

Maintenance Rating Program

Triangle Expressway

November 2023

2023 Third Quarter Report

CONSULTANT CERTIFICATION OF COMPLETION

October 26, 2023

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

NCTA Monroe By-Pass Roadway Maintenance Performance Rating Program; Q3, FY 2023 Rating

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

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

Sincerely,

Mott MacDonald I&E, LLC

A handwritten signature in blue ink 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 Project Manager – Operations and Maintenance

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1.0 Executive Summary

The North Carolina Turnpike Authority (NCTA) Maintenance Rating Program (MRP) is a maintenance evaluation program for roadway features and toll facilities on the NCTA system. This report presents results from the 2023 Third Quarter Assessment of the Triangle Expressway.

The overall 2023 third quarter maintenance rating of the Triangle Expressway was **96.3**, above the NCTA target rating of 90. As shown in **Table 1**, all five elements assessed achieved a rating greater than the target rating of 85.

Table 1: MRP Element Results for the 2023 Third Quarter Assessment

Element	MRP Rating	Target Rating
Road Surface	98.9	85.0
Unpaved Shoulders and Ditches	96.5	85.0
Drainage	96.9	85.0
Roadside	92.0	85.0
Traffic Control Devices	96.2	85.0
Overall MRP Performance Rating	96.3	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 **95.6**.

Table 2: MRP Rolling Element Results

Element	Q4 2022 Rating	Q1 2023 Rating	Q2 2023 Rating	Q3 2023 Rating	Rolling Rating
Road Surface	96.0	96.9	98.0	98.9	97.4
Unpaved Shoulders and Ditches	98.7	99.1	97.4	96.5	97.9
Drainage	94.8	93.3	95.7	96.9	95.2
Roadside	93.8	94.2	95.9	92.0	94.0
Traffic Control Devices	90.9 ¹	94.2 ¹	95.3 ¹	96.2	94.2 ²
Overall MRP Performance Rating	94.3¹	95.3¹	96.4¹	96.3	95.6²

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

²Excludes quarter ratings for elements listed above.

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

2.0 Introduction

The NCTA MRP is a comprehensive planning, measuring, and managing process that provides a means for communicating to managers, stakeholders, and customers the impacts of policy and budget decisions on program service delivery.

Using outcome-based performance measures and the service level scale (0 through 100), the inspection results are rated against established threshold criteria. The program analysis is accomplished using sampling procedures that capture the level of service being provided for individual assets. The evaluation procedure is based on the establishment of threshold conditions that quantify the maximum defect allowed on assets. Over time, the results can be charted to identify work needs and subsequent necessary actions.

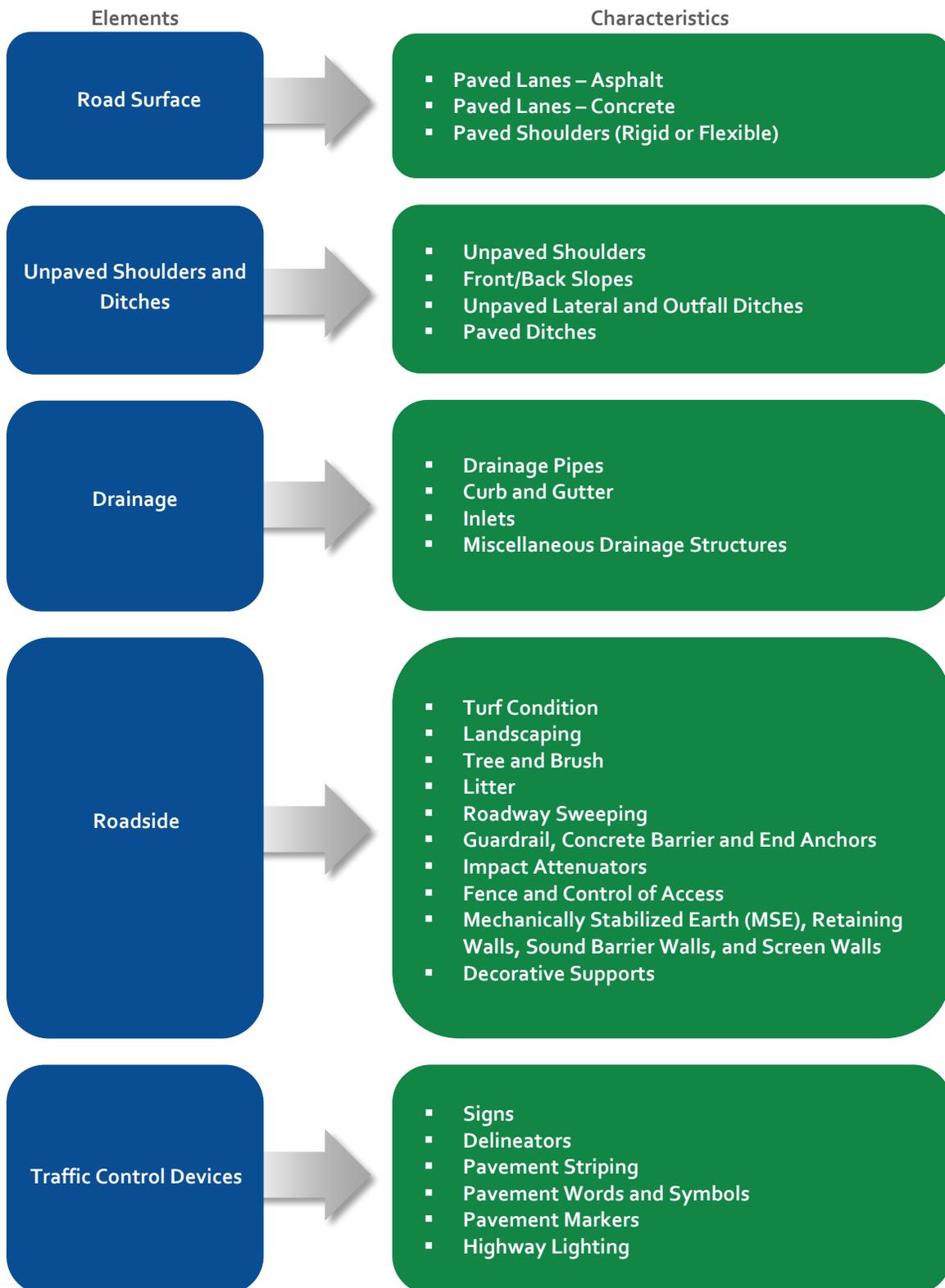
The NCTA performance standards, threshold criteria, and maintenance rating program were developed through a collaborative effort by NCTA managers, NCDOT maintenance staff, and consultants.

Using field survey information, a maintenance matrix can be developed to show the ties between maintenance activities and the characteristics of various roadway features. The purpose of this evaluation is to provide information that can be used to schedule and prioritize routine maintenance activities and provide uniform maintenance conditions that meet established objectives.

3.0 MRP Procedure

Per the *NCTA Roadway and Facility Maintenance Performance Standards V7*, roadway assets or characteristics on NCTA facilities have been grouped into elements. These elements and corresponding characteristics are shown in *Figure 1*:

