



NORTH CAROLINA
Turnpike Authority

Maintenance Rating Program

Triangle Expressway

2019 Fourth Quarter and Annual Report

1 S. Wilmington Street
Raleigh, NC 27601



Last Updated:
February 4, 2020

CONSULTANT CERTIFICATION OF COMPLETION

February 4, 2020

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

NCTA Triangle Expressway Roadway Maintenance Performance Rating Program; Q4, FY 2019 Rating

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

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

Sincerely,

The Kercher Group, Inc.

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

Ken M. McEntire, PE
Principal

1100 Navaho Drive, Suite 125
Raleigh, NC 27609

Table of Contents

List of Figures ii

List of Tables ii

1.0 EXECUTIVE SUMMARY 1

2.0 INTRODUCTION 2

3.0 MRP PROCEDURE 2

4.0 TRIANGLE EXPRESSWAY DESCRIPTION 5

5.0 TRIANGLE EXPRESSWAY ASSET INVENTORY UPDATE 6

6.0 MRP FOURTH QUARTER ASSESSMENT 7

 6.1 Quarterly Results 7

 6.2 Quarter Analysis and Recommendations 9

7.0 MRP ANNUAL 2019 ASSESSMENT 11

 7.1 Annual Results 11

 7.2 Annual Analysis and Recommendations 13

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
2019 Fourth Quarter (October – December) and Annual Report

List of Figures

Figure 1: Maintenance Elements and Characteristics 3
Figure 2: Triangle Expressway Map 5
Figure 3: Paved Lanes Asphalt Inspection Results Sample 10
Figure 4: Annual Rating Comparison Chart..... 13
Figure 5: Green Level West Historic District Signs, Landscape Areas 14

List of Tables

Table 1: MRP Element Results for the 2019 Fourth Quarter Assessment 1
Table 2: MRP Element Results for the 2019 Annual Assessment 1
Table 3: Asset Inventory 6
Table 4: MRP Element Results for Q4 2019 7
Table 5: MRP Characteristic Results for Q4 2019 8
Table 6: MRP Element Results for 2019..... 11
Table 7: MRP Rolling Element Results 12

Appendices

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

Maintenance Rating Program for the Triangle Expressway
2019 Fourth Quarter (October – December) and Annual Report

1.0 EXECUTIVE SUMMARY

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

The overall 2019 fourth quarter maintenance rating of the Triangle Expressway was 93.6, exceeding the NCTA target rating of 90. As shown in **Table 1**, all five elements assessed achieved a rating greater than the target rating of 85.

Table 1: MRP Element Results for the 2019 Fourth Quarter Assessment		
Element	MRP Rating	Target Rating
Road Surface	89.5	85.0
Unpaved Shoulders and Ditches	99.1	85.0
Drainage	98.1	85.0
Roadside	96.2	85.0
Traffic Control Devices	90.9	85.0
Overall MRP Performance Rating	93.6	90.0

This report also provides a summary and analysis of the 2019 Annual Assessment of the Triangle Expressway, which considers the results of all four quarterly inspections conducted in 2019 during the months of February, May, August, and November. The summation of these results produces the annual rating, which is a statistically valid representation of the assets’ conditions with a 95% confidence level in statistical sampling.

The overall 2019 annual maintenance rating of the Triangle Expressway was 93.0, which is above the NCTA target rating of 90. As shown in **Table 2**, all annual element ratings were above the target rating of 85.

Table 2: MRP Element Results for the 2019 Annual Assessment					
Element	Q1 2019 Rating	Q2 2019 Rating	Q3 2019 Rating	Q4 2019 Rating	Annual Rating
Road Surface	96.0	92.6	96.9	89.5	93.8
Unpaved Shoulders and Ditches	97.4	97.8	94.7	99.1	97.3
Drainage	91.3	94.0	92.3	98.1	93.9
Roadside	92.8	92.8	94.7	96.2	94.1
Traffic Control Devices	92.1	87.9	86.6	90.9	89.3
Overall MRP Performance Rating	93.7	92.1	92.5	93.6	93.0

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.

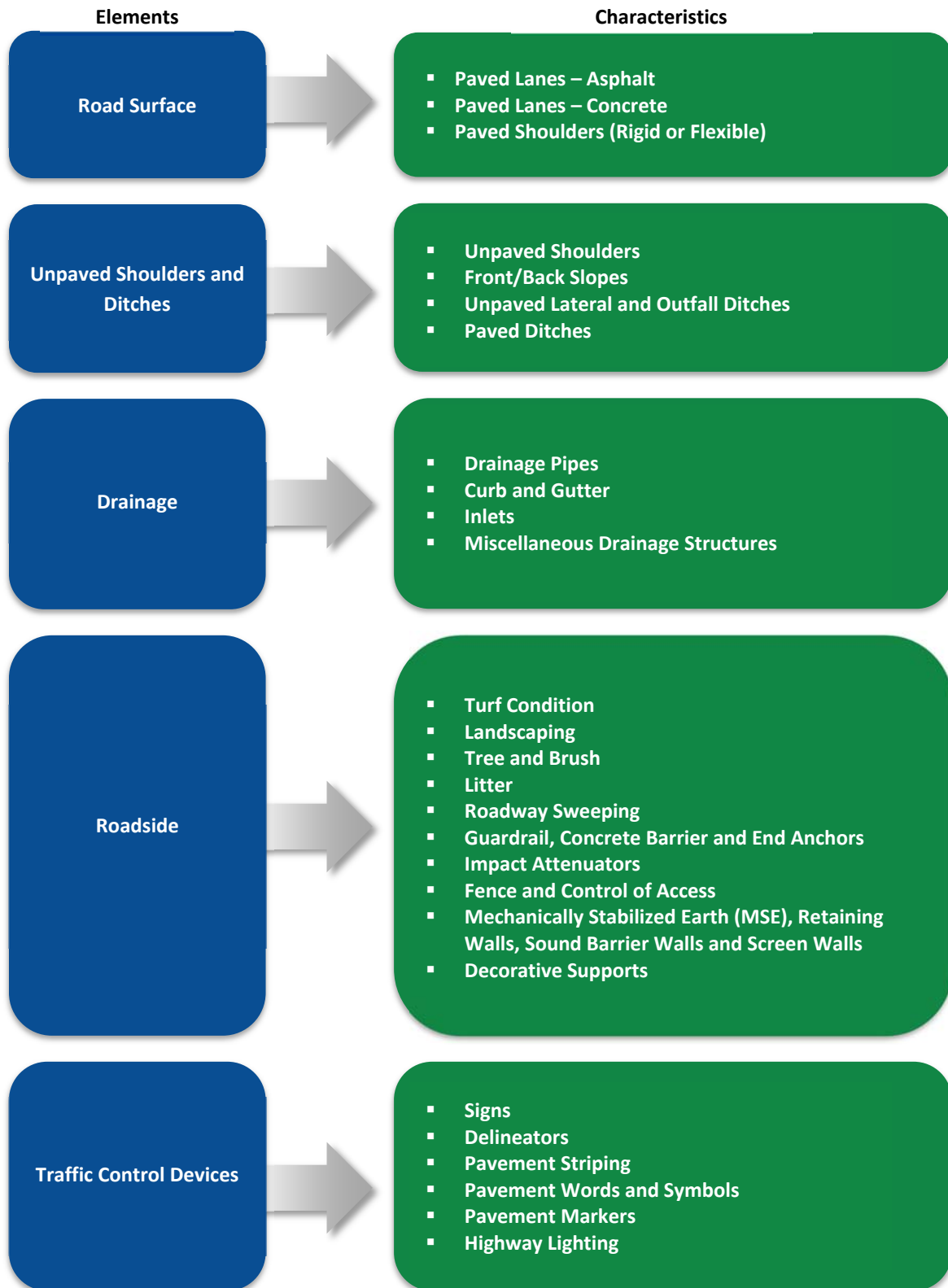
The NCTA performance standards, threshold criteria, and maintenance rating program were developed through a collaborative effort by NCTA managers, NCDOT maintenance staff, and consultants.

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 V4*, roadway assets or characteristics on NCTA facilities have been grouped into elements. These elements and corresponding characteristics are shown in **Figure 1**:

Figure 1: Maintenance Elements and Characteristics



Maintenance Rating Program for the Triangle Expressway
2019 Fourth Quarter (October – December) and Annual Report

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 V4*. 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:

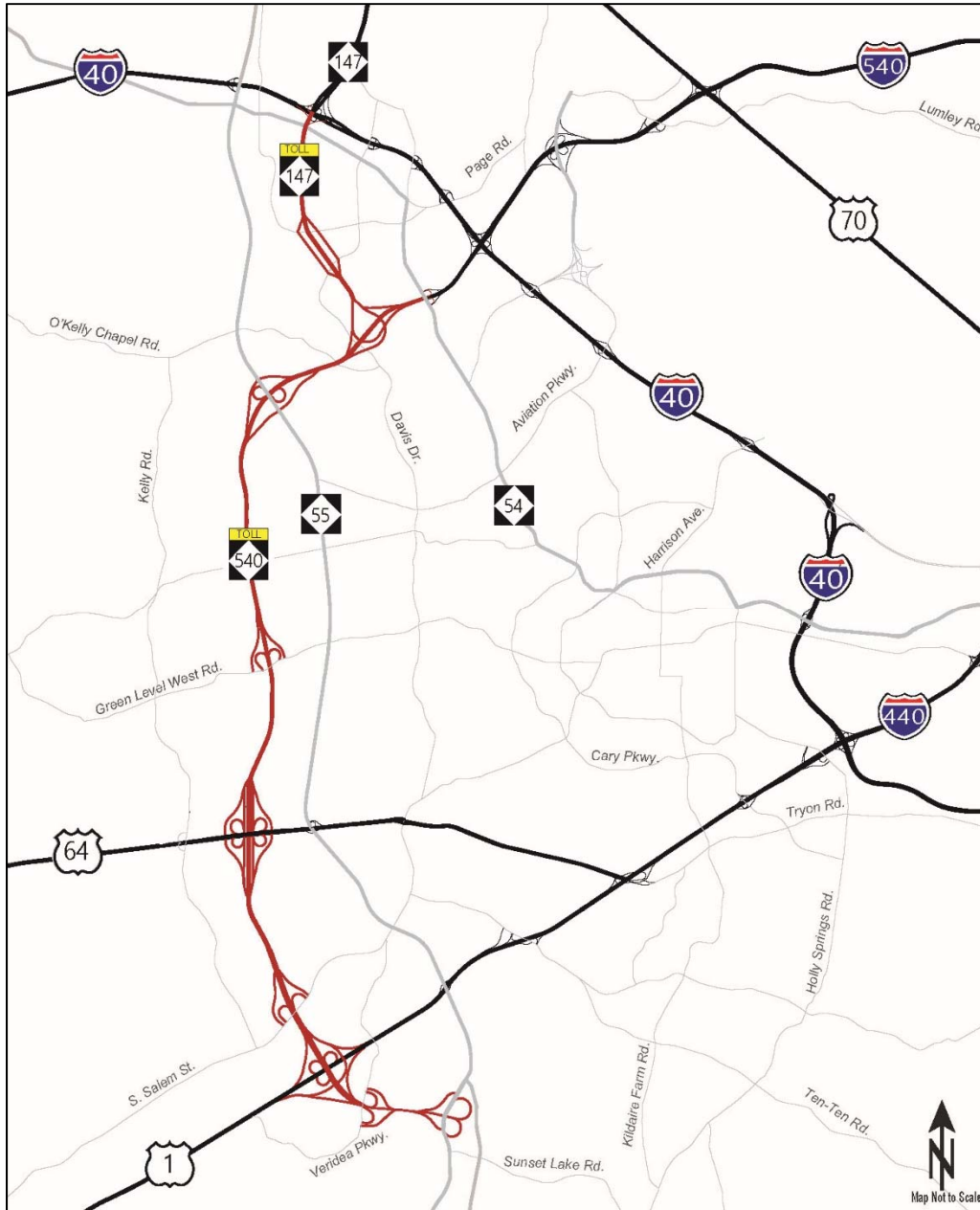
Road Surface =	25%
Unpaved Shoulders =	13%
Drainage =	15%
Roadside =	17%
Traffic Control Devices =	30%
<hr/>	
Total	100%

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

Figure 2: Triangle Expressway Map



5.0 TRIANGLE EXPRESSWAY ASSET INVENTORY UPDATE

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

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

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

6.0 MRP FOURTH QUARTER ASSESSMENT

6.1 Quarterly Results

The overall 2019 fourth quarter maintenance rating of the Triangle Expressway was 93.6, exceeding NCTA's target overall rating of 90. All elements assessed achieved ratings above the target rating of 85 established for element groups. Paved Lanes Asphalt (75) is the only characteristic that scored below the target rating of 80.

It is important to note that these results are only representative of the 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 at the end of each calendar year, provides 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 2019	
Element	Q4 2019 MRP Rating
Road Surface	89.5
Unpaved Shoulders and Ditches	99.1
Drainage	98.1
Roadside	96.2
Traffic Control Devices	90.9
Overall MRP Performance Rating	93.6

Maintenance Rating Program for the Triangle Expressway
2019 Fourth Quarter (October – December) and Annual Report

Table 5: MRP Characteristic Results for Q4 2019

Road Surface	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q4 Rating
Paved Lanes Asphalt	9	12	9	81	108	75
Paved Lanes Concrete	20	20	9	180	180	100
Paved Shoulder	28	32	5	140	160	88
Element Total				401	448	89.5
Unpaved Shoulders and Ditches	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q4 Rating
Unpaved Shoulder	32	32	9	288	288	100
Front/Back Slopes	31	32	6	186	192	97
Lateral and Outfall Ditches, Unpaved	32	32	6	192	192	100
Ditches, Paved	2	2	5	10	10	100
Element Total				676	682	99.1
Drainage	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q4 Rating
Drainage Pipes	34	34	7	238	238	100
Curb and Gutter	28	28	6	168	168	100
Inlets	33	34	7	231	238	97
Misc. Drainage Structure	35	37	4	140	148	95
Element Total				777	792	98.1
Roadside	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q4 Rating
Turf Condition	30	33	7	210	231	91
Landscaping	24	24	4	96	96	100
Trees and Brush	30	30	4	120	120	100
Litter	32	32	4	128	128	100
Roadway Sweeping	32	32	5	160	160	100
Guardrail, Concrete Barrier and End Anchors	31	32	9	279	288	97
Impact Attenuators	9	9	9	81	81	100
Fence, Control Access	27	29	7	189	203	93
Retaining Walls and Sound Barrier Walls	12	14	5	60	70	86
Decorative Supports	23	25	5	115	125	92
Graffiti and Stain Removal	44	44	4	176	176	100
Element Total				1614	1678	96.2
Traffic Control Devices	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q4 Rating
Signs	35	35	7	245	245	100
Delineators	28	32	3	84	96	88
Pavement Striping/Marking	28	32	8	224	256	88
Words and Symbols	28	31	7	196	217	90
Pavement Markers	29	32	9	261	288	91
Highway Lighting	24	28	6	144	168	86
Element Total				1154	1270	90.9

Maintenance Rating Program for the Triangle Expressway
2019 Fourth Quarter (October – December) and Annual Report

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 Quarter Analysis and Recommendations

Elements

During the fourth quarter, all elements exceeded NCTA's threshold criteria of 85. Unpaved Shoulder/Ditches (99.1), Drainage (98.1), and Roadside (96.2) all achieved scores higher than 95 this quarter. These elements, as well as Traffic Control Devices (90.9), also experienced increases in ratings from last quarter. Drainage (98.1) experienced the most significant increase of 5.8 points. Road Surface (89.5) was the only element to receive a rating less than 90 and experience a decrease in rating from the previous quarter. The decrease of 7.4 points was predominately due to the characteristic score for Paved Lanes Asphalt (75).

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

Characteristics

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

Maintenance Rating Program for the Triangle Expressway
2019 Fourth Quarter (October – December) and Annual Report

Paved Lanes Asphalt (75 rating – 3 of the 12 assets did not pass): All three of the asphalt linear segments that did not pass inspection were due to unsealed cracking in the pavement. Two of the segments that did not pass inspection are presented in **Figure 3**.

Figure 3: Paved Lanes Asphalt Inspection Results Sample



In accordance with *NCTA Roadway and Facility Maintenance Standards V6*, referenced below, the maintenance provider shall plan regular crack sealing and mill-and-fill repairs in order to maintain safe travel conditions and extend the lifecycle of asphalt pavement throughout the facility. In addition, all unanticipated asphalt pavement deficiencies encountered annually must be repaired.

Paved Lanes Asphalt Maintenance Program Standards:

- 1) Emergency repair response time (the time to arrive at the site and provide temporary repair or mitigate for safety) shall be 2 hours regardless of the day or time of the notification unless otherwise specified. Permanent repairs shall be scheduled within 5 calendar days.
- 2) All patches shall be reasonably square or rectangular and shall not present a bump or depression and shall provide a smooth ride and transition.
- 3) All milled areas must be resurfaced prior to opening to traffic.

