



NORTH CAROLINA
Turnpike Authority

Maintenance Rating Program

Triangle Expressway

2019 Second Quarter Report

1 S. Wilmington Street
Raleigh, NC 27601



Last Updated:
August 5, 2019

CONSULTANT CERTIFICATION OF COMPLETION

August 2, 2019

Dennis Jernigan, P.E.
Director of Highway Operations, NCTA
1 South Wilmington Street
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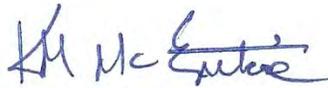
NCTA Triangle Expressway Roadway Maintenance Performance Rating Program; Q2, FY 2019 Rating

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

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Maintenance Rating Program for the Triangle Expressway

2019 Second Quarter (April – June)

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 Second Quarter Assessment of the Triangle Expressway.

The overall 2019 second quarter maintenance rating of the Triangle Expressway was 92.1, meeting 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 Second Quarter Assessment		
Element	MRP Rating	Target Rating
Road Surface	92.6	85.0
Unpaved Shoulders and Ditches	97.8	85.0
Drainage	94.0	85.0
Roadside	92.8	85.0
Traffic Control Devices	87.9	85.0
Overall MRP Performance Rating	92.1	90.0

This report also provides a rolling rating of the latest four quarterly inspections of the Triangle Expressway. As presented in **Table 2**, the rolling maintenance rating of the Triangle Expressway was 94.9.

Table 2: MRP Rolling Element Results					
Element	Q3 2018 Rating	Q4 2018 Rating	Q1 2019 Rating	Q2 2019 Rating	Rolling Rating
Road Surface	99.2	99.2	96.0	92.6	97.1
Unpaved Shoulders and Ditches	97.1	99.0	97.4	97.8	97.9
Drainage	96.1	92.8	91.3	94.0	93.6
Roadside	94.9	97.1	92.8	92.8	94.6
Traffic Control Devices	94.6 ¹	95.1	92.1	87.9	92.6 ²
Overall MRP Performance Rating	96.4¹	96.6	93.7	92.1	94.9²

¹ Excludes pavement striping, characters, symbols, and markers on concrete pavement surfaces.

² Excludes the third quarter ratings for characteristics listed above.

In addition, the report provides findings of the Green Level Historic District signs inspection. This quarter, all three signs inspected 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.

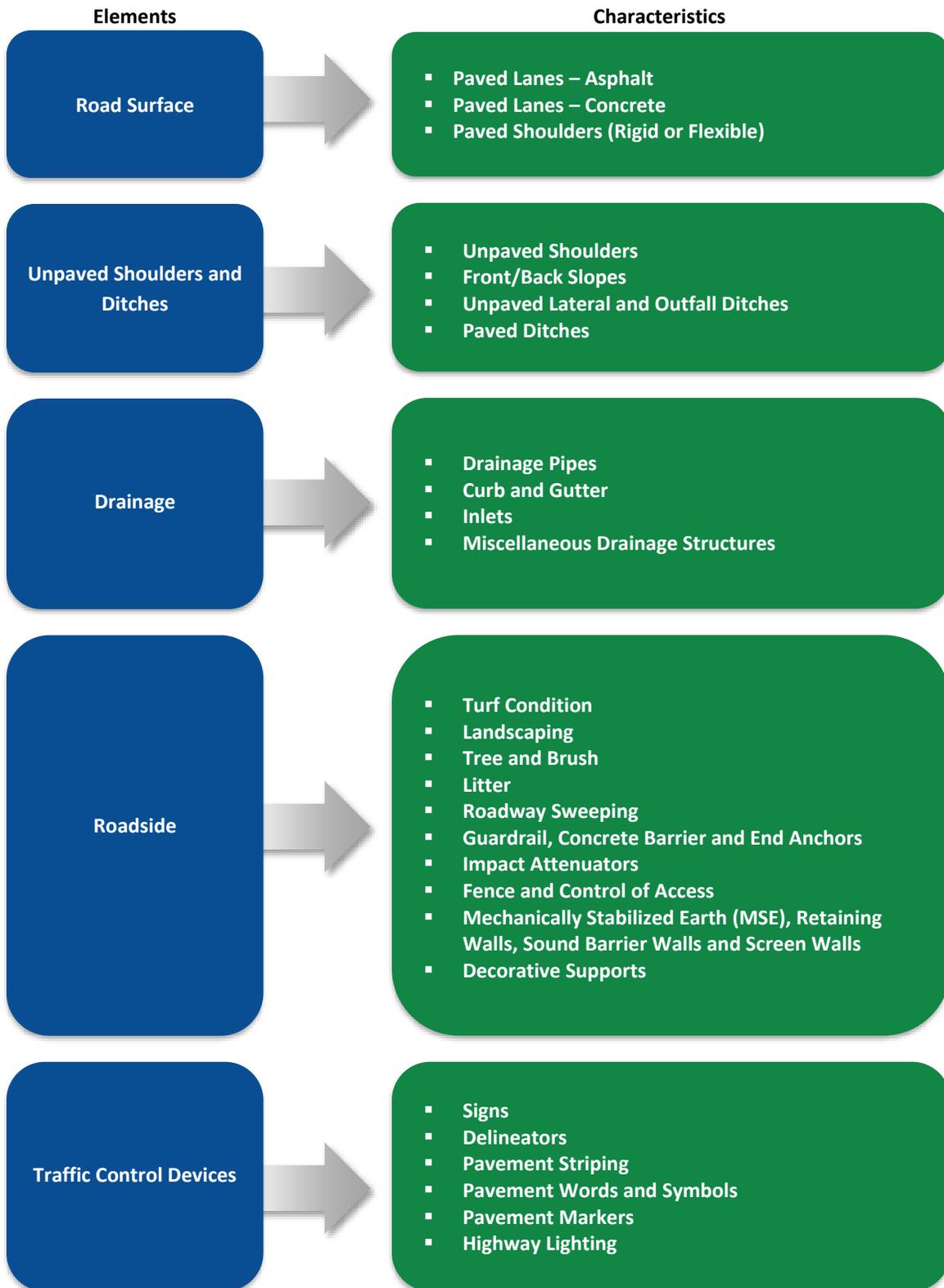
The NCTA performance standards, threshold criteria, and maintenance rating program were developed through a collaborative effort by NCTA managers, NCDOT maintenance staff, and consultants.

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



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

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

When the evaluation process is completed, the number of PASSING samples and total 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:

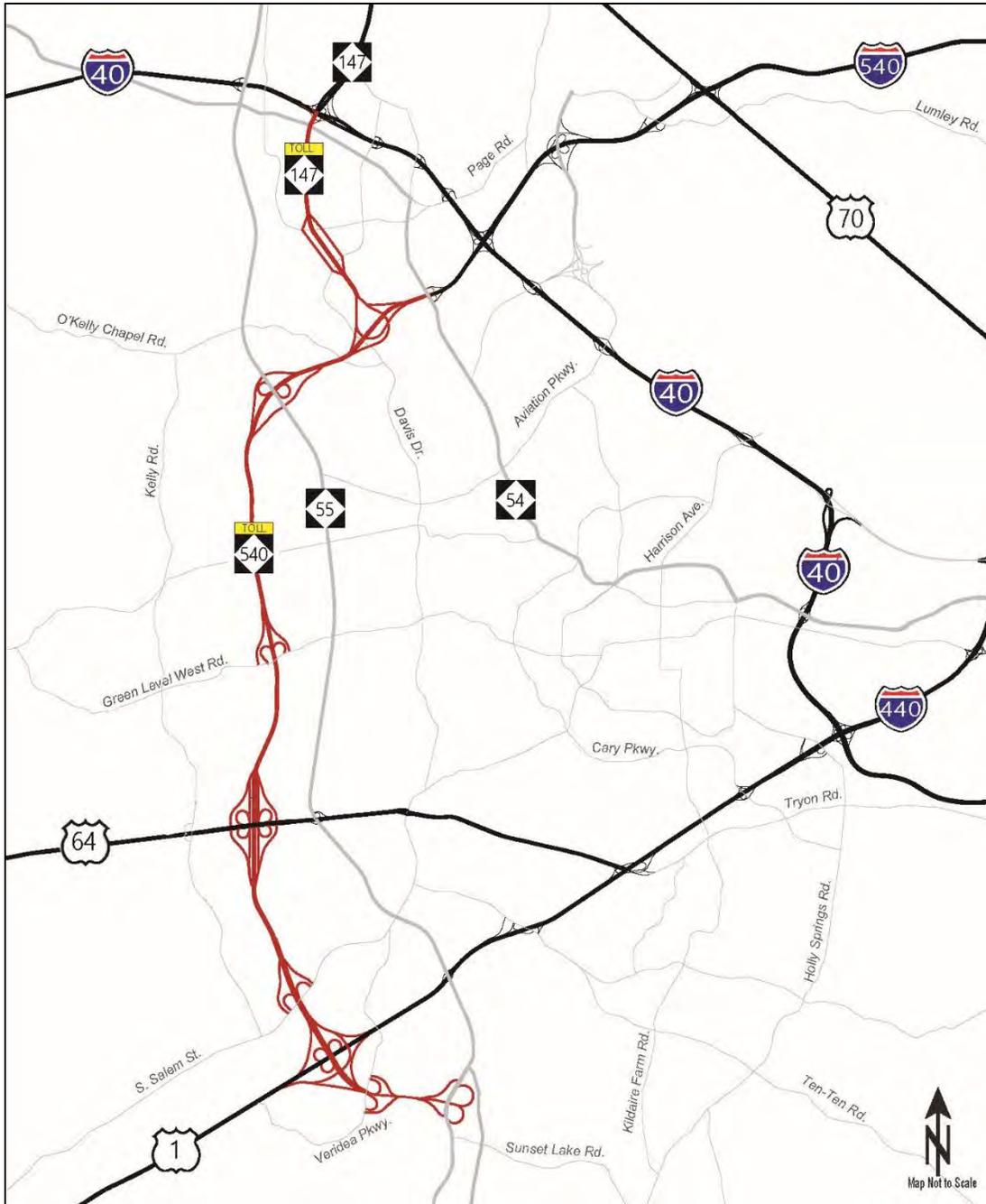
Road Surface =	25%
Unpaved Shoulders =	13%
Drainage =	15%
Roadside =	17%
Traffic Control Devices =	30%
<hr/>	
Total	100%

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.

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. Also, in this quarter, assets on Exit 67 Ramp from Toll NC 540 North to Toll NC 147 North were removed from the inventory while repair work is ongoing. **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 SECOND QUARTER ASSESSMENT

6.1 Quarterly Results

The overall 2019 second quarter maintenance rating of the Triangle Expressway was 92.1, meeting NCTA’s target overall rating of 90. All elements assessed achieved ratings above the target rating of 85 established for element groups. Turf Condition (73) 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 second quarter sample, one of the four surveys to provide an intermediate snapshot of seasonal conditions. Therefore, they are not a statistically valid representation of the assets; only the total of all four quarterly inspections, reported at the end of each calendar year, provides a 95% confidence level in statistical sampling. The second quarter MRP performance ratings for elements and characteristics are presented in **Table 4** and **Table 5**, respectively.

Table 4: MRP Element Results for Q2 2019	
Element	Q2 2019 MRP Rating
Road Surface	92.6
Unpaved Shoulders and Ditches	97.8
Drainage	94.0
Roadside	92.8
Traffic Control Devices	87.9
Overall MRP Performance Rating	92.1

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Table 5: MRP Characteristic Results for Q2 2019

Road Surface	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q2 Rating
Paved Lanes Asphalt	13	14	9	117	126	93
Paved Lanes Concrete	17	18	9	153	162	94
Paved Shoulder	29	32	5	145	160	91
Element Total				415	448	92.6
Unpaved Shoulders and Ditches	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q2 Rating
Unpaved Shoulder	31	32	9	279	288	97
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				667	682	97.8
Drainage	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q2 Rating
Drainage Pipes	34	34	7	238	238	100
Curb and Gutter	24	28	6	144	168	86
Inlets	33	34	7	231	238	97
Misc. Drainage Structure	31	35	4	124	140	89
Element Total				737	784	94.0
Roadside	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q2 Rating
Turf Condition	24	33	7	168	231	73
Landscaping	23	24	4	92	96	96
Trees and Brush	29	30	4	116	120	97
Litter	32	32	4	128	128	100
Roadway Sweeping	32	32	5	160	160	100
Guardrail, Concrete Barrier and End Anchors	31	31	9	279	279	100
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	20	25	5	100	125	80
Graffiti and Stain Removal	44	44	4	176	176	100
Element Total				1549	1669	92.8
Traffic Control Devices	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q2 Rating
Signs	31	34	7	217	238	91
Delineators	22	26	3	66	78	85
Pavement Striping/Marking	28	32	8	224	256	88
Words and Symbols	26	31	7	182	217	84
Pavement Markers	27	32	9	243	288	84
Highway Lighting	27	28	6	162	168	96
Element Total				1094	1245	87.9

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

6.2 Analysis and Recommendations

Elements

During the second quarter, all elements exceeded NCTA's threshold criteria of 85. Unpaved Shoulder/Ditches (97.8) continued to obtain a rating higher than 95. All elements, with the exception of Traffic Control Devices (87.9), continued exceeding a score higher than 90.

Drainage (94.0) experienced the highest increase in rating compared to the previous quarter. The rating for this element was 2.7 points higher than the first quarter rating. The increase was predominately due to higher ratings for Miscellaneous Drainage Structures (89). Given the subsurface Triassic soil conditions encountered on this project, the edge drain system is a critical component of maintaining the design life of pavements as it provides a conduit to channel water away from the subgrade and base.

Traffic Control Devices (87.9) experienced a decrease in rating compared to the previous quarter. The rating for this element was 4.2 points lower than the first quarter rating. The decrease was predominately due to lower ratings for Pavement Striping/Marking (88) and Pavement Words and Symbols (84). Pavement Markers (84) were replaced, per contract schedule, shortly after Quarter 2 inspections were performed which should improve scores for next quarter.

Road Surface (92.6) experienced a decrease in rating of 3.4 points. Repaving of all asphalt lanes is scheduled to begin during Q1 of next year. Roadside (92.8) experienced no change in rating from the previous quarter. The decrease in rating for Decorative Supports (80) was offset by the increase in ratings for Litter (100) and Roadway Sweeping (100).

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

Characteristics

This quarter, all but one characteristic, Turf Condition (73), 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**.

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Turf Condition (73 rating – 24 of the 33 assets passed): Of the 9 turf areas that did not pass the inspection, 8 were due to bare ground conditions and 1 was due to the presence of noxious weeds. Two of these turf areas are presented in **Figure 3**.

Figure 3: Turf Inspection Results Sample



To continue to improve the Turf Condition rating, it is recommended that the maintenance provider continue with an aggressive schedule for seeding and fertilization cycles of bare ground areas during the spring and early summer. As part of their routine, the maintenance provider should closely monitor mowing heights during the 2019 mowing cycle pursuant to the NCTA Roadway and Facility Maintenance Standards V6, referenced below. It was observed during the second quarter inspection that turf areas unusually exceeded the previous mowing evaluation standard of 12 inches throughout the corridor. Since this observation, mowing duties have been assigned to another company to ensure the mowing cycle is properly maintained.

Turf Maintenance Program:

- 1) Roadside mowing should occur as often as necessary to always conform to the evaluation standard. Mowing shall be in accordance with the NCTA approved mowing patterns and must not exceed the mowing lines identified by the approved stakes. These stakes are identified with a 15-inch white top. The maintenance provider shall review and confirm clarity to the NCTA (in writing) for strict adherence to the approved mowing pattern prior to each mowing season.
- 2) Turf grass shall be cut to a height of six inches (6) with a maximum tolerance of two (2) inches plus or minus.
- 3) Maintain roadway mowing 5 feet behind guardrail, unless otherwise specified by landscaping stakes.
- 4) Where landscaping has been established, or around the natural enhancement areas, mowing shall conform to the established contours with smooth flowing transitions.
- 5) Roadside trimming shall occur around all traffic appurtenances including, but not limited to guardrail, sign posts, light poles, and ITS device poles.
- 6) Chemical applications:

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- a. Winter:
 - i. Apply limestone.
 - ii. Apply fertilizer.
- b. Spring:
 - i. Apply pre- and post- emergent broadleaf weed control in accordance with the manufacturer's recommendations in April.
 - ii. Bare ground areas shall be scheduled for seeding as necessary.
- c. Fall:
 - i. Apply post-emergence herbicides to select locations in accordance with the manufacturer's recommendations in August.
 - ii. Bare ground areas shall be seeded in the fall as needed.

Turf Maintenance and Evaluation Standards:

Turf does not meet the maintenance standards when any of the following criteria is observed:

- 1) More than 25% of the undesirable vegetation is present within the mowing limits of the area.
- 2) Noxious weeds present.
- 3) More than 50 cumulative SF of bare ground is present in the turf evaluation area.

Maintenance Rating Program for the Triangle Expressway

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7.0 CURRENT ROLLING MRP RATING

The rolling maintenance rating of the Triangle Expressway was 94.9, exceeding NCTA’s target overall rating of 90. All elements exceeded NCTA’s rolling rating threshold criteria of 85. Also, all but one characteristic rating met or exceeded the target rating of 80. The rolling rating for Miscellaneous Drainage Structure was 75 with a rating below the target rating of 80 in Q4 2018 and Q1 2019.