Figure 1: Maintenance Elements and Characteristics



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

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

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

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

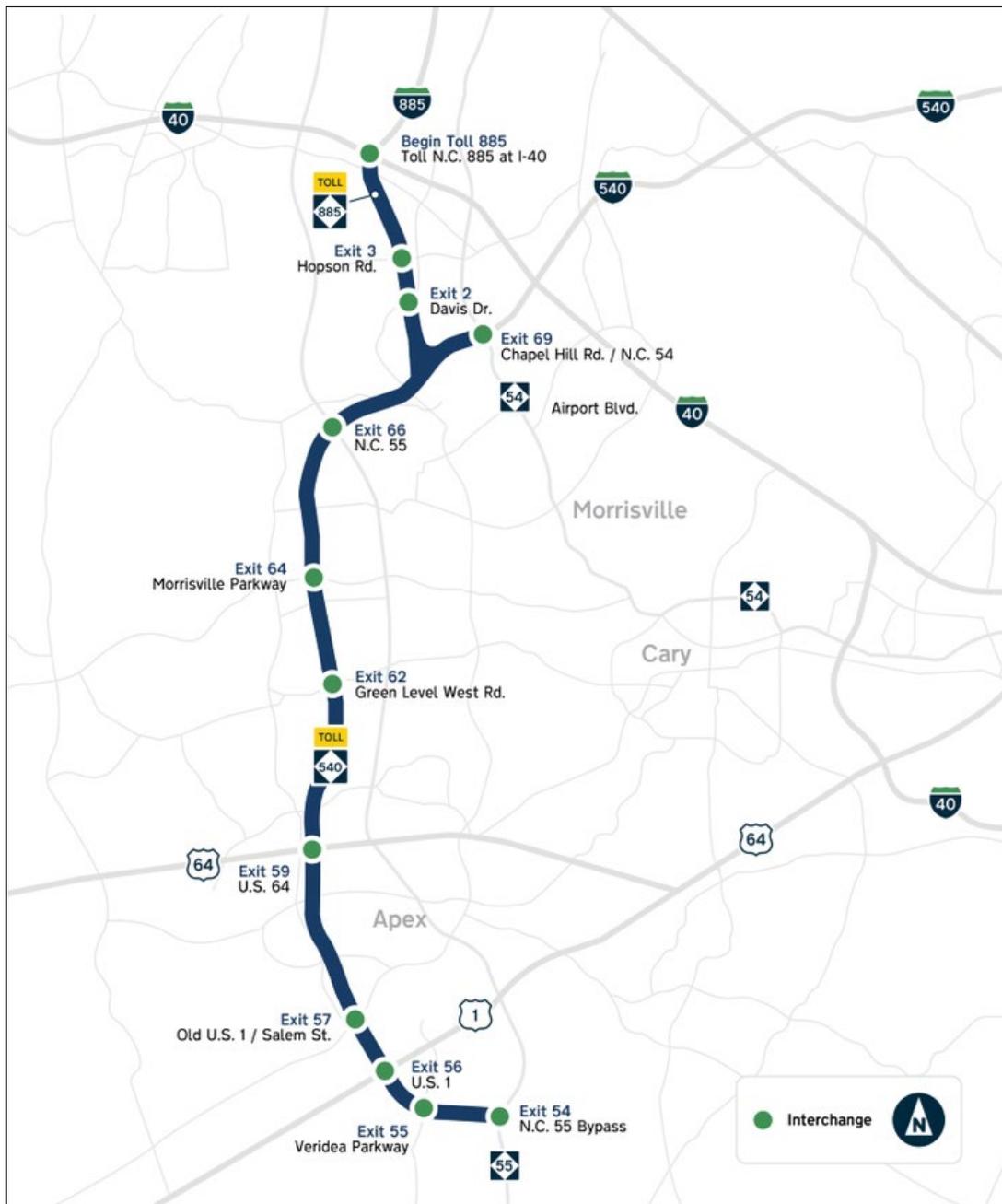
Road Surface =	25%
Unpaved Shoulders =	13%
Drainage =	15%
Roadside =	17%
Traffic Control Devices =	30%
<hr/>	
Total	100%

The NCTA's overall target rating is 90, with elements scoring 85 or higher, and characteristics 80 or higher. In addition to quarterly ratings, the cumulative rolling annual rating is calculated each quarter. This rating is obtained by adding the ratings of the latest four quarterly inspections to compensate for the likelihood of uneven sample sizes.

4.0 Triangle Expressway Description

The Triangle Expressway extends for approximately 18.8 miles from the interchange of I-40 and Toll NC-885 in Durham to the NC-55 Bypass near Holly Springs (*Figure 2*). It includes a one-mile segment on Toll NC-540 extending north from the Toll NC-540 / Toll NC-885 interchange to the NC-54 interchange. The Triangle Expressway consists of twelve interchanges and twenty-two all-electronic toll collection zones.

Figure 2: Triangle Expressway Map



5.0 Triangle Expressway Asset Inventory Update

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

During this quarter assets on Toll NC 540 exit ramps to and from NC-55 Bypass were removed from the inventory due to the Complete 540 construction project. **Table 3** presents the updated number of assets that are currently available for inspections.

Table 3: Asset Inventory

Assets	Total Inventory	2023 Eligible Inventory
Barriers	801	616
Curb and Gutter	428	391
Decorative Supports	305	298
Drainage	1179	1127
Misc. Drainage	218	202
Fences	508	483
Highway Lighting	435	430
Impact Attenuators	48	46
Inlets	1129	1075
Linear Segments	795	755
Plant Beds	266	257
Paved Ditches	2	2
Pavement Symbols	652	591
Signs	1224	1168
Tree and Brush	603	567
Turf	1074	1011
Walls	88	84

6.0 MRP Second Quarter Assessment

6.1 Quarterly Results

The overall 2023 third quarter maintenance rating of the Triangle Expressway was 96.3, above NCTA’s target overall rating of 90. All elements assessed achieved quarter ratings above the target rating of 85 established for element groups.

It is important to note that these results are only representative of the second quarter sample, one of the four surveys to provide an intermediate snapshot of seasonal conditions. Therefore, they are not a statistically valid representation of the assets; only the total of all four quarterly inspections, reported as the rolling rating, provide a 95% confidence level in statistical sampling. The 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 2023

Element	MRP Rating
Road Surface	98.9
Unpaved Shoulders and Ditches	96.5
Drainage	96.9
Roadside	92.0
Traffic Control Devices	96.2
Overall MRP Performance Rating	96.3

Table 5: MRP Characteristics Results for Q3 2023

Road Surface	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q3 Rating
Paved Lanes Asphalt	11	11	9	99	99	100
Paved Lanes Concrete	21	21	9	189	189	100
Paved Shoulder	31	32	5	155	160	97
Element Total				443	448	98.9
Unpaved 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	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				658	682	96.5
Drainage	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q3 Rating
Drainage Pipes	33	34	7	231	238	97
Curb and Gutter	28	28	6	168	168	100
Inlets	34	34	7	238	238	100
Misc. Drainage Structure	21	25	4	84	100	84
Element Total				721	744	96.9
Roadside	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q3 Rating
Turf Condition	32	38	7	224	266	84
Landscaping	23	25	4	92	100	92
Trees and Brush	31	31	4	124	124	100
Litter	31	32	4	124	128	97
Roadway Sweeping	31	32	5	155	160	97
Guardrail, Concrete Barrier, and End Anchors	28	31	9	252	279	90
Impact Attenuators	9	9	9	81	81	100
Fence, Control Access	26	30	7	182	210	87
Retaining Walls and Sound Barrier Walls	13	18	5	65	90	72
Decorative Supports	26	26	5	130	130	100
Graffiti and Stain Removal	44	44	4	176	176	100
Element Total				1605	1744	92.0
Traffic Control Devices	Sample Passed	Sample Total	Weighted Values	Actual Pts	Available Pts	Q3 Rating
Signs	25	27	7	175	189	93
Delineators	30	32	3	90	96	94
Pavement Striping/Marking	32	32	8	256	256	100
Words and Symbols	30	31	7	210	217	97
Pavement Markers	29	29	9	261	261	100
Highway Lighting	26	29	6	156	174	90
Element Total				1148	1193	96.2

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

6.2 Quarterly Analysis and Recommendations

Elements

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

Road Surface (98.9) experienced a 0.3 point decrease from the previous quarter's rolling rating. Paved Shoulder (97) rolling rating decreased by 0.8 points. All characteristics within this element continued scoring above 90.

Unpaved Shoulders and Ditches (96.5) experienced an increase in rolling rating. The rating for this element was 0.4 points higher than the previous quarter rolling rating. All characteristics within this element continued scoring above 90.

Drainage (96.9) rolling rating also increased by 1.2 points from the previous quarter rolling rating. Curb and Gutter (100) and Inlets (100) rolling rating increased from last quarter by 1.8 and 2.9 points respectively.

Roadside (92.0) rolling rating decreased by 0.3 points from the previous quarter rolling rating. Turf Condition (84) score decreased by 0.6 points from the previous quarter's rolling rating. Fences (87) experienced a decrease in rating of 2.1 points from the previous quarter rolling rating.

Traffic Control Devices (96.2) experienced an increase in rolling rating of 1.1 points from the previous quarter. Pavement Striping (100) and Words and Symbols (97) experienced an increase in rolling rating of 2.1 and 3.5 points respectively. Replacement of striping and markers for the remaining concrete sections was completed in Summer 2023.

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

Characteristics

This quarter, all but one characteristic, Retaining Walls and Sound Barrier Walls (72), met the NCTA target threshold criteria of 80. A description of the characteristic's conditions and future work planning recommendations are provided below. Pictures of all characteristic failures are included in **Appendix B**.

Retaining Walls and Sound Barrier Walls (72 rating – 13 of the 18 assets passed): Four of the wall sections that did not pass inspection had unsealed cracks/joints and one did not pass due to vegetation. Two of the sections that did not pass inspection are presented in *Figure 3*.

