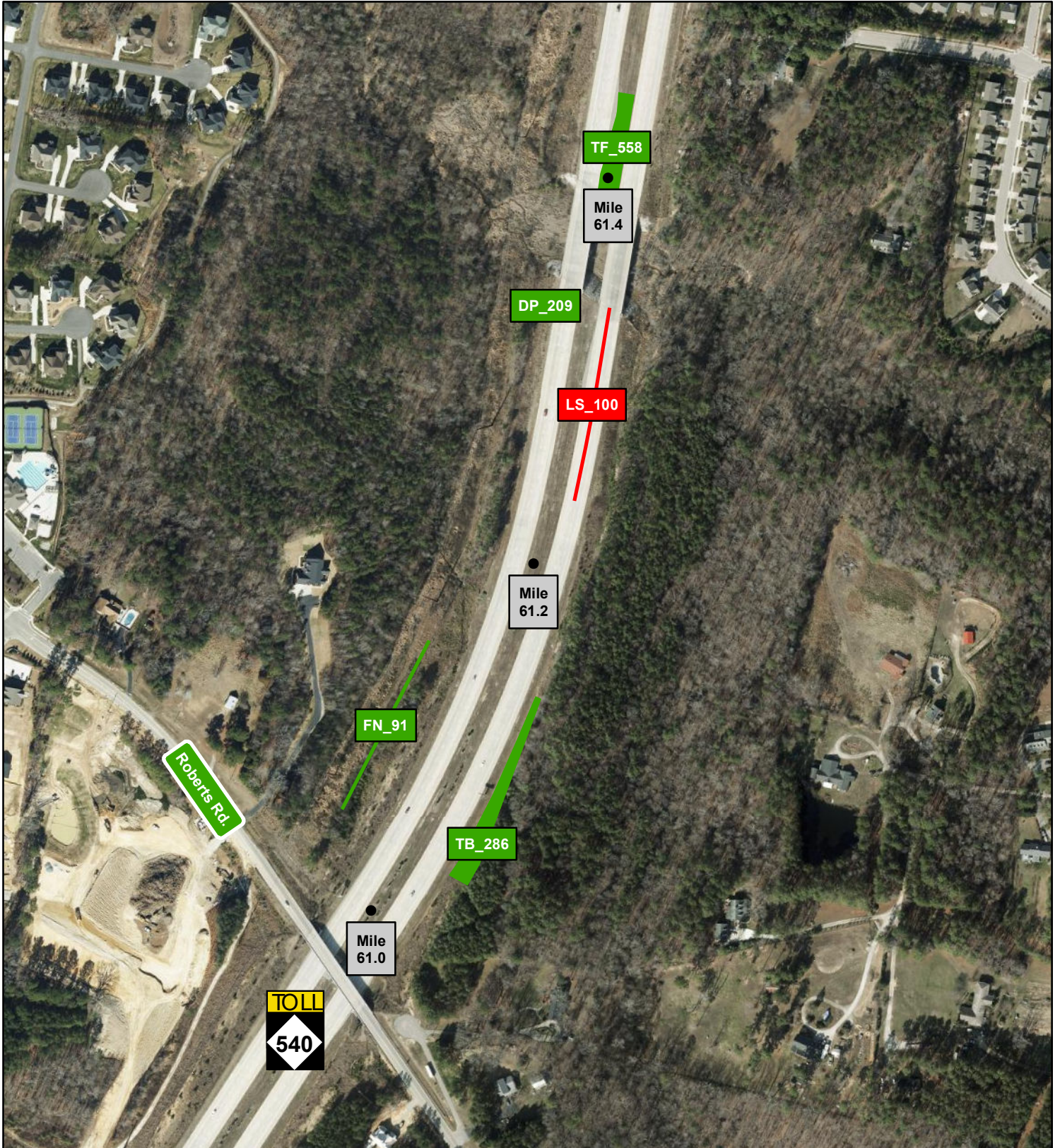


Legend



-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations



Legend



-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

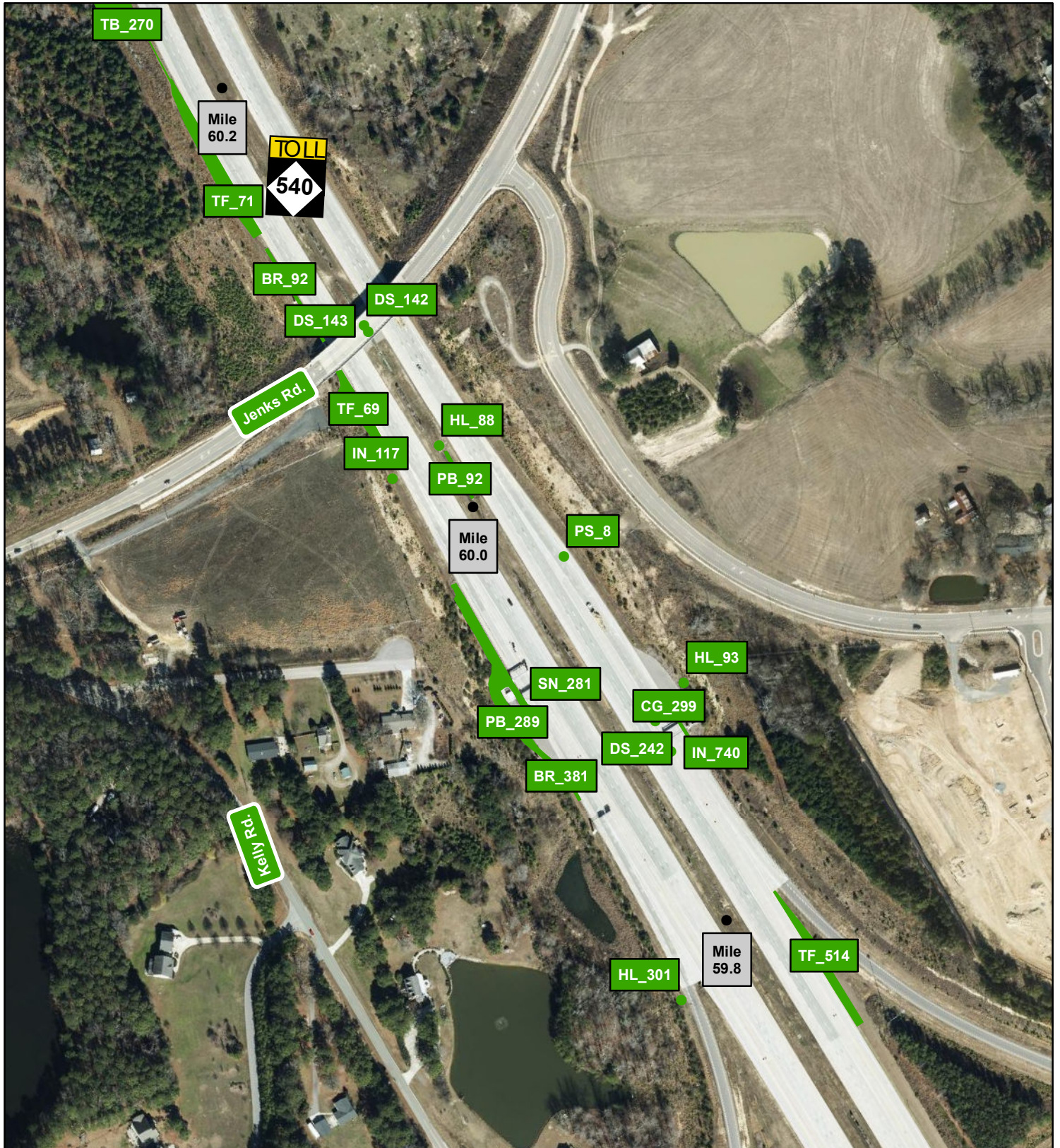


Legend

-  Failing Asset
-  Passing Asset

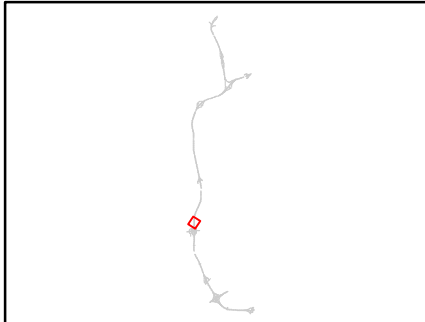


Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset

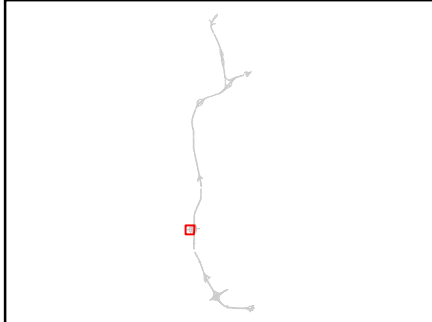


Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

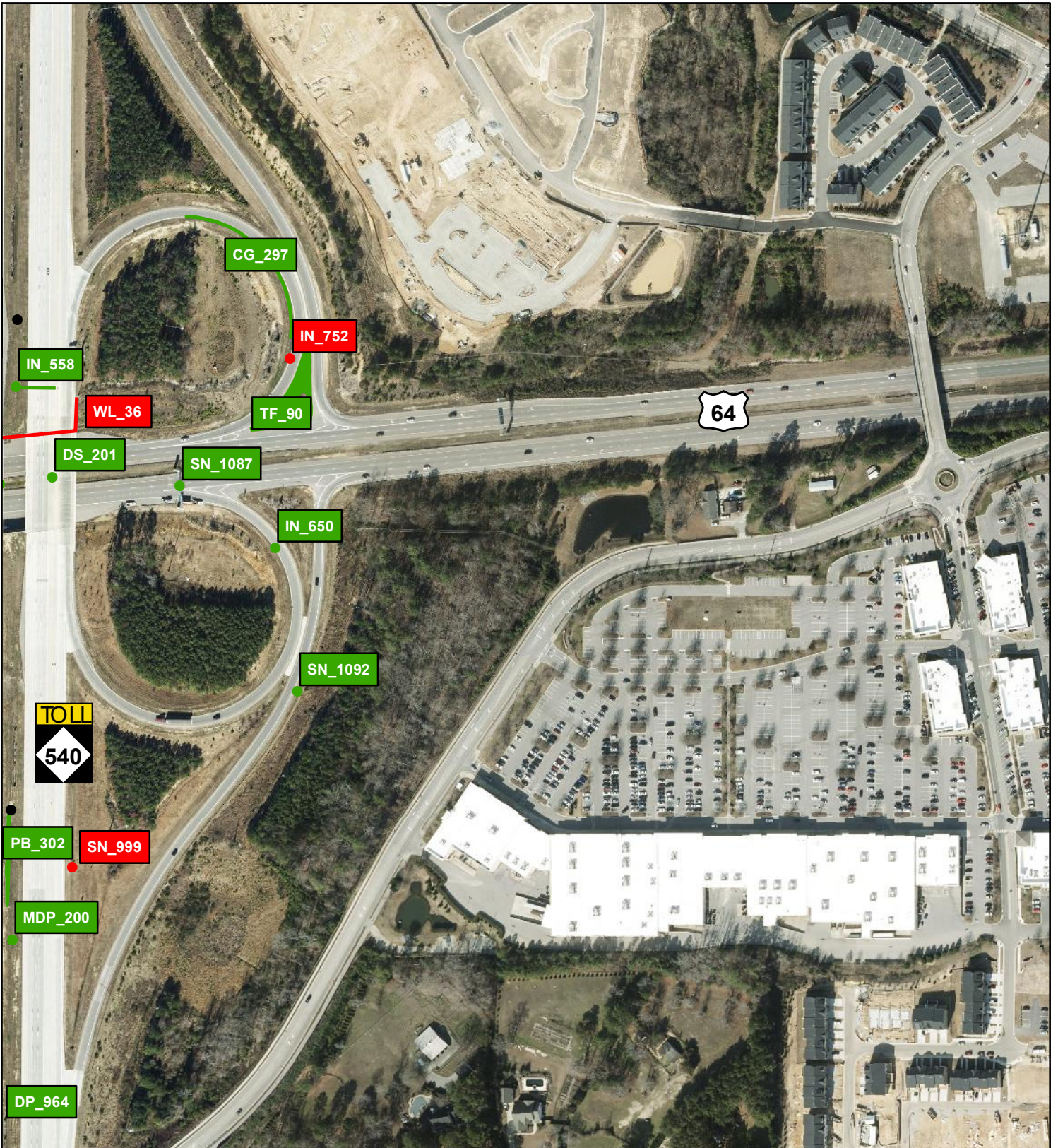


Legend



- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

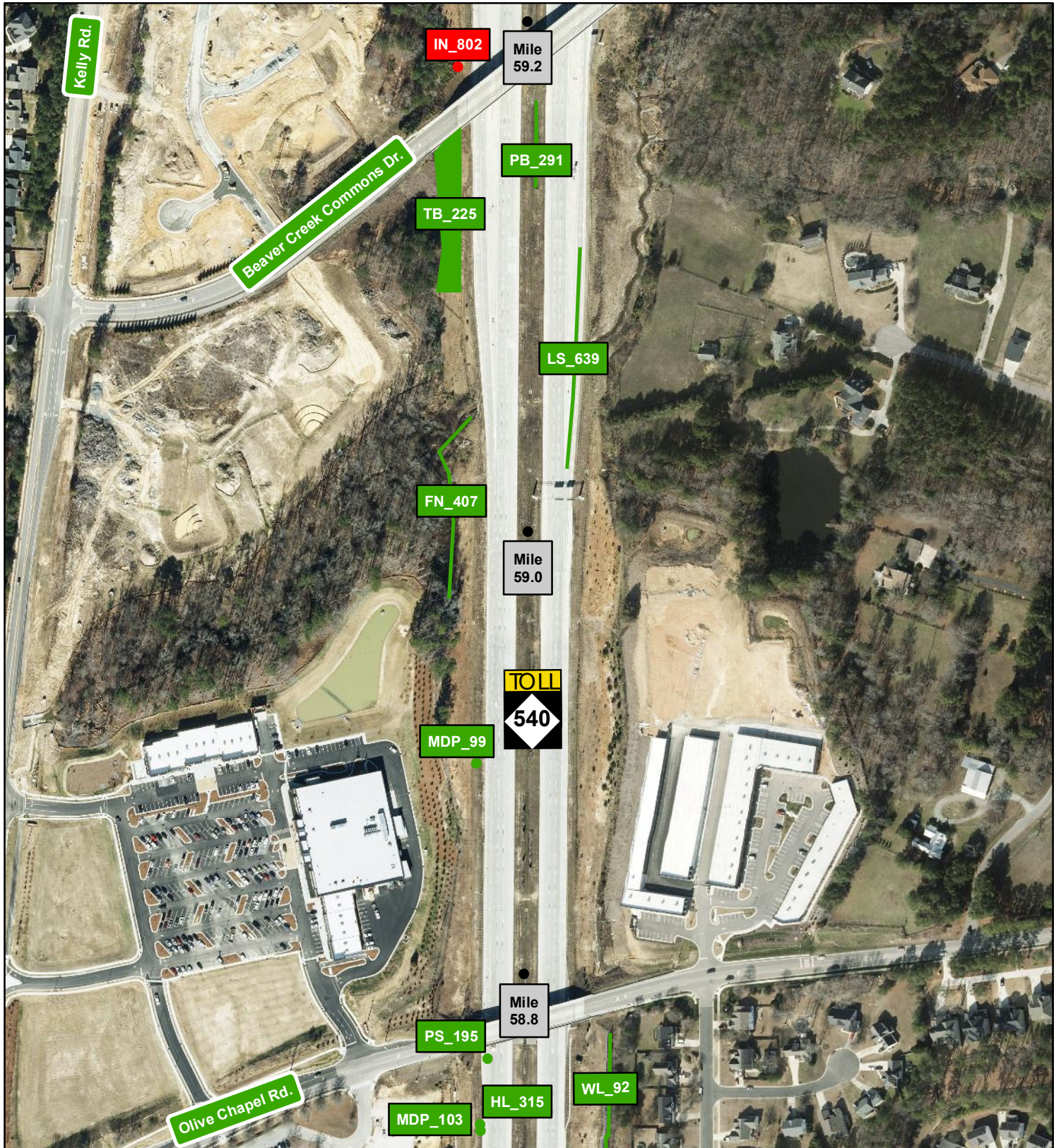


Legend

-  Failing Asset
-  Passing Asset

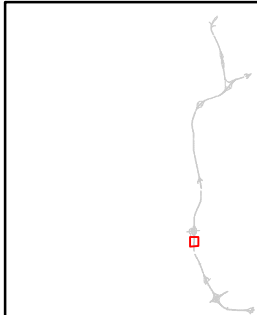


Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

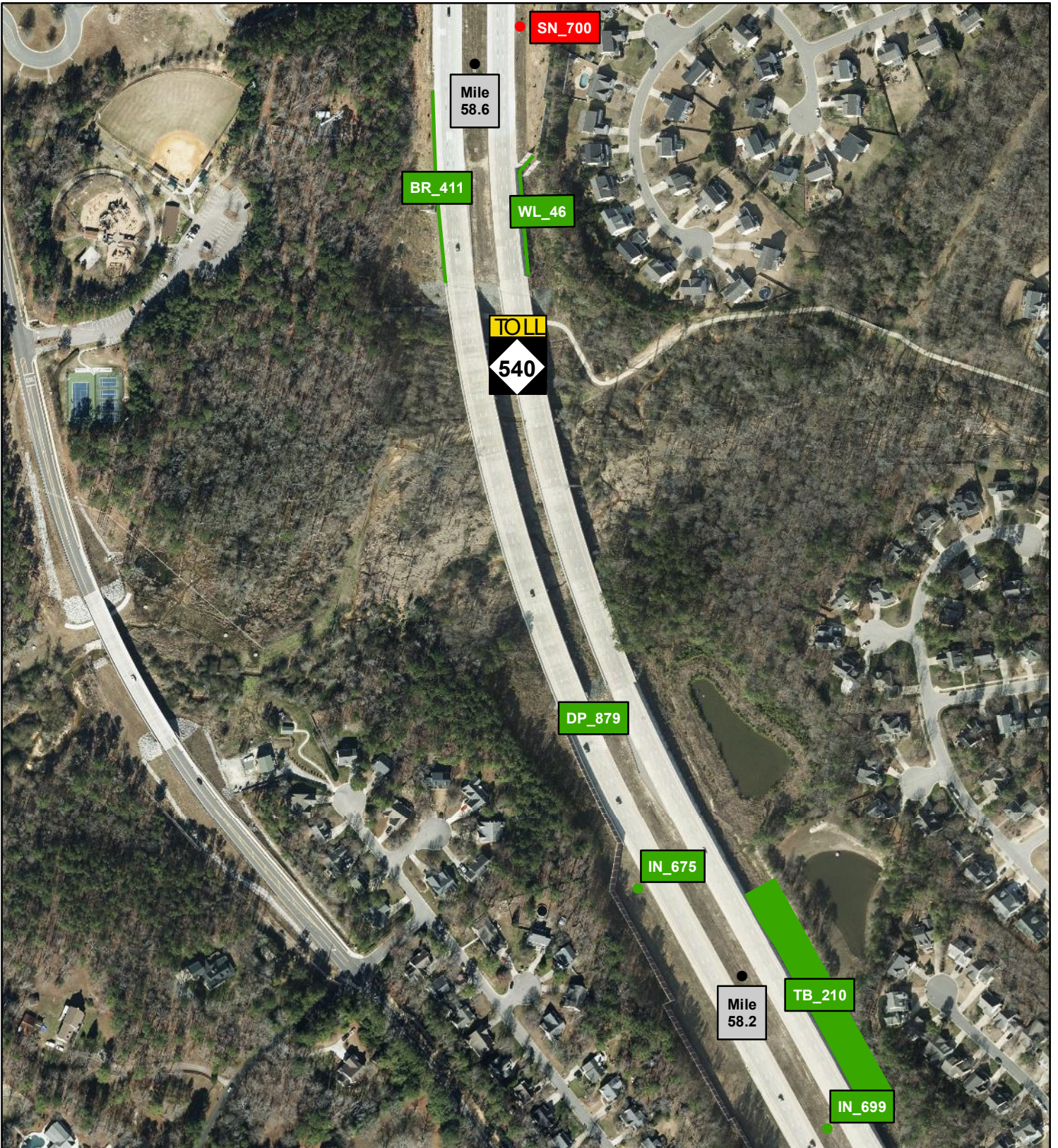