The 2018/2019 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 2019					
Element	Q3 2018 RATING	Q4 2018 RATING	Q1 2019 RATING	Q2 2019 RATING	ROLLING RATING
Road Surface	99.2	99.2	96.0	92.6	97.1
Unpaved Shoulders and Ditches	97.1	99.0	97.4	97.8	97.9
Drainage	96.1	92.8	91.3	94.0	93.6
Roadside	94.9	97.1	92.8	92.8	94.6
Traffic Control Devices	94.6 ¹	95.1	92.1	87.9	92.6 ²
Overall MRP Performance Rating	96.4¹	96.6	93.7	92.1	94.9²

¹ Excludes pavement striping, characters, symbols, and markers on concrete pavement surfaces.

² Excludes the third quarter ratings for characteristics listed above.

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Table 7: MRP Rolling Element Results					
Road Surface	Q3 2018 RATING	Q4 2018 RATING	Q1 2019 RATING	Q2 2019 RATING	ROLLING RATING
Paved Lanes Asphalt	100	100	86	93	95
Paved Lanes Concrete	100	100	100	94	99
Paved Shoulder	98	98	100	91	97
Element Total	99	99.2	96.0	92.6	97.1
Unpaved Shoulders and Ditches	Q3 2018 RATING	Q4 2018 RATING	Q1 2019 RATING	Q2 2019 RATING	ROLLING RATING
Unpaved Shoulder	93	98	94	97	95
Front/Back Slopes	100	100	100	100	100
Lateral and Outfall Ditches, Unpaved	100	100	100	97	99
Ditches, Paved	100	100	100	100	100
Element Total	97.1	99.0	97.4	97.8	97.9
Drainage	Q3 2018 RATING	Q4 2018 RATING	Q1 2019 RATING	Q2 2019 RATING	ROLLING RATING
Drainage Pipes	100	100	97	100	99
Curb and Gutter	97	97	96	86	94
Inlets	100	97	97	97	98
Misc. Drainage Structure	81	65	65	89	75
Element Total	96.1	92.8	91.3	94.0	93.6
Roadside	Q3 2018 RATING	Q4 2018 RATING	Q1 2019 RATING	Q2 2019 RATING	ROLLING RATING
Turf Condition	85	90	76	73	83
Landscaping	96	100	96	96	97
Trees and Brush	100	100	93	97	98
Litter	100	100	88	100	97
Roadway Sweeping	100	100	97	100	99
Guardrail, Concrete Barrier and End Anchors	94	100	100	100	98
Impact Attenuators	100	100	100	100	100
Fence, Control Access	94	95	90	93	93
Retaining Walls and Sound Barrier Walls	94	100	100	86	95
Decorative Supports	100	96	92	80	92
Graffiti and Stain Removal	100	100	100	100	100
Element Total	94.9	97.1	92.8	92.8	94.6
Traffic Control Devices	Q3 2018 RATING	Q4 2018 RATING	Q1 2019 RATING	Q2 2019 RATING	ROLLING RATING
Signs	100	97	94	91	96
Delineators	89	100	86	85	91
Pavement Striping/Marking	94	98	100	88	95
Words and Symbols	100 ¹	100	100	84	96 ²
Pavement Markers	100 ¹	91	84	84	89 ²
Highway Lighting	86	90	82	96	88
Element Total	94.6¹	95.1	92.1	87.9	92.6²

¹ Excludes pavement striping, characters, symbols, and markers on concrete pavement surfaces.

² Excludes 2018 third quarter ratings for characteristics listed above.

8.0 GREEN LEVEL HISTORIC DISTRICT SIGNS

The three 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. The three signs included in the inspection inventory were found to be in good condition, with the landscaped areas being well maintained. Construction activities were identified adjacent to two of the three signs; however, the landscaped beds surrounding the signs were protected. **Figure 4** shows these signs.

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



9.0 CONCLUSION

This report presents the 2019 second 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 second quarter 2019 overall rating was 92.1 and the rolling rating was 94.9, both ratings met the target rating of 90.

All element ratings were above the target ratings for the quarter and rolling assessment. During the second quarter assessment, all characteristics except Turf Condition (73) met or exceeded the target rating of 80. Miscellaneous Drainage, with a rolling rating of 75 averaged from the last four quarter assessments, was the only characteristic that did not meet the rolling rating target of 80.

To improve the ratings, it is recommended to the maintenance provider that bare area seeding/fertilization program efforts continue during summer seasons to promote new turf growth. The maintenance provider should also closely monitor mowing heights during the 2019 mowing cycle with attention given to the location of landscaping stakes.

To continue to improve upon characteristic ratings that scored a rating below 80 in the last four quarters, the maintenance provider is encouraged to continue a routine pattern of patrols and clearing of obstructions from the shoulder drains.

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

Appendix A

Triangle Expressway 2019 Second Quarter Asset Assessment Locations

Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

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

- Guardrail, Concrete Barrier and End Anchors – BR
- Curb and Gutter – CG
- Decorative Supports – DS
- Drainage Pipes – DP
- Misc. Drainage Structures – MDP
- Fence and Control of Access – FN
- Graffiti - 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 2019 Second Quarter Asset Assessment Locations