Paved Lanes Asphalt Evaluation Standards: Paved lanes do not meet the maintenance standards when any of the following criteria is observed:

- 1) Unsealed cracks are greater than 0.25 inches wide and more than 50 feet cumulative.
- 2) No potholes greater than 6 inches in diameter and 1.5 inch or greater in depth.
- 3) Detrimental settlements or asphalt heaving is greater than 1.5 inches.
- 4) Pervious base is exposed in any pothole.
- 5) Flushing/bleeding or raveling is greater than 25% of the surface area per lane.
- 6) Rutted areas are greater than 0.75 inches in depth.

Maintenance Rating Program for the Triangle Expressway
2019 Fourth Quarter (October – December) and Annual Report

7.0 MRP ANNUAL 2019 ASSESSMENT

7.1 Annual Results

The 2019 annual maintenance rating of the Triangle Expressway was 93.0, exceeding NCTA’s target overall rating of 90. All element ratings exceeded the target rating of 85. Also, all characteristic rating met or exceeded the annual target rating of 80.

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

Table 6: MRP Element Results for 2019					
Element	Q1 2019 Rating	Q2 2019 Rating	Q3 2019 Rating	Q4 2019 Rating	Annual Rating
Road Surface	96.0	92.6	96.9	89.5	93.8
Unpaved Shoulders and Ditches	97.4	97.8	94.7	99.1	97.3
Drainage	91.3	94.0	92.3	98.1	93.9
Roadside	92.8	92.8	94.7	96.2	94.1
Traffic Control Devices	92.1	87.9	86.6	90.9	89.3
Overall MRP Performance Rating	93.7	92.1	92.5	93.6	93.0

Maintenance Rating Program for the Triangle Expressway
2019 Fourth Quarter (October – December) and Annual Report

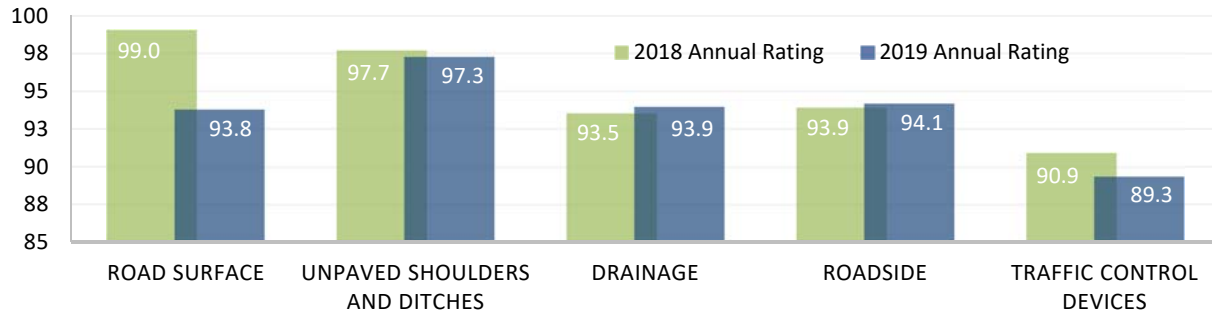
Table 7: MRP Rolling Element Results					
Road Surface	Q1 2019 RATING	Q2 2019 RATING	Q3 2019 RATING	Q4 2019 RATING	ROLLING RATING
Paved Lanes Asphalt	86	93	93	75	87
Paved Lanes Concrete	100	94	100	100	99
Paved Shoulder	100	91	97	88	94
Element Total	96.0	92.6	96.9	89.5	93.8
Unpaved Shoulders and Ditches	Q1 2019 RATING	Q2 2019 RATING	Q3 2019 RATING	Q4 2019 RATING	ROLLING RATING
Unpaved Shoulder	94	97	88	100	95
Front/Back Slopes	100	100	100	97	99
Lateral and Outfall Ditches, Unpaved	100	97	100	100	99
Ditches, Paved	100	100	100	100	100
Element Total	97.4	97.8	94.7	99.1	97.3
Drainage	Q1 2019 RATING	Q2 2019 RATING	Q3 2019 RATING	Q4 2019 RATING	ROLLING RATING
Drainage Pipes	97	100	97	100	99
Curb and Gutter	96	86	93	100	94
Inlets	97	97	94	97	96
Misc. Drainage Structure	65	89	81	95	83
Element Total	91.3	94.0	92.3	98.1	93.9
Roadside	Q1 2019 RATING	Q2 2019 RATING	Q3 2019 RATING	Q4 2019 RATING	ROLLING RATING
Turf Condition	76	73	91	91	82
Landscaping	96	96	100	100	98
Trees and Brush	93	97	97	100	97
Litter	88	100	94	100	95
Roadway Sweeping	97	100	100	100	99
Guardrail, Concrete Barrier and End Anchors	100	100	94	97	98
Impact Attenuators	100	100	100	100	100
Fence, Control Access	90	93	97	93	93
Retaining Walls and Sound Barrier Walls	100	86	86	86	89
Decorative Supports	92	80	84	92	87
Graffiti and Stain Removal	100	100	100	100	100
Element Total	92.8	92.8	94.7	96.2	94.1
Traffic Control Devices	Q1 2019 RATING	Q2 2019 RATING	Q3 2019 RATING	Q4 2019 RATING	ROLLING RATING
Signs	94	91	94	100	95
Delineators	86	85	100	88	90
Pavement Striping/Marking	100	88	78	88	88
Words and Symbols	100	84	84	90	90
Pavement Markers	84	84	84	91	86
Highway Lighting	82	96	89	86	88
Element Total	92.1	87.9	86.6	90.9	89.3

Maintenance Rating Program for the Triangle Expressway
2019 Fourth Quarter (October – December) and Annual Report

7.2 Annual Analysis and Recommendations

Based on the combined results of all four quarterly inspections conducted in 2019, all elements exceeded NCTA’s threshold criteria of 85. In addition, all characteristics exceeded the target threshold criteria of 80. See **Figure 4** shows the comparison in annual ratings from 2018 to 2019.

Figure 4: Annual Rating Comparison Chart



Road Surface (93.8) was the element with the most significant decrease from the 2018 annual rating with a difference of 5.2 points. This decrease is predominantly due to the characteristic Paved Lanes Asphalt (87) which obtained a rating less than 80 in one of the four quarters; however, received a score above 90 in two of the four quarters. This characteristic had the most significant decrease from the previous annual rolling rating with a difference of 11.7 points. Repaving of asphalt lanes is scheduled to begin the first quarter of 2020.

Unpaved Shoulders and Ditches (97.3) continued to receive a rating greater than 95. Drainage (93.9) was the element with the most significant increase in rating from the 2018 annual rating with a difference of 0.4 points. Miscellaneous Drainage Structures (83) received a rating less than 80 in the first quarter which improved over the year to a score of 95 in the fourth quarter. Miscellaneous Drainage Structures (83) was the characteristic that had the most significant increase in rating from the last annual rating with an increase of 7.9 points.

Roadside (94.1) also increased in rating from the 2018 annual rating by 0.2 points. Turf Condition (82) received ratings below 80 in the first two quarters and ratings above 90 in the next two quarters overall increasing from 2018 annual rating by 1.4 points.

Traffic Control Devices (89.3) decreased in rating by 1.6 points from the 2018 annual rating. While both the characteristic rating for Delineators (90) and Words and Symbols (90) decreased by 5.6 and 5.7 points, respectively, Highway Lighting (88) increased in rating by 7.9 points from the 2018 annual rating. Pavement Striping/Marking (88) received one rating less than 80 in one of the four quarters.

To continue receiving annual element ratings above NCTA’s threshold of 85, it is recommended that the maintenance provider continue to follow the maintenance program and standards presented in the *NCTA Roadway and Facility Maintenance Standards V6* as well as the *35-Year Facility Capital Improvement Projects Plan*.

8.0 GREEN LEVEL HISTORIC DISTRICT SIGNS

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

8.1 Analysis and Recommendations

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

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



9.0 CONCLUSION

This report presents the 2019 fourth quarter and annual rating assessment of the Triangle Expressway. The NCTA's target ratings are 90 overall, 85 for elements, and 80 for characteristics. The fourth quarter 2019 overall rating was **93.6** and the annual rating was **93.0**, both ratings exceeded the target rating of 90.

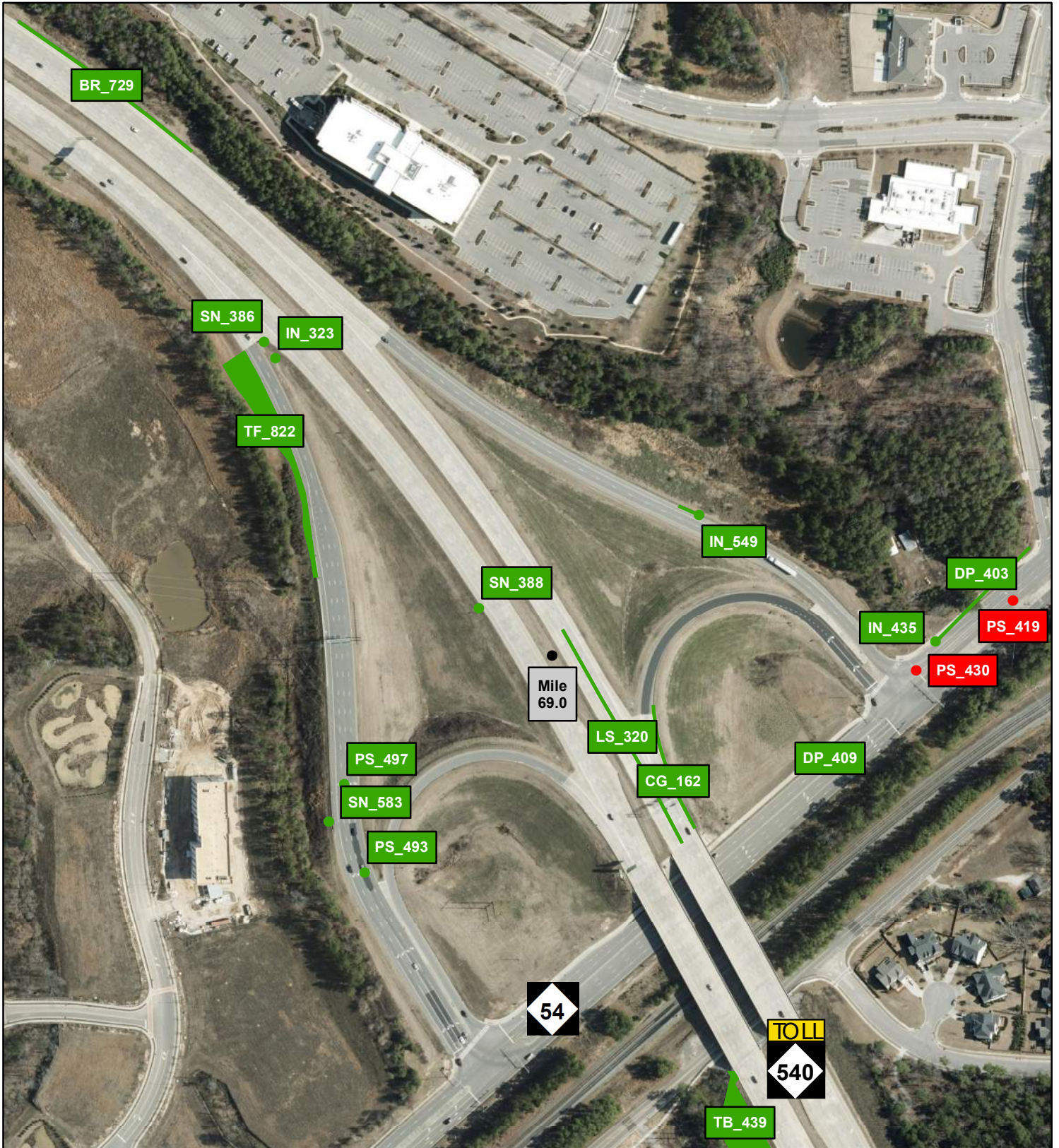
All element ratings were above the target ratings for the quarter and annual assessment. Road Surface (89.5) was the only element to experience a decrease in rating compared to the previous quarter. Unpaved Shoulders and Ditches (99.1) rating increased by 4.4 points, Drainage (98.1) rating increased by 5.8 points, Roadside (96.2) rating increased by 1.5 points, and Traffic Control Devices (90.9) rating increased by 4.3 points.

During the fourth quarter assessment, all but one characteristic met or exceeded the target rating of 80. This characteristic was Paved Lanes Asphalt (75). All characteristics in the annual assessment met or exceeded the rolling target rating of 80. As part of a preventative maintenance program, it is recommended that NCTA consider a long-term pavement preservation strategy that includes; asphalt crack sealing, varying surface treatments up to and including mill-and-inlay of the asphalt pavement sections. Repaving of asphalt lanes is scheduled to begin the first quarter of 2020, which would include the replacement of Pavement Markers, Pavement Striping, and Words/Symbols.

To continue to improve upon characteristic ratings that have scored a quarter rating below 80 this year, it is recommended that the maintenance provider continue routine patrols and clearing of obstructions from shoulder drains. Also, bare areas seeding/fertilization program efforts should continue during the spring and summer seasons to promote new turf growth.