Legend



- Failing Asset
- Passing Asset

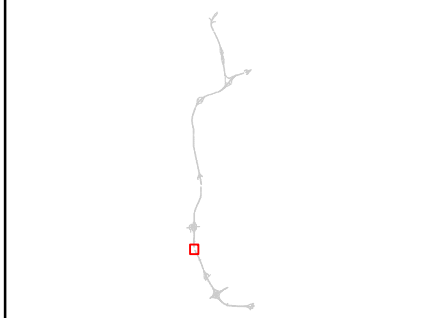


Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset

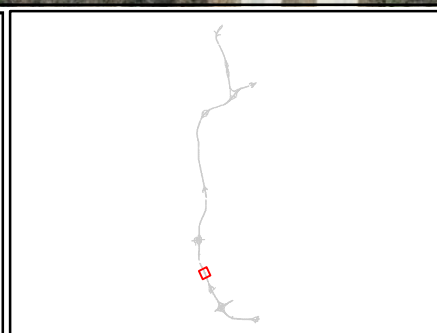


Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset

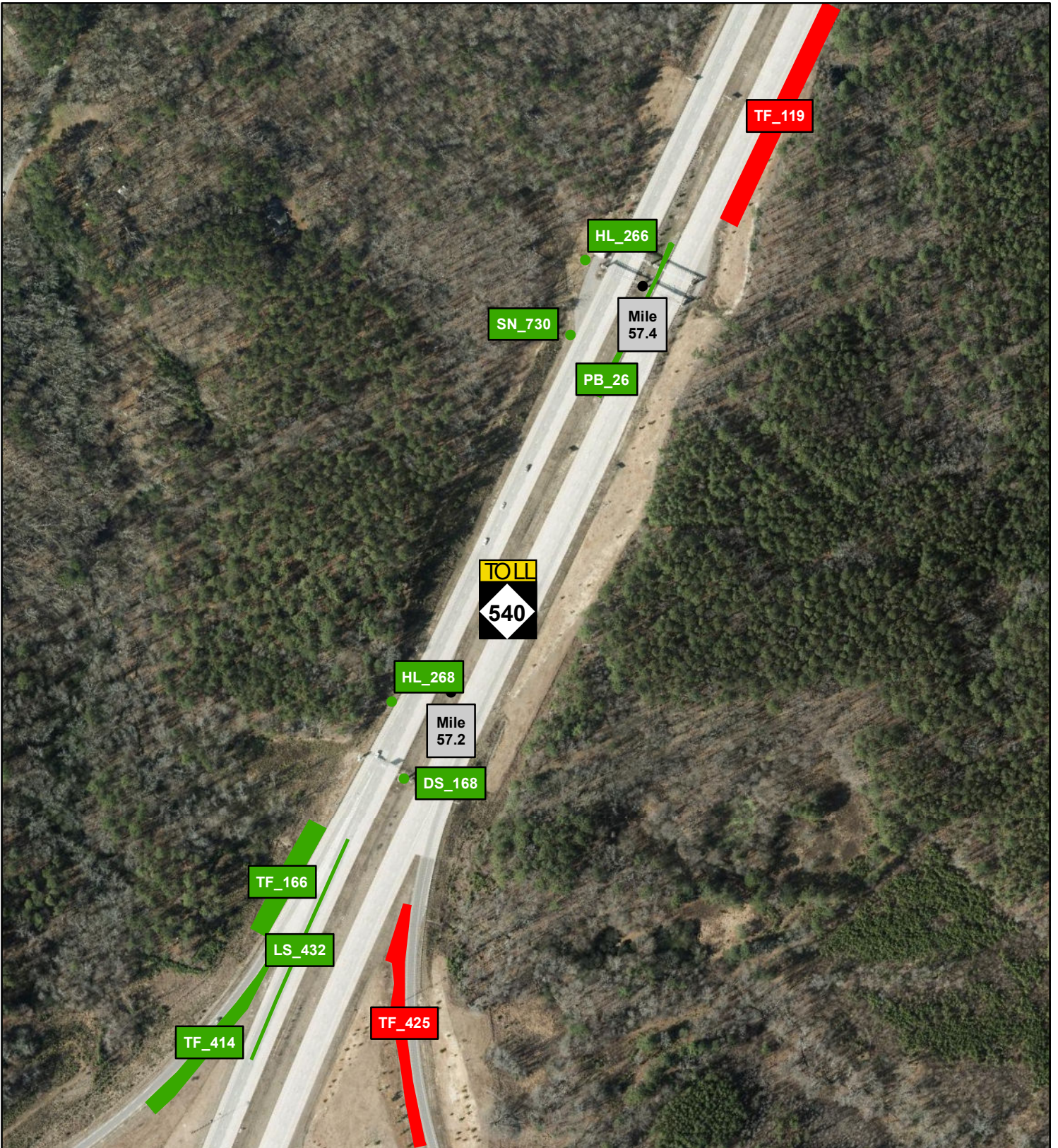








A23

Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

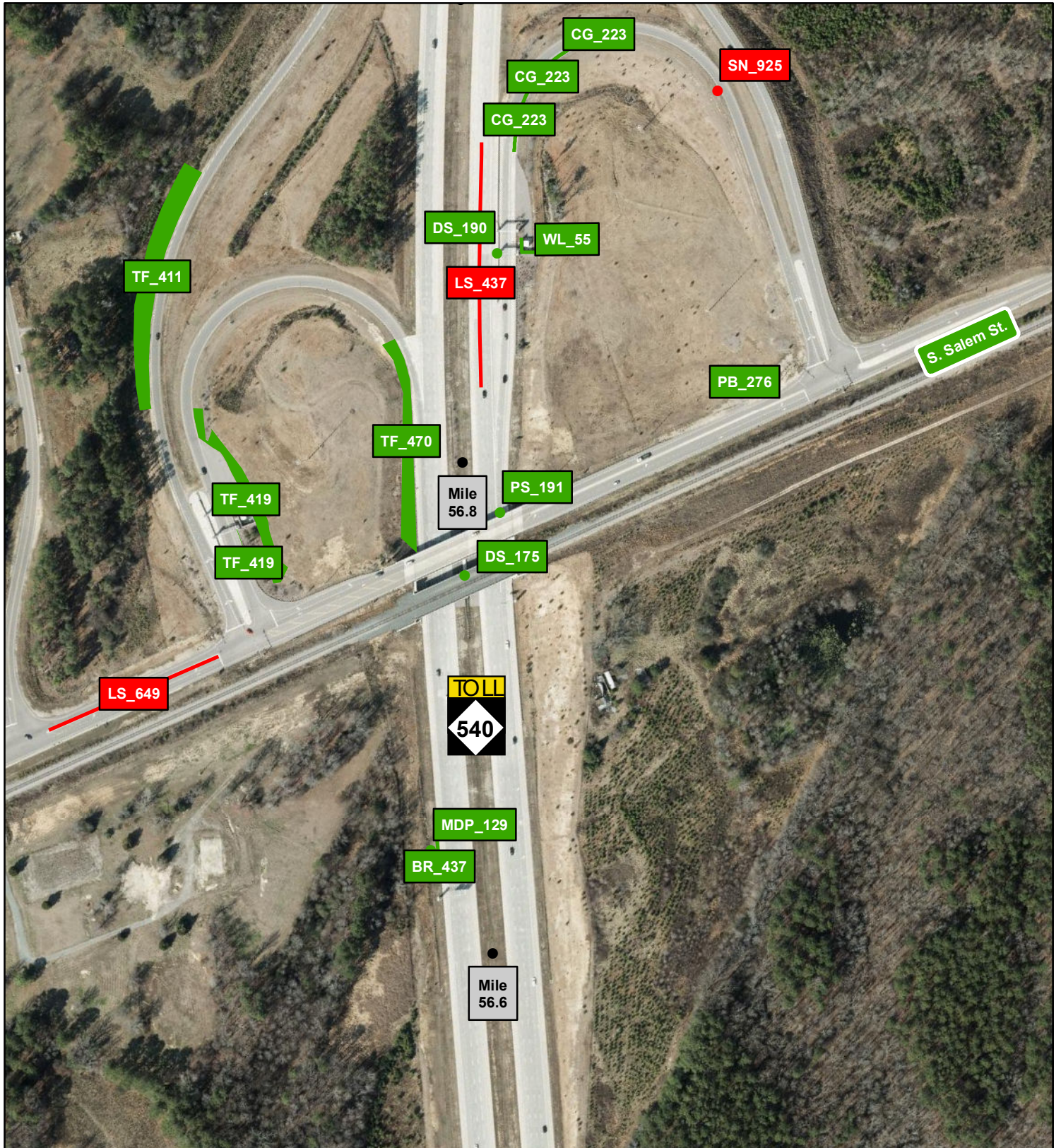


Legend