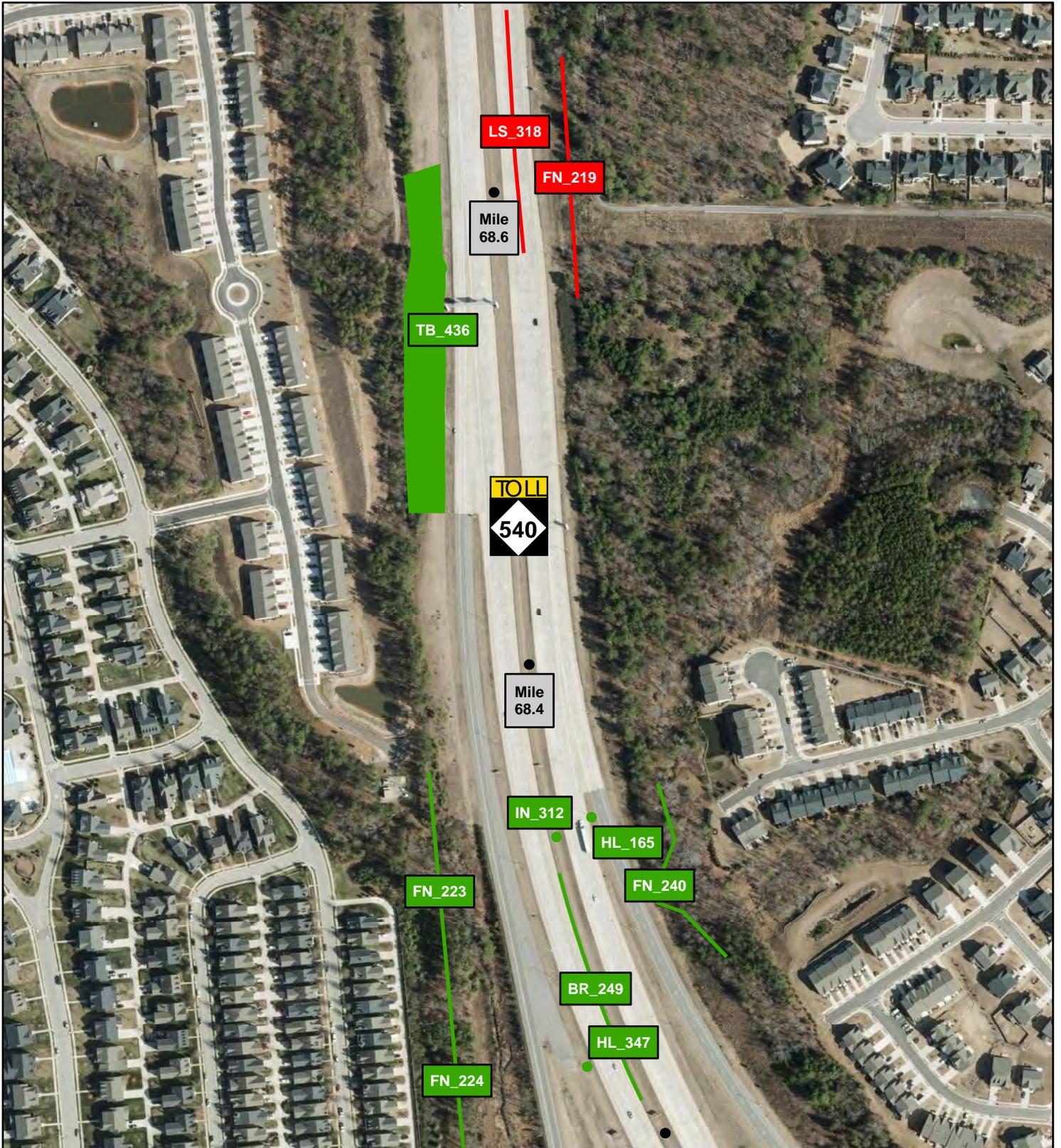


Legend

- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

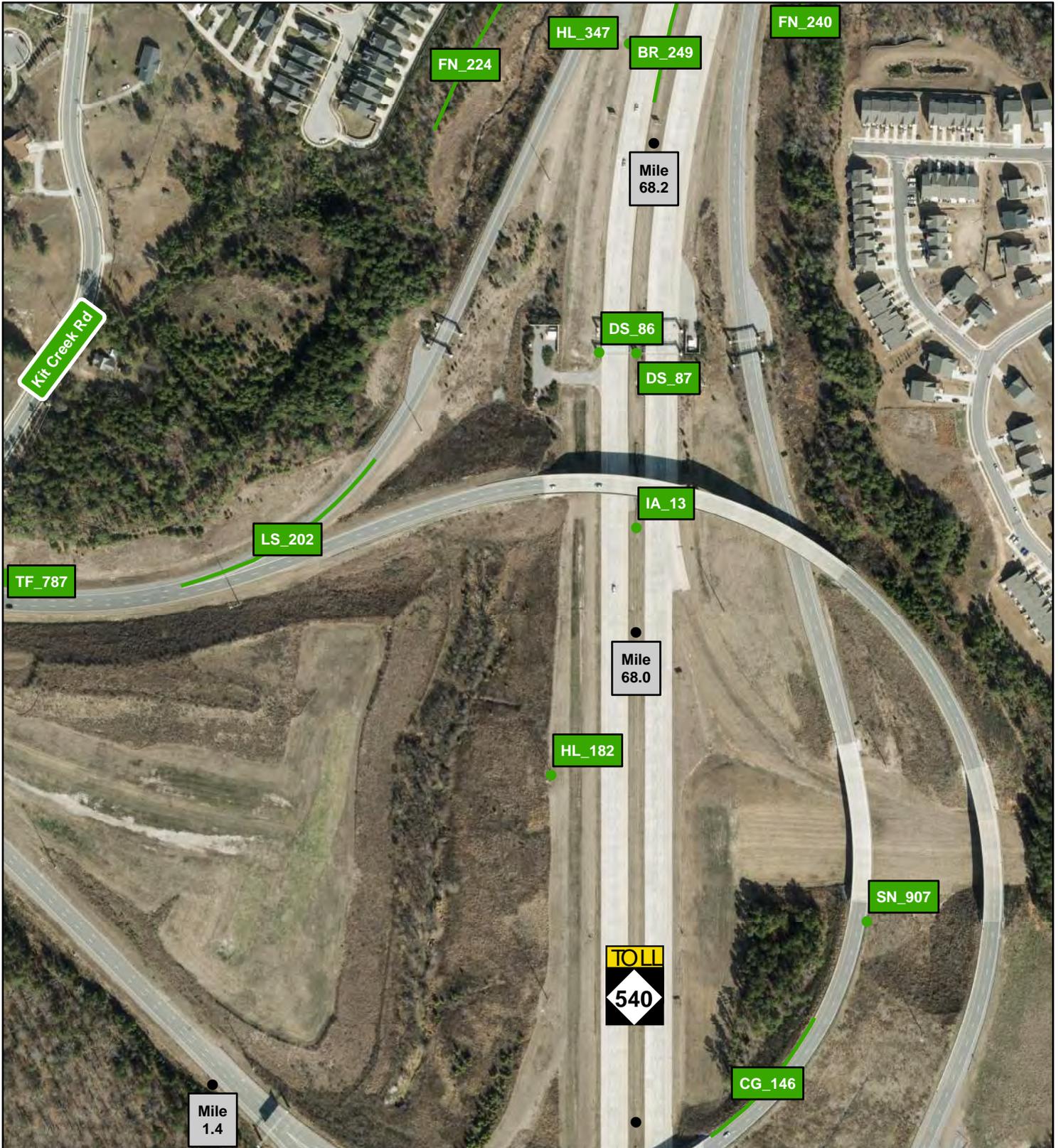


Legend

-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

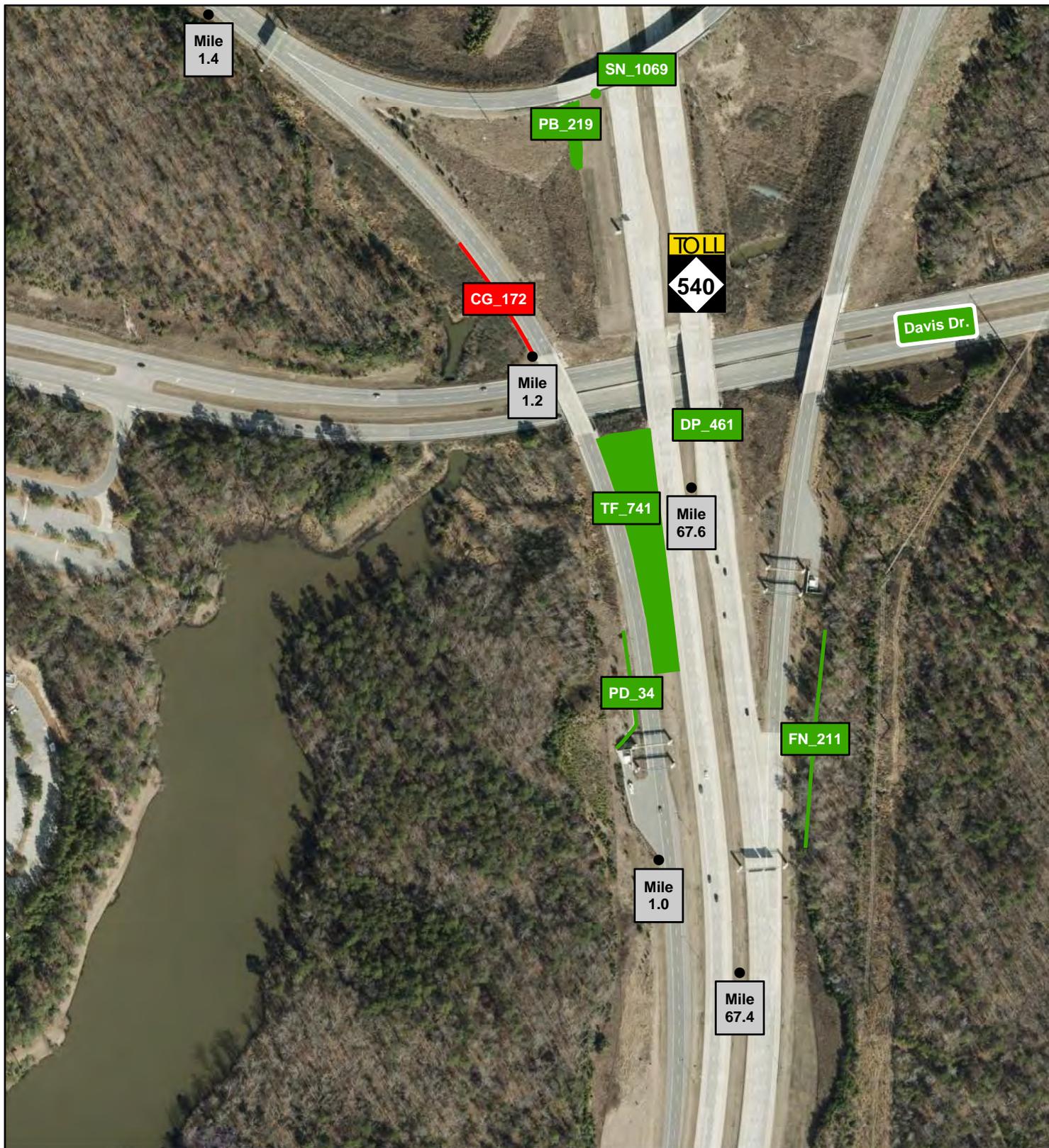


Legend

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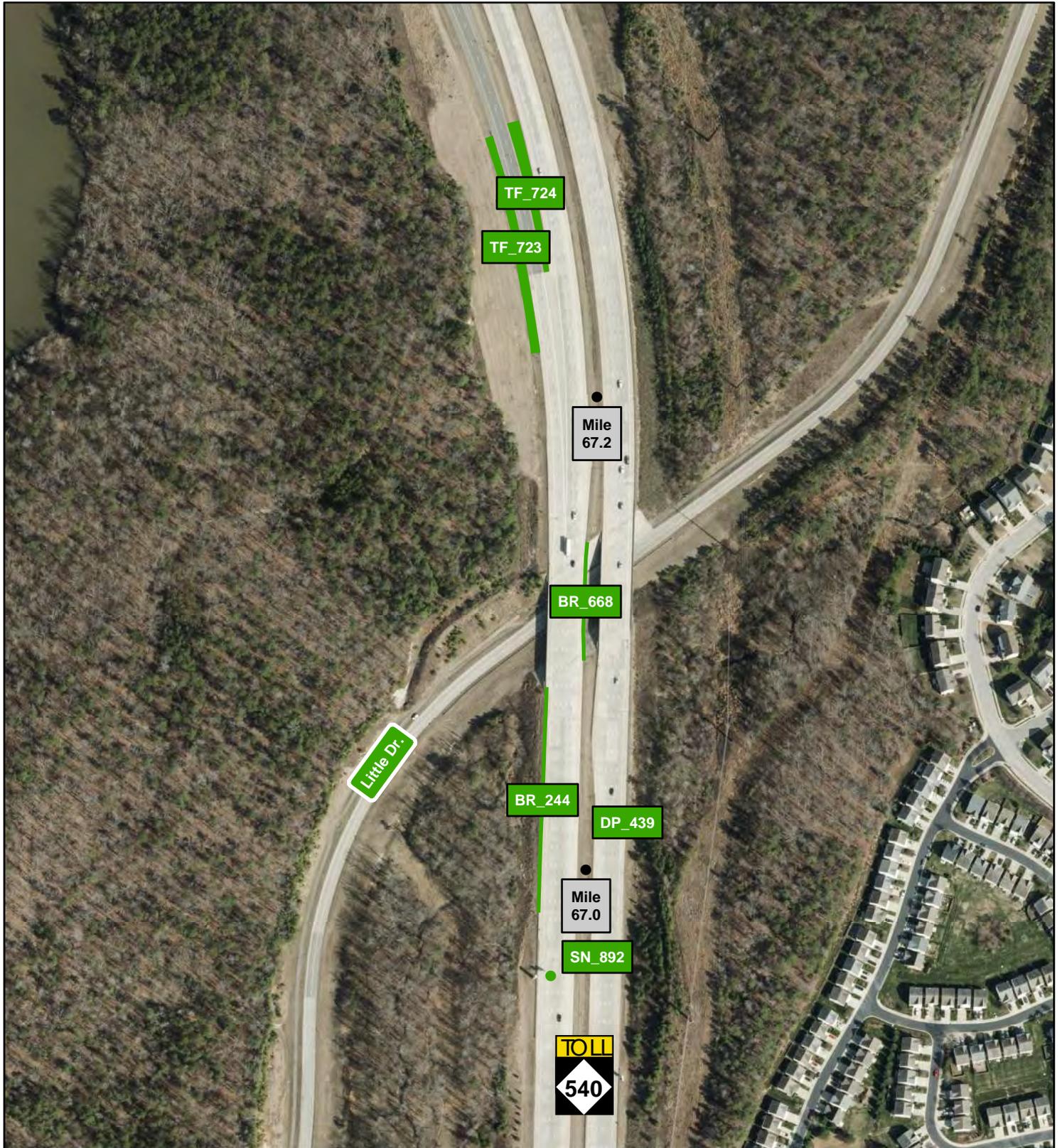


Legend

-  Failing Asset
-  Passing Asset



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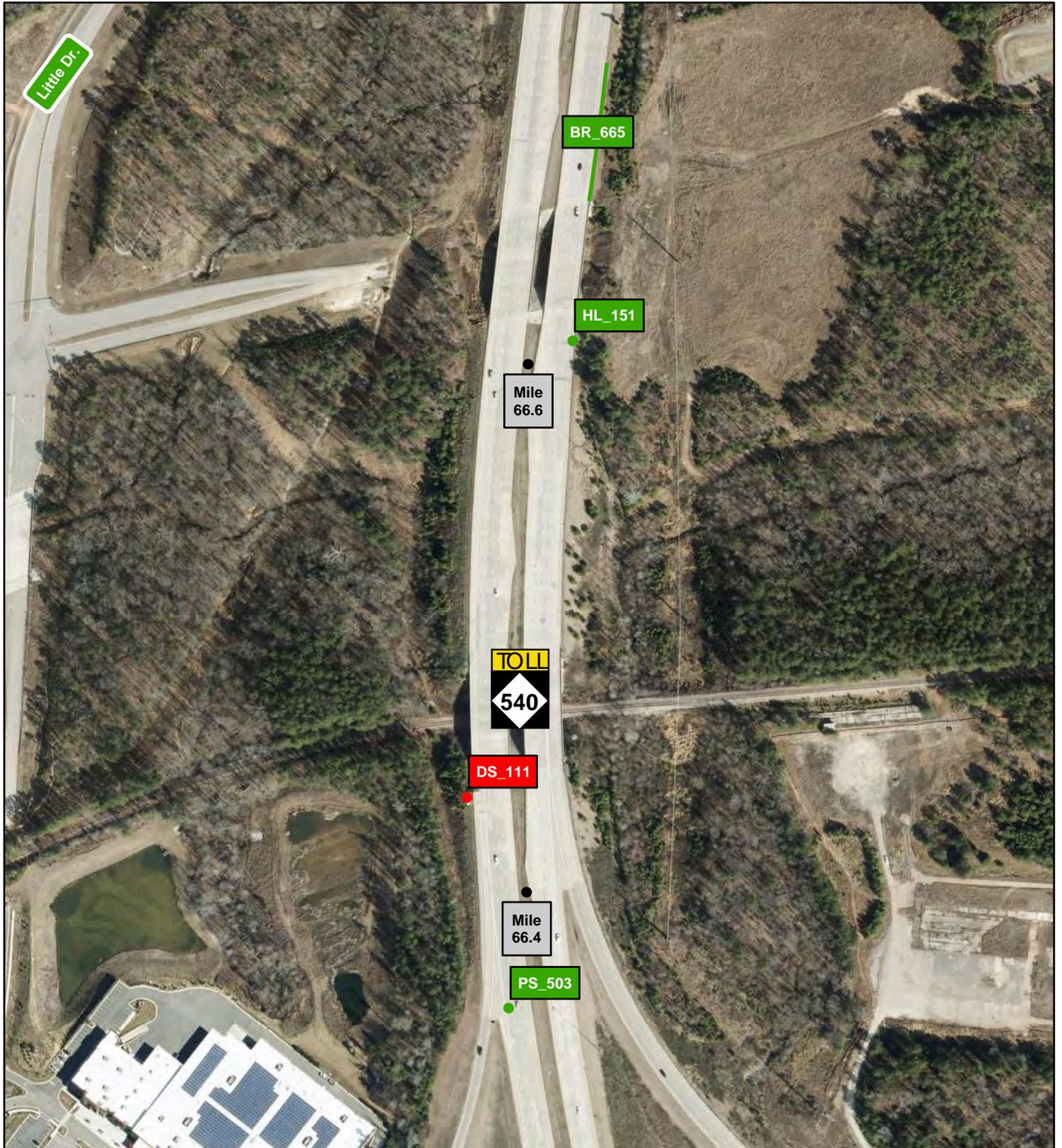


Legend

-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations



Legend



Failing Asset



Passing Asset



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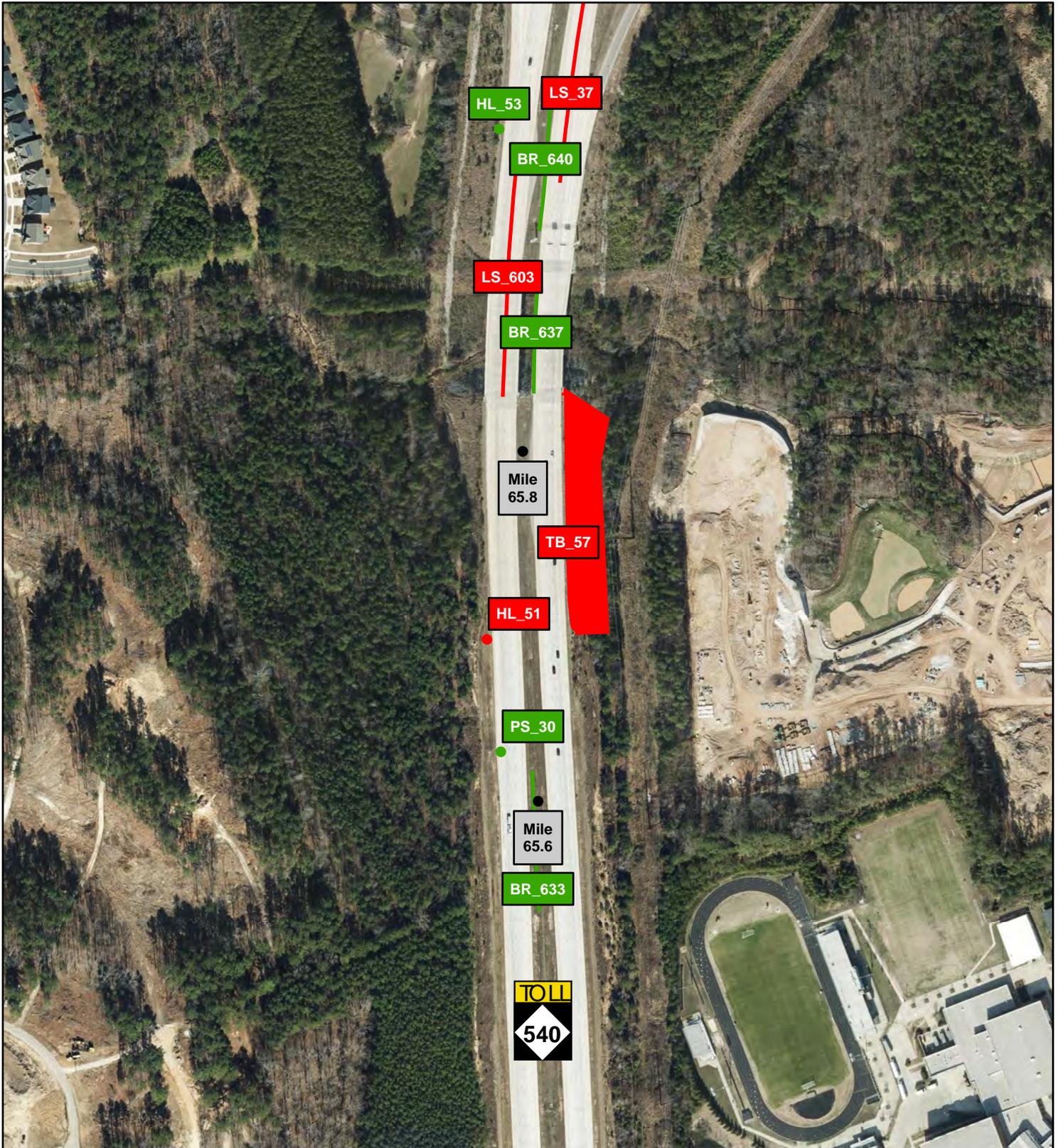


Legend

- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset



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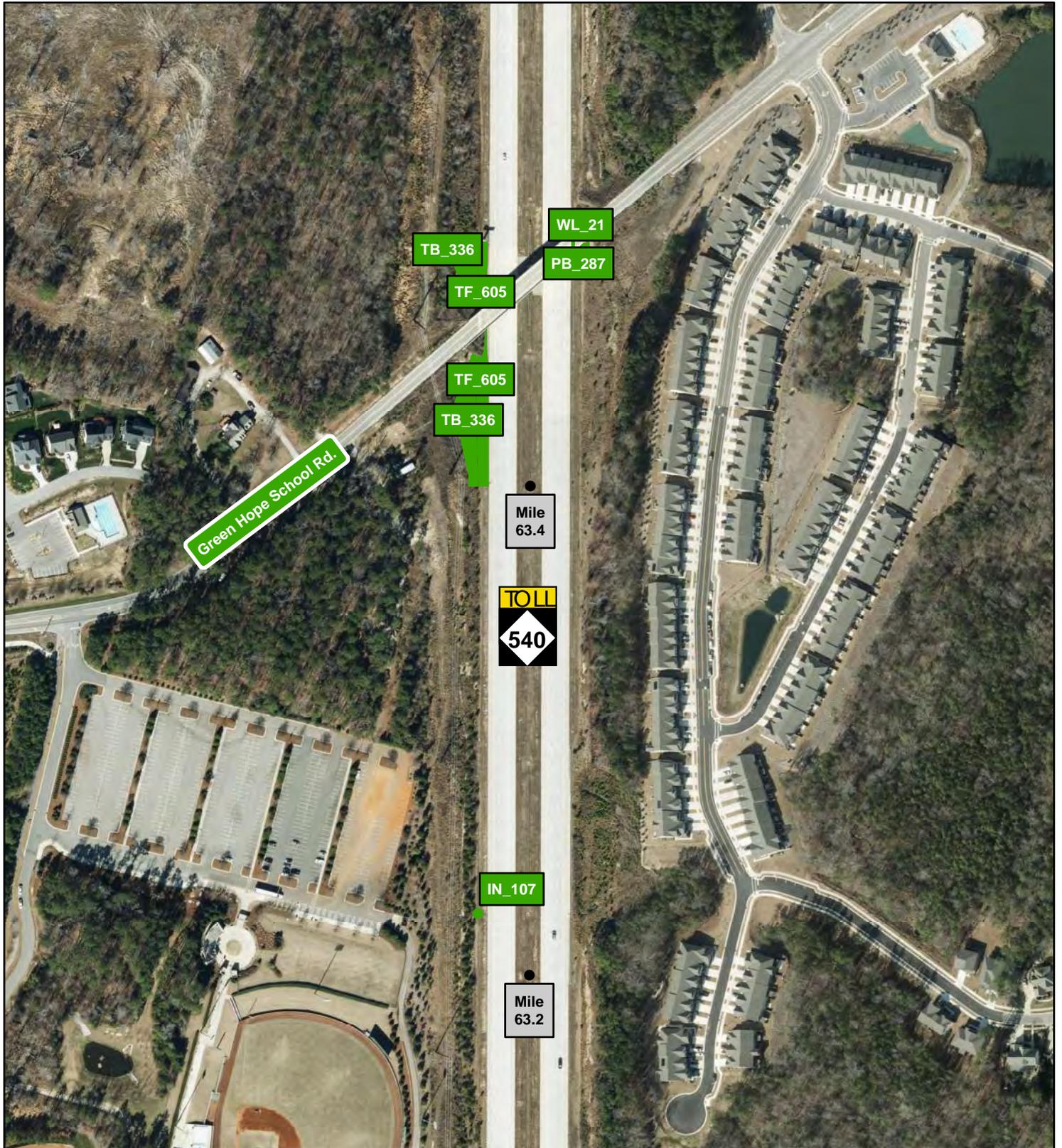