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



Maintenance Program:

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

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

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

7.0 Current Rolling MRP Rating

The rolling maintenance rating of the Triangle Expressway was **96.3**, exceeding NCTA's target overall rating of **90**. All elements exceeded NCTA's rolling rating threshold criteria of 85. Twenty-seven of the twenty-eight characteristic ratings met or exceeded the target rating of 80.

The 2022/2023 results are presented in **Exhibit 1** and **Table 6**. These results are a collection of the four quarterly inspections conducted in the last year.

Exhibit 1: MRP Element Results for 2022/2023

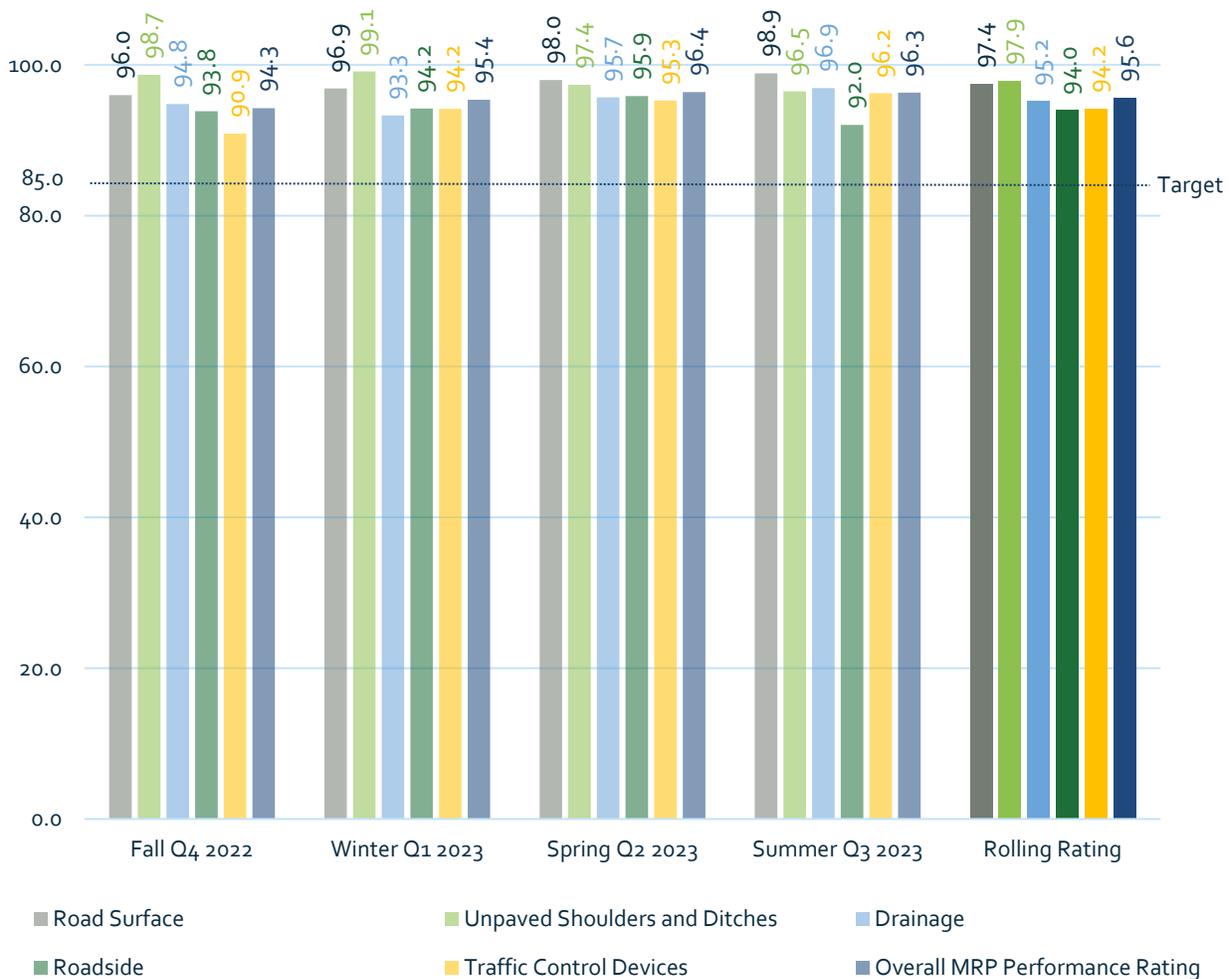


Table 6: MRP Rolling Element Results

Road Surface	Q4 2022 Rating	Q1 2023 Rating	Q2 2023 Rating	Q3 2023 Rating	Rolling Rating
Paved Lanes Asphalt	100	100	100	100	100
Paved Lanes Concrete	88	94	94	100	94
Paved Shoulder	100	97	100	97	98
Element Total	96.0	96.9	98.0	98.9	97.4
Unpaved Shoulders and Ditches	Q4 2022 Rating	Q1 2023 Rating	Q2 2023 Rating	Q3 2023 Rating	Rolling Rating
Unpaved Shoulder	97	100	94	94	96
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	98.7	99.1	97.4	96.5	97.9
Drainage	Q4 2022 Rating	Q1 2023 Rating	Q2 2023 Rating	Q3 2023 Rating	Rolling Rating
Drainage Pipes	94	88	97	97	94
Curb and Gutter	96	96	96	100	97
Inlets	97	100	97	100	99
Misc. Drainage Structure	89	84	88	84	86
Element Total	94.8	93.3	95.7	96.9	95.2
Roadside	Q4 2022 Rating	Q1 2023 Rating	Q2 2023 Rating	Q3 2023 Rating	Rolling Rating
Turf Condition	88	97	92	84	90
Landscaping	100	96	92	92	95
Trees and Brush	100	100	100	100	100
Litter	88	100	88	97	93
Roadway Sweeping	100	100	100	97	99
Guardrail, Concrete Barrier, and End Anchors	100	94	100	90	96
Impact Attenuators	100	100	100	100	100
Fence, Control Access	80	71	97	87	87
Retaining Walls and Sound Barrier Walls	75	83	78	72	77
Decorative Supports	92	100	100	100	98
Graffiti and Stain Removal	98	100	100	100	99
Element Total	92.3	94.2	95.9	92.0	94.0
Traffic Control Devices	Q4 2022 Rating	Q1 2023 Rating	Q2 2023 Rating	Q3 2023 Rating	Rolling Rating
Signs	91	91	97	93	93
Delineators	91	94	88	94	91
Pavement Striping/Marking	100 ¹	100 ¹	100 ¹	100	100 ²
Words and Symbols	82 ¹	92 ¹	96 ¹	97	91 ²
Pavement Markers	100 ¹	100 ¹	100 ¹	100	100 ²
Highway Lighting	94	97	90	90	93
Element Total	90.9¹	94.2¹	95.3¹	96.2	94.2²

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

² Excludes the indicated quarter ratings for characteristics listed above.

8.0 Green Level Historic District Signs

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

8.1 Analysis and Recommendations

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

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



9.0 Conclusion

This report presents the 2023 third quarter assessment of the Triangle Expressway. The NCTA's target ratings are 90 for the rolling rating, 90 for the overall quarter rating, 85 for elements, and 80 for characteristics. The third quarter 2023 overall rating was 96.3 and the rolling rating was 95.6, both ratings met the target rating of 90.

All element ratings were above the target ratings for the quarter and rolling assessment. During the third quarter assessment, all but one characteristic met or exceeded the target rating of 80. The characteristic that received a quarter score less than 80 was Retaining Walls and Sound Barriers (72).

To maintain/improve the condition ratings, it is recommended that the pavement striping/markings replacement cycles are completed as planned in the capital budget. Replacement of pavement striping, and marking was ongoing during this quarter's inspection.