-  Failing Asset
-  Passing Asset

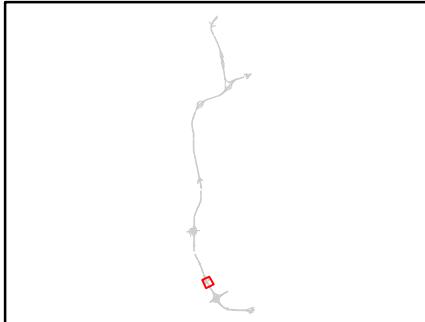


Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

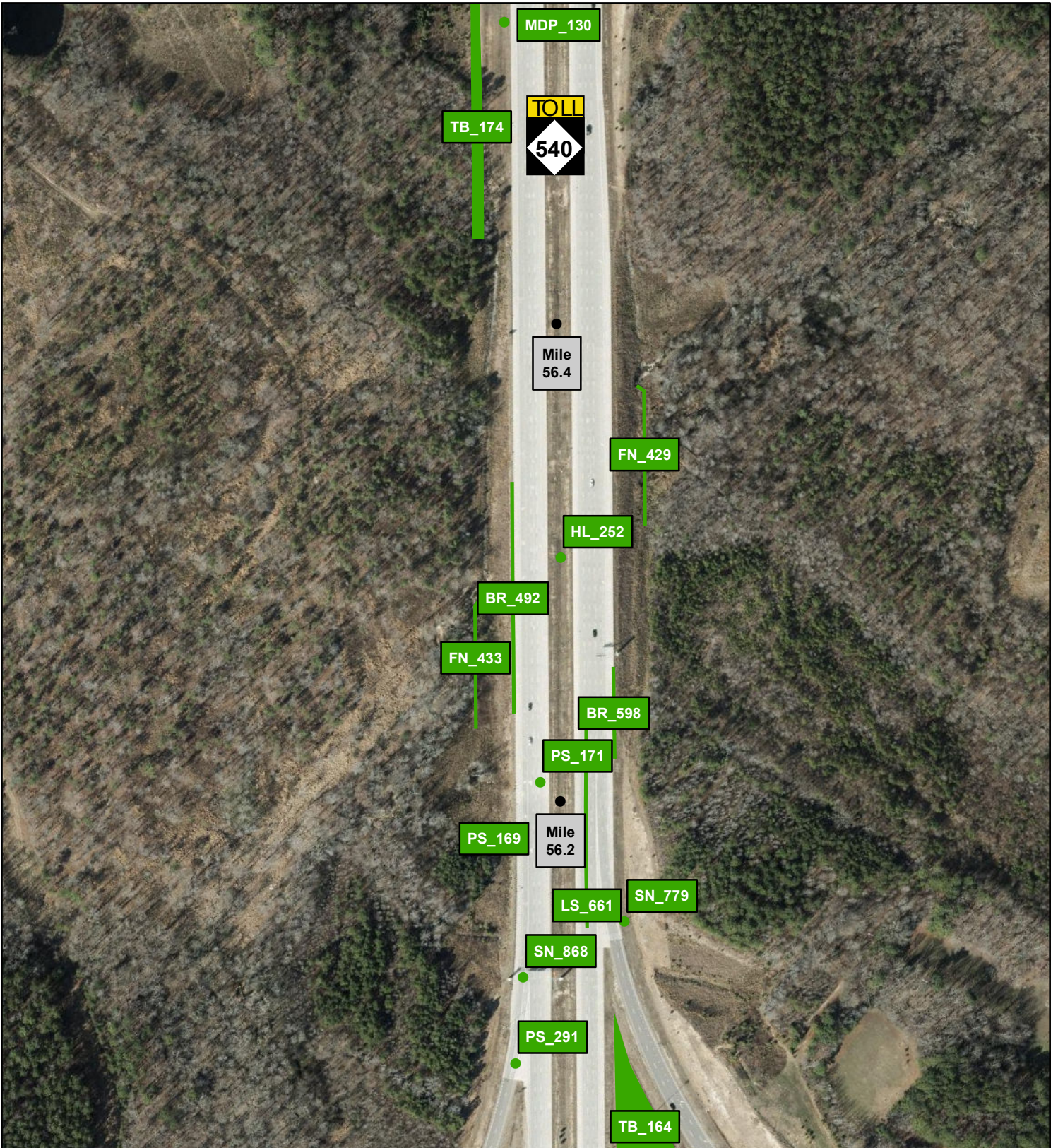


Legend



- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

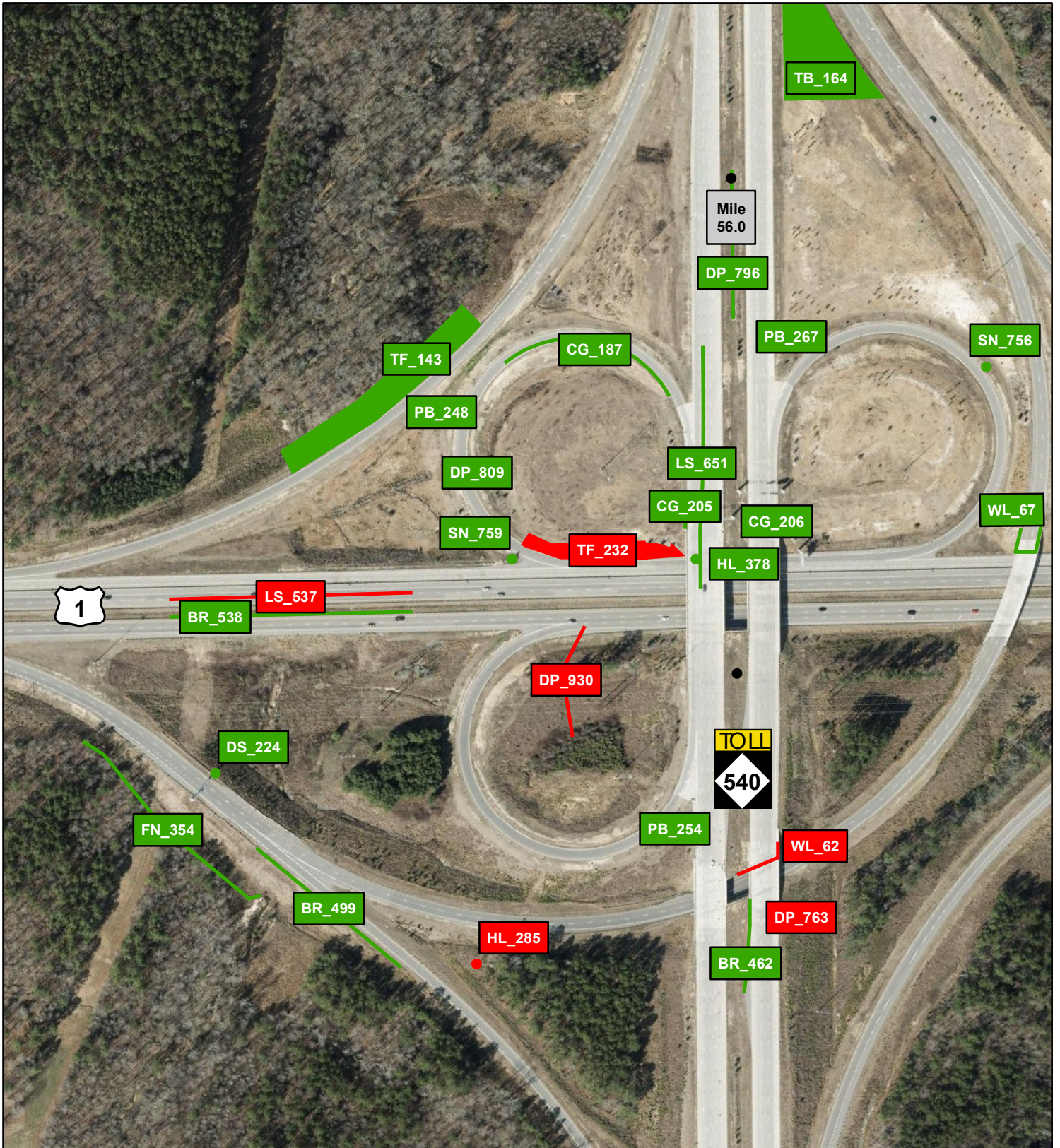


Legend

-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

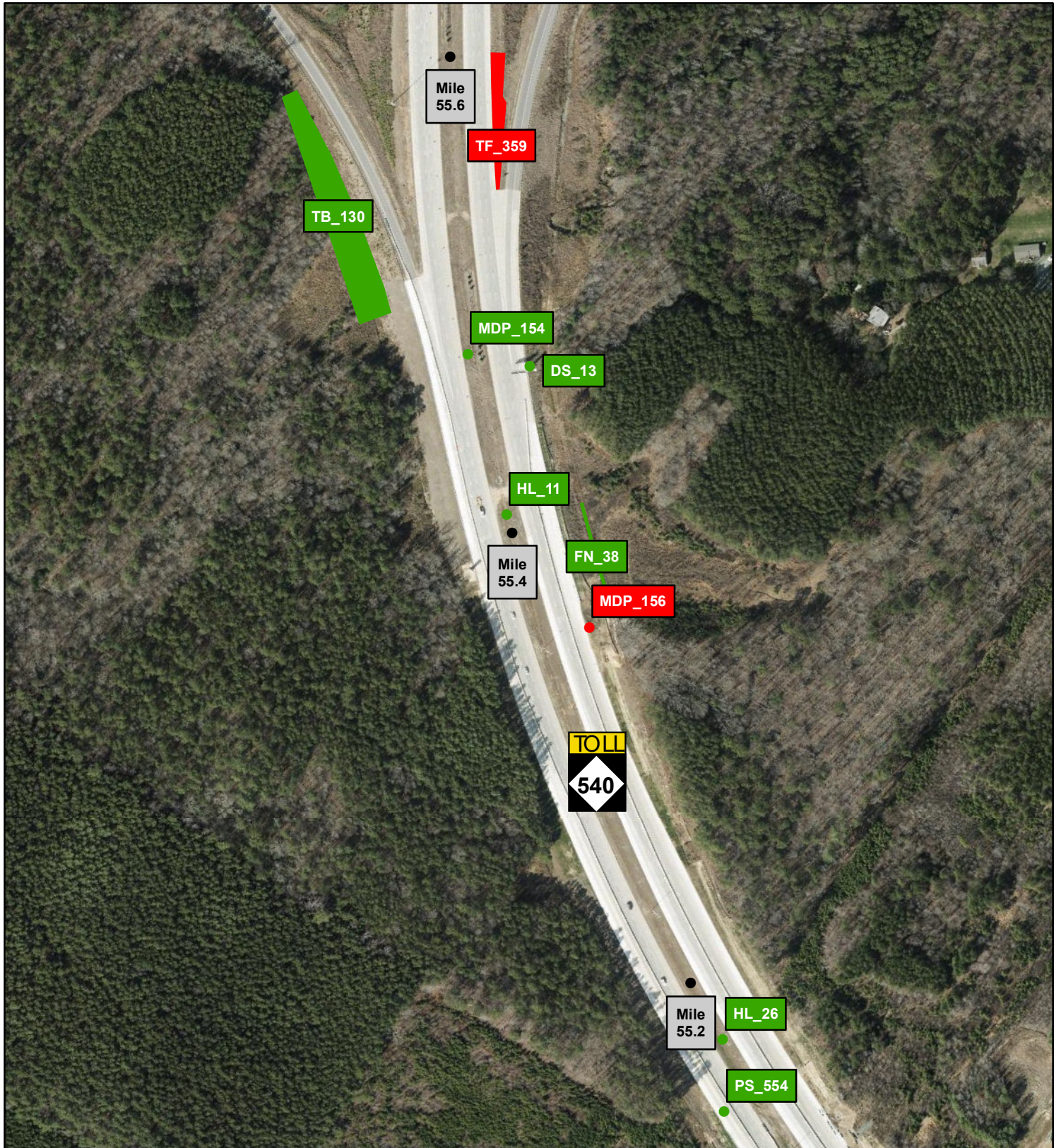


Legend