Legend

- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

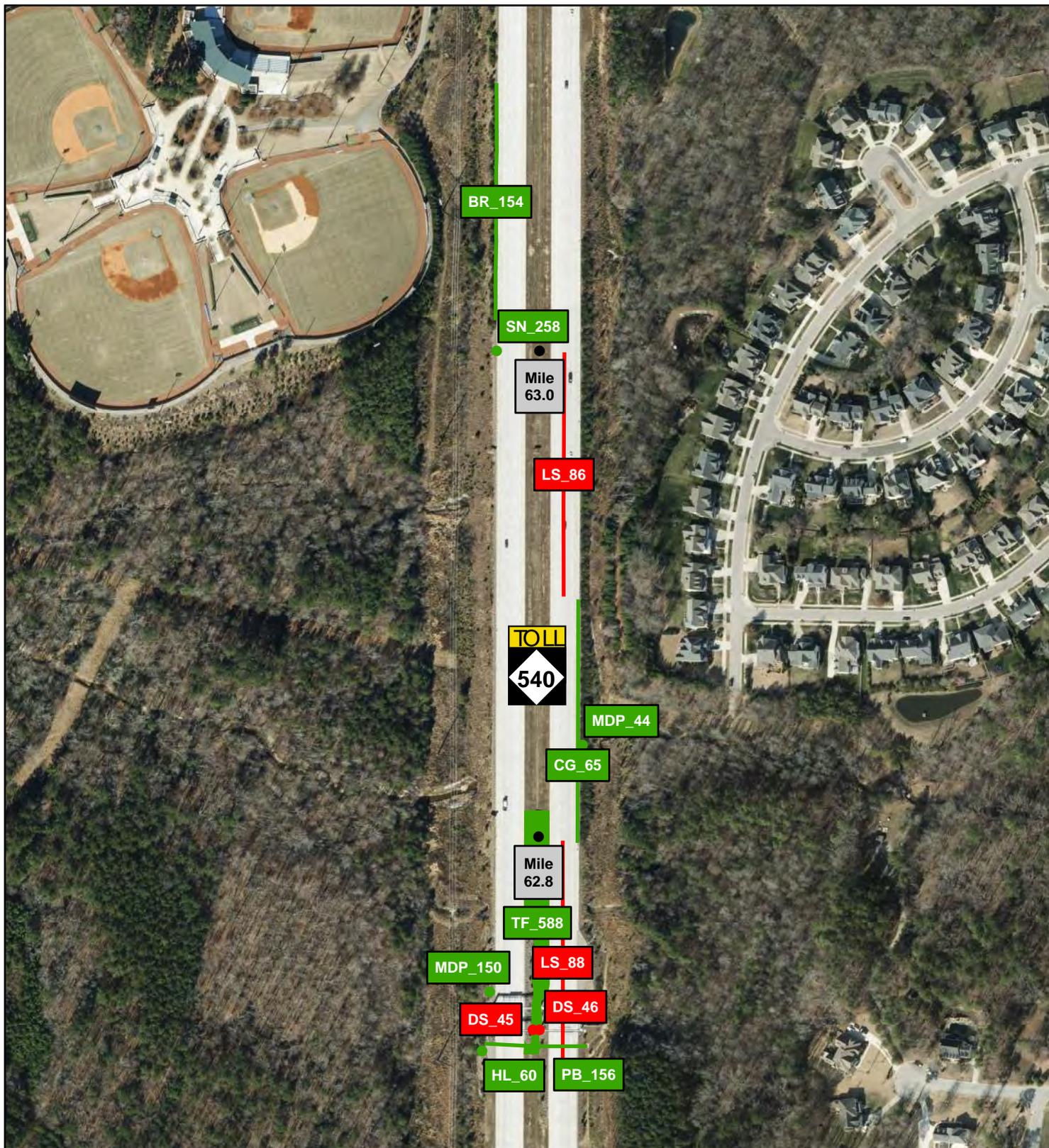


Legend

-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

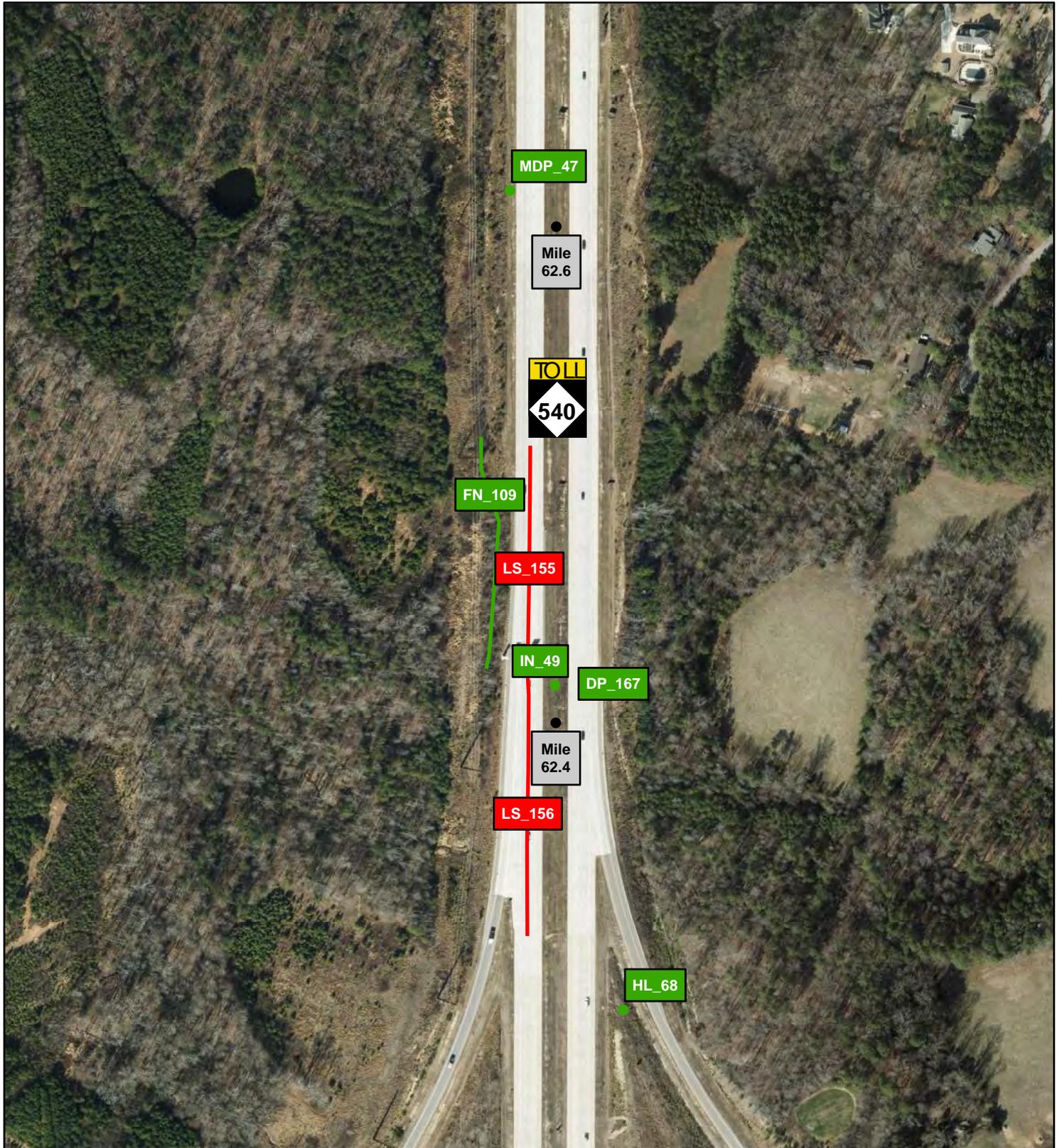


Legend

- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

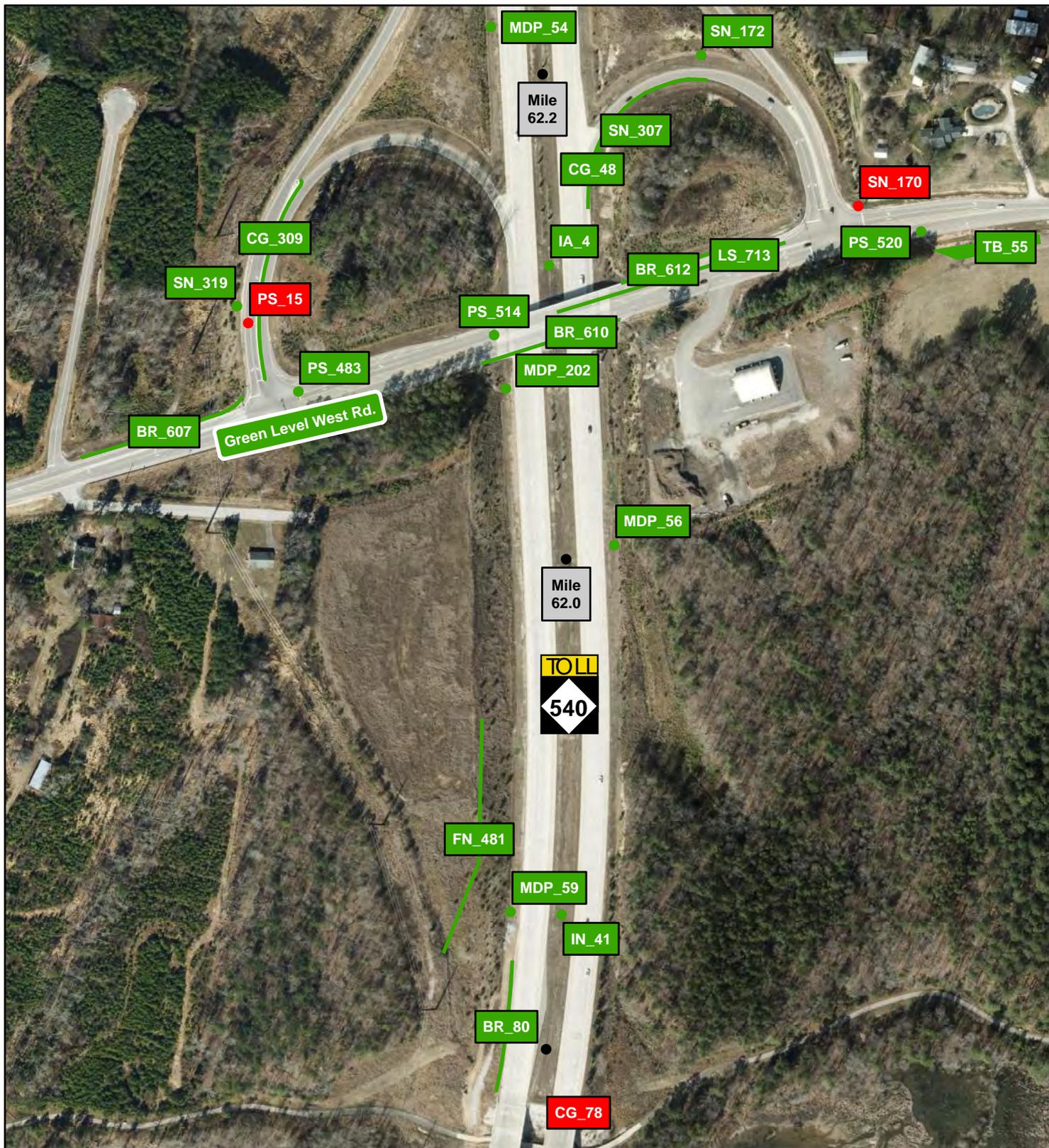


Legend

-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

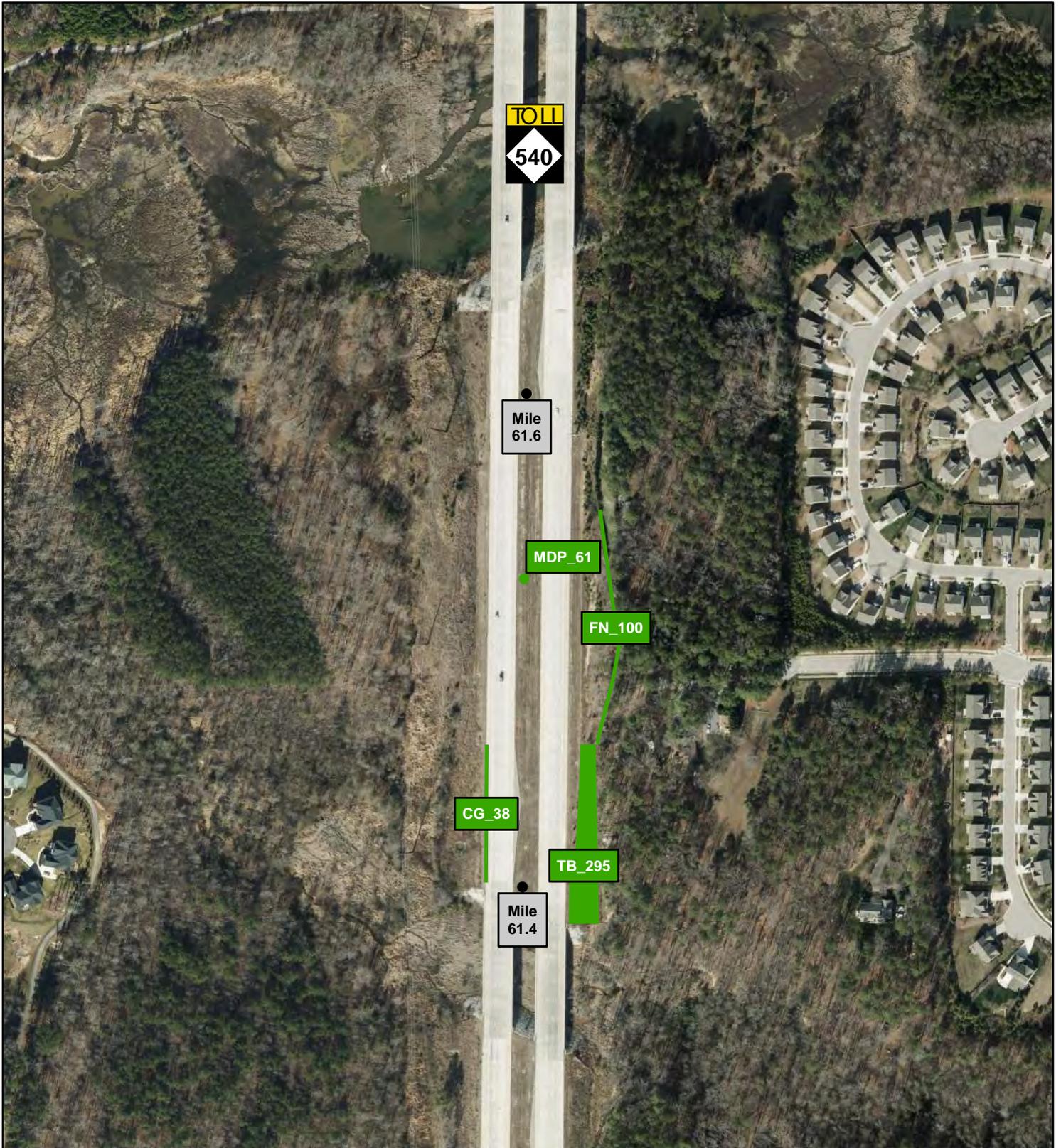


Legend

- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

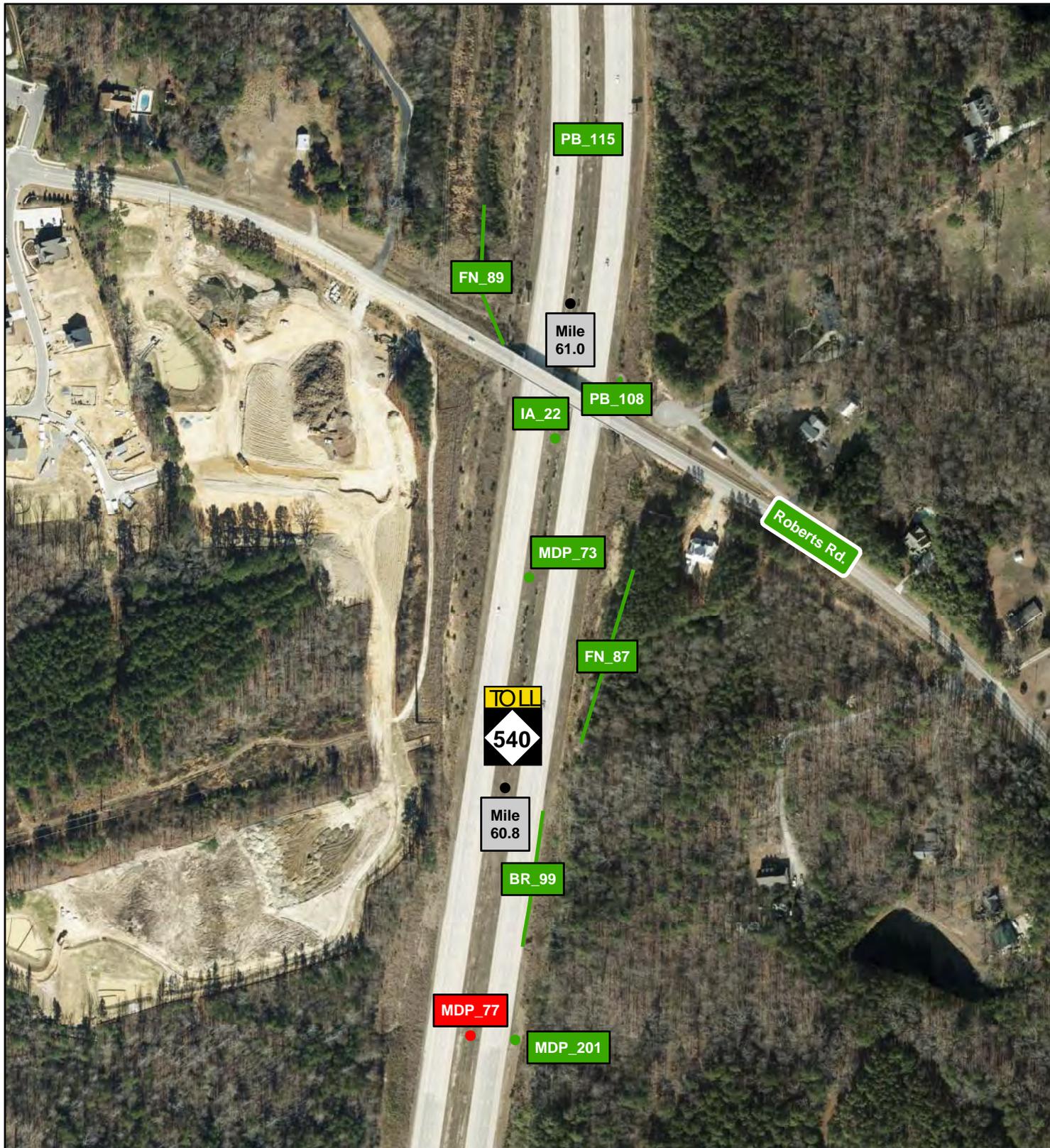


Legend

-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