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

Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations

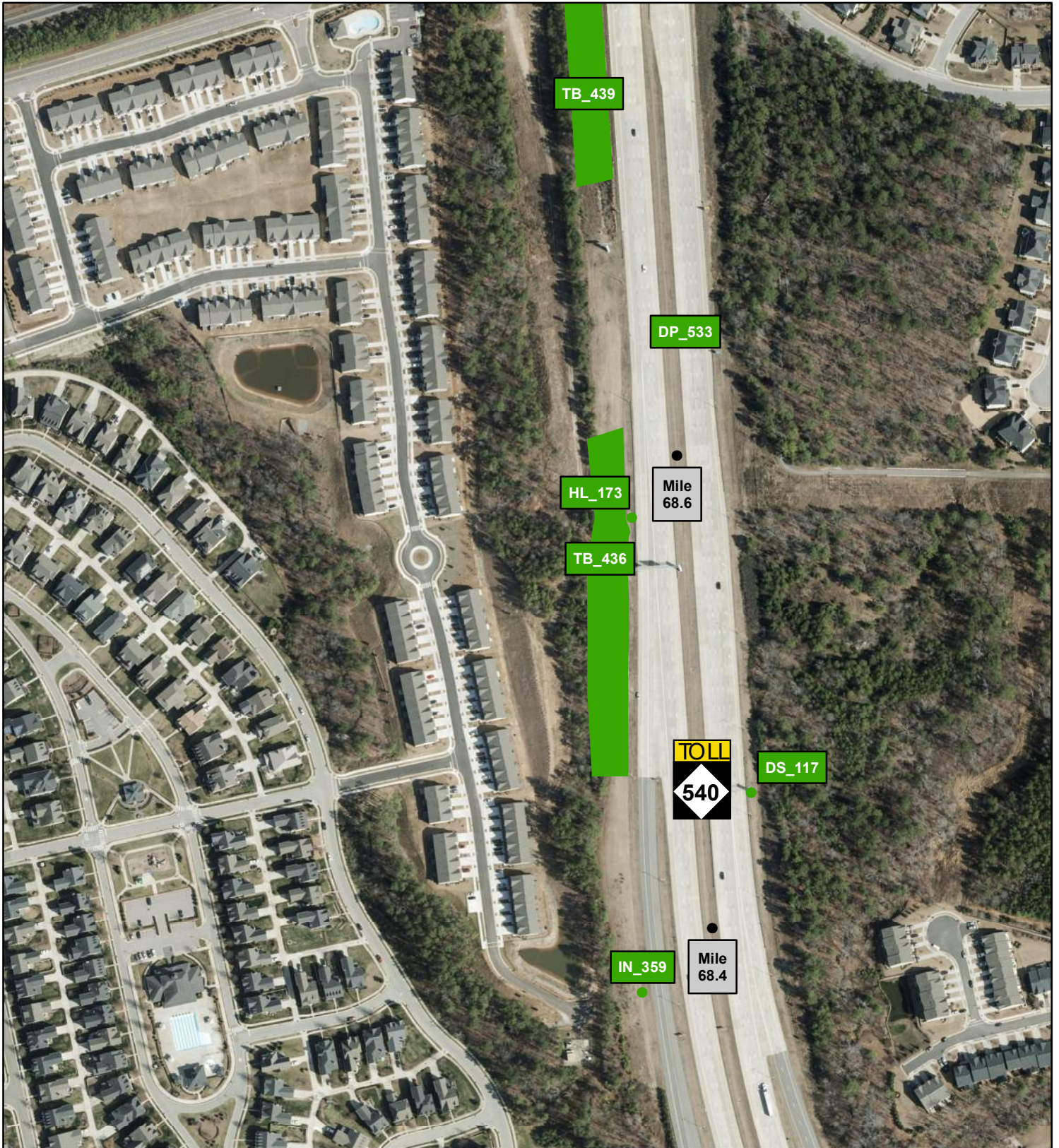


Legend



- Failing Asset
- Passing Asset

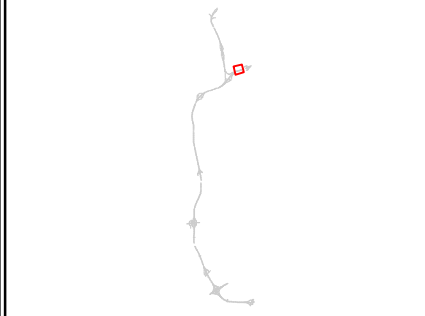


Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations



Legend



-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations

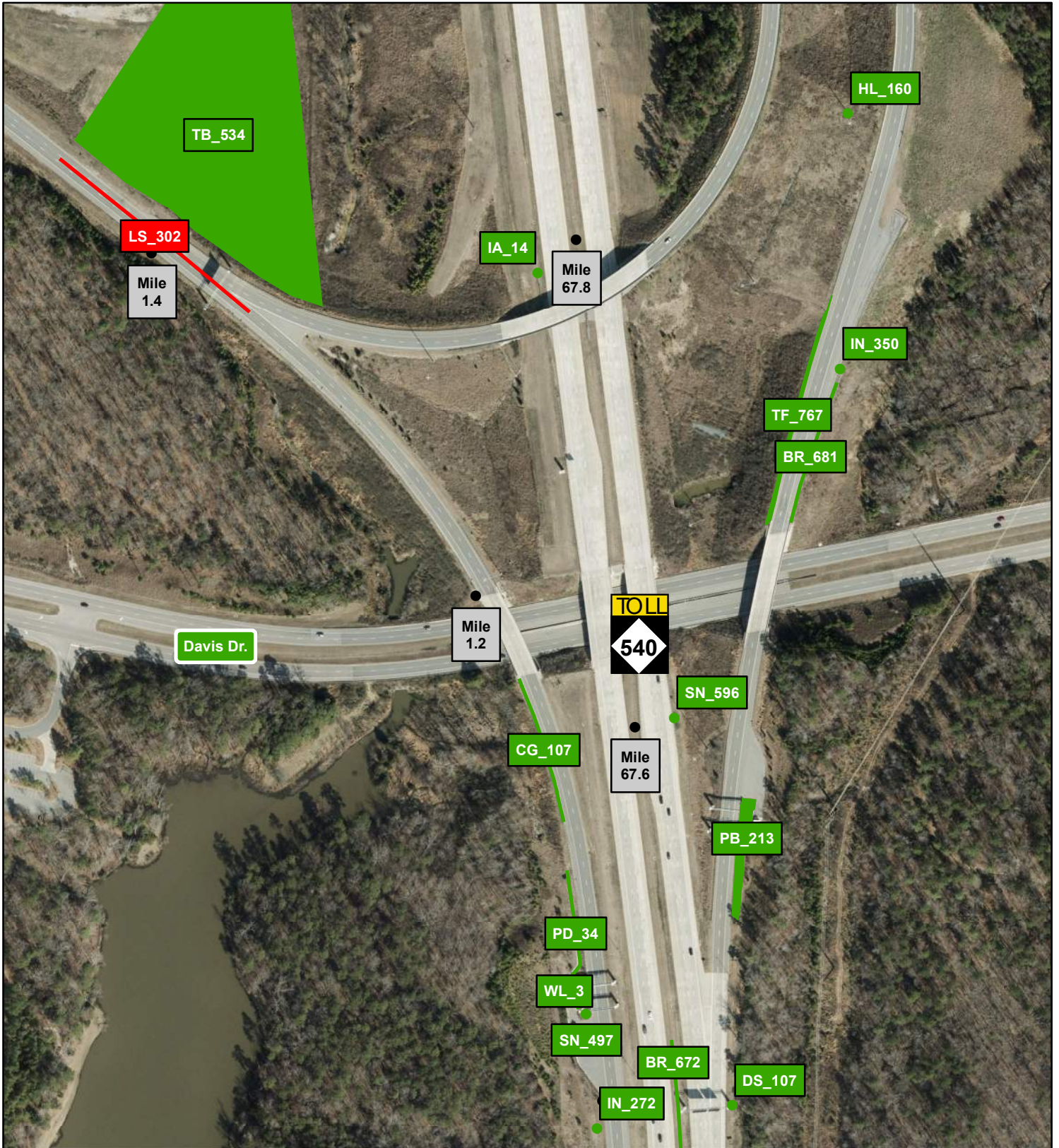


Legend



-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations



Legend



-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations



Legend



-  Failing Asset
-  Passing Asset



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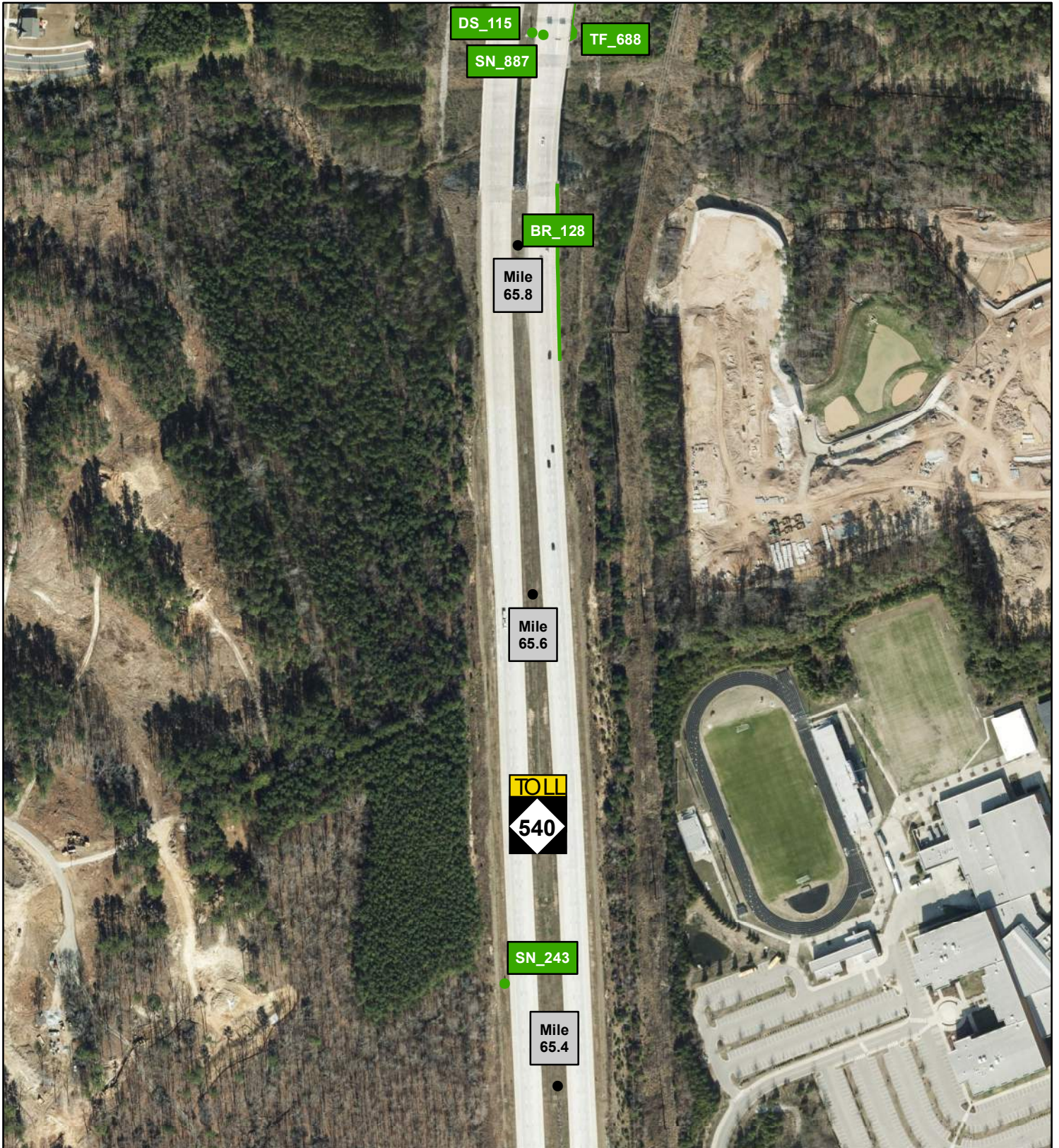


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-  Failing Asset
-  Passing Asset



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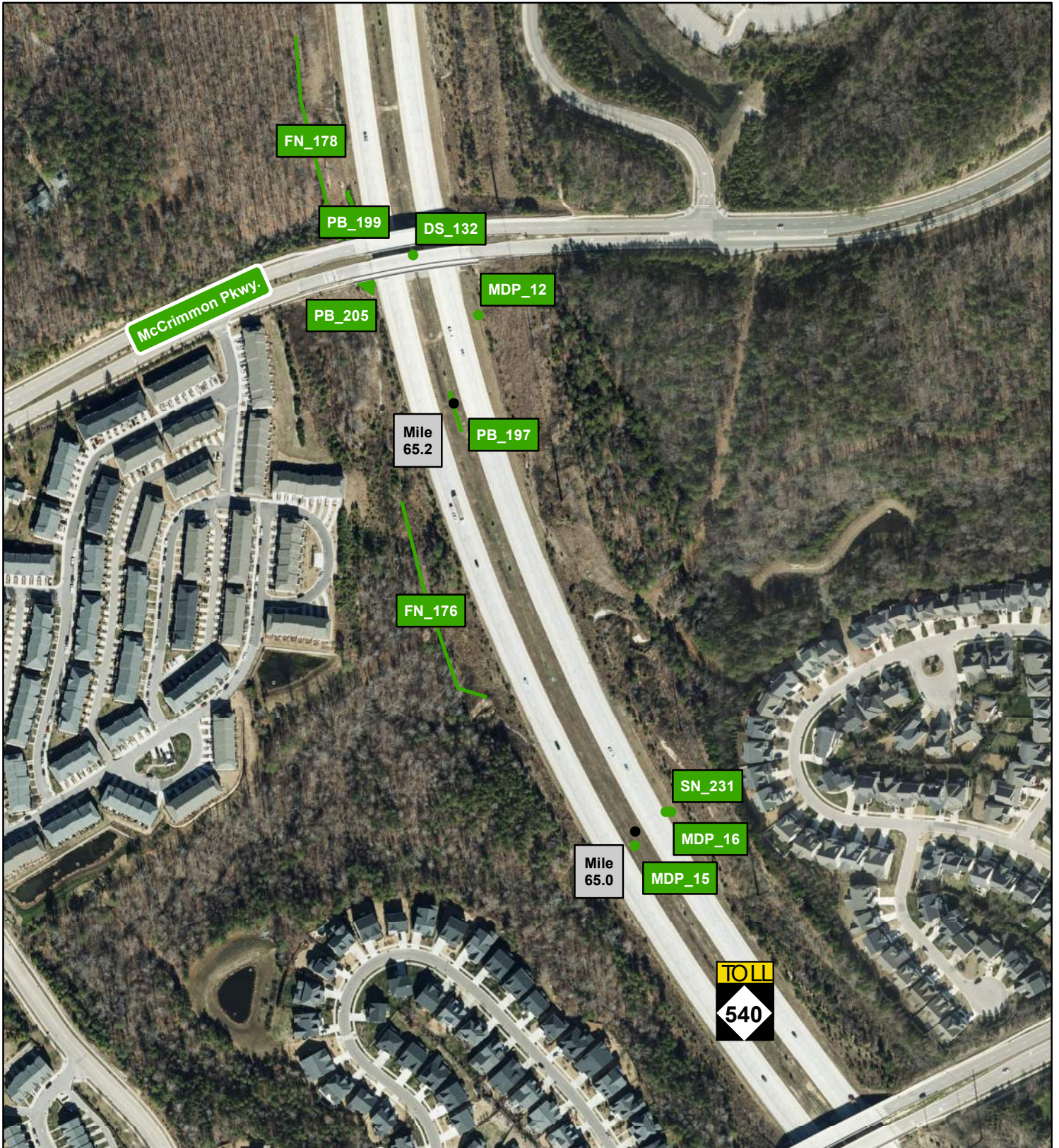


Legend

-  Failing Asset
-  Passing Asset

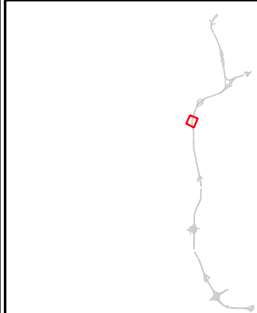


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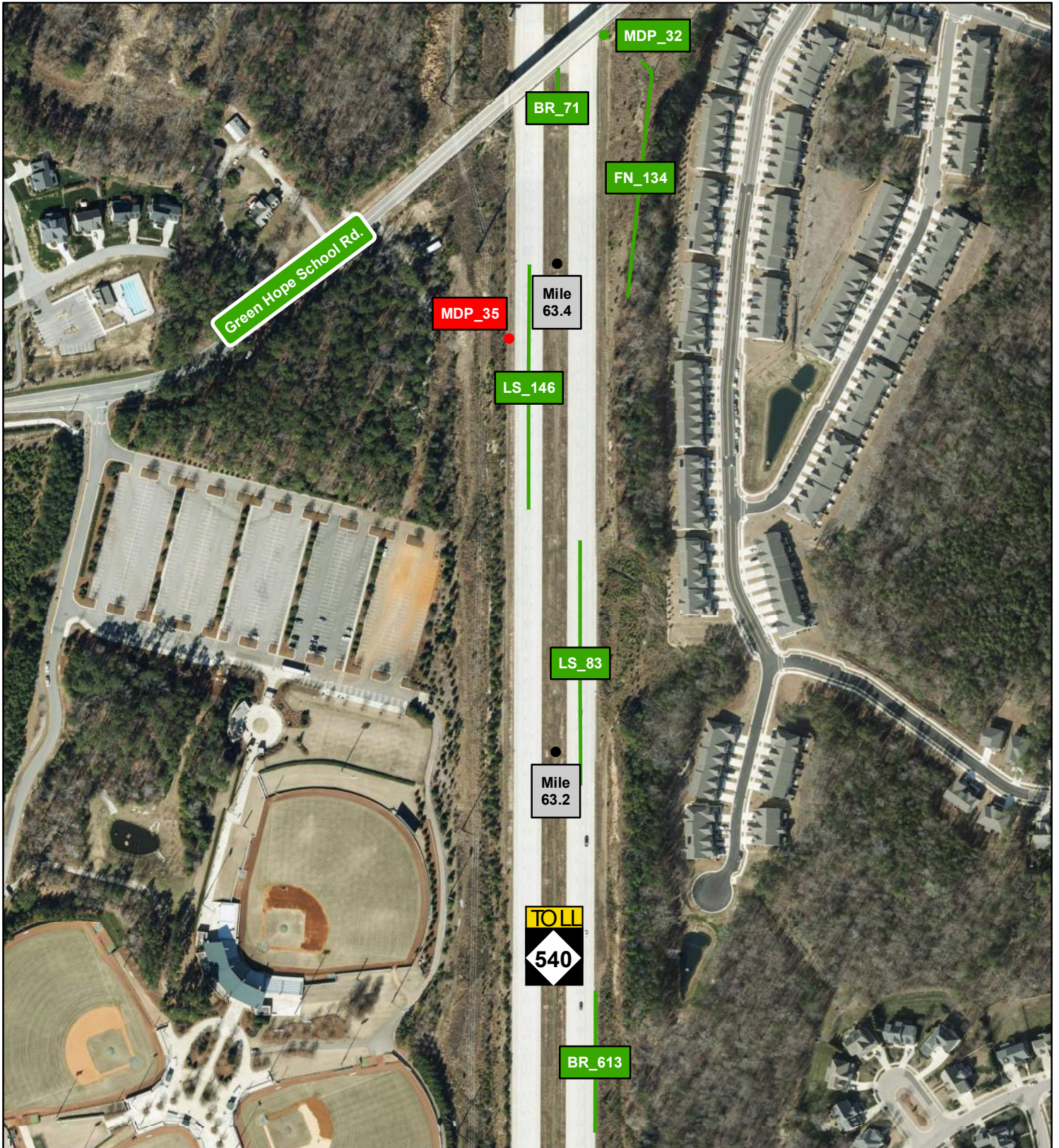


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- Failing Asset
- Passing Asset