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

Appendix A

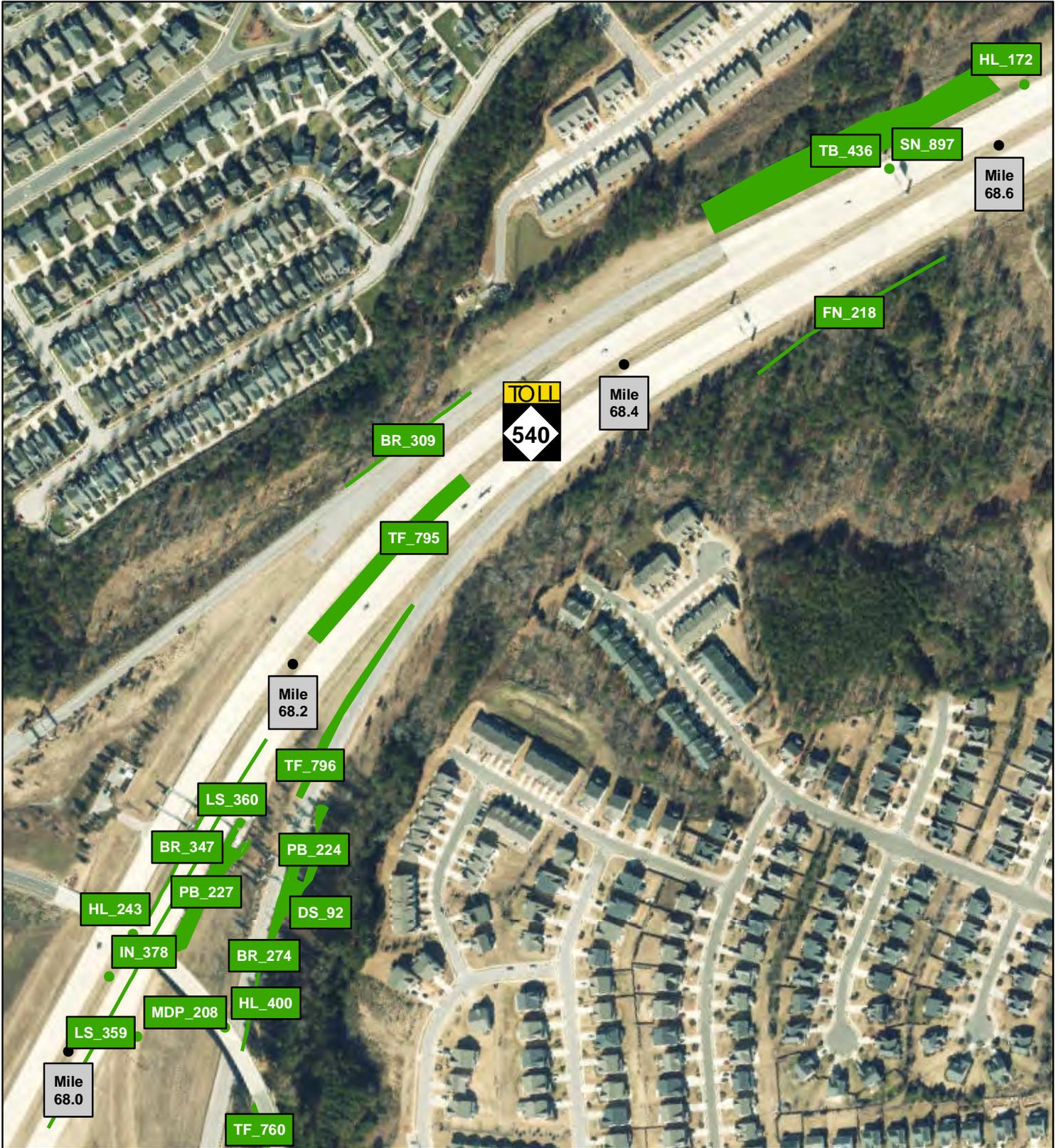
Triangle Expressway 2032 Third Quarter Asset Assessment Locations

Appendix A: Triangle Expressway 2023 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 – GR
- Highway Lighting – HL
- Impact Attenuators – IA
- Inlets – IN
- Landscaping – PB
- Linear Samples – LS
 - Paved Lanes – Asphalt
 - Paved Lanes – Concrete
 - Paved Shoulders
 - Unpaved Shoulders
 - Front/Back Slopes
 - Unpaved Lateral and Outfall Ditches
 - Litter
 - Roadway Sweeping
 - Pavement Striping/Markings
 - Pavement Markers
 - Delineators
- Paved Ditches – PD
- Pavement Words and Symbols – PS
- Signs – SN
- Tree and Brush – TB
- Turf Condition – TF
- MSE/Retaining Walls, Sound Barrier Walls, and Screen Walls – WL

Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset

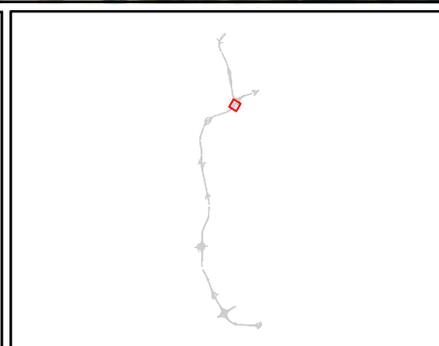


Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset



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Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations

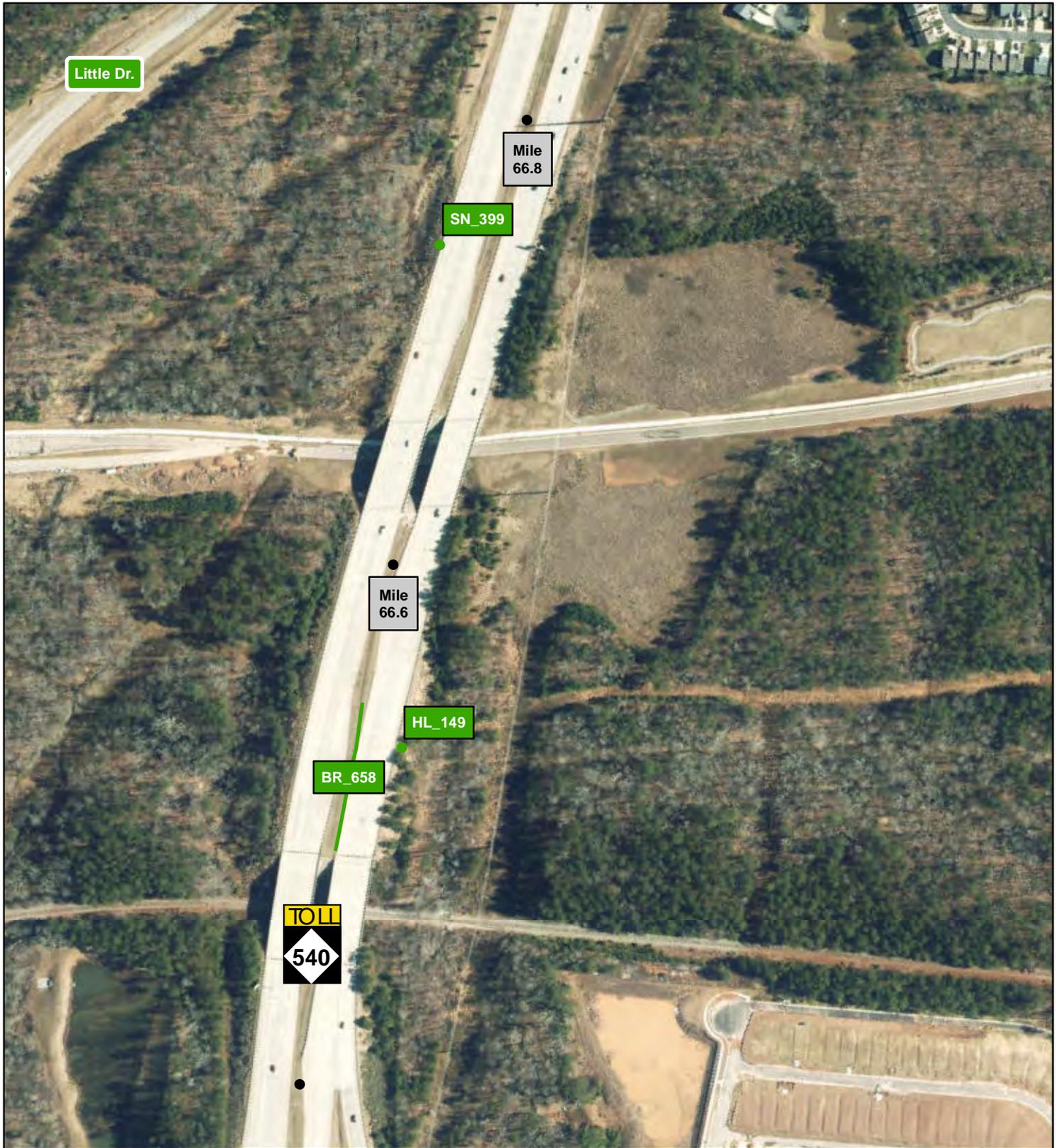


Legend

-  Failing Asset
-  Passing Asset

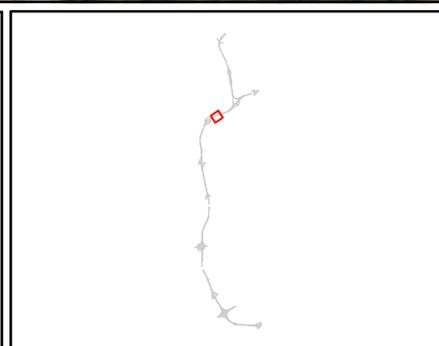


Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset



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Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