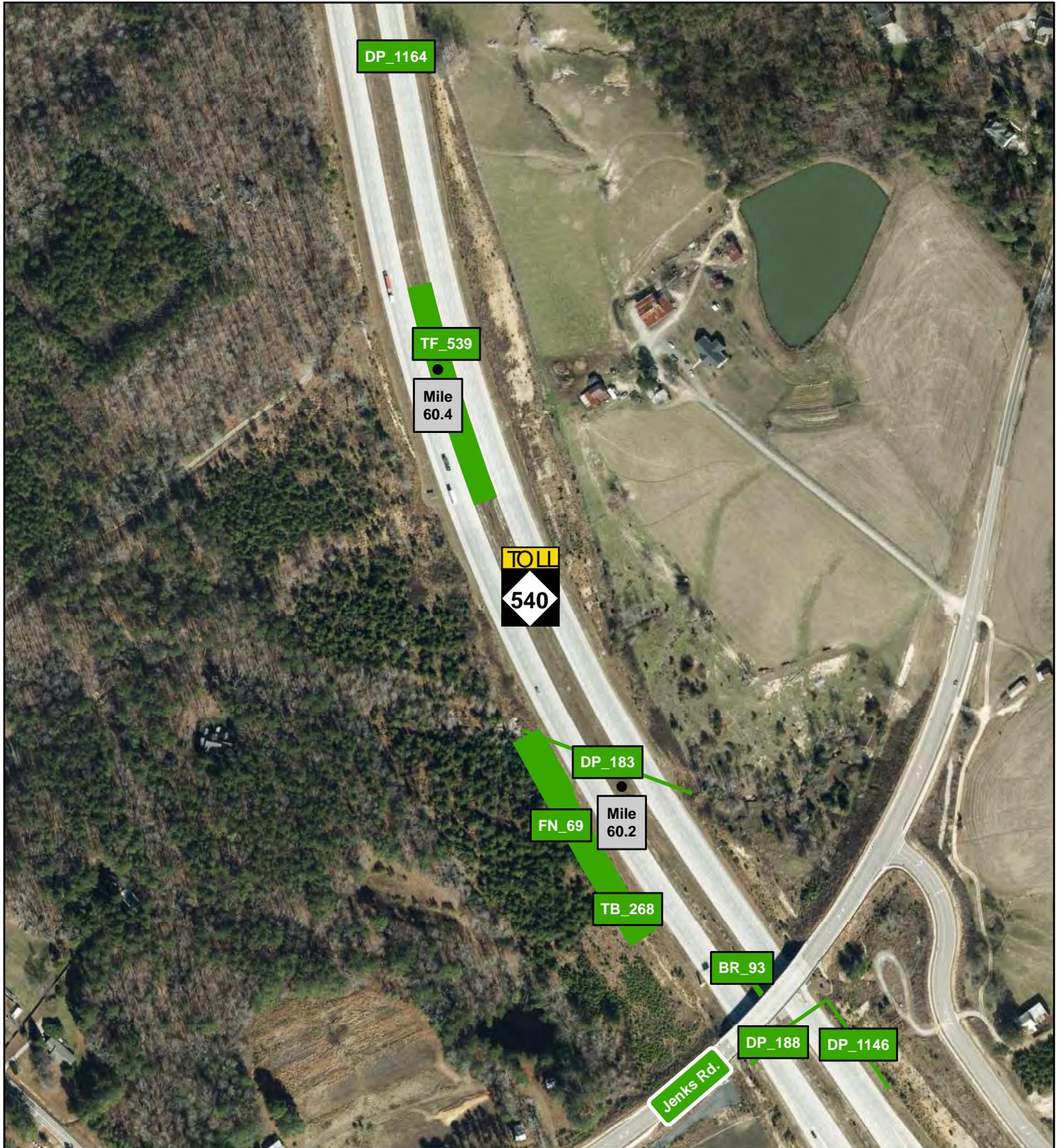


Legend

-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

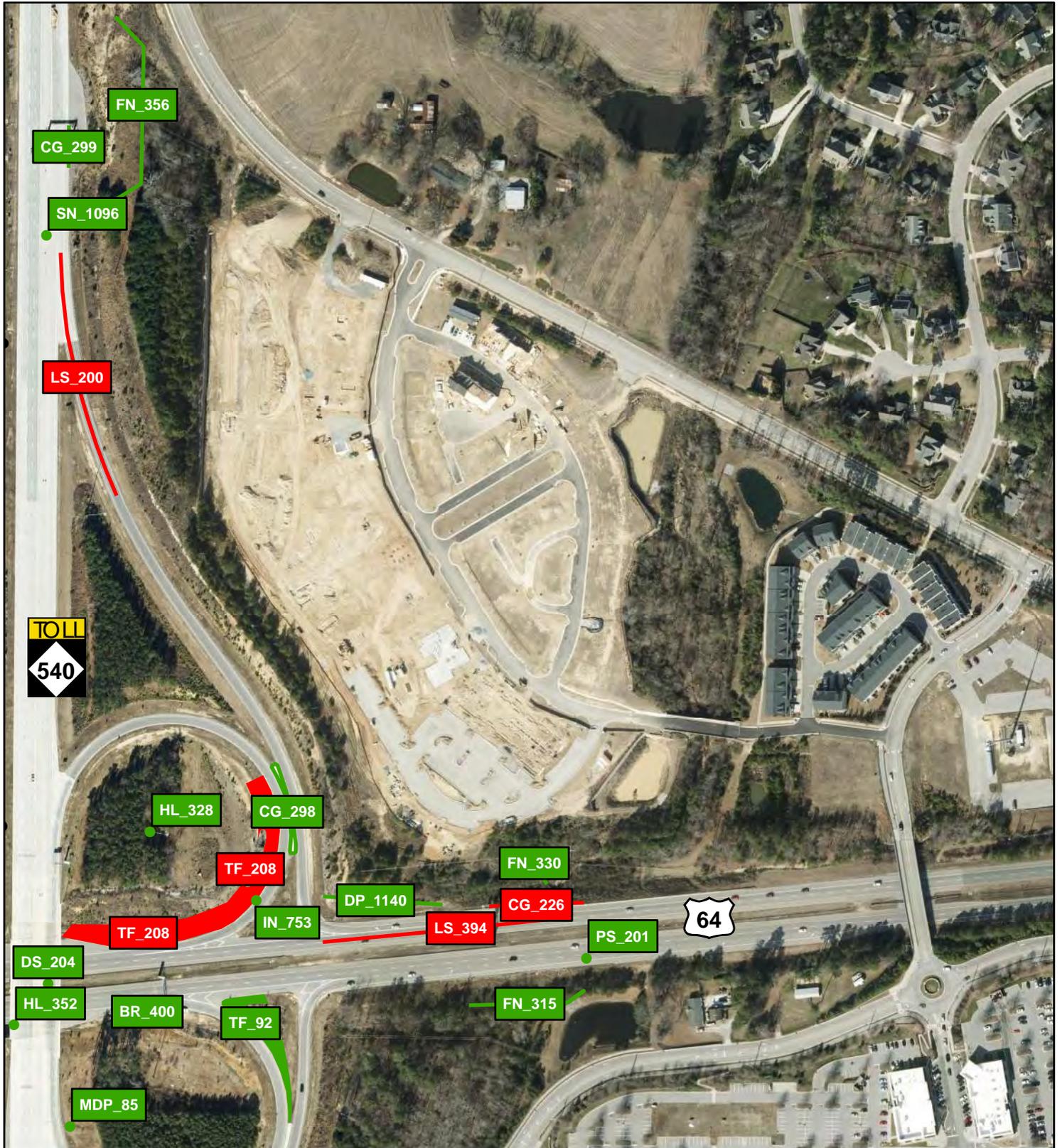


Legend

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

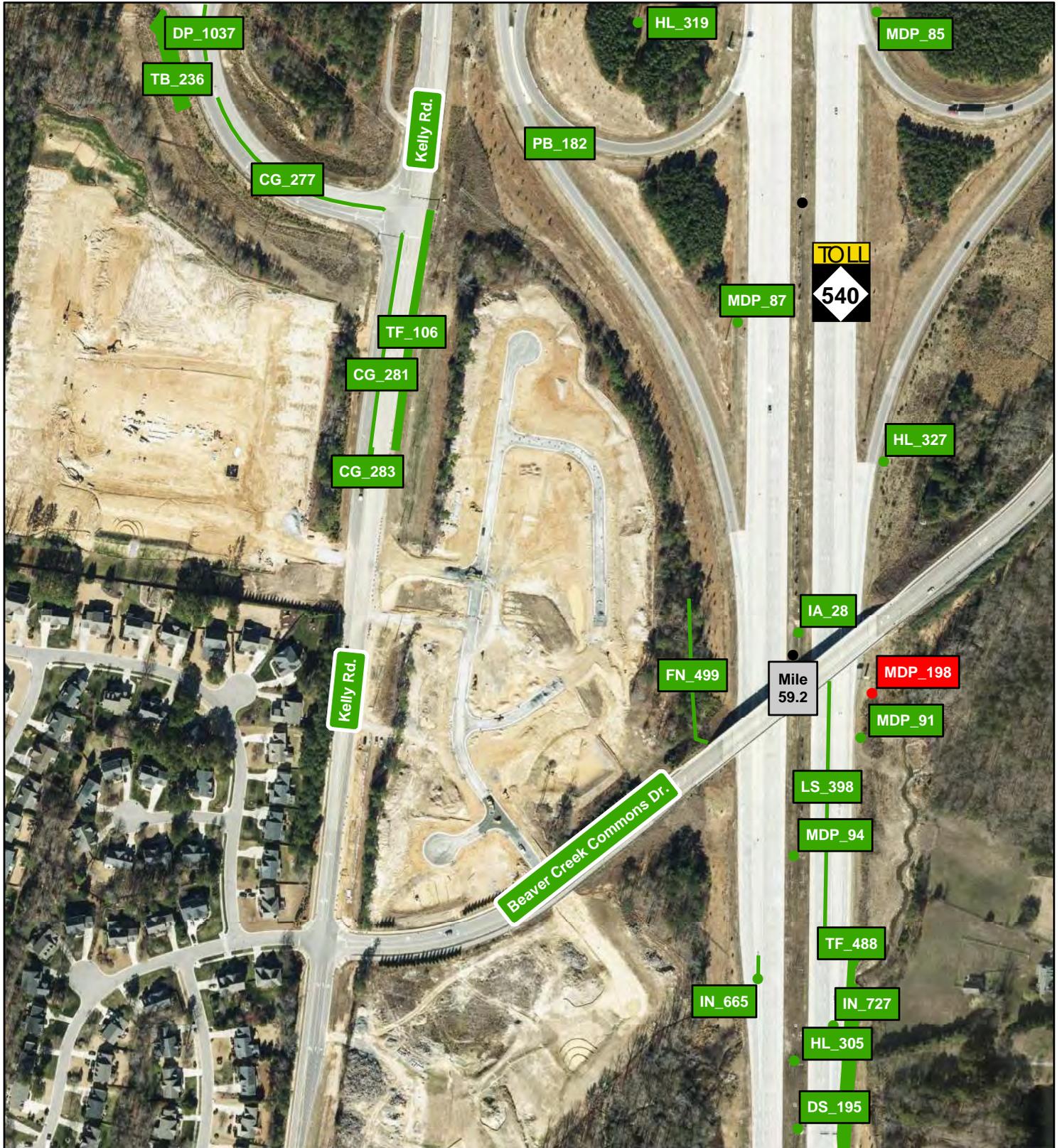


Legend

- Failing Asset
- Passing Asset

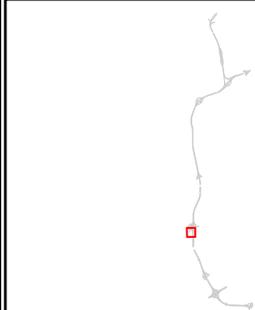


Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

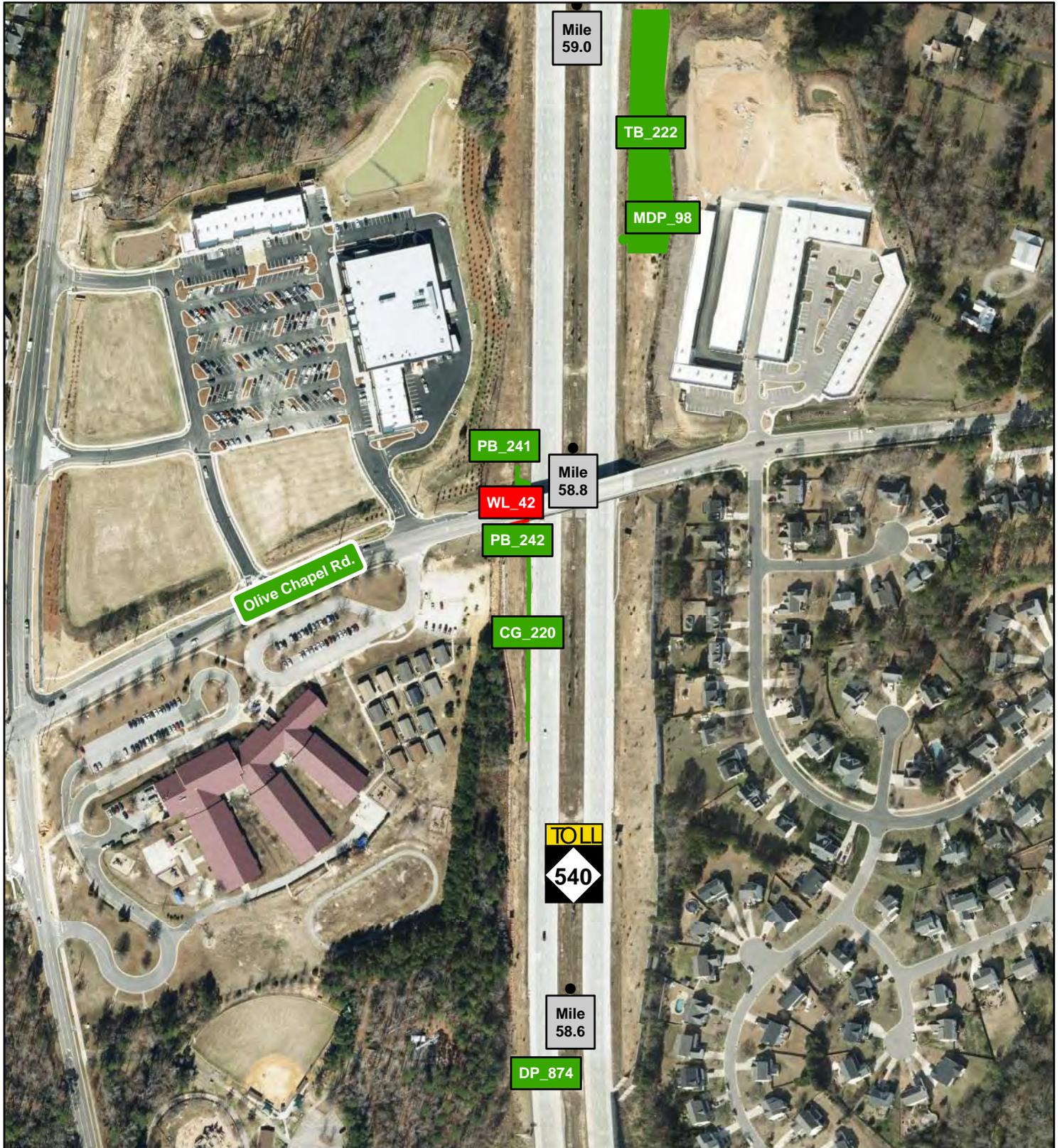


Legend

- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

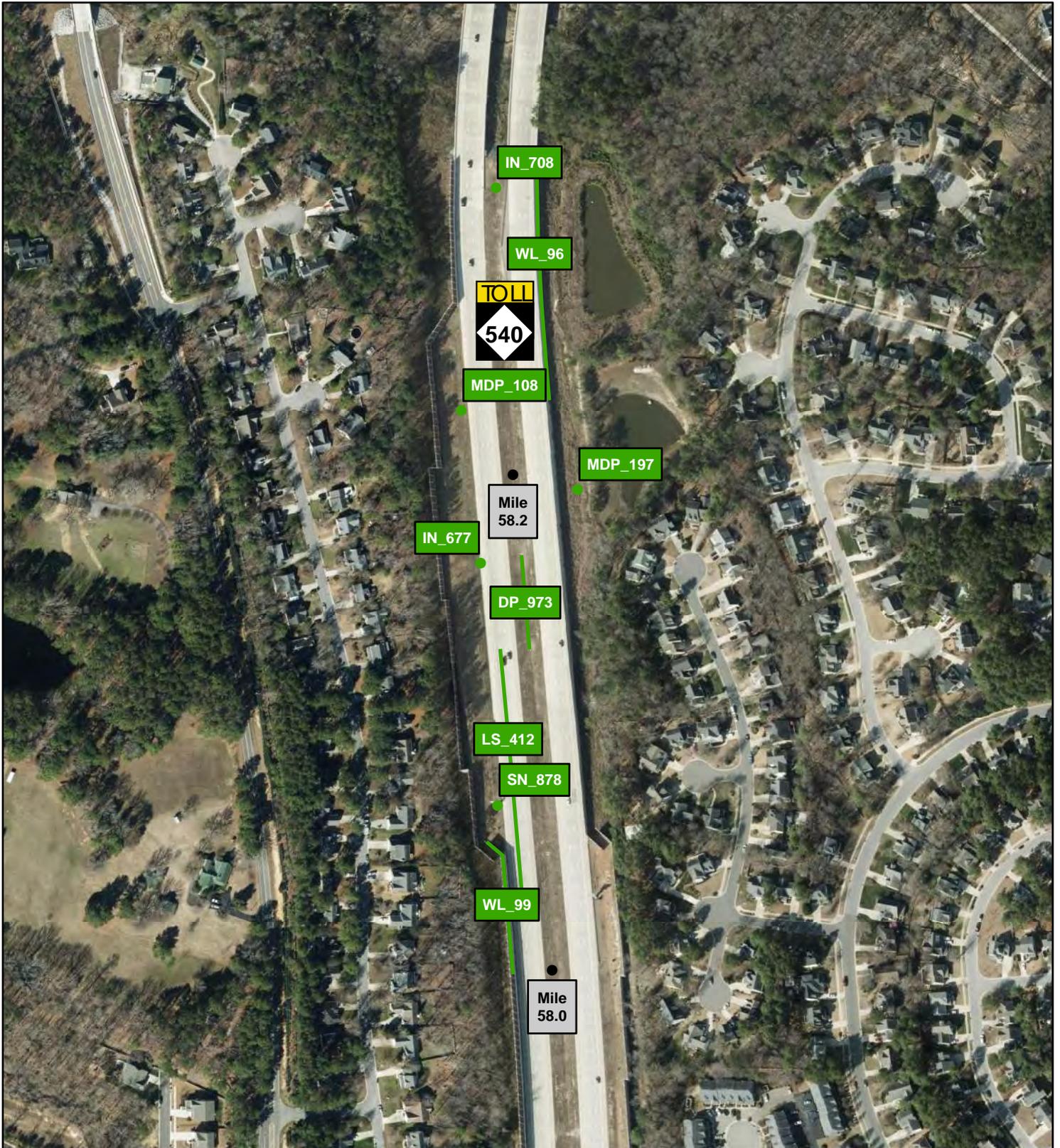


Legend

- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations



Legend



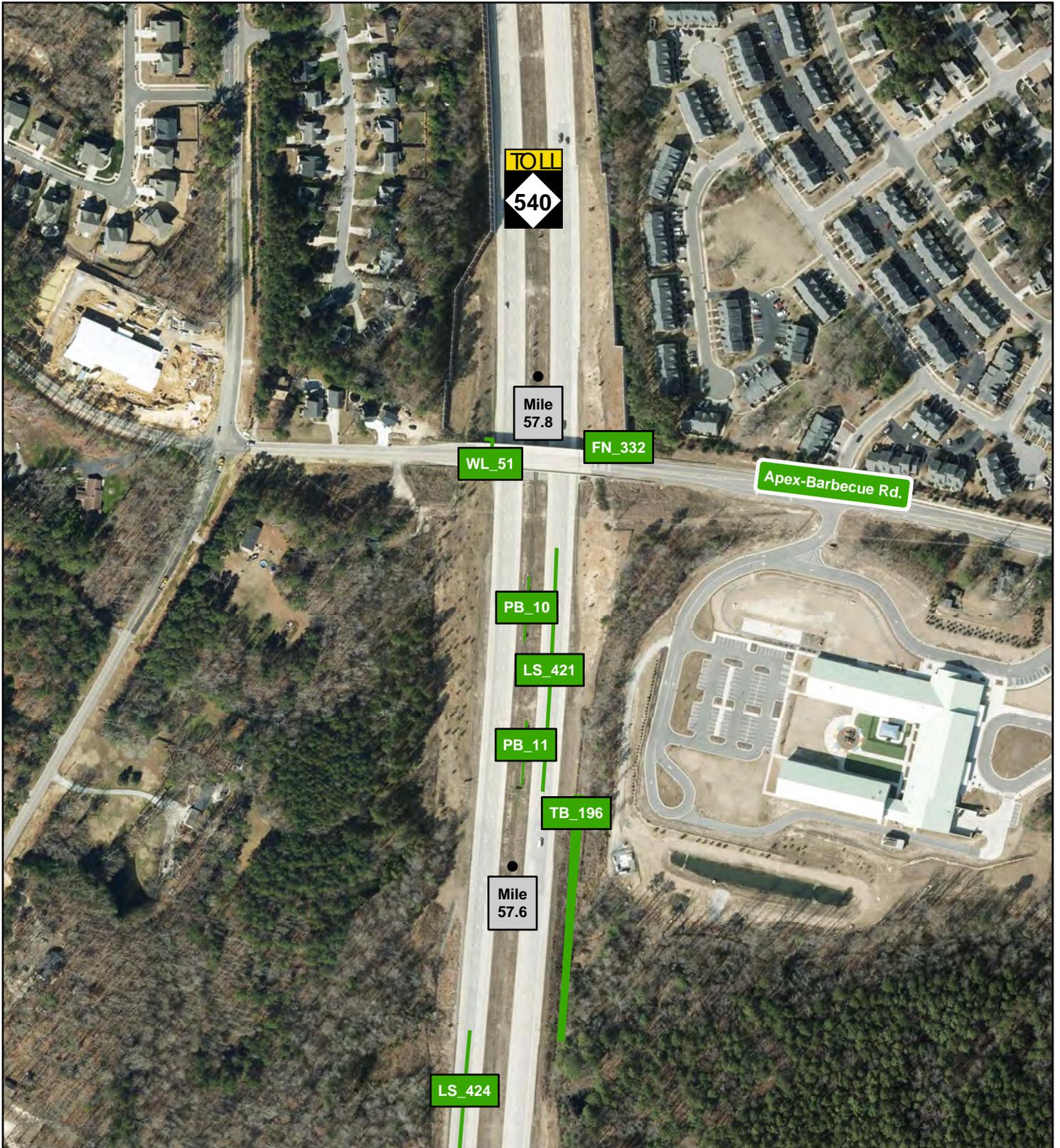
Failing Asset



Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

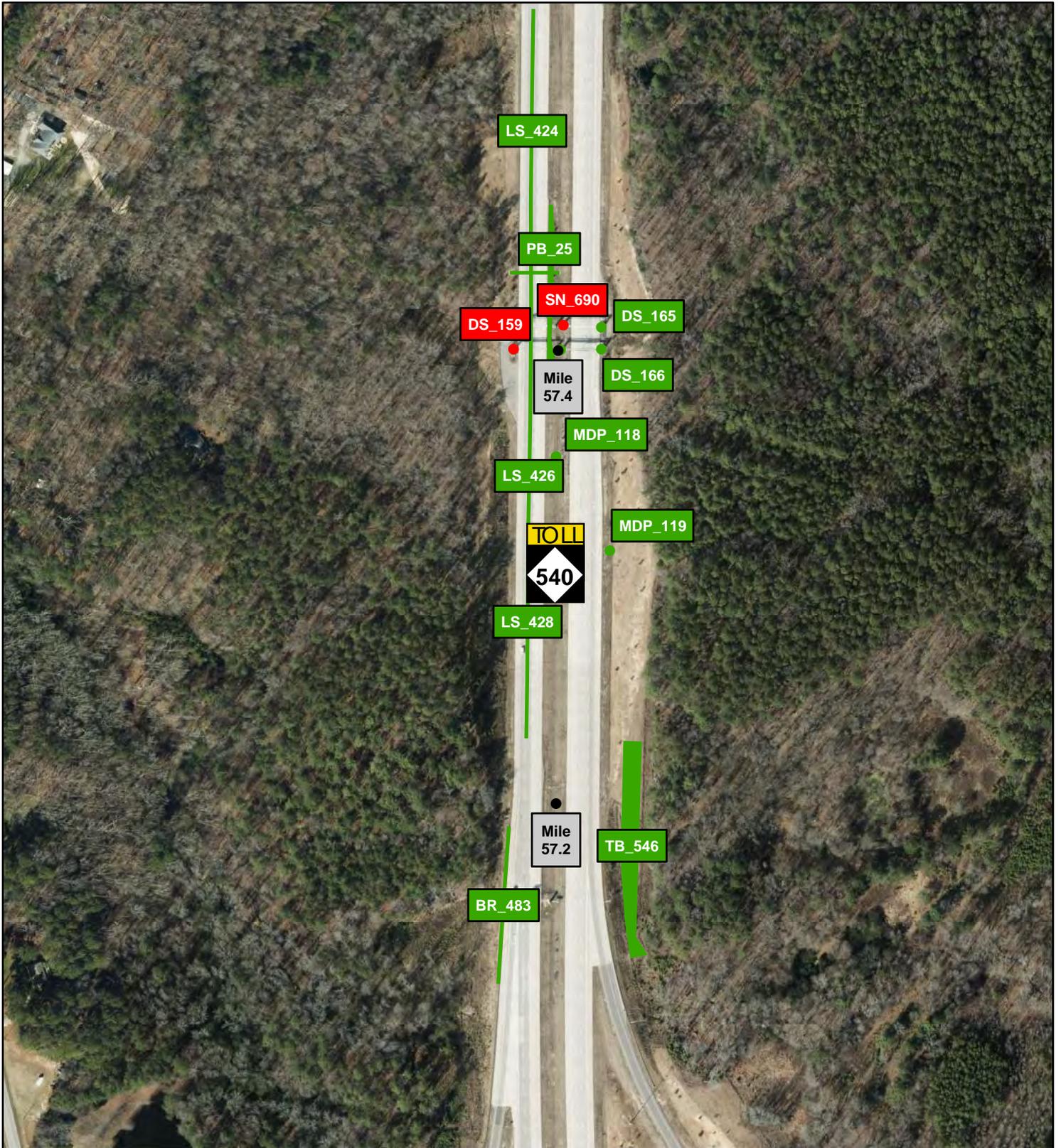


Legend

-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

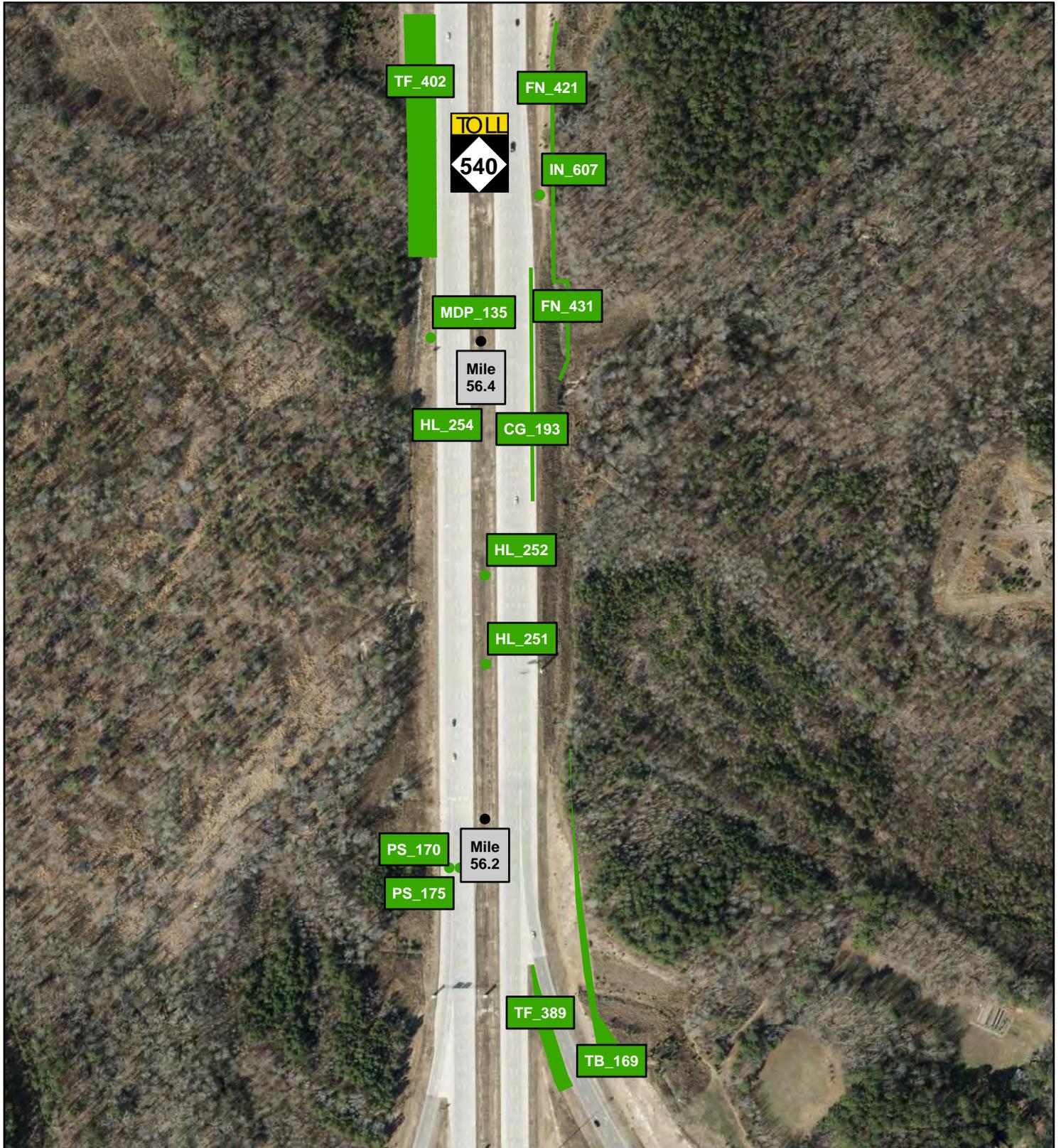


Legend

- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

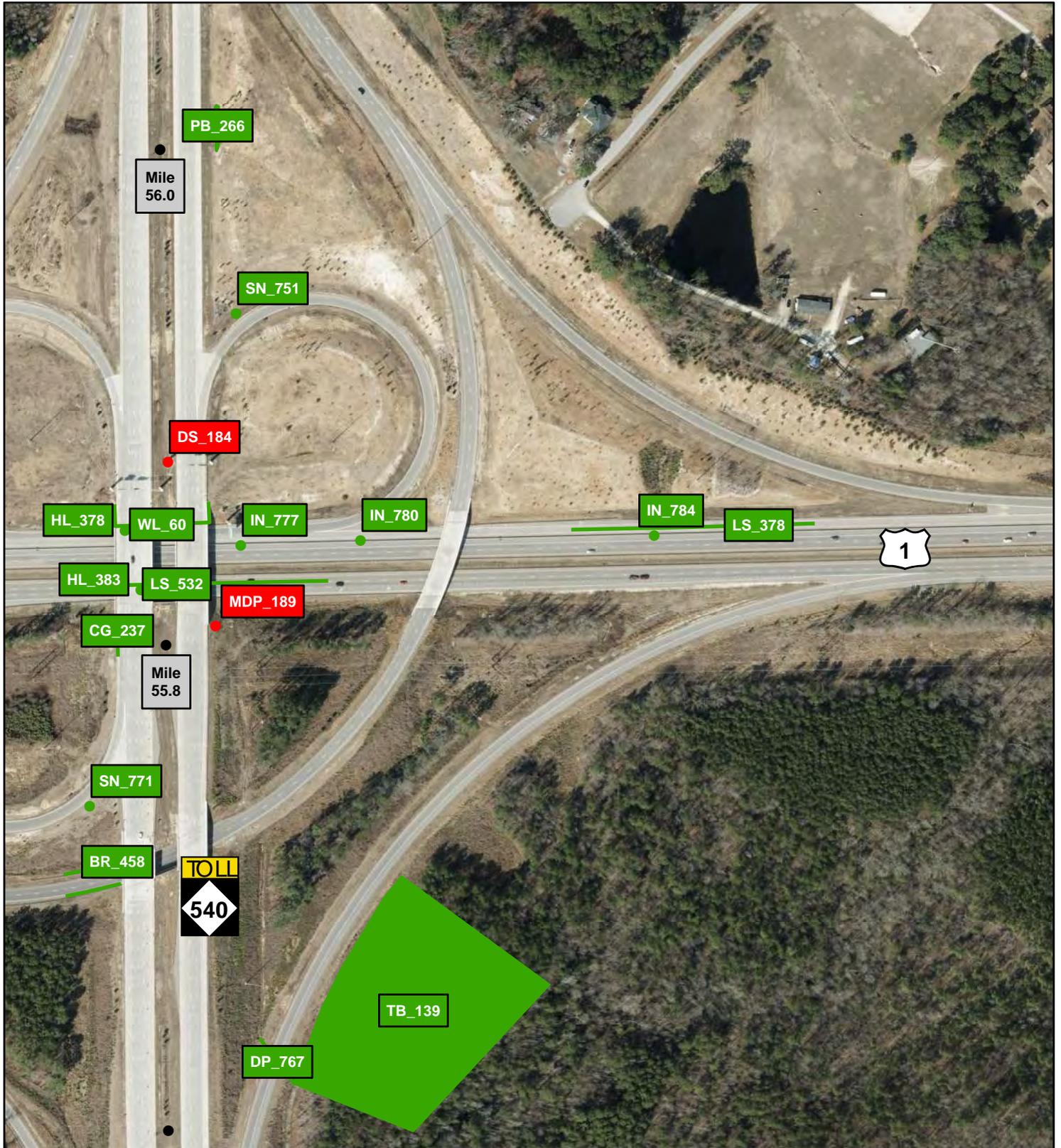


Legend

-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset



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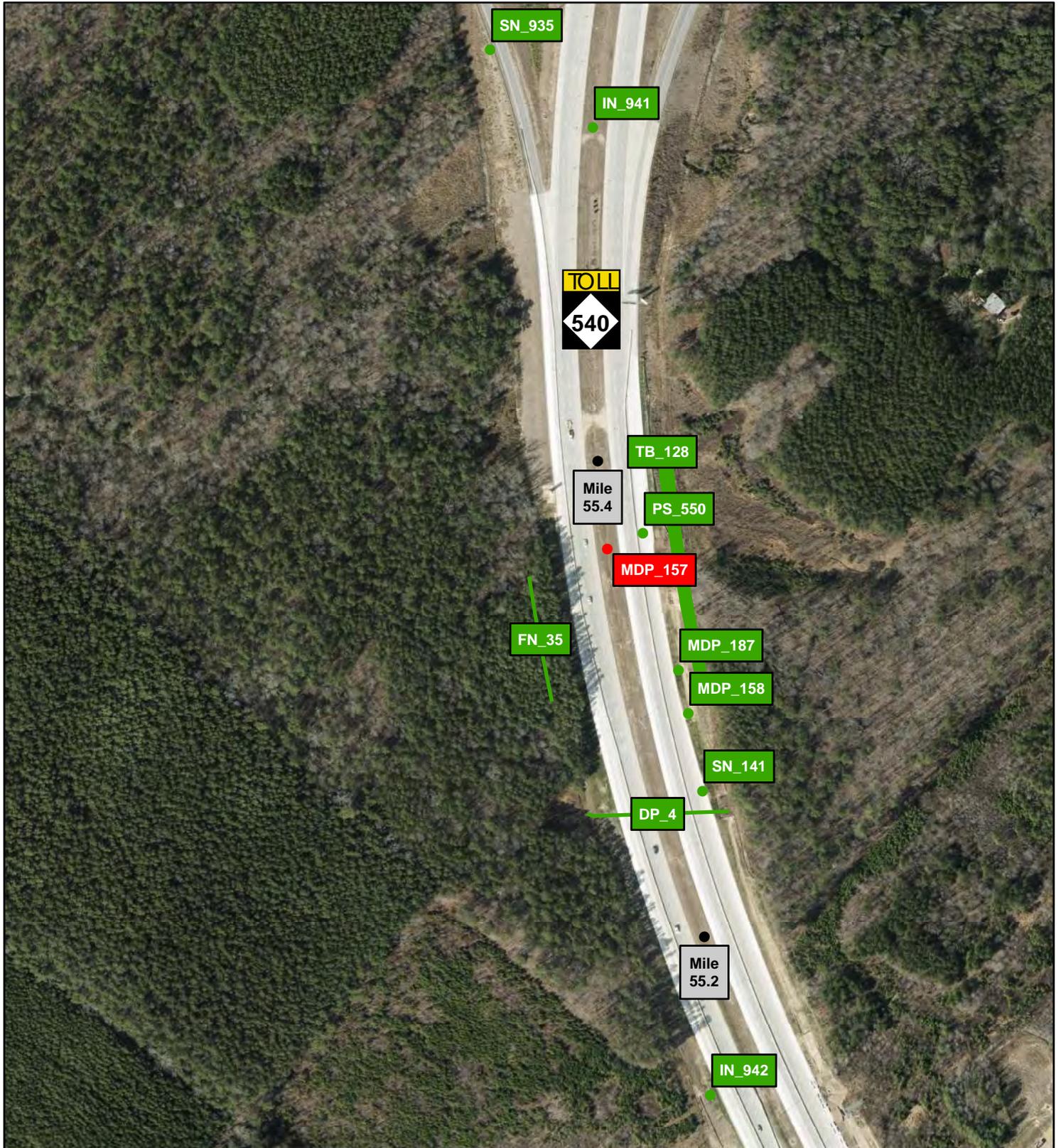