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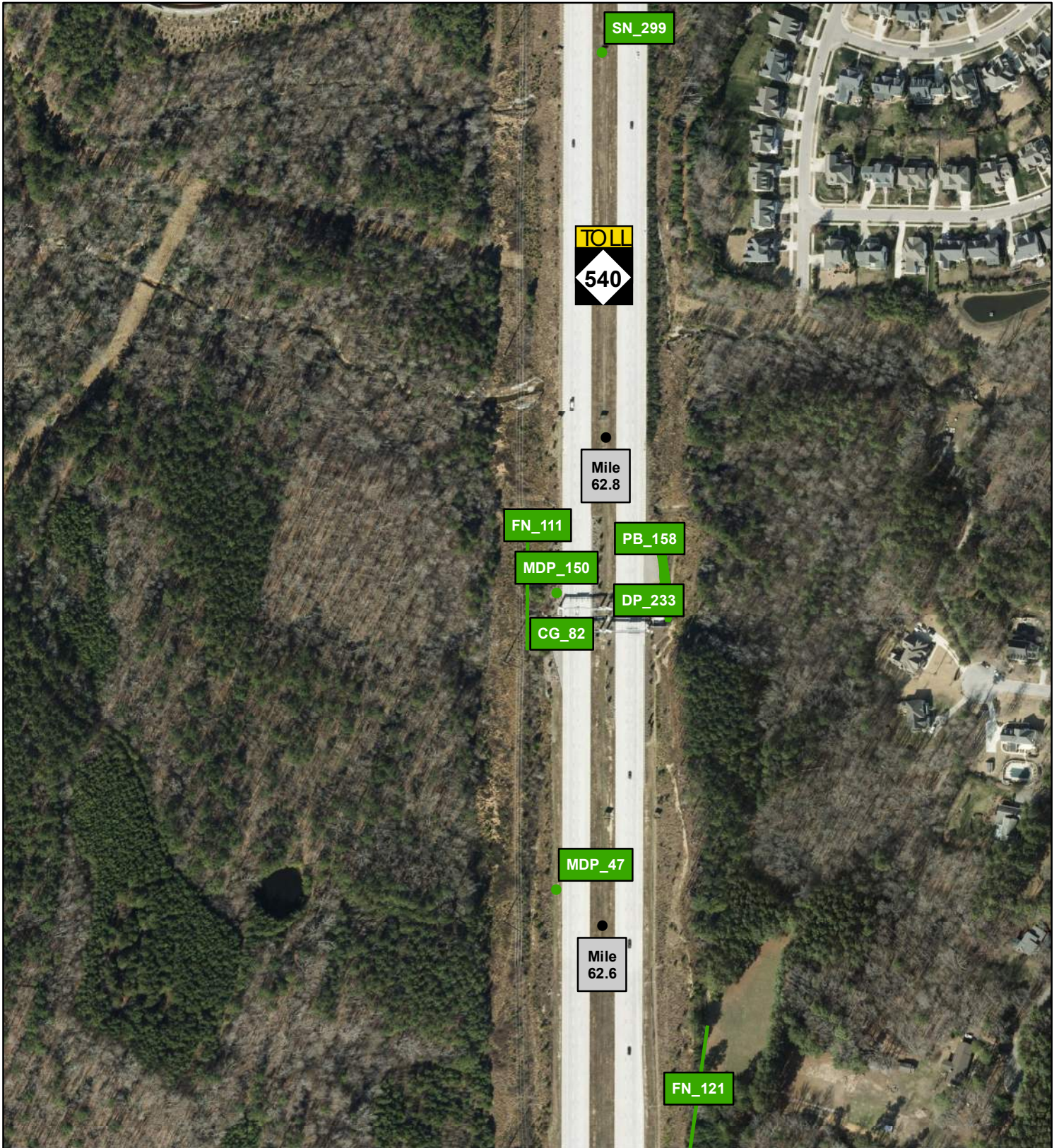


Legend



-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations



Legend



-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations

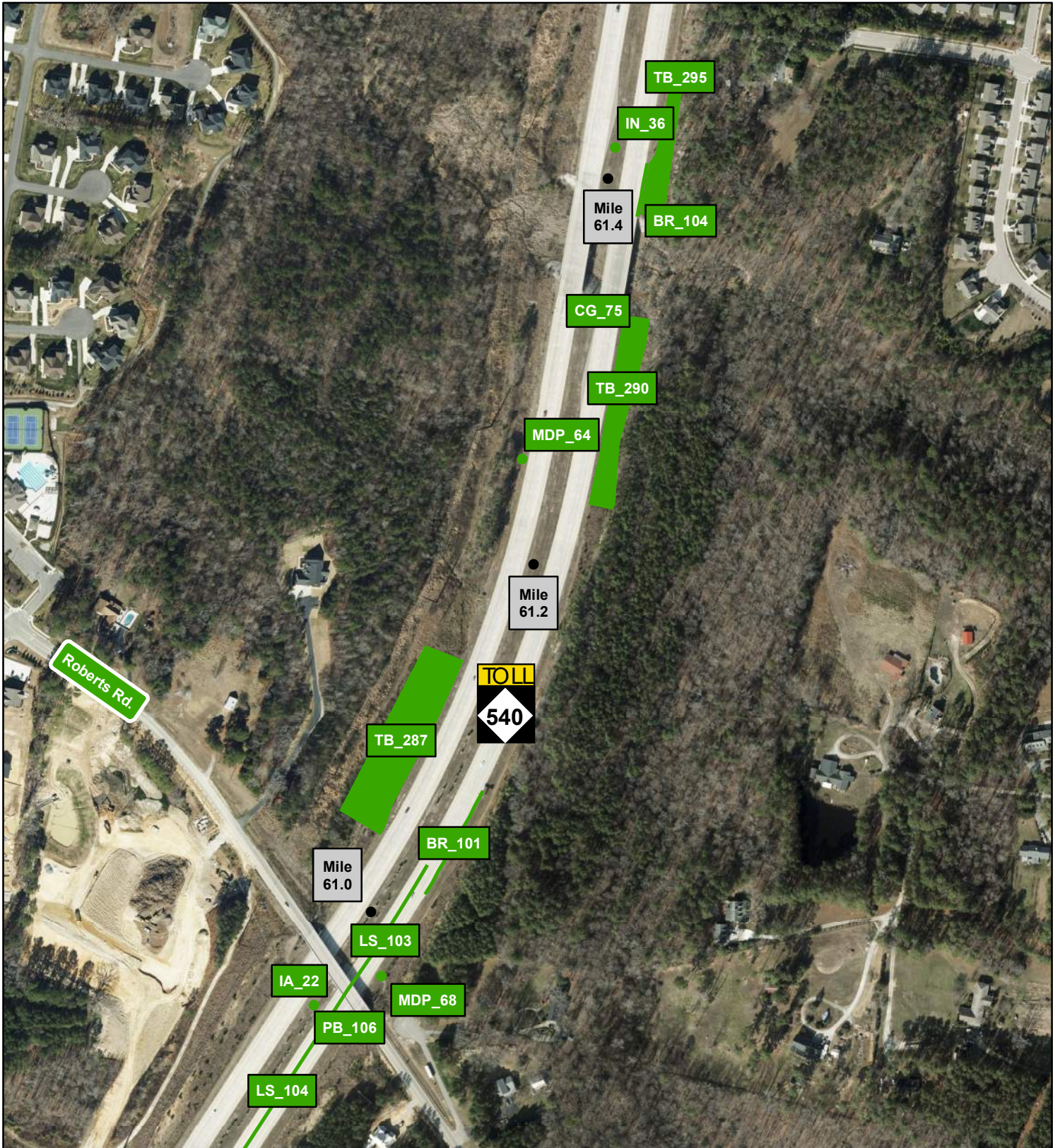


Legend

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Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations

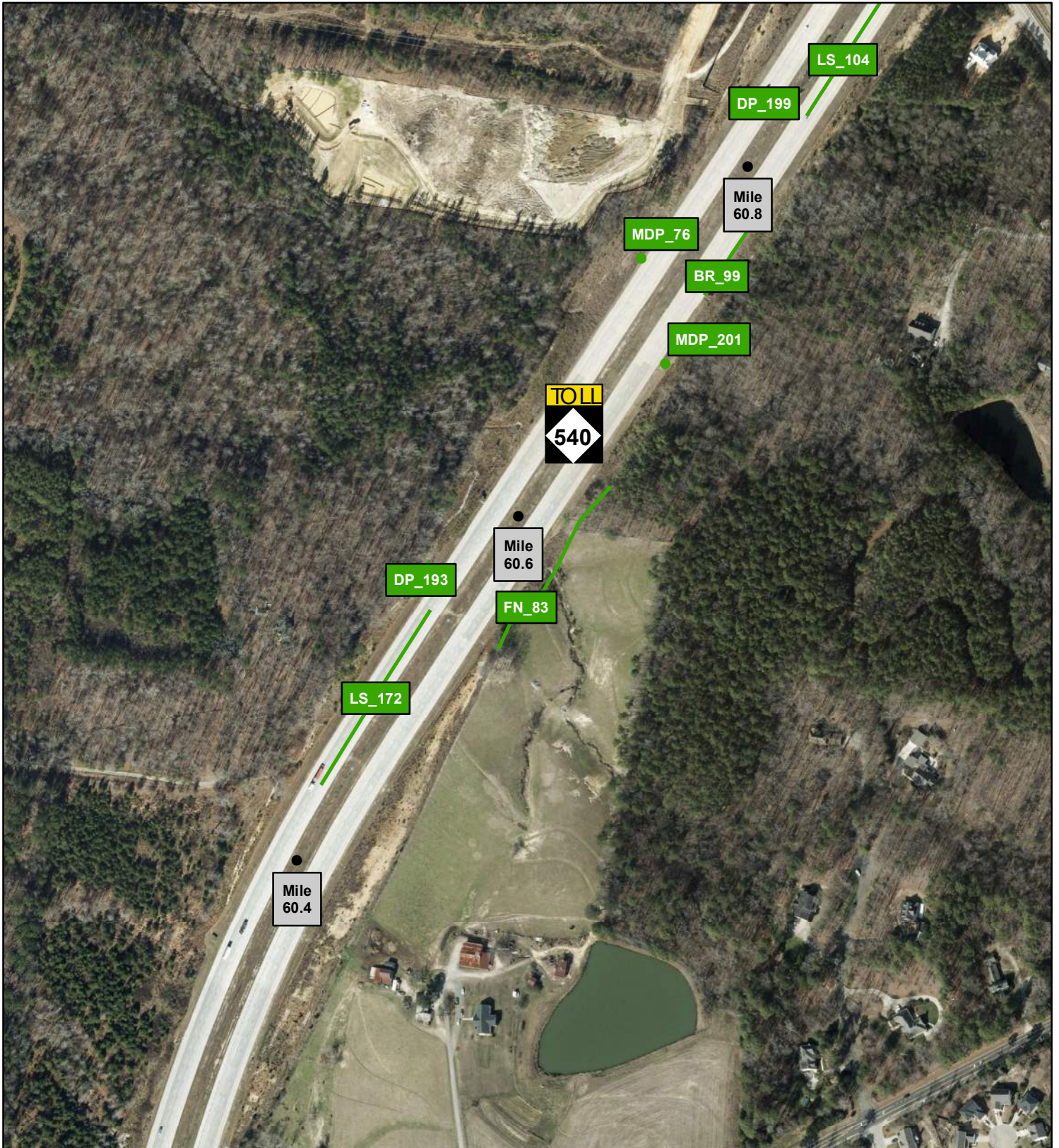


Legend



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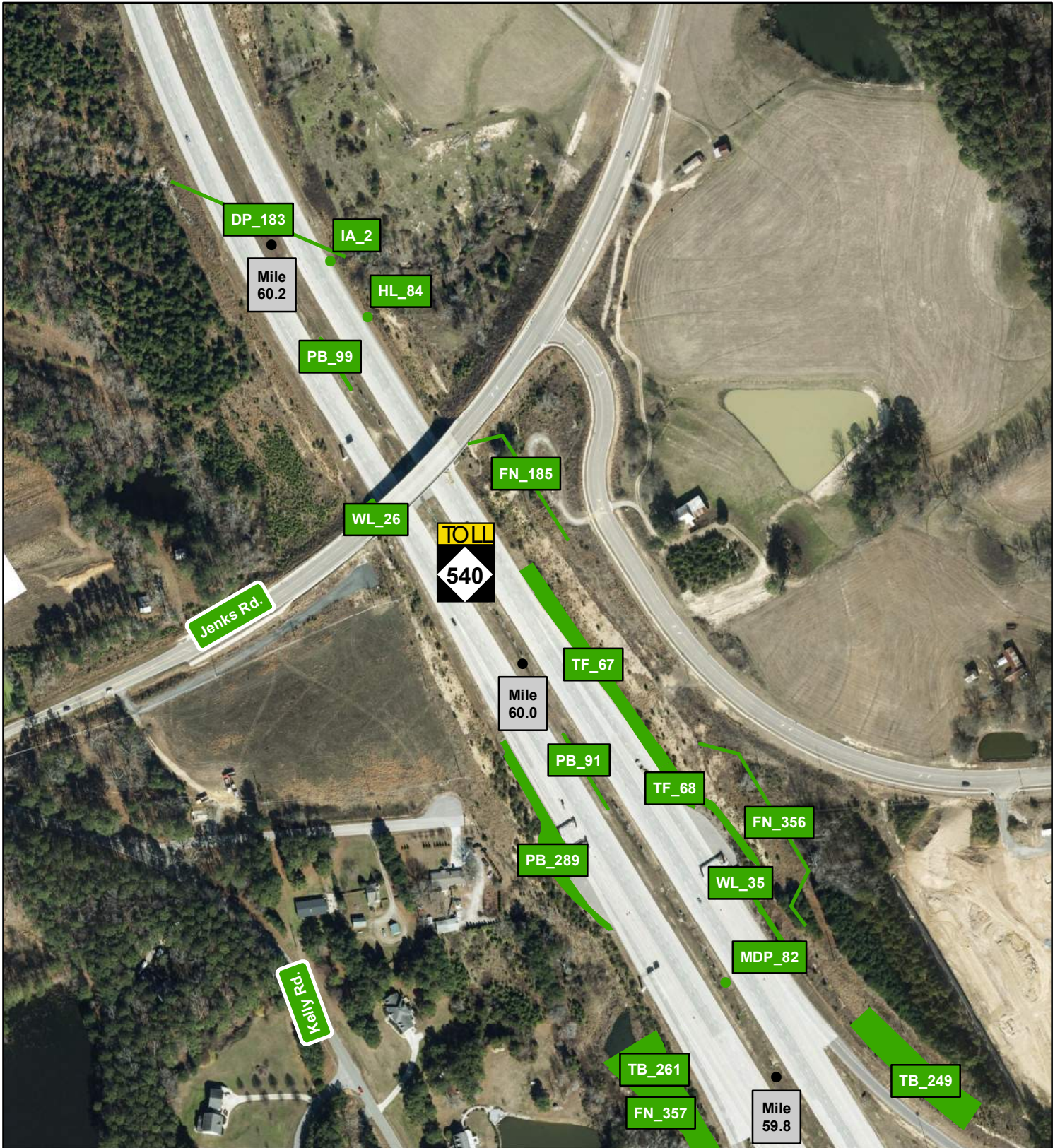


Legend

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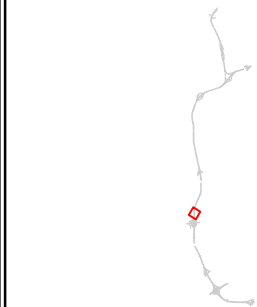


Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations

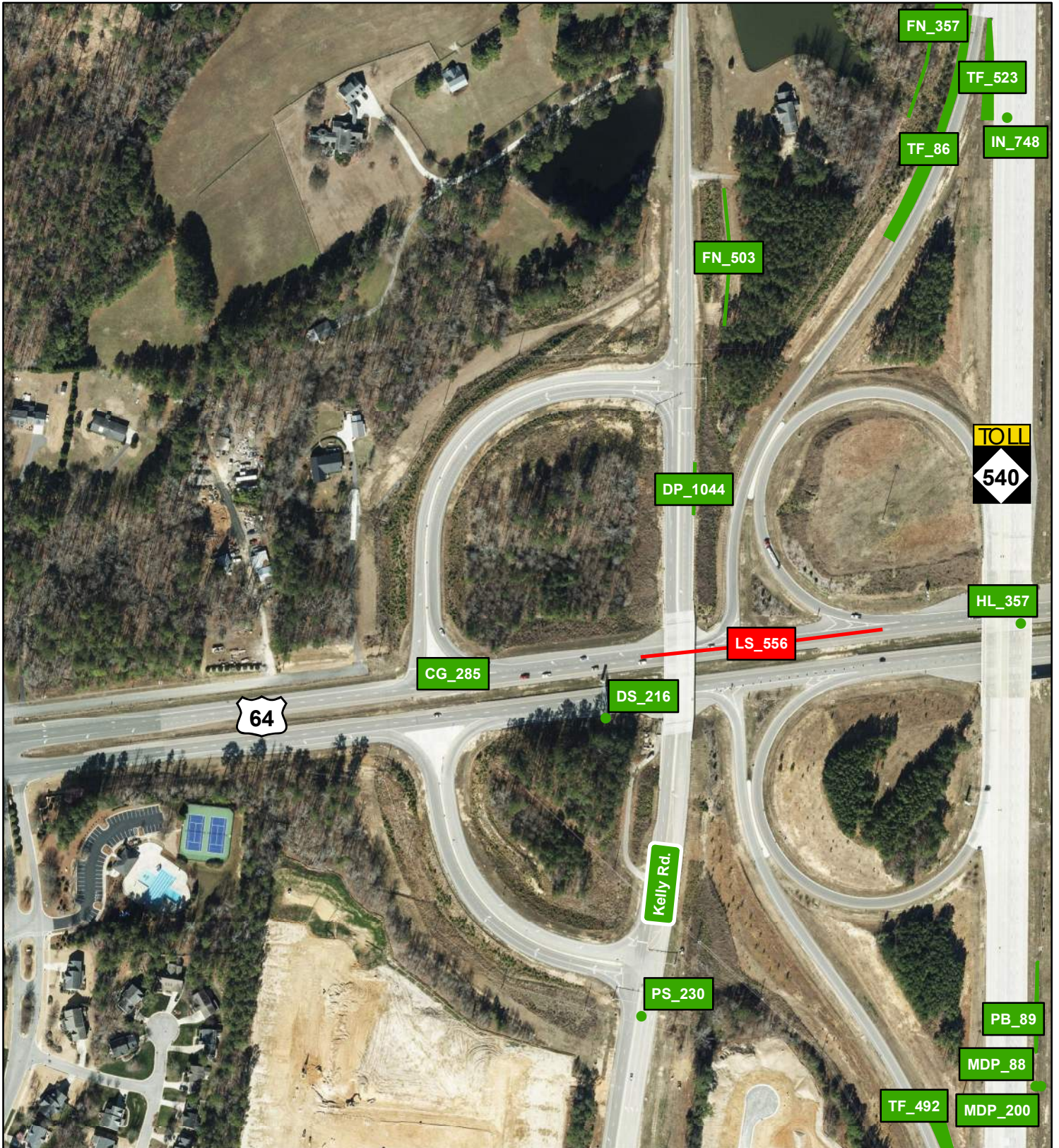


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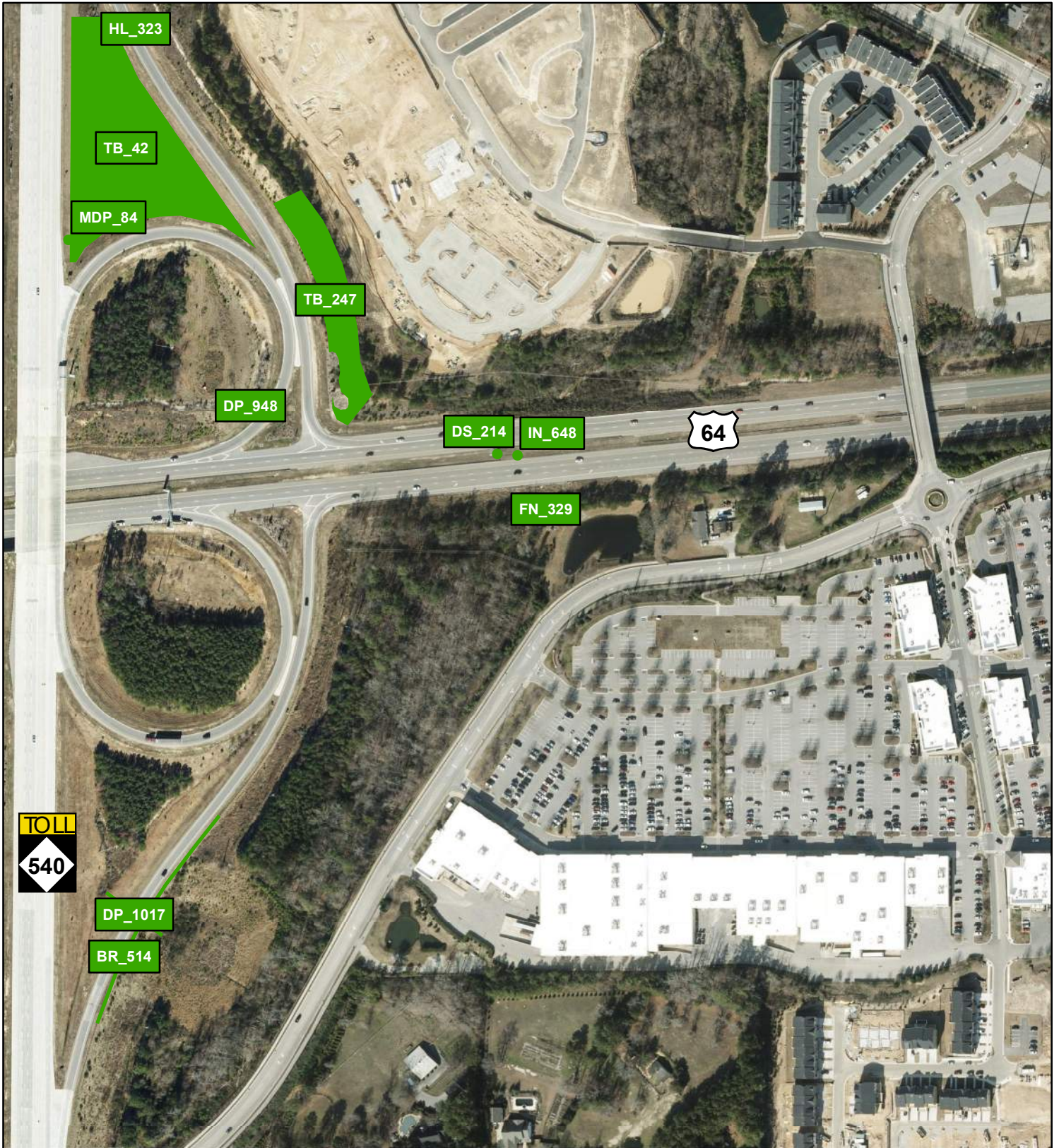


Legend



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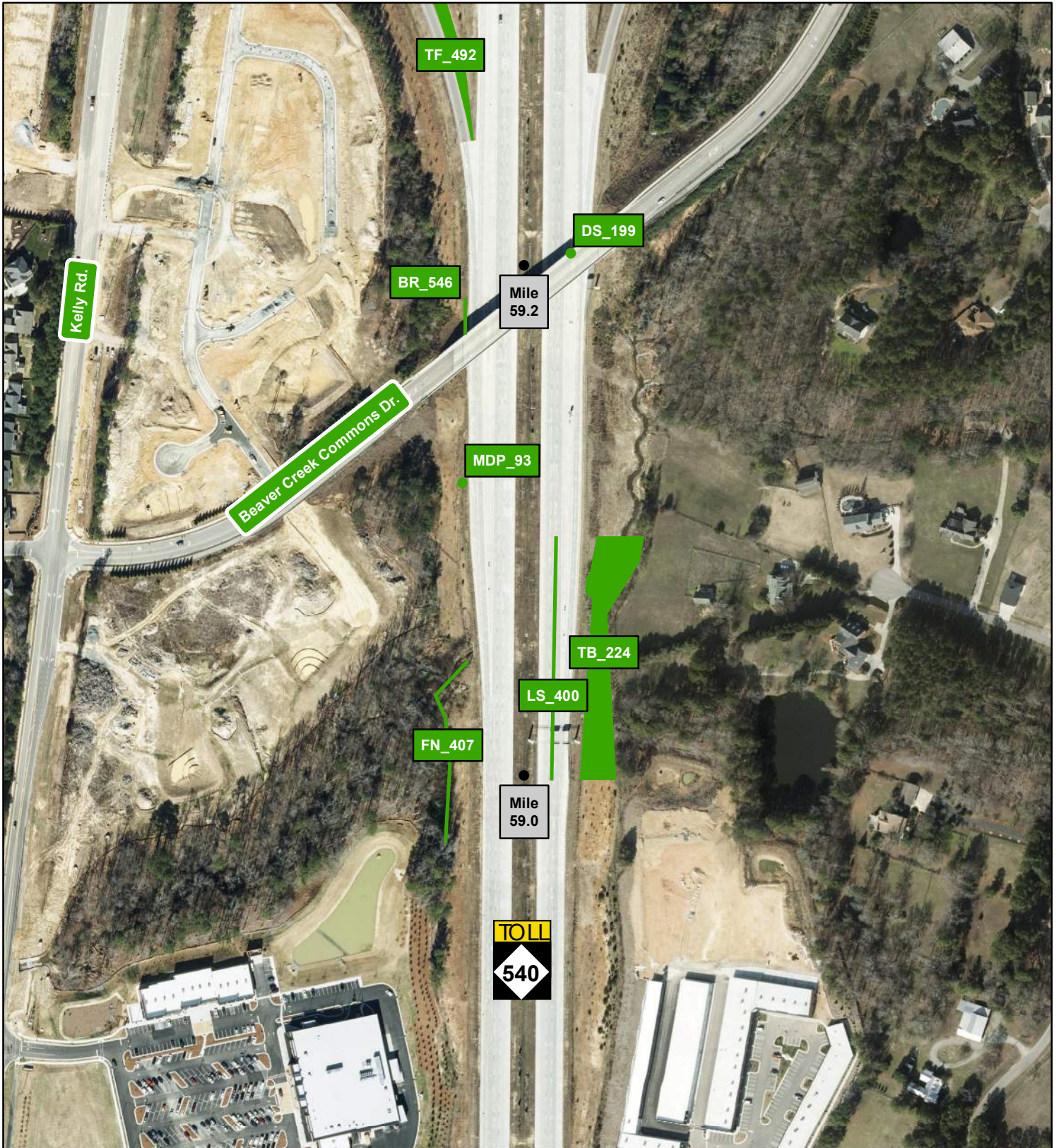


Legend

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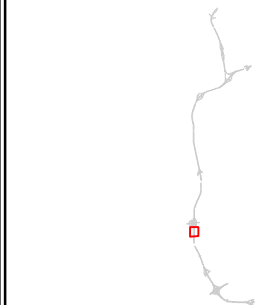


Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations

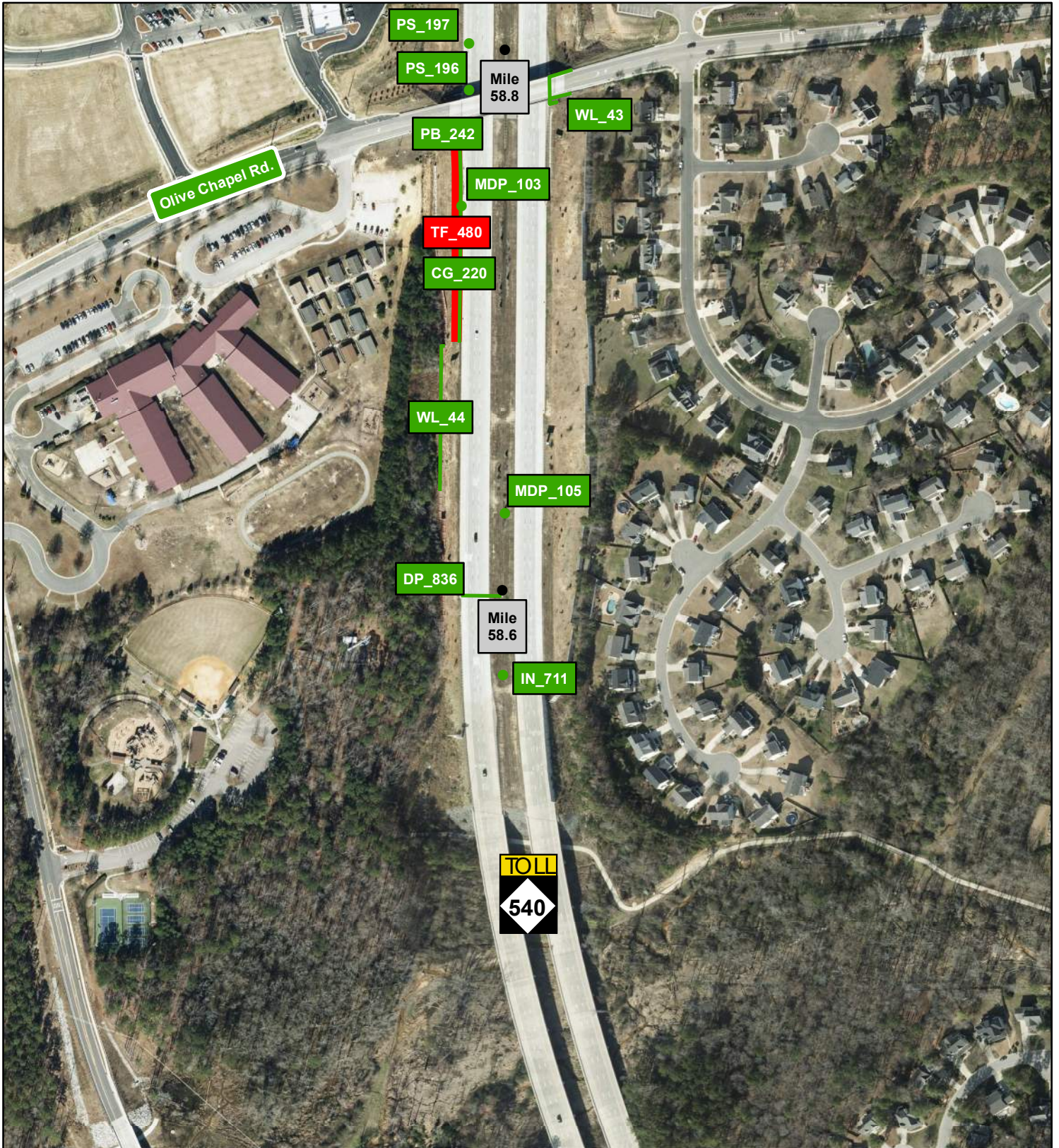


Legend



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Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations

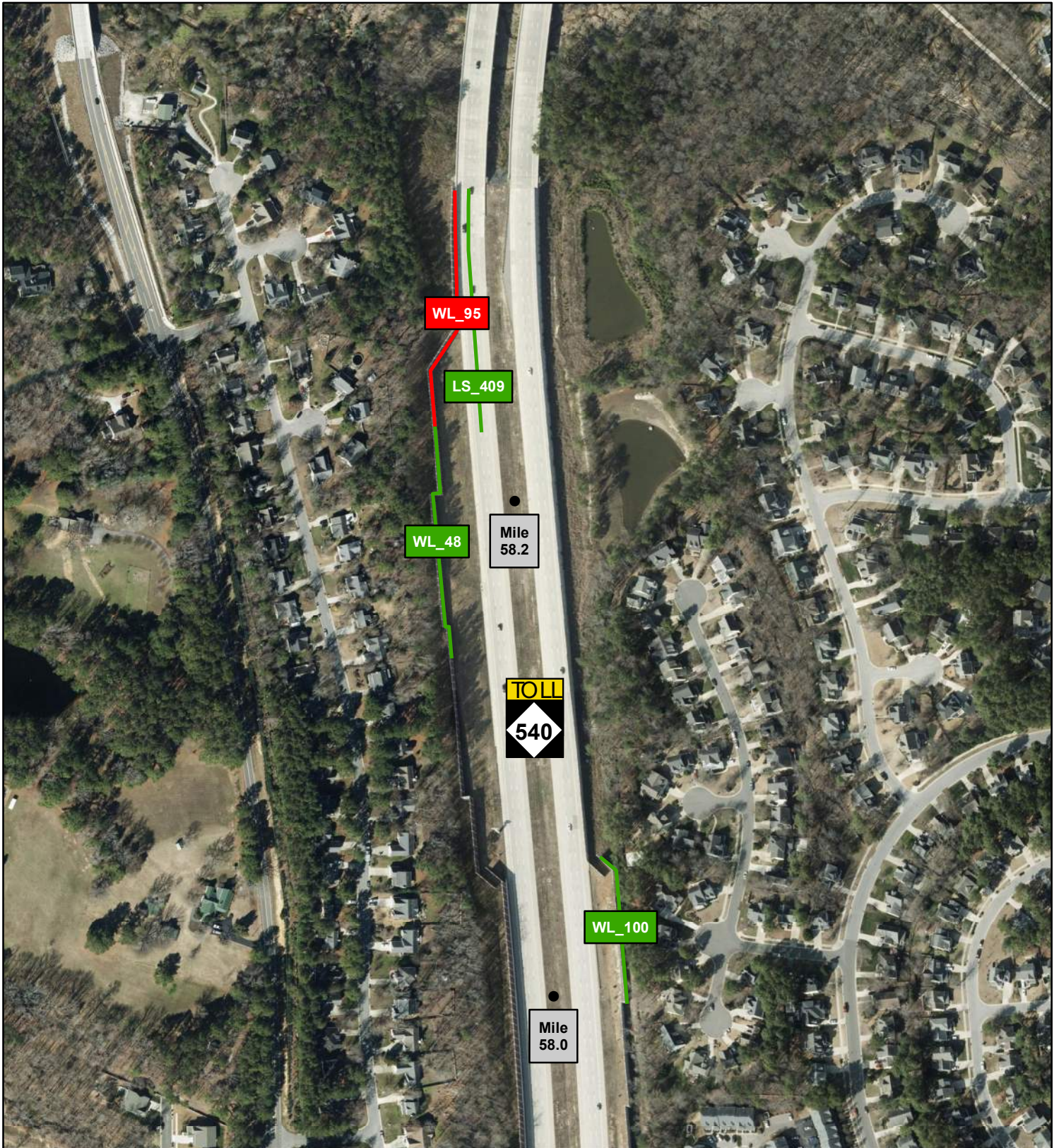


Legend



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Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations

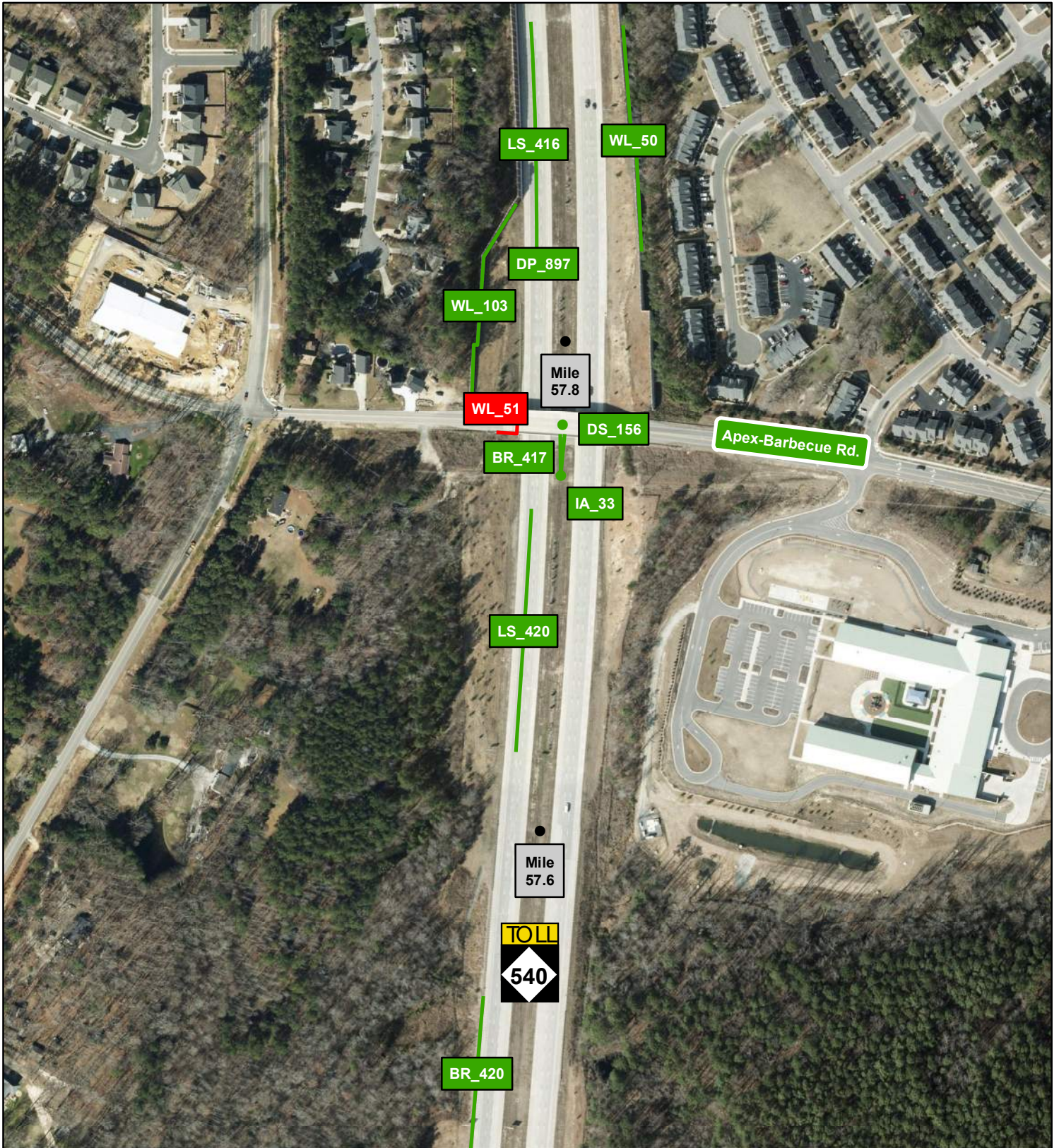


Legend



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Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations

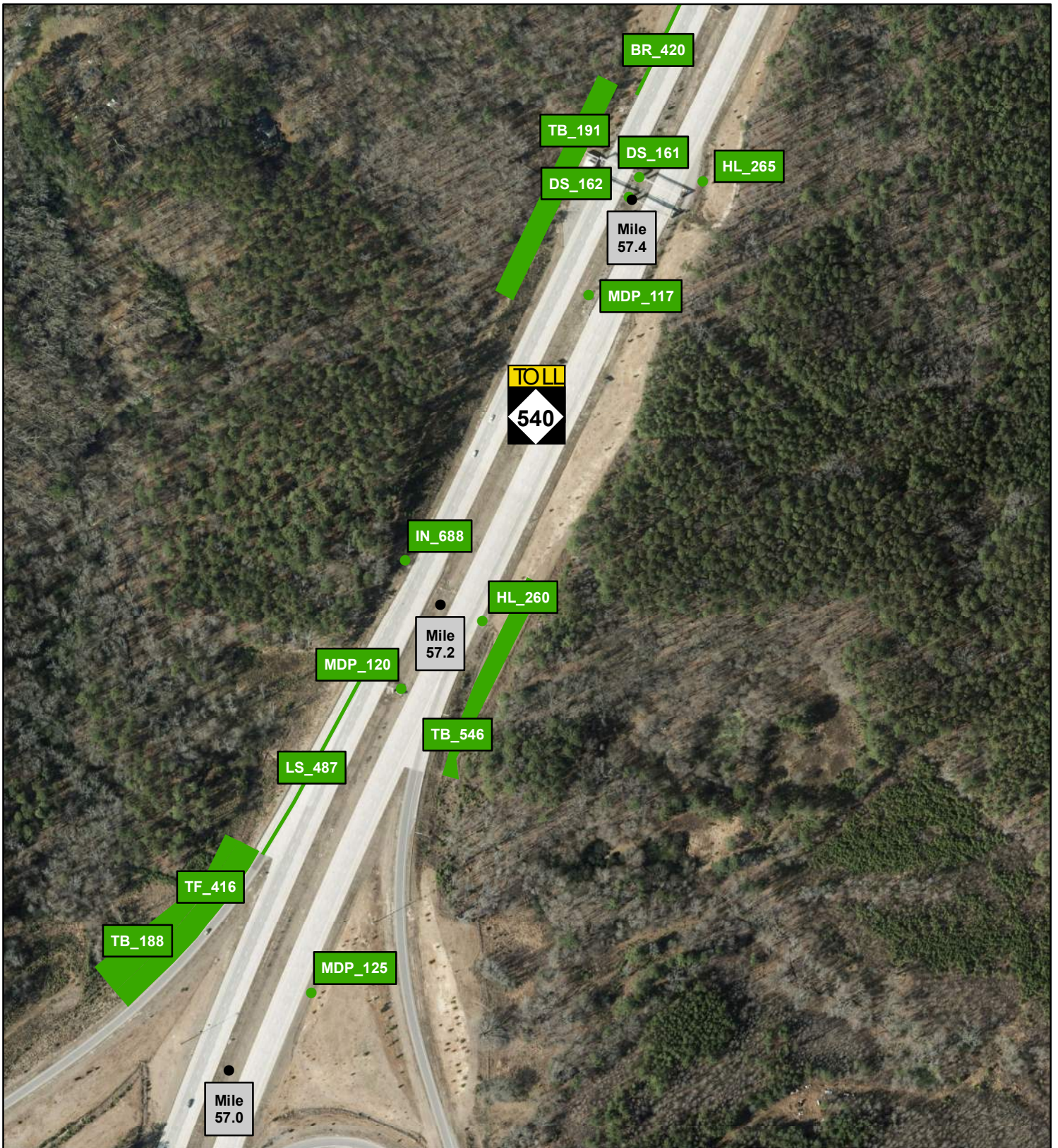


Legend

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Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset



NORTH CAROLINA
Turnpike Authority

Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations

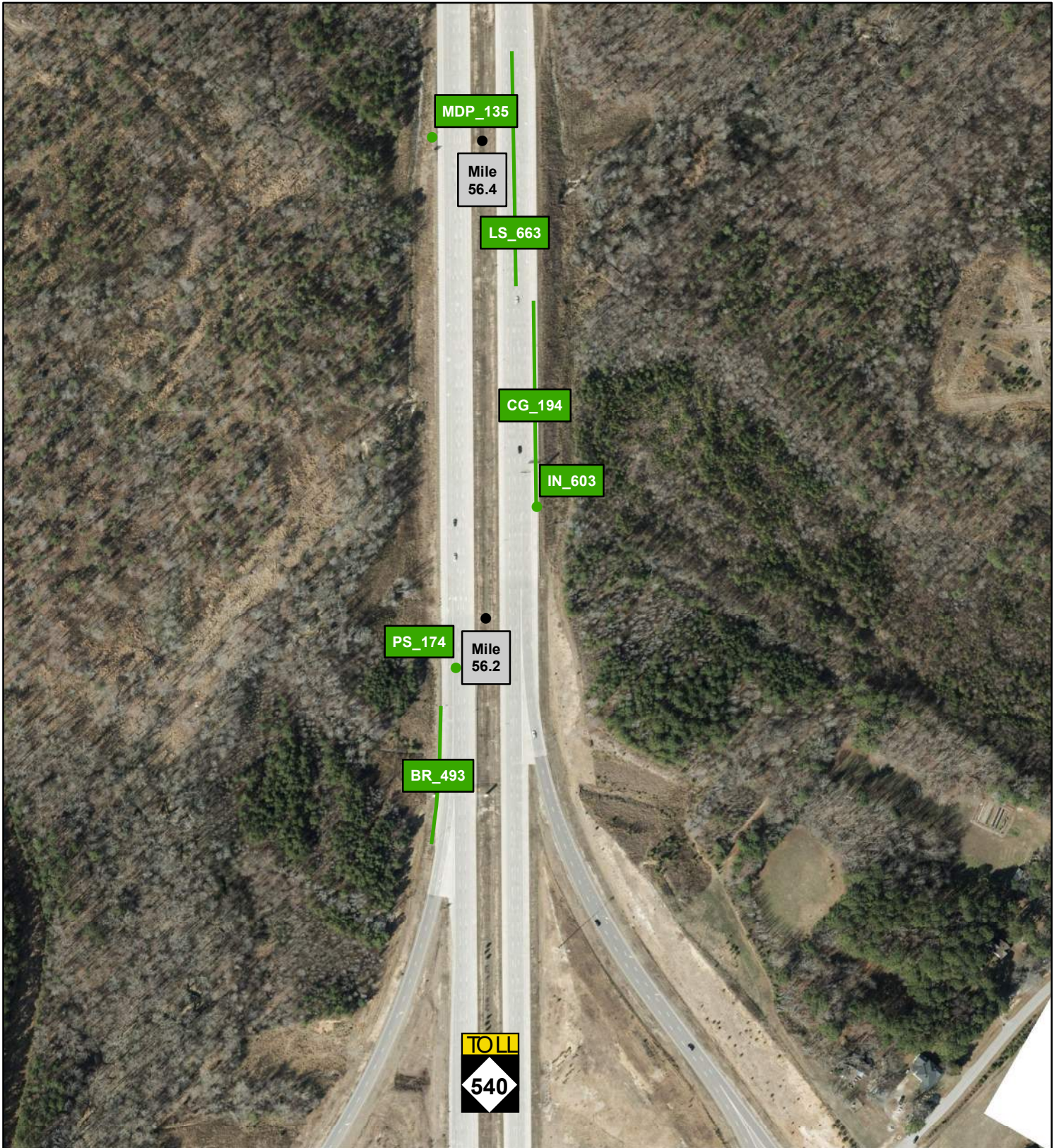


Legend



- Failing Asset
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Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations



Legend



-  Failing Asset
-  Passing Asset



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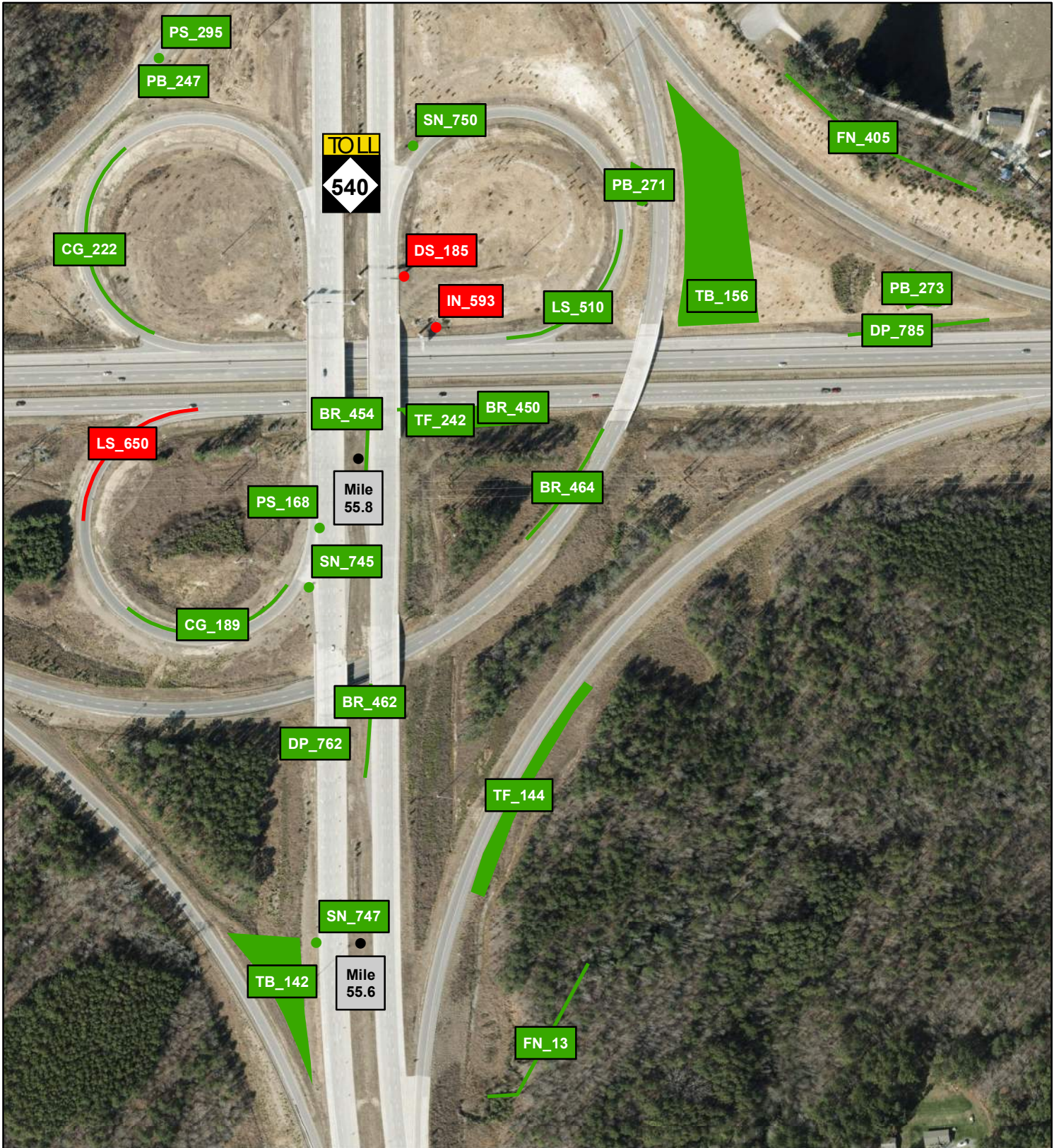


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-  Failing Asset
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Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations

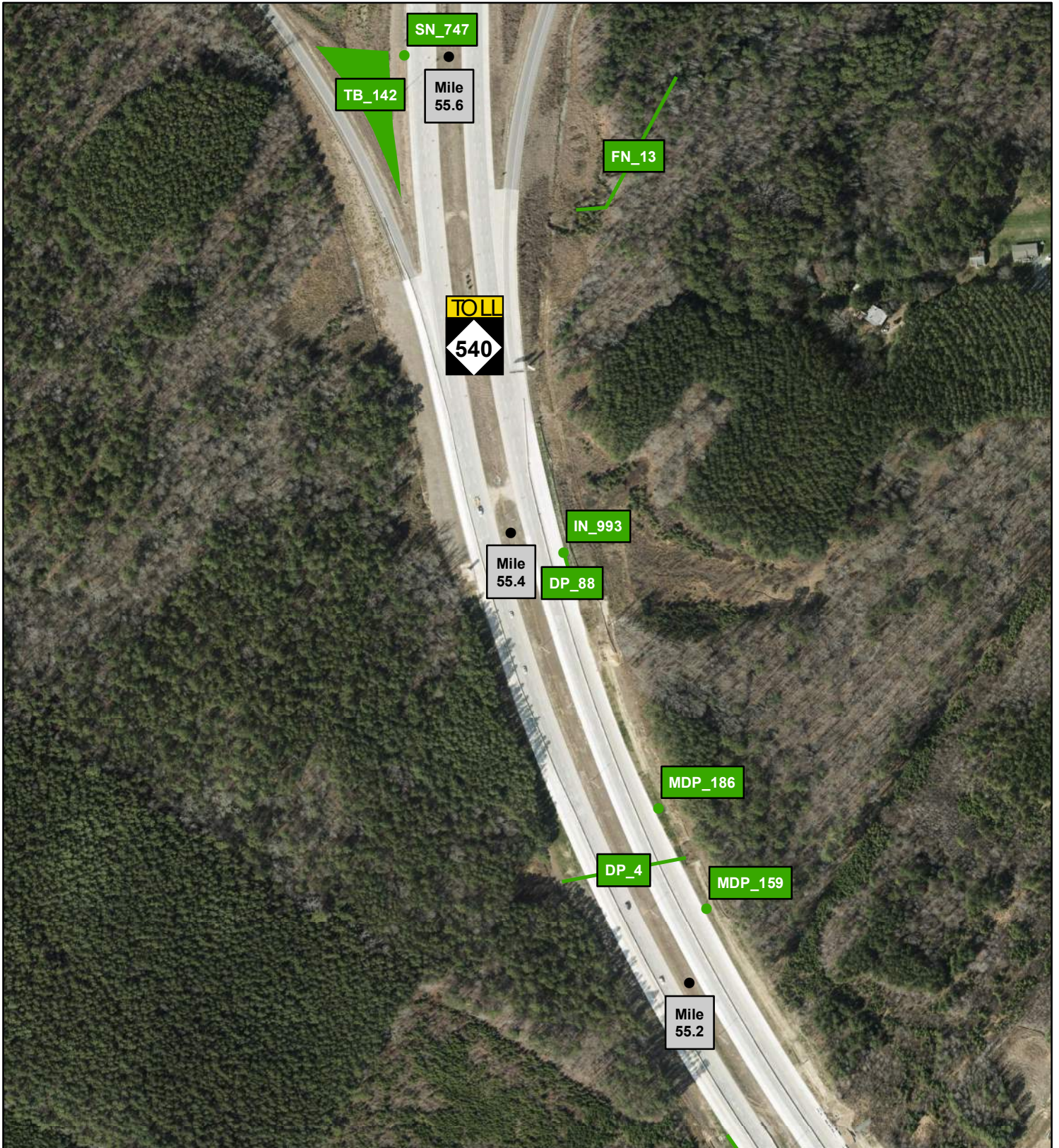


Legend



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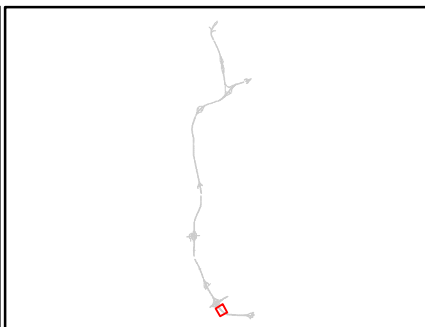