- Failing Asset
- Passing Asset

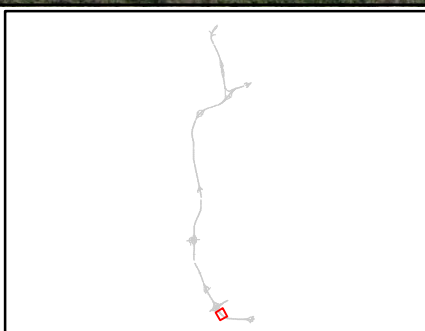


Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

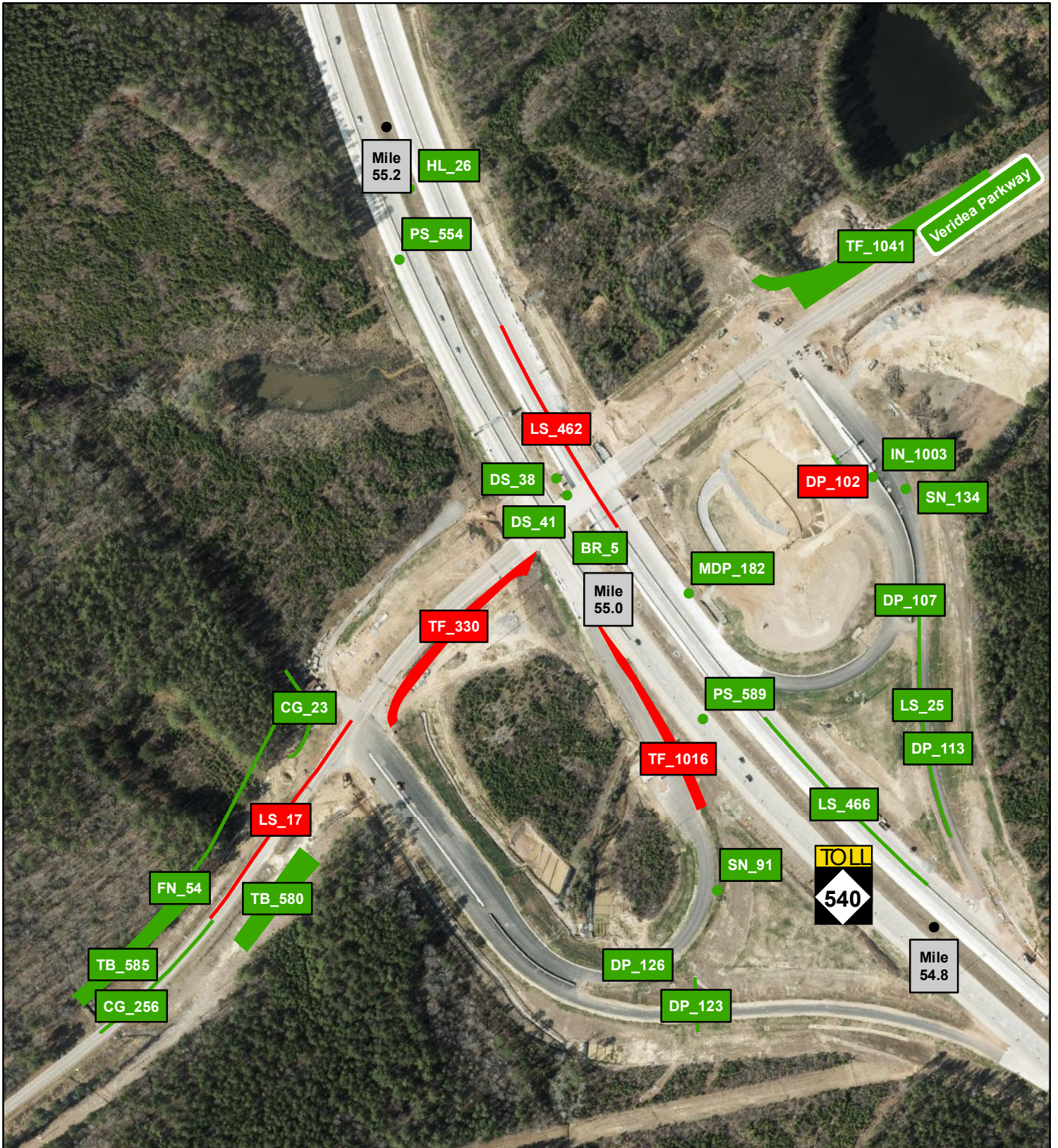


Legend

-  Failing Asset
-  Passing Asset

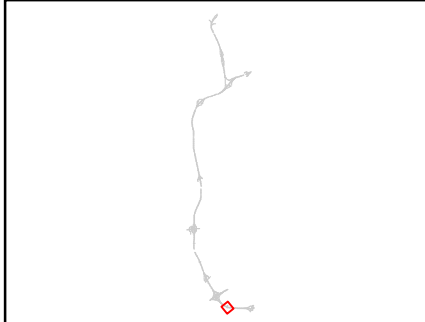


Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations



Legend



- Failing Asset
- Passing Asset

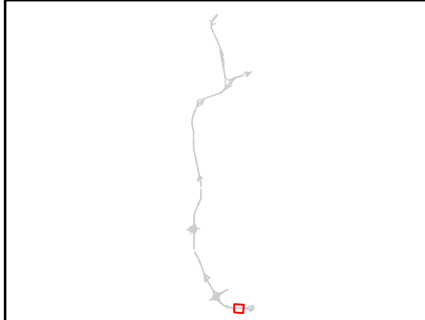


Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset

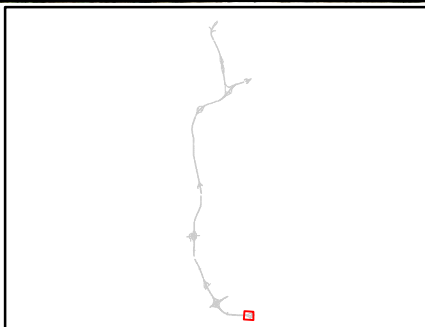


Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

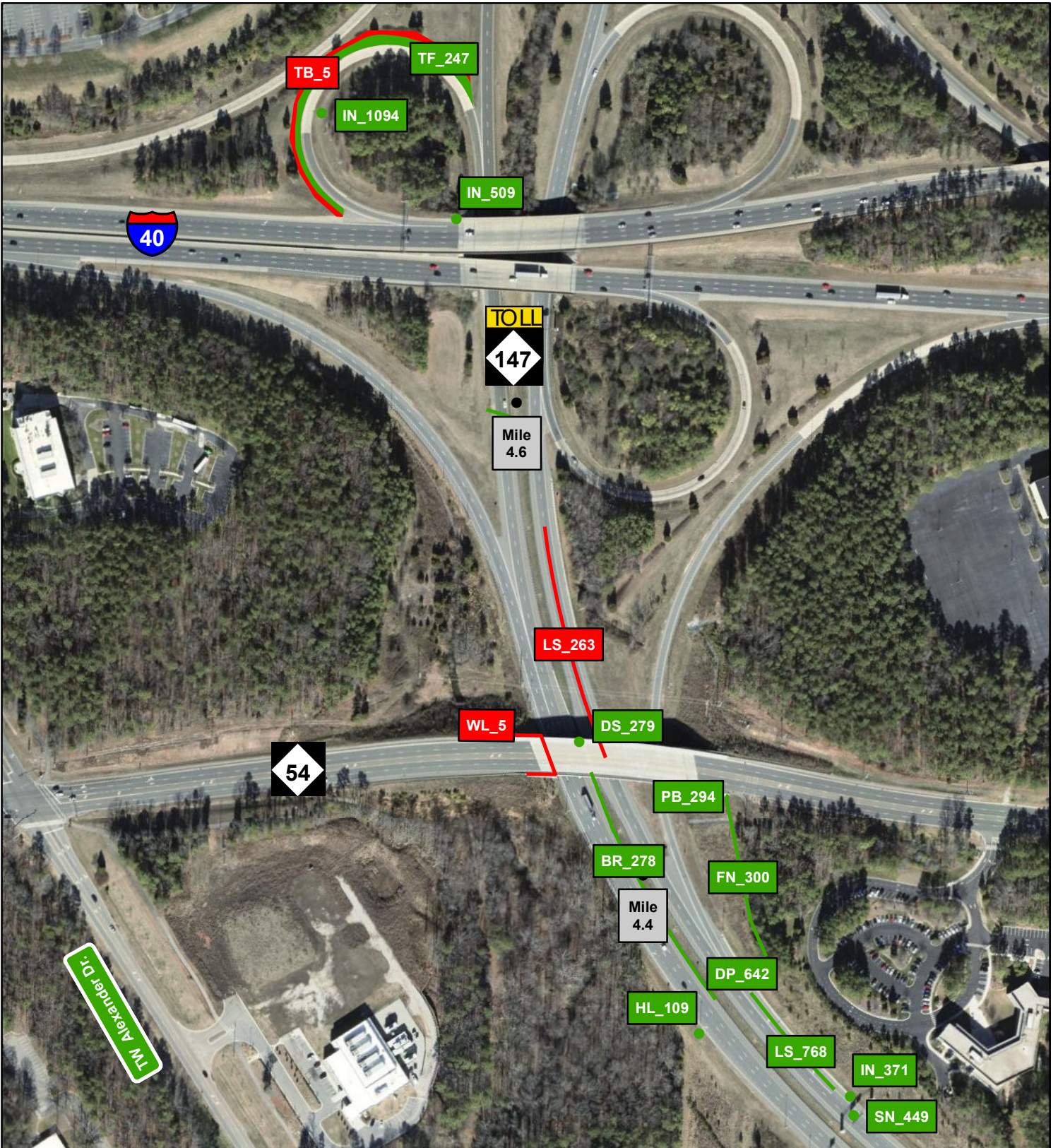


Legend

- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations



Legend



- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations



Legend



-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset

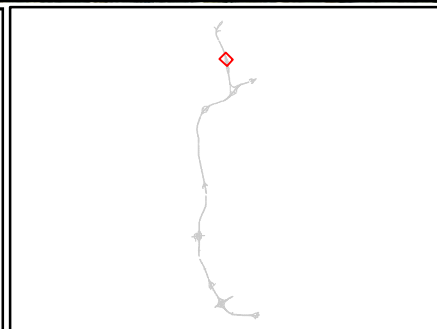


Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset



NORTH CAROLINA
Turnpike Authority

A35

Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations

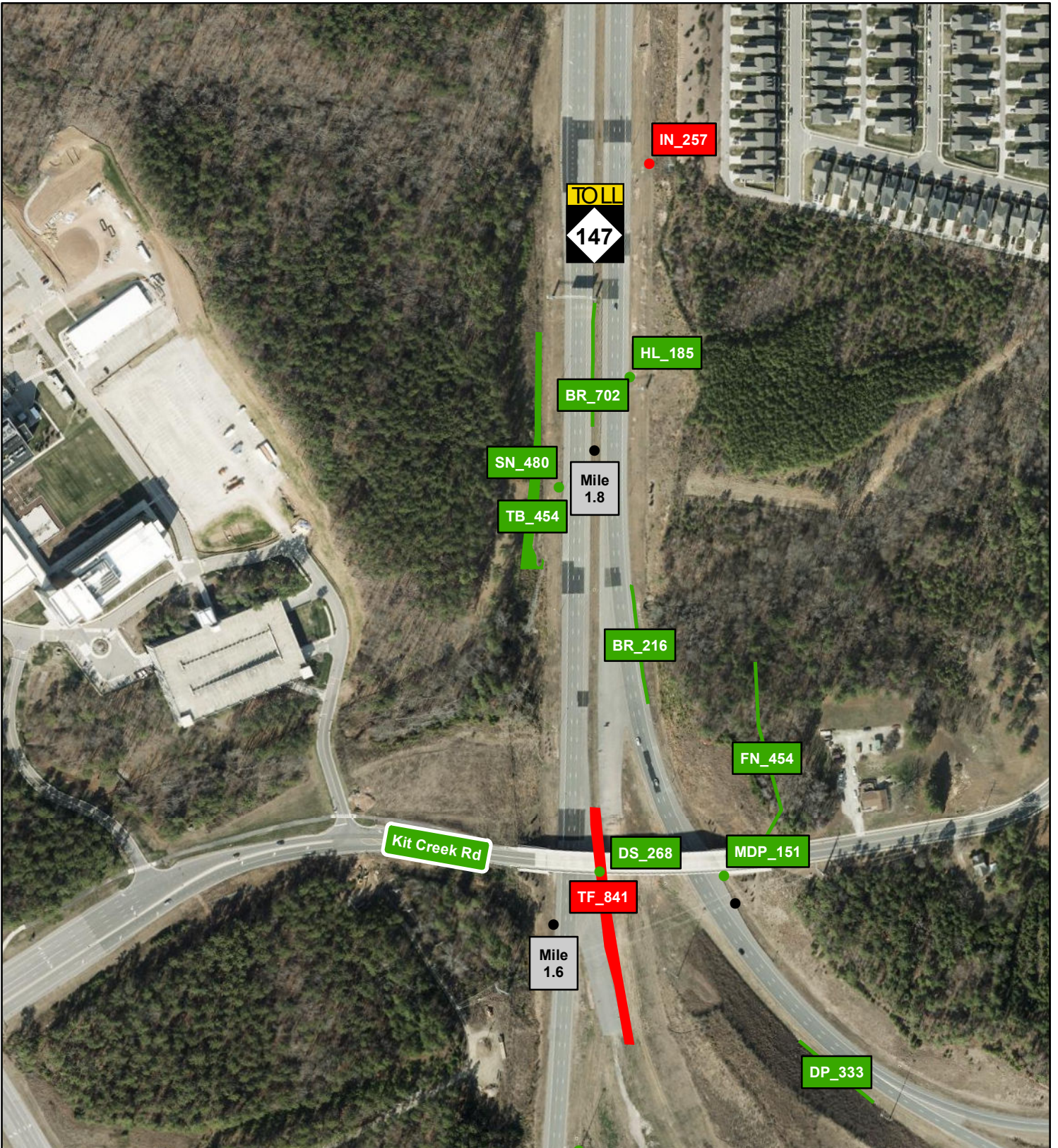


Legend



- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2020 Third Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset



Appendix B

Triangle Expressway 2020 Third Quarter Table Results of Assets Failing MRP

Appendix B: Triangle Expressway 2020 Third Quarter Table Results of Assets Failing MRP

Provided below are a series of tables outlining the existing failures that occurred throughout the facility. Assets are defined by an Inventory ID, which is a unique identifier given to each individual asset. The components that make up the Inventory ID are an asset specific prefix along with a number, such as LS_1. All assets and their respective prefixes are listed below:

Guardrail, Concrete Barrier and End Anchors (BR).....	2
Curb and Gutter (CG).....	3
Decorative Supports (DS).....	4
Drainage Pipes (DP).....	5
Misc. Drainage Structure (MDP).....	6
Fence and Control of Access (FN).....	8
Graffiti (GR).....	9
Highway Lighting (HL).....	11
Impact Attenuators (IA).....	12
Inlets (IN).....	13
Landscaping (PB).....	15
Paved Lanes – Asphalt (LS).....	16
Paved Lanes – Concrete (LS).....	17
Paved Shoulders (LS).....	18
Unpaved Shoulders (LS).....	19
Front/Back Slopes (LS).....	20
Unpaved Lateral and Outfall Ditches (LS).....	21
Litter (LS).....	22
Roadway Sweeping (LS).....	23
Pavement Striping (LS).....	24
Pavement Markers (LS).....	26
Delineators (LS).....	27
Paved Ditches (PD).....	28
Pavement Words and Symbols (PS).....	29
Signs (SN).....	31
Tree and Brush (TB).....	33
Turf Condition (TF).....	34
MSE/Retaining Walls, Sound Barrier Walls and Screen Walls (WL).....	37

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

Guardrail, Concrete Barrier and End Anchors (BR)

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




Curb and Gutter (CG)

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





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_102	End Protection Damage		A29
2	Drain	DP_763	End Protection Damage		A27
2	Drain	DP_930	End Protection Damage		A27




Misc. Drainage Structure (MDP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Shoulder Drain	MDP_31	Obstruction & Missing Rodent Screen		A11
2	Shoulder Drain	MDP_112	End Damage & Missing Rodent Screen		A23
3	Shoulder Drain	MDP_156	End Damage		A28
4	Shoulder Drain	MDP_205	Obstruction		A11





Misc. Drainage Structure (MDP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Shoulder Drain	MDP_216	Missing Rodent Screen		A35





Fence and Control of Access (FN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Woven	FN_222	Fence Height		A2
2	Woven	FN_303	Fence Height		A1
3	Woven	FN_502	Fence Height		A19

Graffiti (GR)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Bridge Wall	GR_1	Graffiti		A9
2	Bridge Wall	GR_2	Graffiti		A9
3	Bridge Wall	GR_3	Graffiti		A10
4	Bridge Wall	GR_4	Graffiti		A10

Graffiti (GR)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Bridge Wall	GR_5	Graffiti		A11
6	Signal Cabinet	GR_6	Graffiti		A14
7	Bridge Wall	GR_7	Graffiti		A6
8	Bridge Wall	GR_8	Graffiti		A4





Highway Lighting (HL)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Single Roadway	HL_7	Part Damage		A30
2	High Mast	HL_161	Rodent Screen		A3
3	Single Roadway	HL_162	Part Damage		A2
4	High Mast	HL_285	Part Damage		A27



Impact Attenuators (IA)

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




Inlets (IN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Drop Inlet	IN_161	Obstruction		A14
2	Drop Inlet	IN_257	Eroded Area		A37
3	Drop Inlet	IN_306	Obstruction & Surface Damage		A3
4	Drop Inlet	IN_635	Obstruction		A23

Inlets (IN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Drop Inlet	IN_752	Obstruction		A20
6	Drop Inlet	IN_802	Obstruction		A21


Landscaping (PB)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Plant Bed	PB_21	Health		A35
2	Plant Bed	PB_120	Health		A14
3	Plant Bed	PB_224	Health		A3


Paved Lanes – Asphalt (LS)

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

Paved Lanes – Concrete (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_462	Pothole		A29

Paved Shoulders (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_569	Joint Separation		A31


Unpaved Shoulders (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_263	Shoulder Drop-Off		A32
2	Asphalt	LS_649	Shoulder Drop-Off		A25




Front/Back Slopes (LS)

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

Unpaved Lateral and Outfall Ditches (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_421	Blocked Ditch		A23

Litter (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_377	Litter		A31
2	Asphalt	LS_537	Litter		A27
3	Asphalt	LS_682	Litter		A31




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	Asphalt	LS_17	Nighttime Visiblity		A29
2	Concrete	LS_43	Line Missing		A15
3	Concrete	LS_95	Line Missing		A14
4	Concrete	LS_100	Line Missing		A16



Pavement Striping (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Concrete	LS_143	Line Missing		A11
6	Concrete	LS_437	Line Missing		A25
7	Asphalt	LS_553	Line Missing		A19

Pavement Markers (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_95	Nighttime Reflectivity		A14
2	Asphalt	LS_553	Reflective Marker Missing & Nighttime Reflectivity		A19
3	Asphalt	LS_683	Reflective Marker Missing & Nighttime Reflectivity		A31





Delineators (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_537	Delineators Missing		A27
2	Concrete	LS_595	Delineators Missing		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)

#	Symbol Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Merge Left	PS_240	Nighttime Reflectivity	Not Available for Nighttime Failure	A19
2	Right Turn	PS_247	Nighttime Reflectivity		A19
3	Left Turn	PS_394	Nighttime Reflectivity		A1
4	Right Turn	PS_417	Daytime Assessment & Nighttime Reflectivity		A1
11	Stop Bar	PS_429	Nighttime Reflectivity		A1


Pavement Words and Symbols (PS)

#	Symbol Type	Object ID	Failure Type	Photo	GIS Reference Page
12	Left Turn	PS_431	Daytime Assessment & Nighttime Reflectivity		A7


Signs (SN)

#	Sign Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Merge	SN_219	Height Requirement		A14
2	Speed Limit Interstate	SN_700	Height Requirement		A22
3	Exit	SN_925	Missing Parts		A25
4	Merge	SN_999	Height Requirement		A20





Signs (SN)

#	Sign Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Pedestrian Xing	SN_1033	Surface Damage		A36




Tree and Brush (TB)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Tree and Brush	TB_5	Barrier Clearance		A32


Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Turf	TF_101	Bare Ground		A19
2	Turf	TF_119	Bare Ground		A24
3	Turf	TF_232	Bare Ground		A27
4	Turf	TF_330	Bare Ground		A29




Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Turf	TF_359	Bare Ground		A28
6	Turf	TF_425	Bare Ground		A24
7	Turf	TF_841	Bare Ground		A37
8	Turf	TF_902	Bare Ground		A36

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
9	Turf	TF_1016	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		A32
2	Bridge Wall	WL_36	Unsealed Cracks		A19, A20
3	Bridge Wall	WL_62	Vegetation		A27