Legend

-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

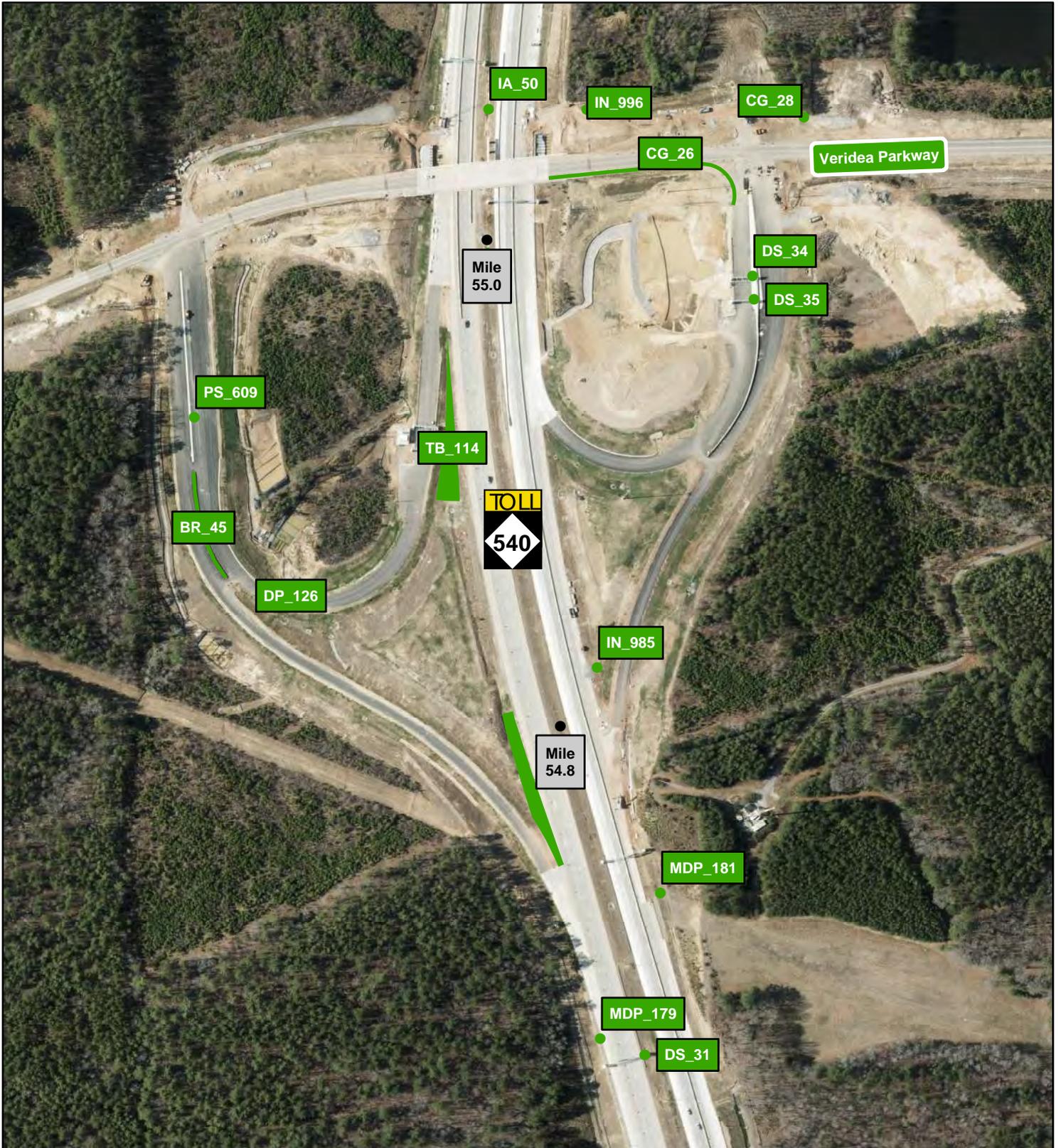


Legend

-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

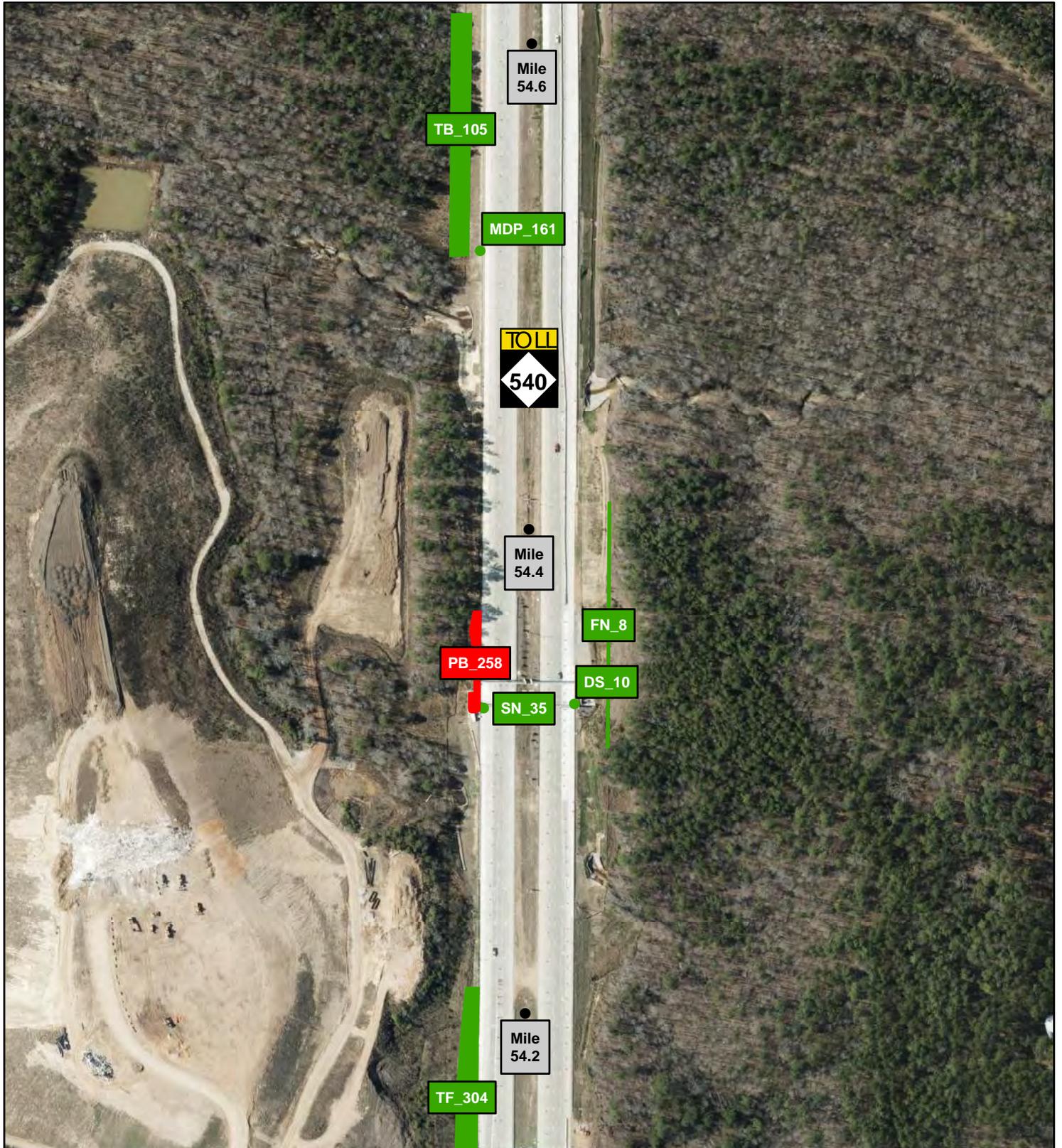


Legend

- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations



Legend



Failing Asset



Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

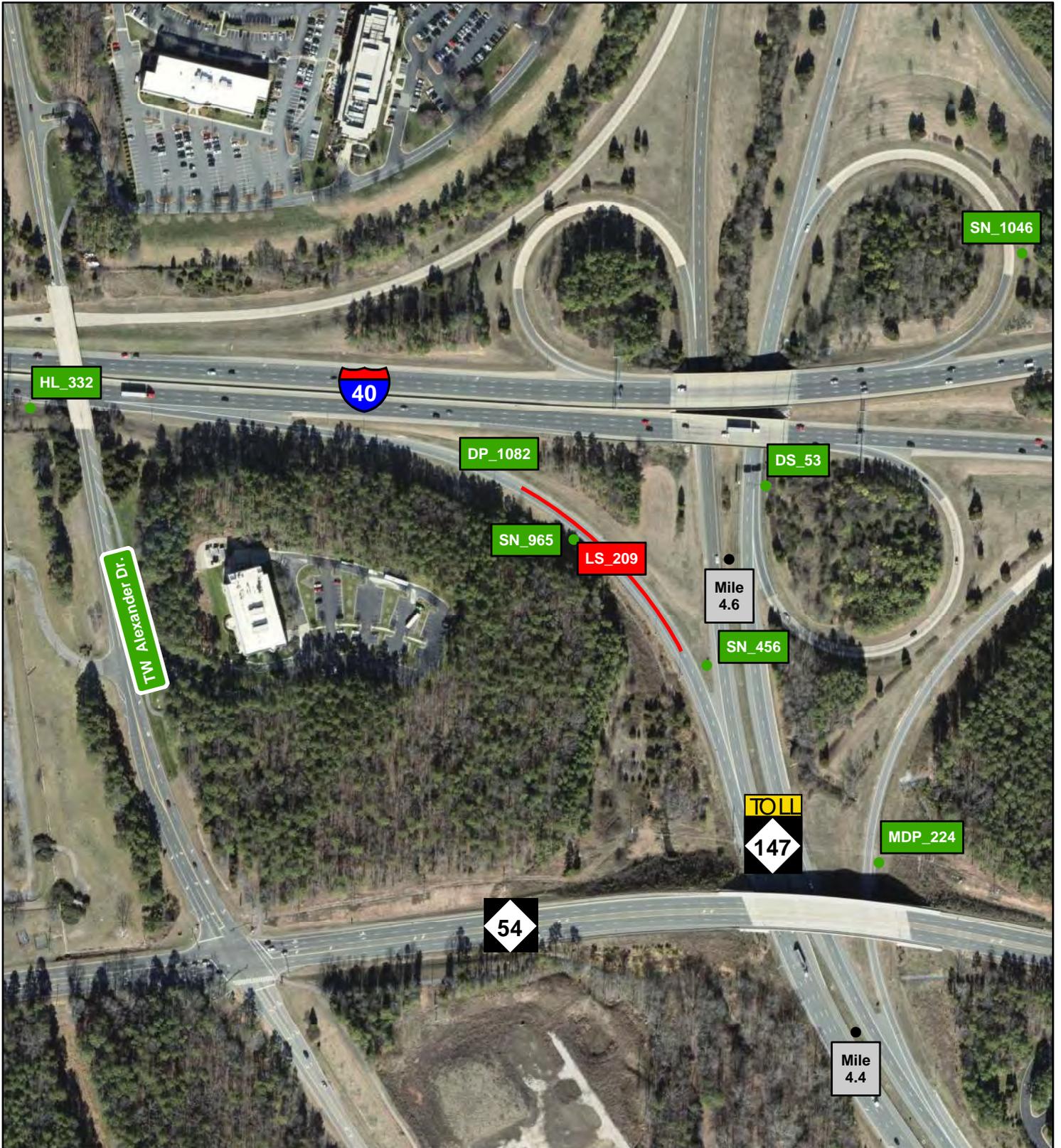


Legend

-  Failing Asset
-  Passing Asset

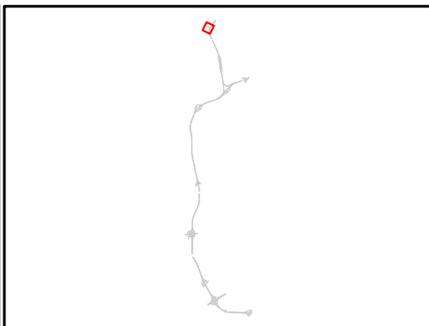


Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

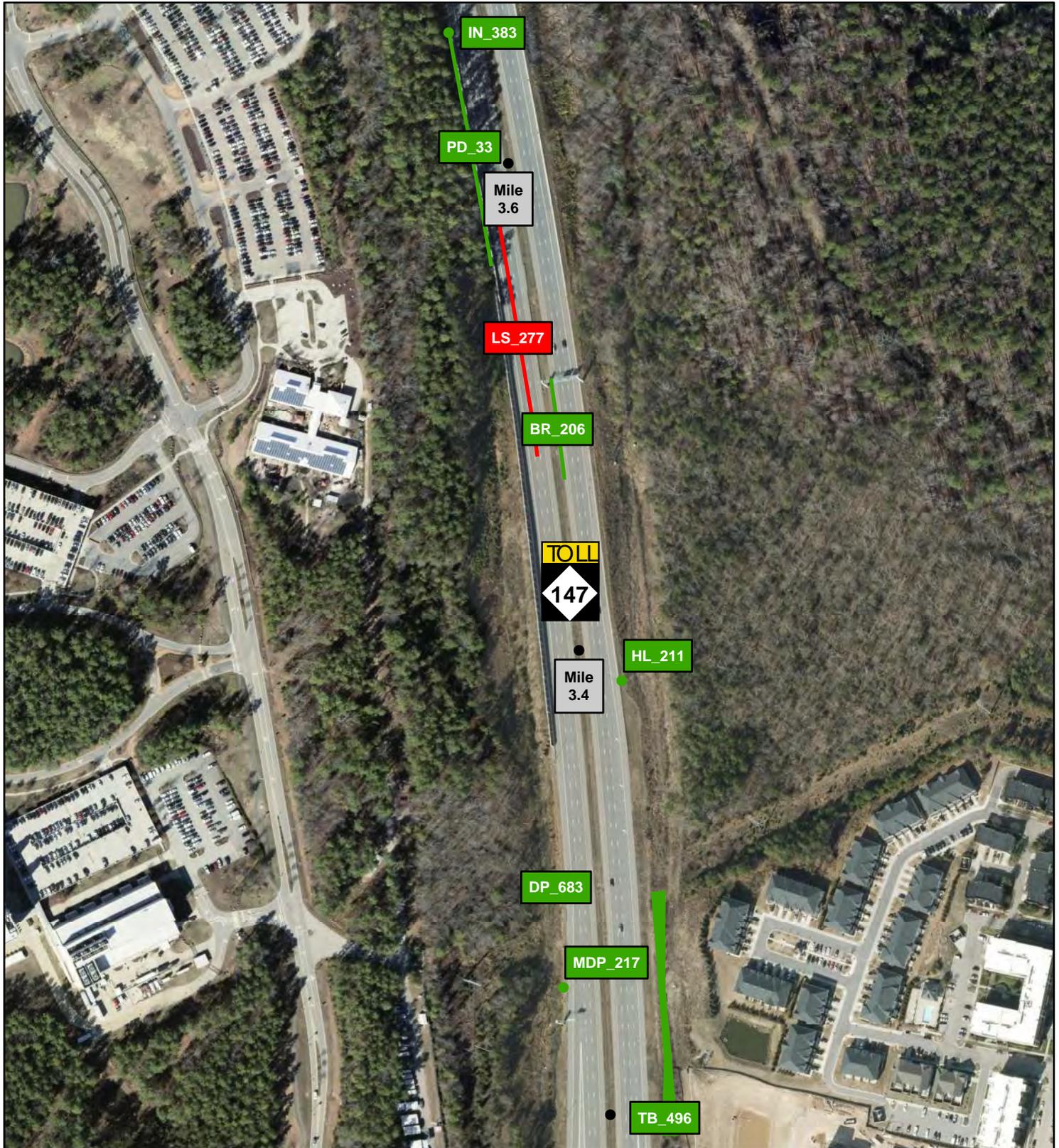


Legend

-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

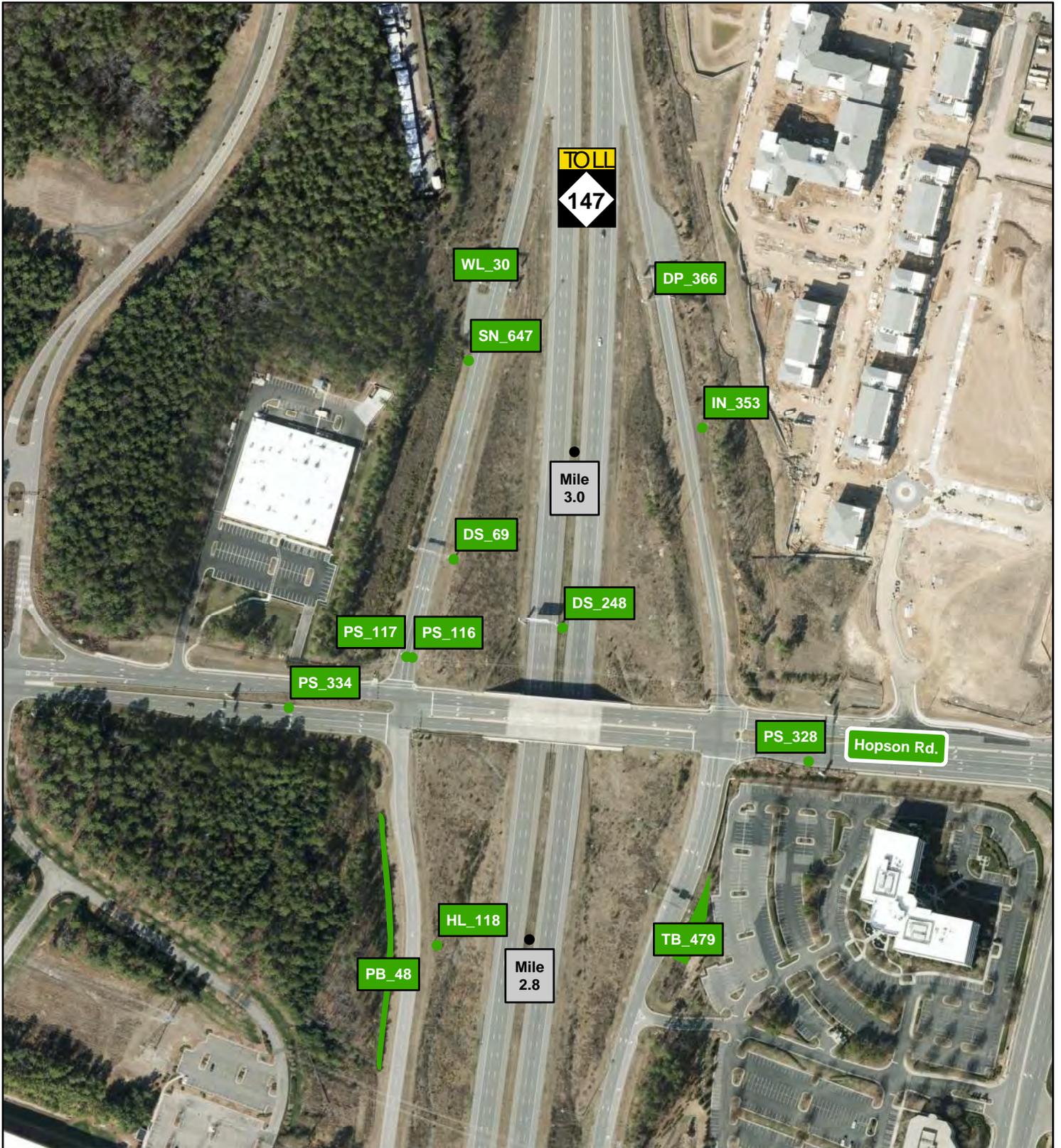


Legend

-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations

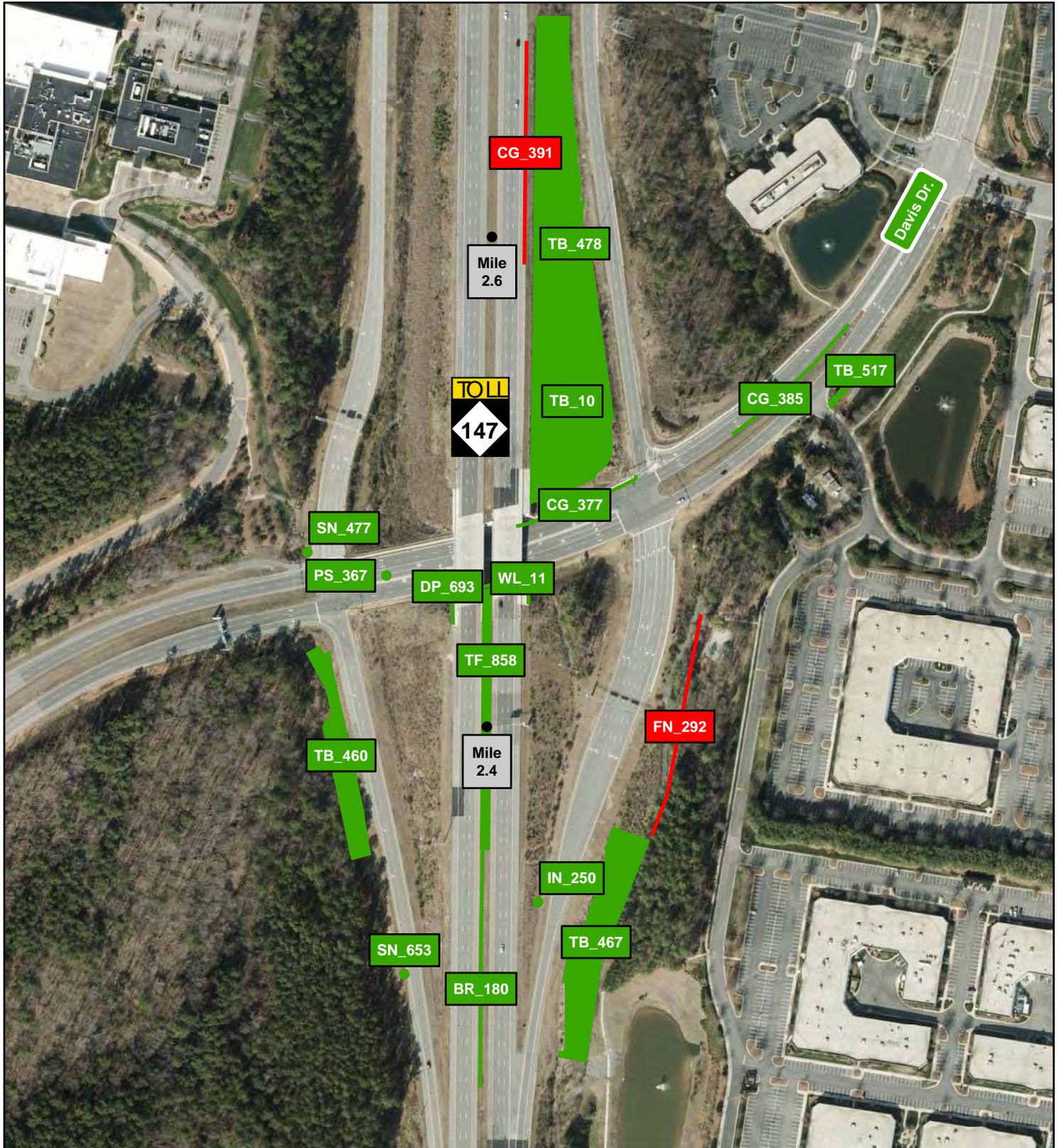


Legend

- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset



Appendix A: Triangle Expressway 2019 Second Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset



Appendix B

Triangle Expressway 2019 Second Quarter Table Results of Assets Failing MRP

Appendix B: Triangle Expressway 2019 Second Quarter Table Results of Assets Failing MRP

Provided below are a series of tables outlining the existing failures that occurred throughout the facility. Assets are defined by an Inventory ID, which is a unique identifier given to each individual asset. The components that make up the Inventory ID are an asset specific prefix along with a number, such as LS_1. The Inventory ID and GIS Reference Page number correspond to the map packet provided in Appendix A, to allow for the quick location of particular asset failures. Photos of failures are provided when applicable.

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) 6

Misc. Drainage Structure (MDP)..... 7

Fence and Control of Access (FN) 8

Graffiti (GR)..... 9

Highway Lighting (HL) 10

Impact Attenuators (IA) 11

Inlets (IN) 12

Landscaping (PB)..... 13

Paved Lanes – Asphalt (LS) 14

Paved Lanes – Concrete (LS)..... 15

Paved Shoulders (LS) 16

Unpaved Shoulders (LS)..... 17

Front/Back Slopes (LS) 18

Unpaved Lateral and Outfall Ditches (LS) 19

Litter (LS)..... 20

Roadway Sweeping (LS)..... 21

Pavement Striping (LS)..... 22

Pavement Markers (LS)..... 23

Delineators (LS)..... 24

Paved Ditches (PD) 25

Pavement Words and Symbols (PS)..... 26

Signs (SN) 27

Tree and Brush (TB) 28

Turf Condition (TF)..... 29

MSE/Retaining Walls, Sound Barrier Walls and Screen Walls (WL)..... 32

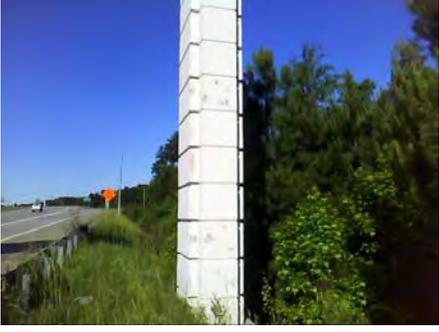
Guardrail, Concrete Barrier and End Anchors (BR)

#	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
1	Shoulder Berm	CG_78	Material Accumulation	 A photograph showing a concrete shoulder berm on the side of a road. There is a significant amount of brown, soil-like material accumulated along the edge of the berm, partially covering the concrete surface.	A13
2	Shoulder Berm	CG_172	Misalignment	 A close-up photograph of a person's hand using a yellow measuring tape to measure the gap between a concrete curb and the asphalt road surface. A blue level is also visible, indicating the curb is not aligned with the road.	A4
3	Shoulder Berm	CG_226	Material Accumulation	 A photograph of a shoulder berm on a road. The berm is heavily cluttered with dry leaves, twigs, and other organic debris, which has accumulated along its length.	A18
4	Shoulder Berm	CG_391	Misalignment	 A photograph showing a person's legs and feet standing on a road surface. A yellow measuring tape is held against the edge of a concrete curb, showing a clear gap between the curb and the road pavement.	A37

Decorative Supports (DS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Gantry Support	DS_45	Paint Scaling		A11