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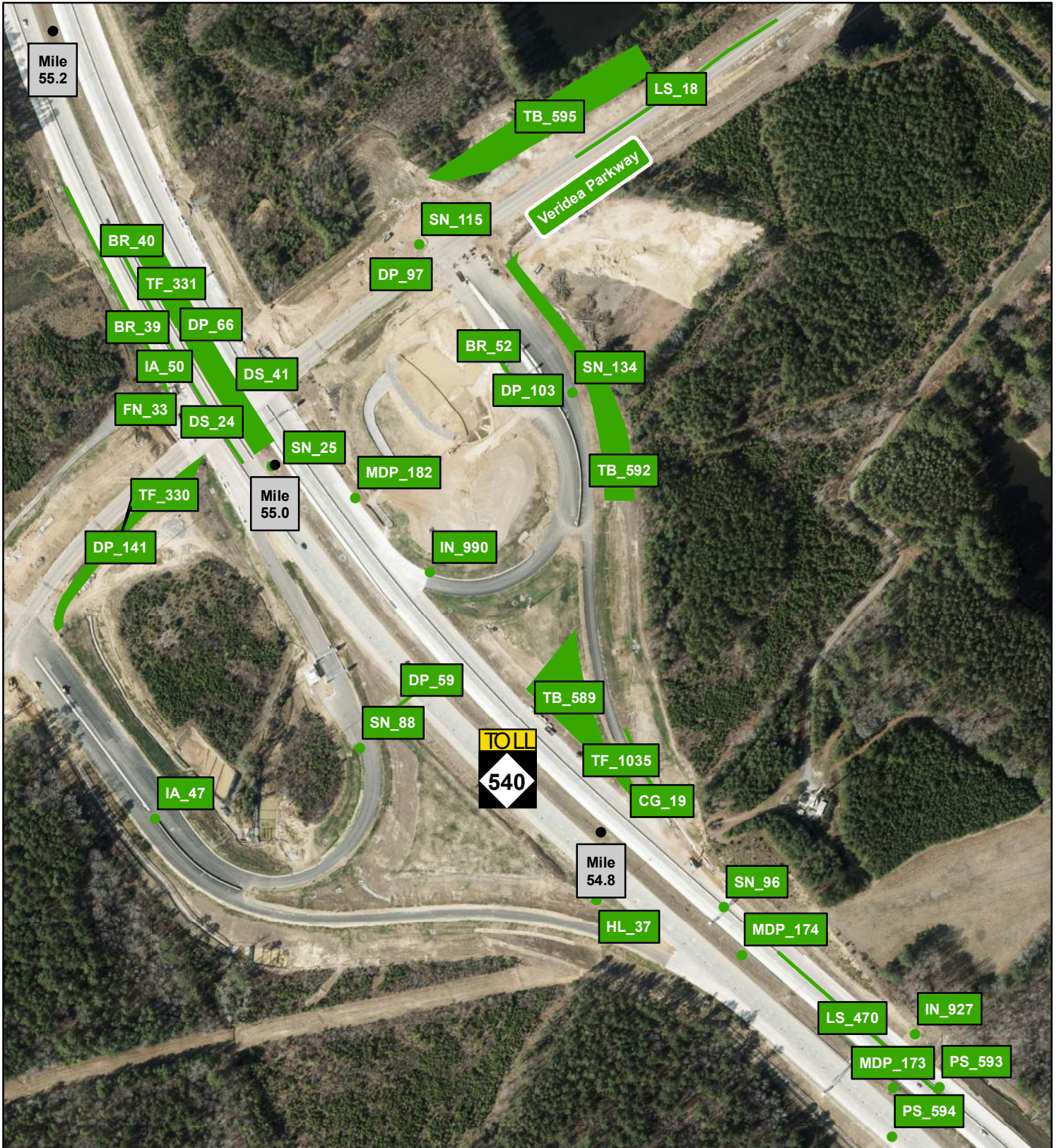


Legend

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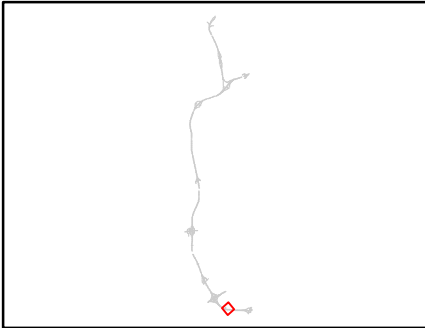


Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations



Legend

- Failing Asset
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Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations

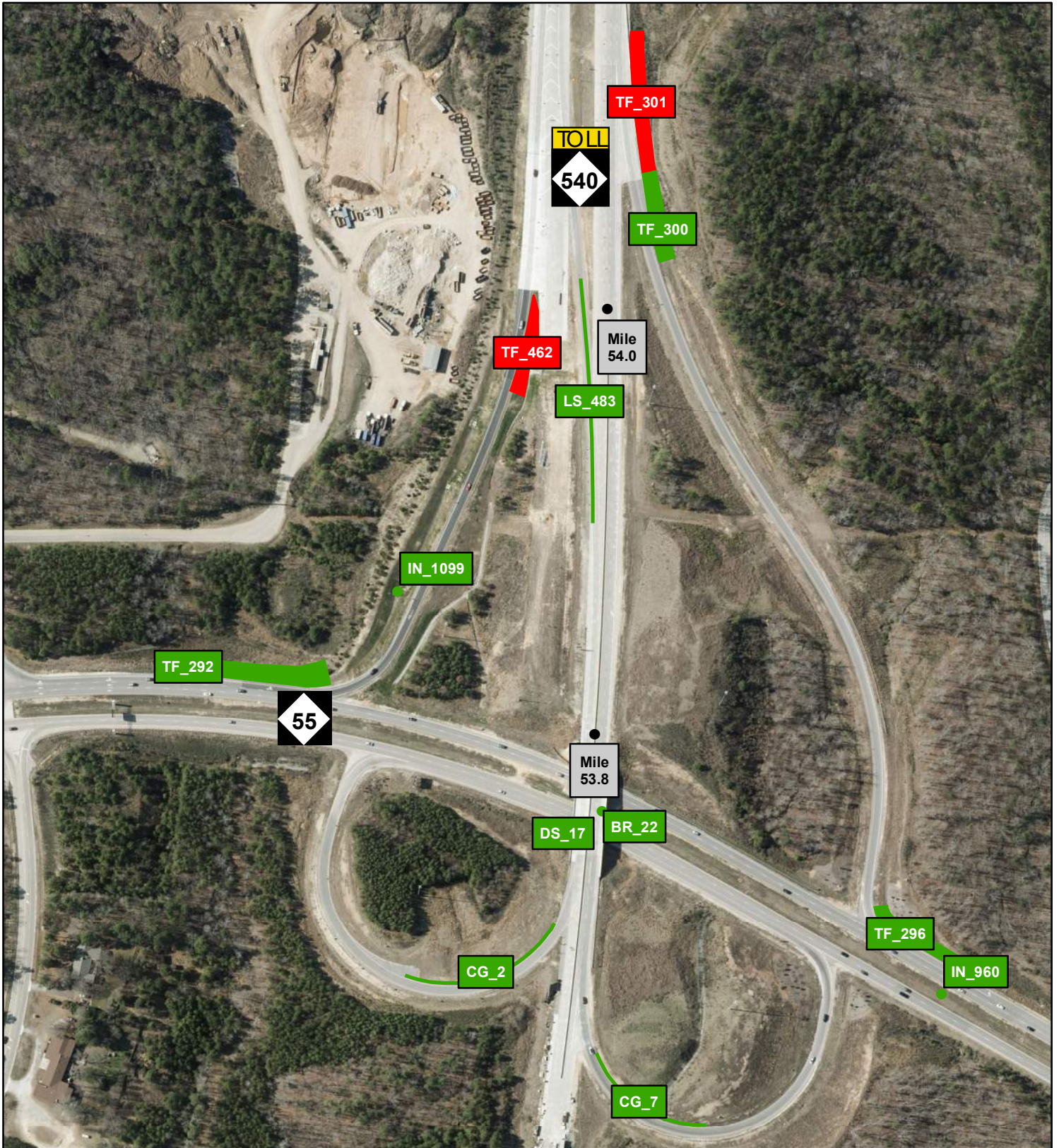


Legend



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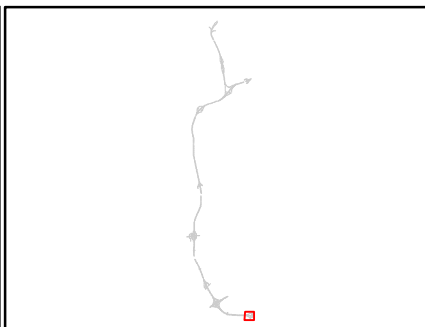


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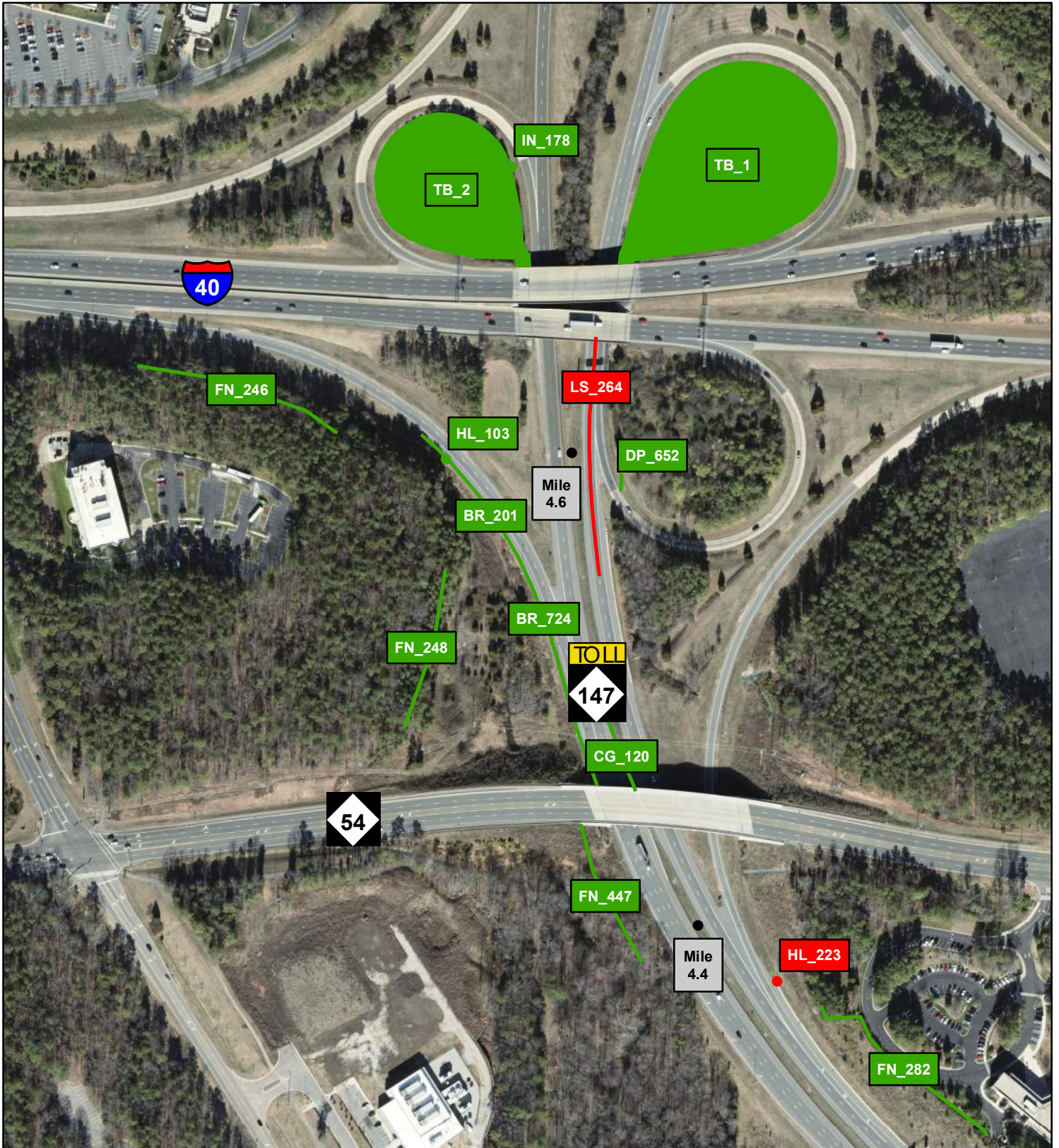


Legend

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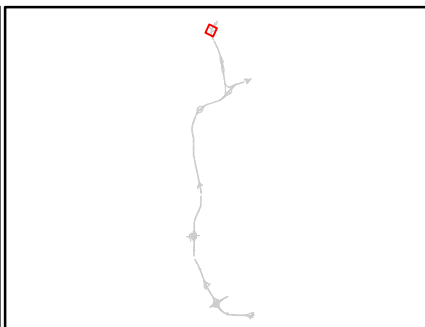


Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations



Legend



- Failing Asset
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Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations

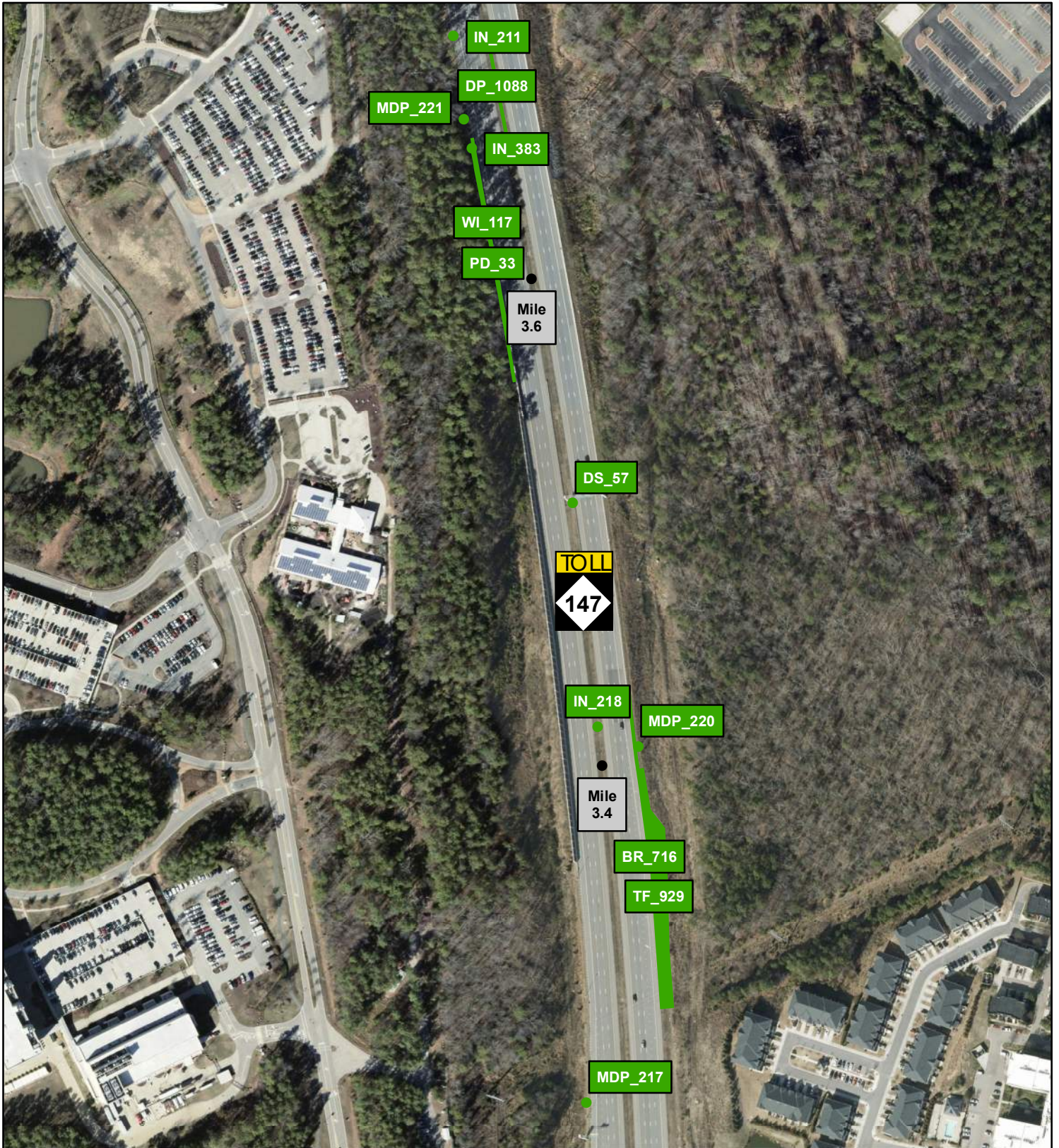


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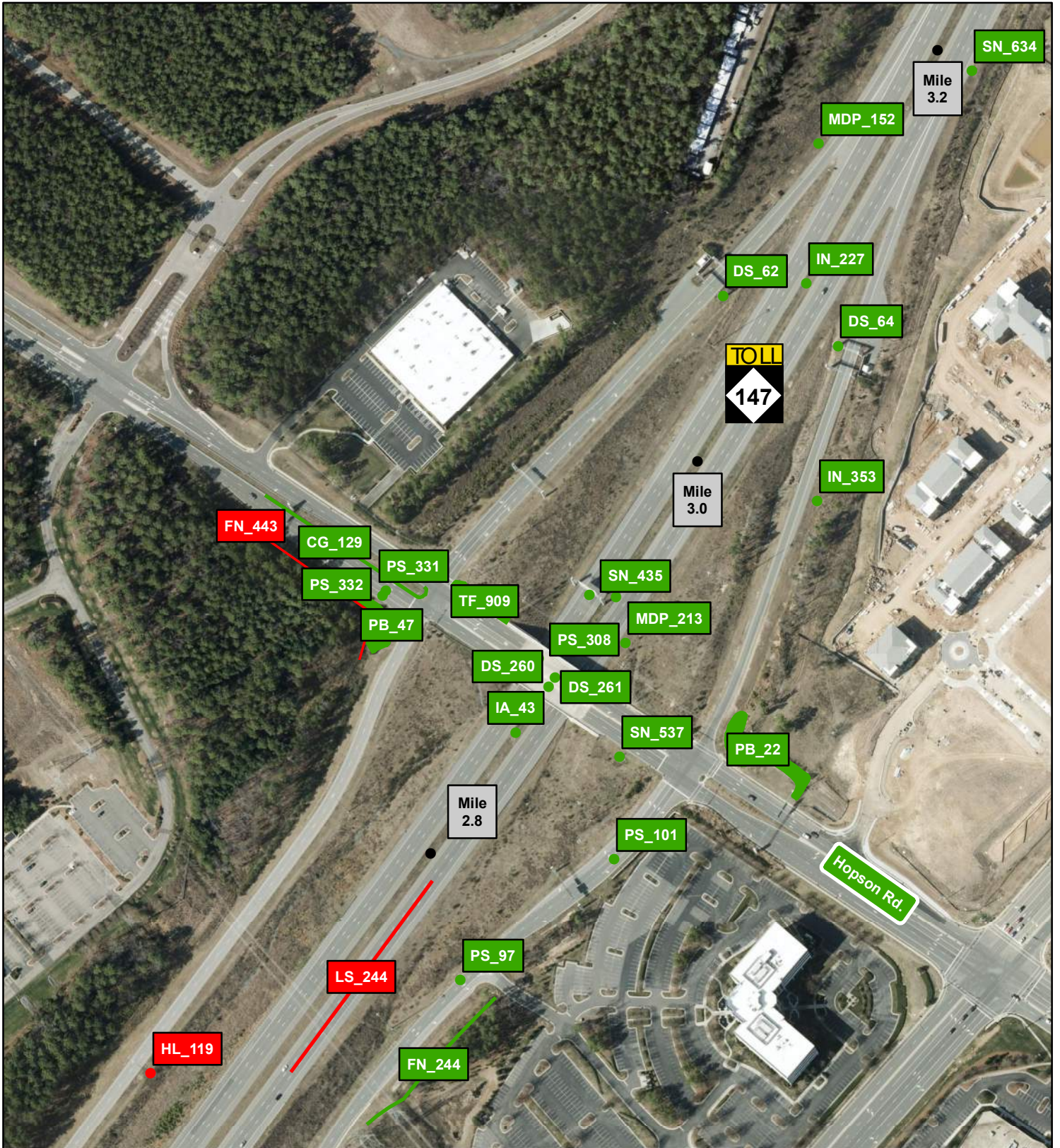


Legend

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Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations

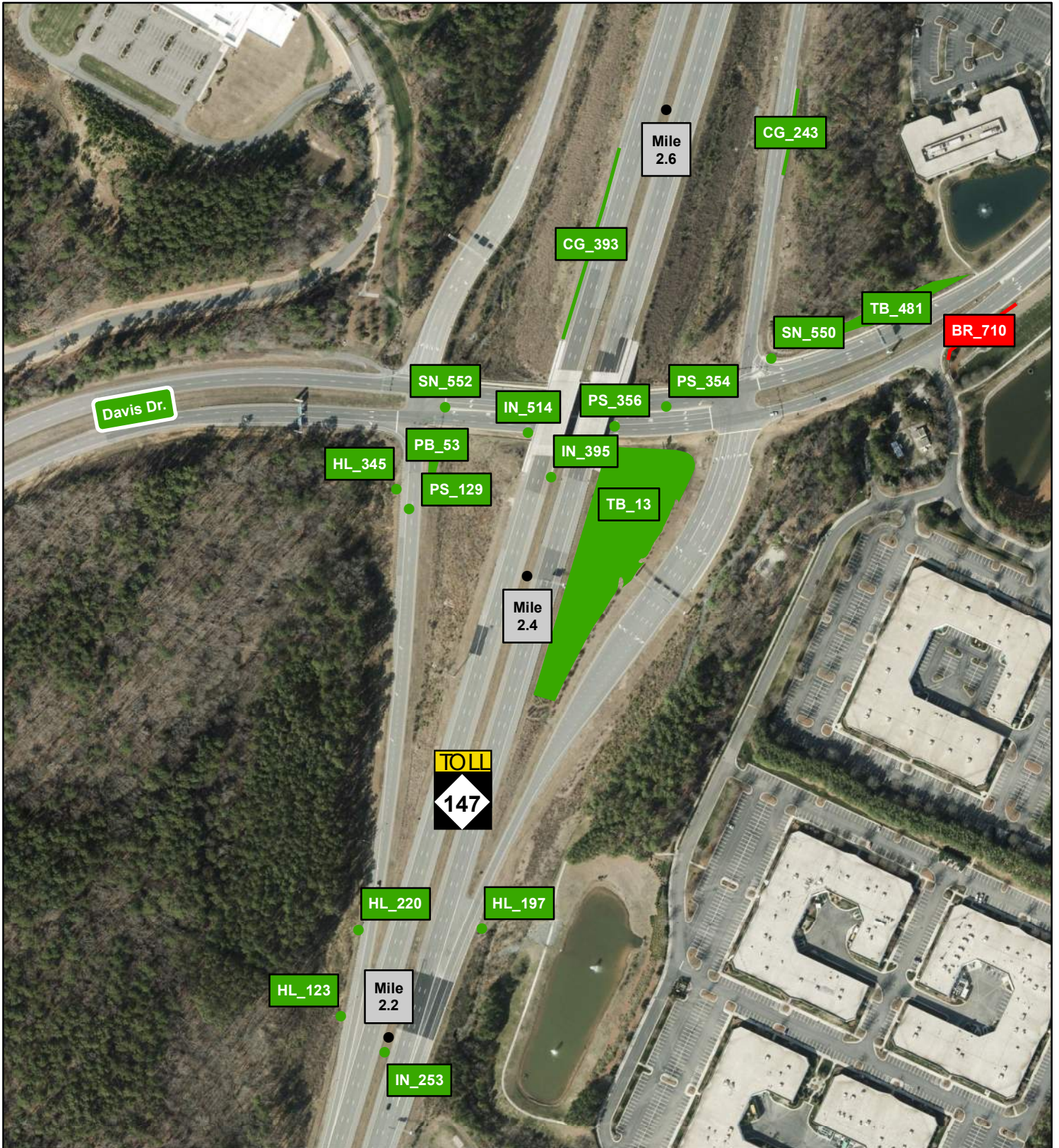


Legend

- Failing Asset
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Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations

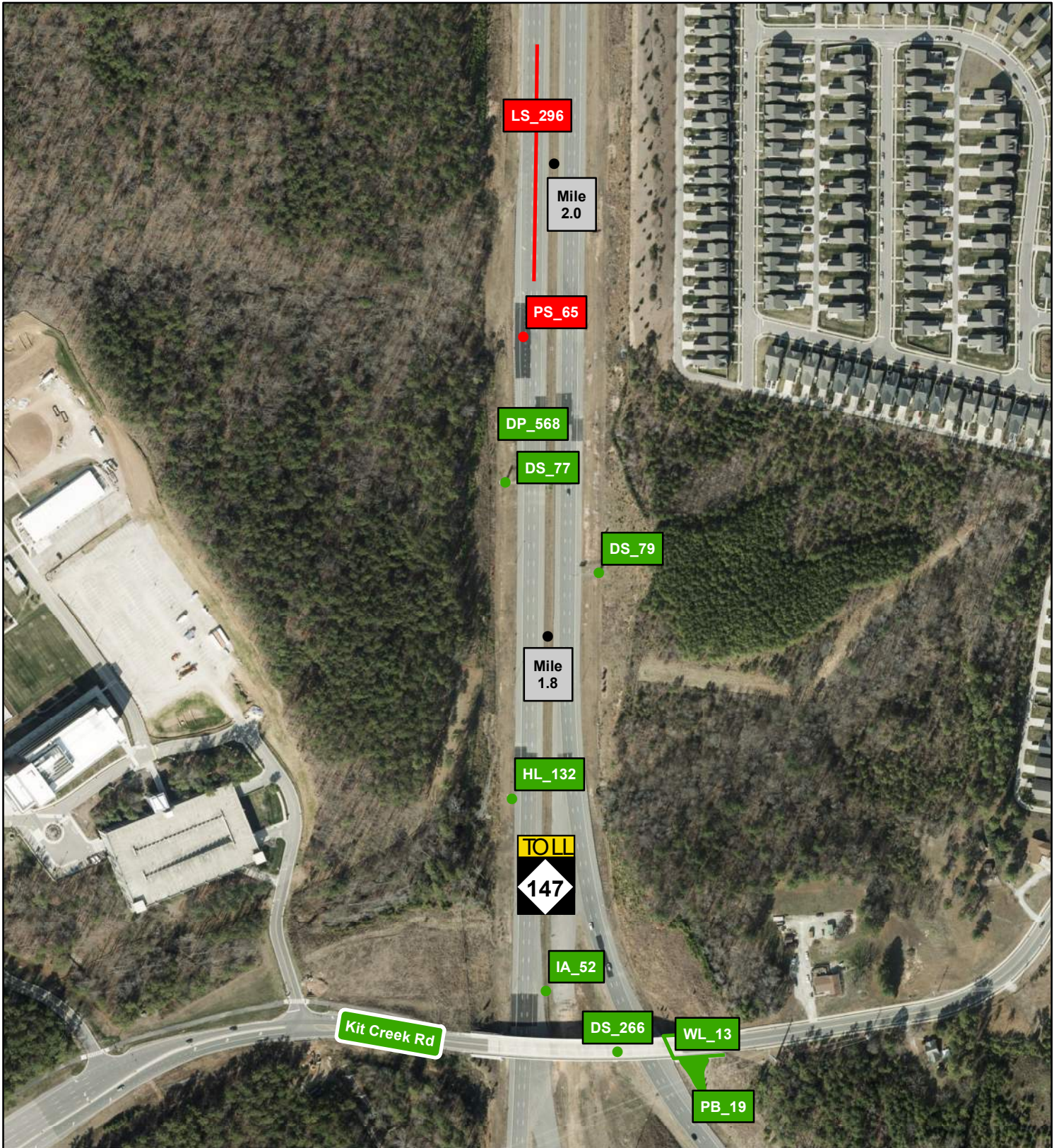


Legend



- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2019 Fourth Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset



Appendix B

Triangle Expressway 2019 Fourth Quarter Table Results of Assets Failing MRP


Appendix B: Triangle Expressway 2019 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)	1
Curb and Gutter (CG)	2
Decorative Supports (DS)	3
Drainage Pipes (DP).....	4
Misc. Drainage Structure (MDP)	5
Fence and Control of Access (FN)	6
Graffiti (GR)	7
Highway Lighting (HL)	8
Impact Attenuators (IA)	9
Inlets (IN).....	10
Landscaping (PB)	11
Paved Lanes – Asphalt (LS).....	12
Paved Lanes – Concrete (LS)	12
Paved Shoulders (LS).....	13
Unpaved Shoulders (LS)	14
Front/Back Slopes (LS)	14
Unpaved Lateral and Outfall Ditches (LS)	14
Litter (LS)	14
Roadway Sweeping (LS)	14
Pavement Striping (LS).....	15
Pavement Markers (LS).....	16
Delineators (LS)	17
Paved Ditches (PD).....	18
Pavement Words and Symbols (PS)	19
Signs (SN)	20
Tree and Brush (TB)	21
Turf Condition (TF).....	22
MSE/Retaining Walls, Sound Barrier Walls and Screen Walls (WL).....	23



Guardrail, Concrete Barrier and End Anchors (BR)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Guardrail	BR_710	Functional Damage		A35

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
1	Overhead Sign Support	DS_12	Scaling		A29
2	Overhead Sign Support	DS_185	Spalling		A26

Drainage Pipes (DP)

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

Misc. Drainage Structure (MDP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Shoulder Drain	MDP_35	End Damage - Buildup		A9
2	Shoulder Drain	MDP_164	End Damage - Buildup		A29

Fence and Control of Access (FN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Woven	FN_65	Fence Height		A6
2	Woven	FN_443	Hole Height		A34

Graffiti (GR)

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


Highway Lighting (HL)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	High Mast	HL_119	Missing Part		A34
2	Double Roadway	HL_142	Pole Damage		A5
3	Single Roadway	HL_223	Part Damage		A31
4	Double Roadway	HL_296	Part Damage		A25

Impact Attenuators (IA)

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




Inlets (IN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Inlet	IN_593	Obstruction		A26

Landscaping (PB)

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





Paved Lanes – Asphalt (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_225	Unsealed Cracks		A3
2	Asphalt	LS_244	Unsealed Cracks		A34
3	Asphalt	LS_302	Unsealed Cracks		A4

Paved Lanes – Concrete (LS)

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


Paved Shoulders (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_214	Unsealed Cracks		A3
2	Asphalt	LS_244	Unsealed Cracks		A34
3	Asphalt	LS_264	Unsealed Cracks		A31
4	Asphalt	LS_302	Unsealed Cracks		A4

Unpaved Shoulders (LS)

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

Front/Back Slopes (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_225	Slope - Deviation		A3

Unpaved Lateral and Outfall Ditches (LS)

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




Litter (LS)

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



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_225	Line Missing		A3
2	Asphalt	LS_302	Line Missing		A4
3	Asphalt	LS_556	Line Missing		A16
4	Asphalt	LS_650	Line Missing		A26

Pavement Markers (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_244	Reflective Marker Missing & Nighttime Reflectivity		A34
2	Asphalt	LS_264	Nighttime Reflectivity	Not Available for Nighttime Failure	A31
3	Asphalt	LS_302	Reflective Marker Missing		A4




Delimiters (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_58	Missing & Nighttime Reflectivity		A6
2	Asphalt	LS_214	Missing & Nighttime Reflectivity		A3
3	Asphalt	LS_296	Missing & Nighttime Reflectivity		A36
4	Asphalt	LS_302	Missing & Nighttime Reflectivity		A4

Paved Ditches (PD)

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

Pavement Words and Symbols (PS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Merge Left	PS_65	Daytime Assessment		A36
2	Thru Arrow	PS_419	Daytime Assessment		A1
3	Stop Bar	PS_430	Daytime Assessment		A1




Signs (SN)

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



Tree and Brush (TB)

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

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Turf	TF_301	Bare Ground		A30
2	Turf	TF_462	Bare Ground		A30
3	Turf	TF_480	Bare Ground		A19

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

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Sound Wall	WL_51	Paint Scale		A21
2	Sound Wall	WL_95	Unsealed Cracks		A20