2	Gantry Support	DS_46	Paint Scaling		A11
3	Overhead Sign Support	DS_111	Paint Scaling		A6
4	Gantry Support	DS_159	Paint Scaling		A23

Decorative Supports (DS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Overhead Sign Support	DS_184	Paint Scaling		A27

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_77	Missing Rodent Screen		A15
2	Shoulder Drain	MDP_157	Obstruction		A29
3	Shoulder Drain	MDP_189	Missing Rodent Screen		A27
4	Shoulder Drain	MDP_198	Obstruction/ Missing Rodent Screen		A19

Fence and Control of Access (FN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Woven	FN_219	Fence Hole		A2
2	Woven	FN_292	Fence Height		A37

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	Single Roadway	HL_51	Part Damage		A8

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	OTCB	IN_481	Surface Damage		A1

Landscaping (PB)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Plant Bed	PB_258	Weeds		A31

Paved Lanes – Asphalt (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_200	Rutted Areas		A18

Paved Lanes – Concrete (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_34	Joint Malfunction		A7

Paved Shoulders (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_86	Paved Shoulder Joint Separation		A11
2	Concrete	LS_156	Paved Shoulder Drop-Off		A12
3	Concrete	LS_318	Paved Shoulder Joint Separation		A2

Unpaved Shoulders (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_548	Shoulder Drop-Off		A17

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	Asphalt	LS_548	Blocked Ditch		A17

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	Concrete	LS_37	Line Width, Line Missing		A7, A8
2	Asphalt	LS_209	Line Width, Line Missing, Nighttime Reflectivity		A33
3	Concrete	LS_603	Line Width, Line Missing, Nighttime Reflectivity		A8
4	Asphalt	LS_716	Line Missing, Nighttime Reflectivity		A7

Pavement Markers (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_394	Nighttime Reflectivity	Not available for Nighttime failure.	A18
2	Asphalt	LS_548	Missing Markers		A17
3	Concrete	LS_603	Missing Markers		A8
4	Asphalt	LS_648	Nighttime Reflectivity	Not available for Nighttime failure.	A24
5	Asphalt	LS_716	Missing Markers		A7

Delineators (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_88	Missing Delineators		A11
2	Concrete	LS_155	Missing Delineators		A12
3	Asphalt	LS_277	Missing Delineators		A35
4	Concrete	LS_603	Missing Delineators		A8

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	Stop Bar	PS_5	Daytime Assessment		A7
2	Right Turn	PS_15	Nighttime Reflectivity	Not available for Nighttime failure.	A13
3	Thru Arrow	PS_449	Daytime Assessment		A7
4	Thru Arrow	PS_459	Daytime Assessment		A7
5	Thru Arrow	PS_460	Daytime Assessment		A7

Signs (SN)

#	Sign Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Toll Other	SN_170	Height Requirement		A13
2	NC Route	SN_334	Height Requirement		A7
3	Do Not Enter	SN_690	Height Requirement		A23

Tree and Brush (TB)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Tree and Brush	TB_57	Clearance		A8

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Turf	TF_208	Bare Ground		A18
2	Turf	TF_271	Bare Ground		A24
3	Turf	TF_378	Bare Ground		A28
4	Turf	TF_380	Bare Ground		A28

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Turf	TF_450	Bare Ground		A32
6	Turf	TF_457	Bare Ground		A32
7	Turf	TF_467	Bare Ground		A32
8	Turf	TF_672	Noxious Weeds		A7

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
9	Turf	TF_1012	Bare Ground		A38

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

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Bridge Wall	WL_12	Paint Scaling		A38
2	Bridge Wall	WL_42	Paint Scaling		A20