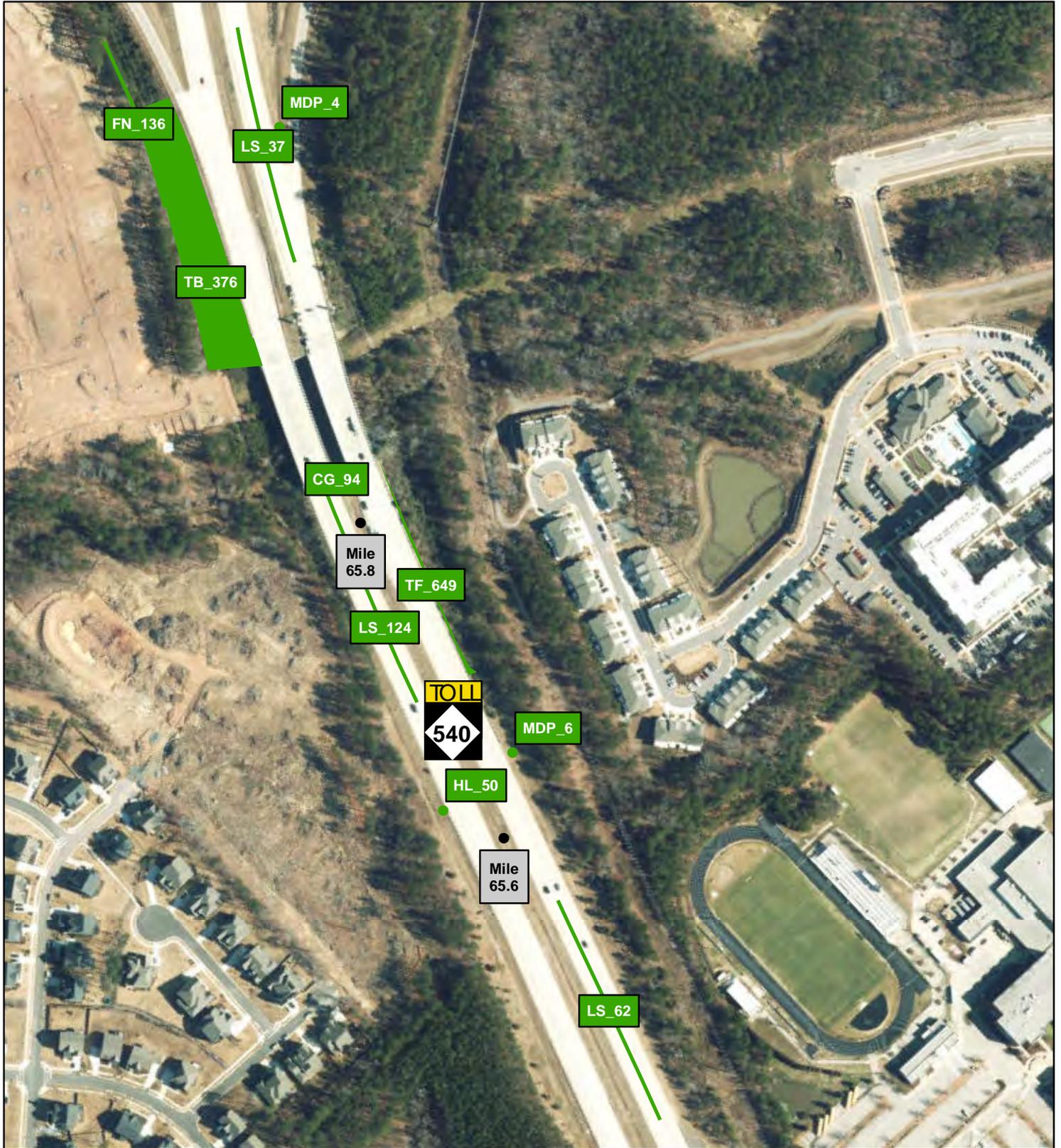
- Failing Asset
- Passing Asset







Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset

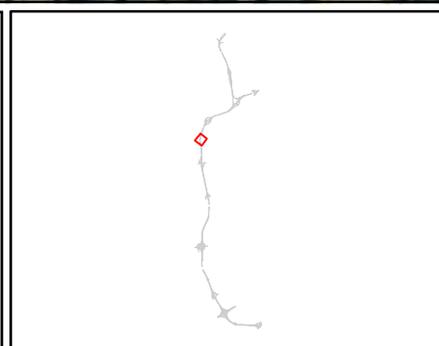


Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset



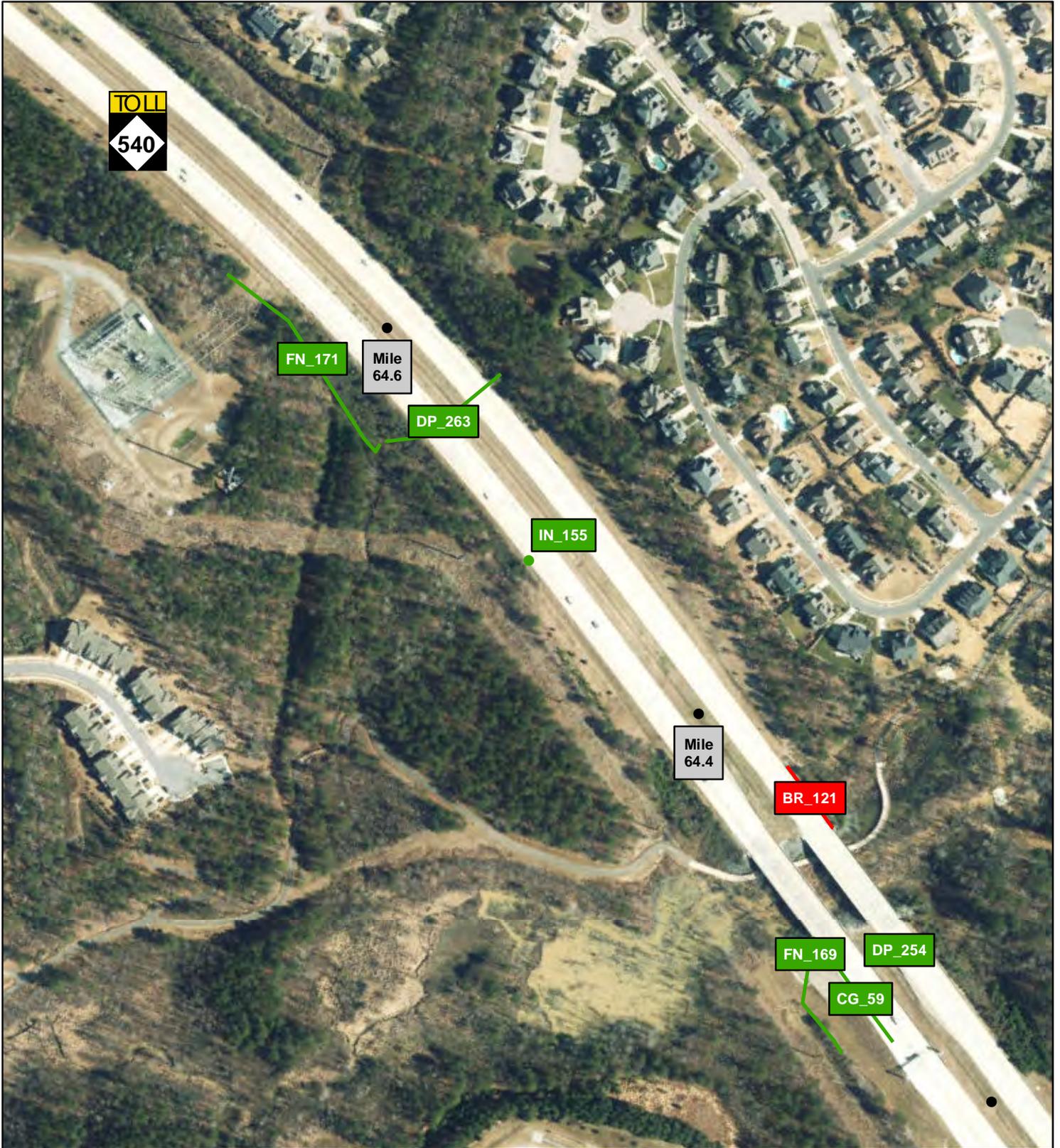




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Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations

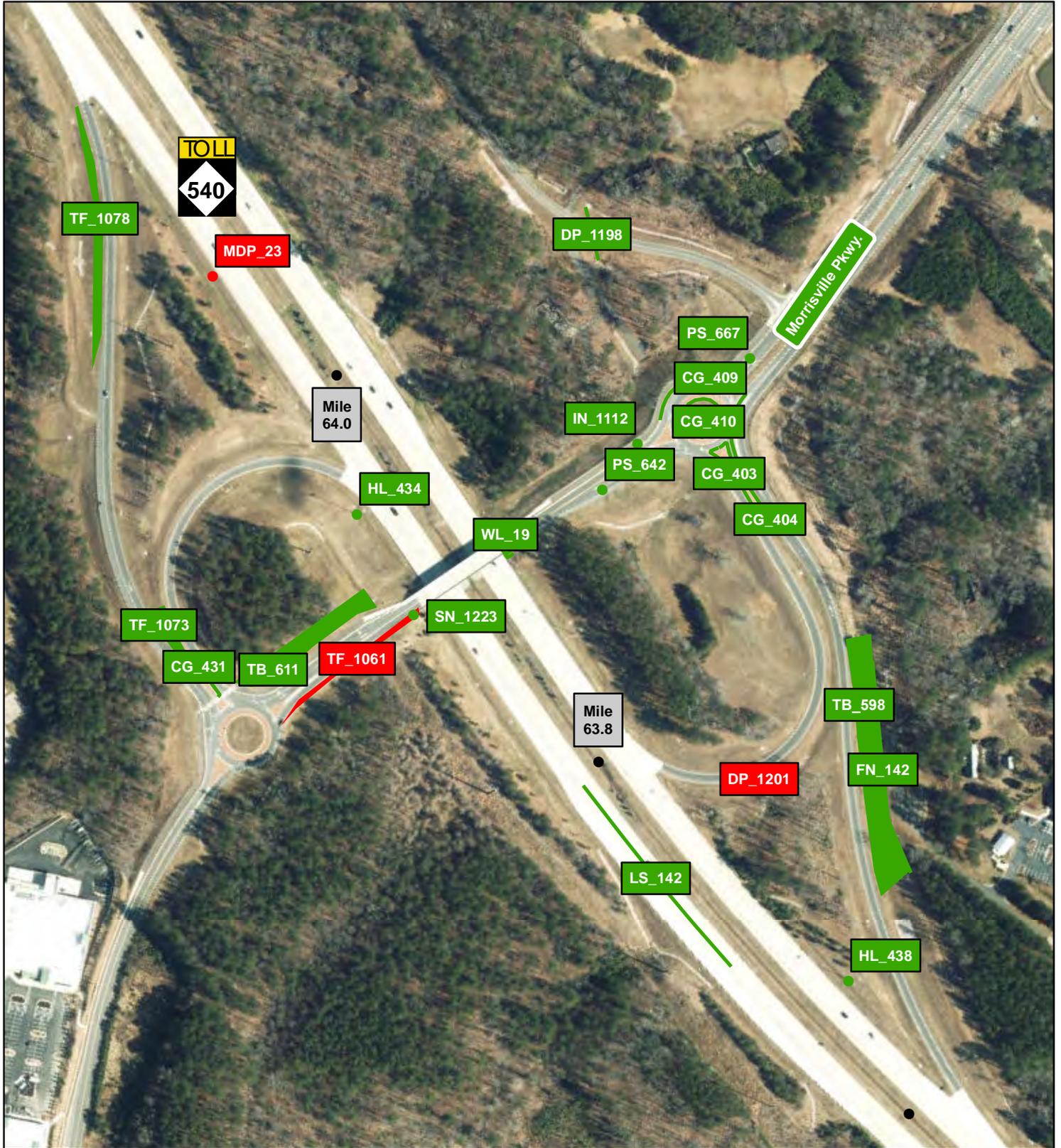


Legend

-  Failing Asset
-  Passing Asset

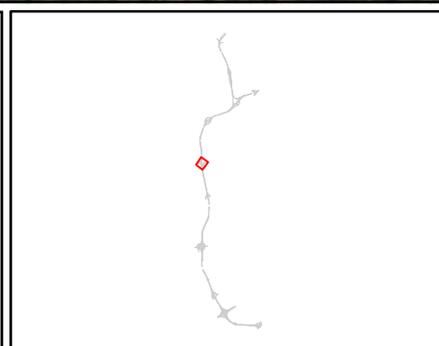


Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset



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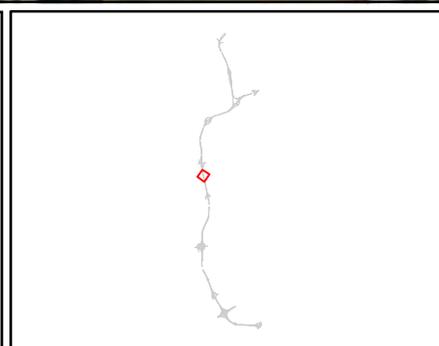
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Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset



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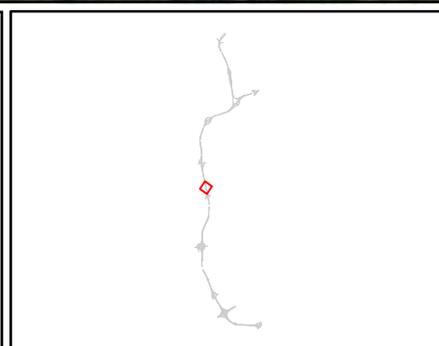
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Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset

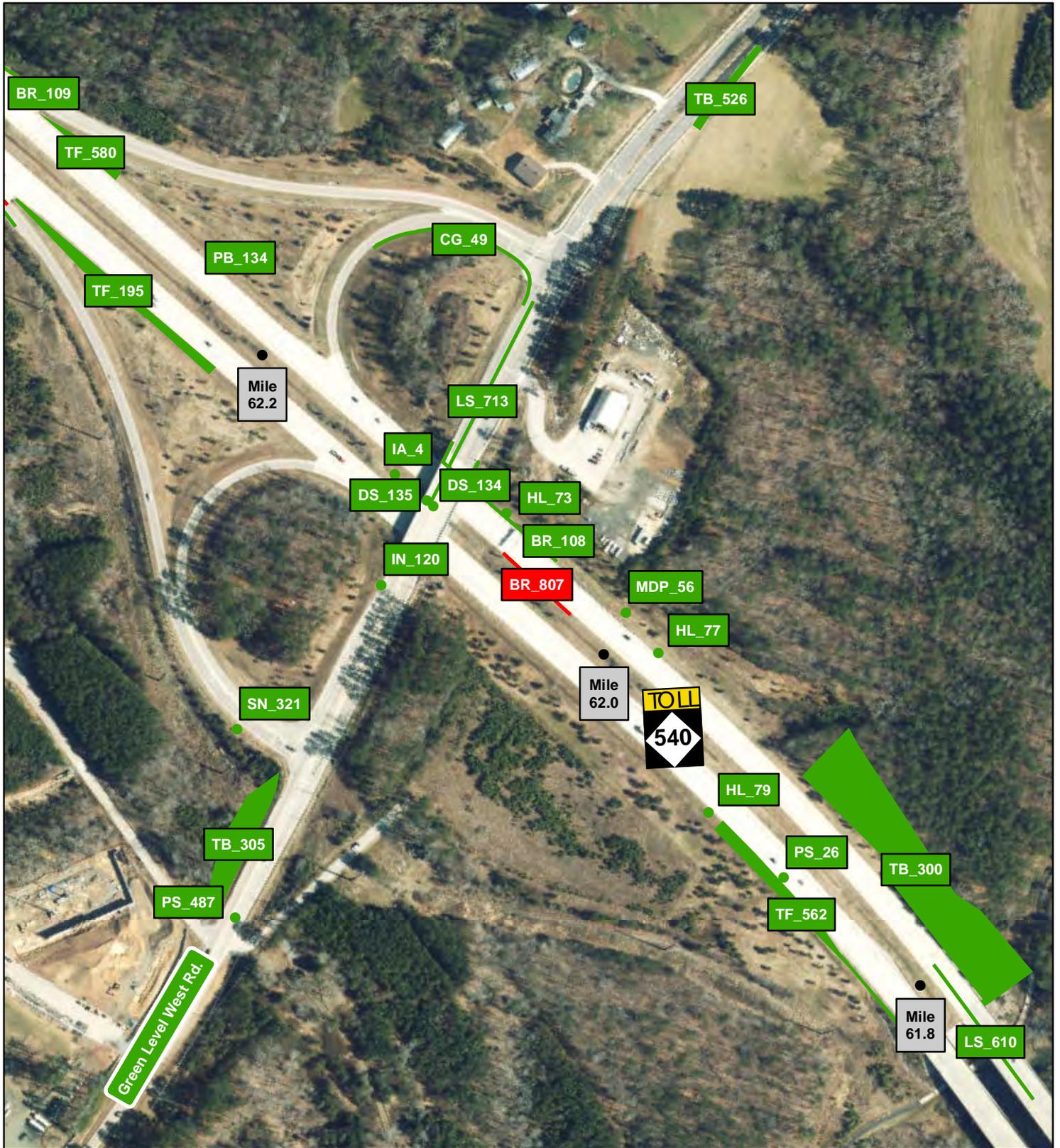


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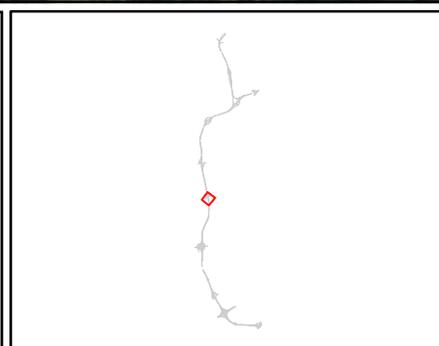
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Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset





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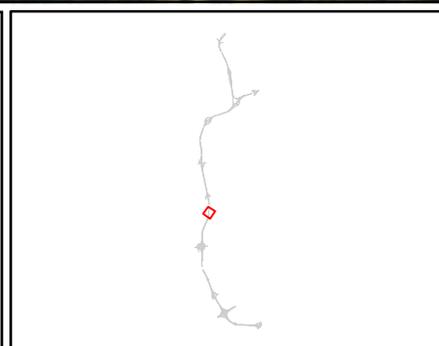
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Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

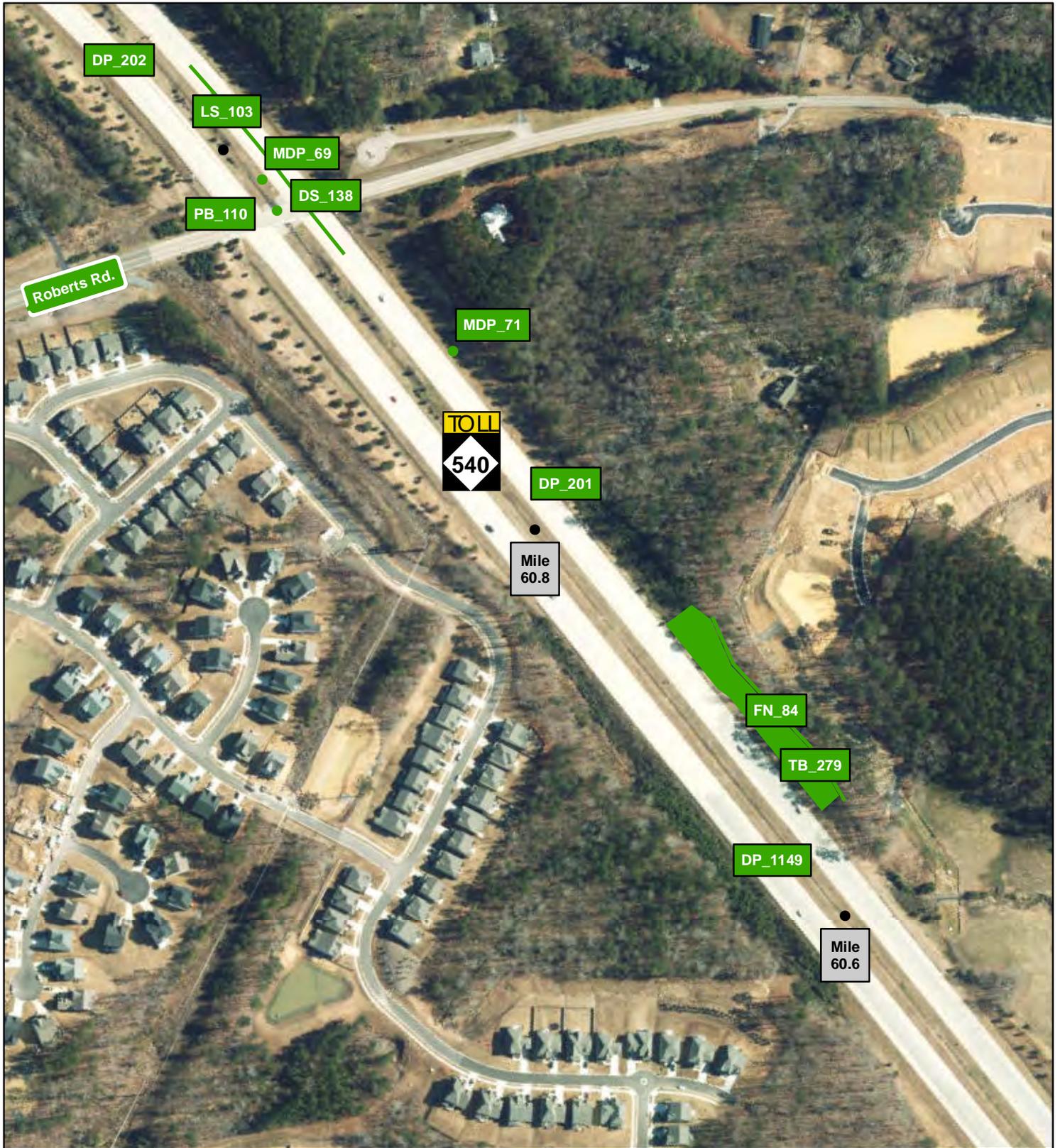
-  Failing Asset
-  Passing Asset



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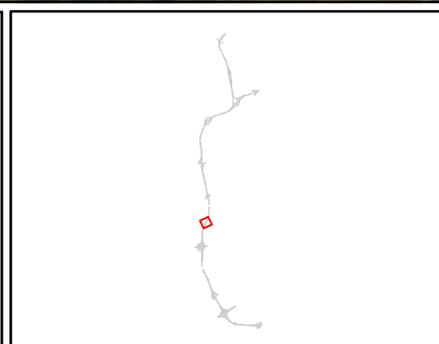
A14

Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset



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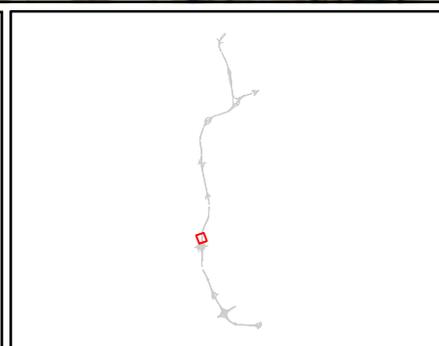
A15

Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset

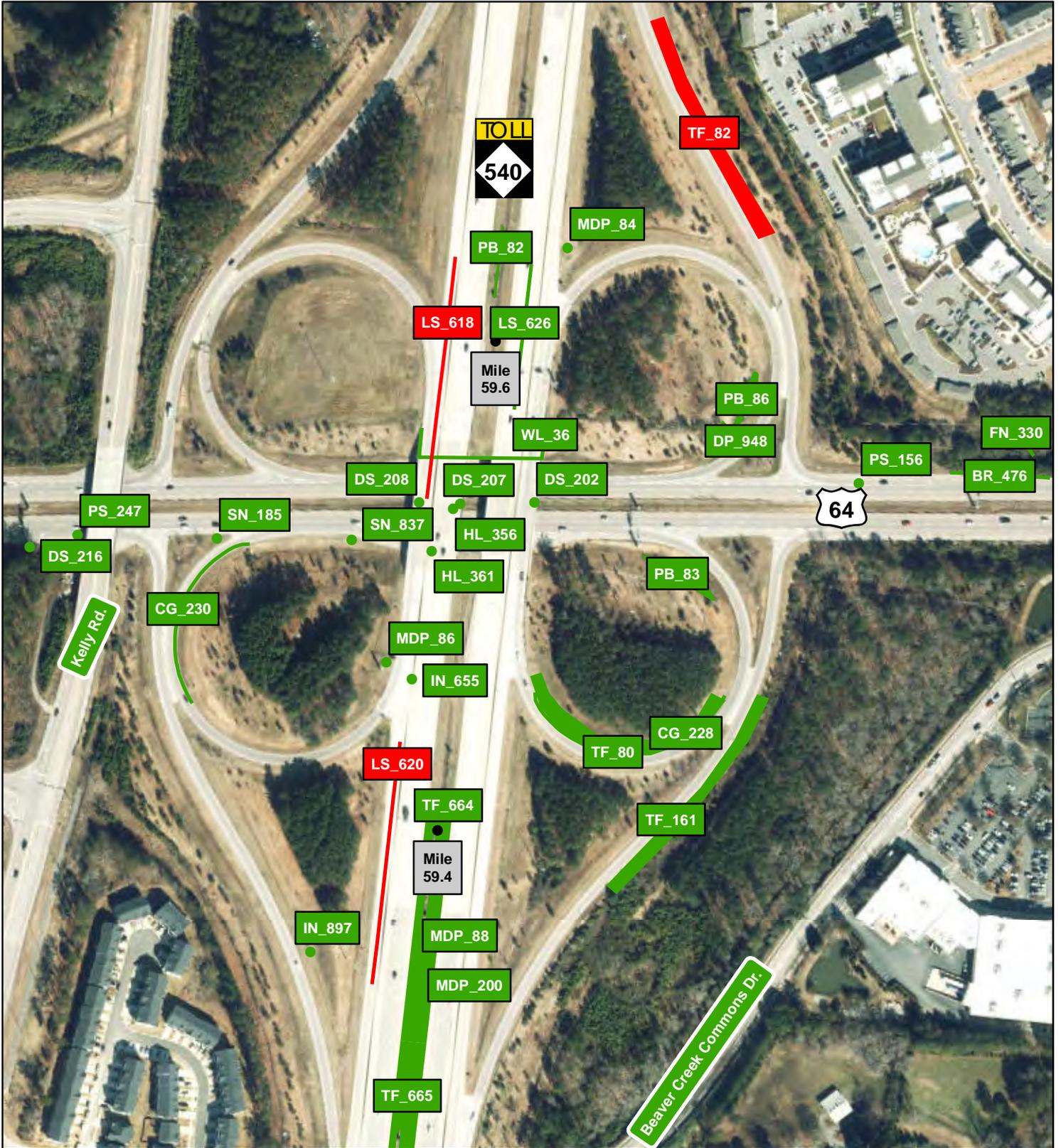






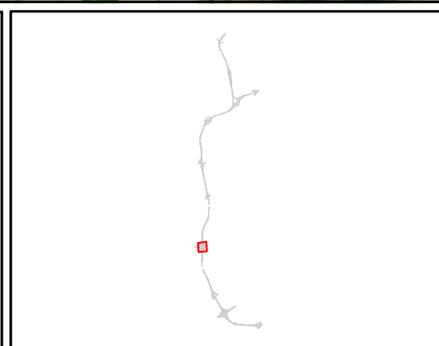
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Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset







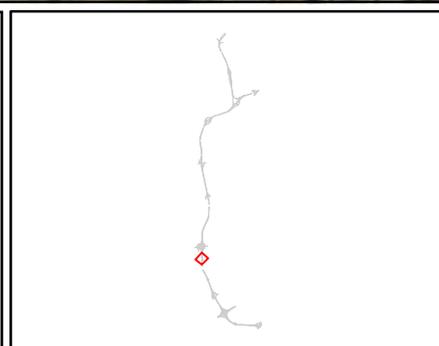
A17

Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset



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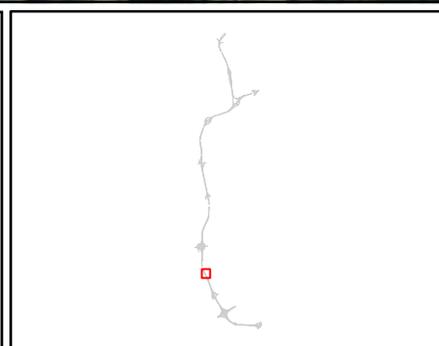
A18

Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

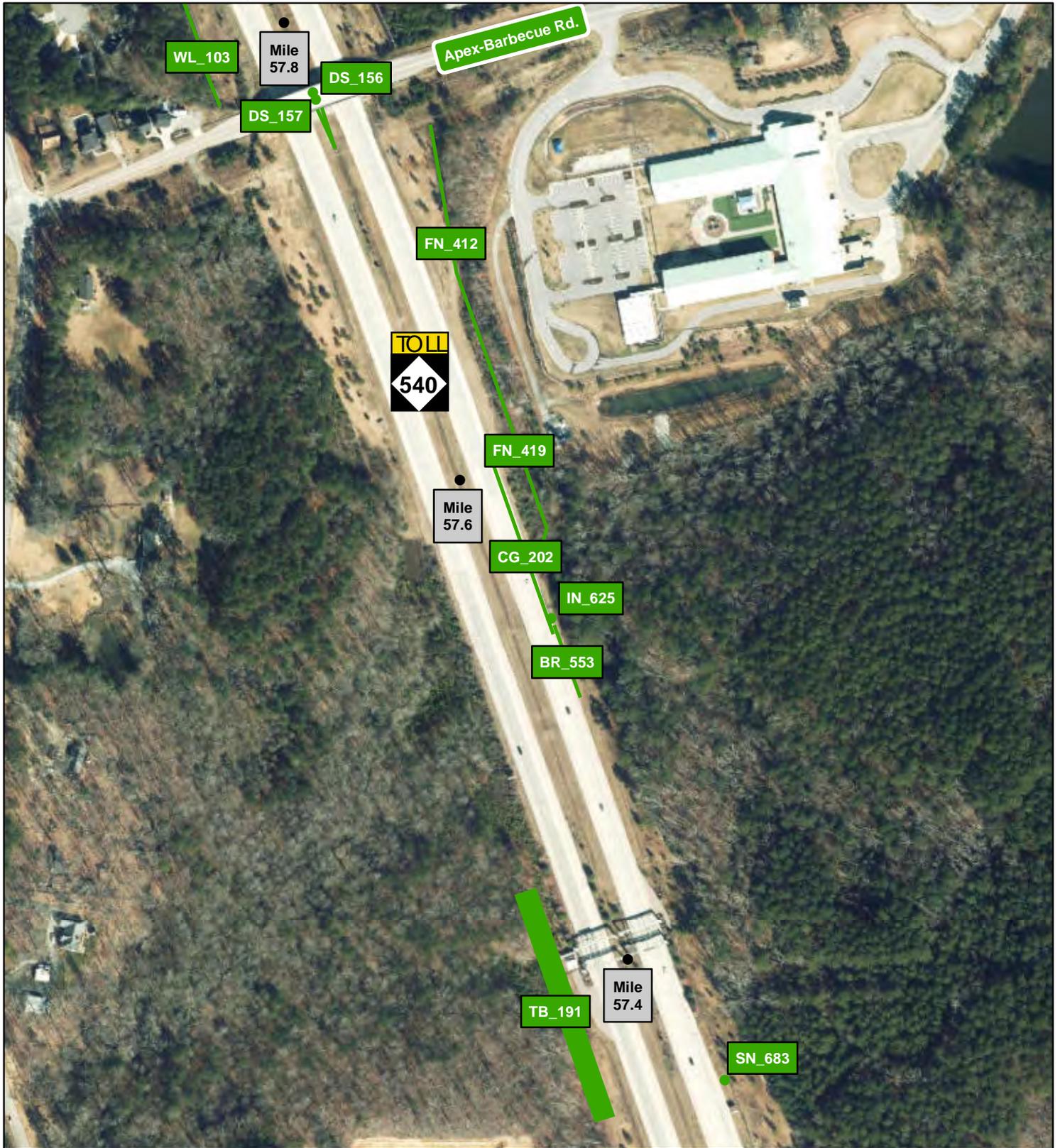
-  Failing Asset
-  Passing Asset




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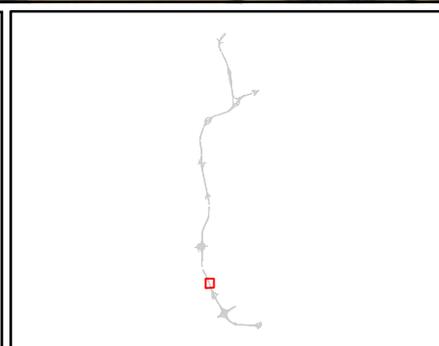
A19

Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset

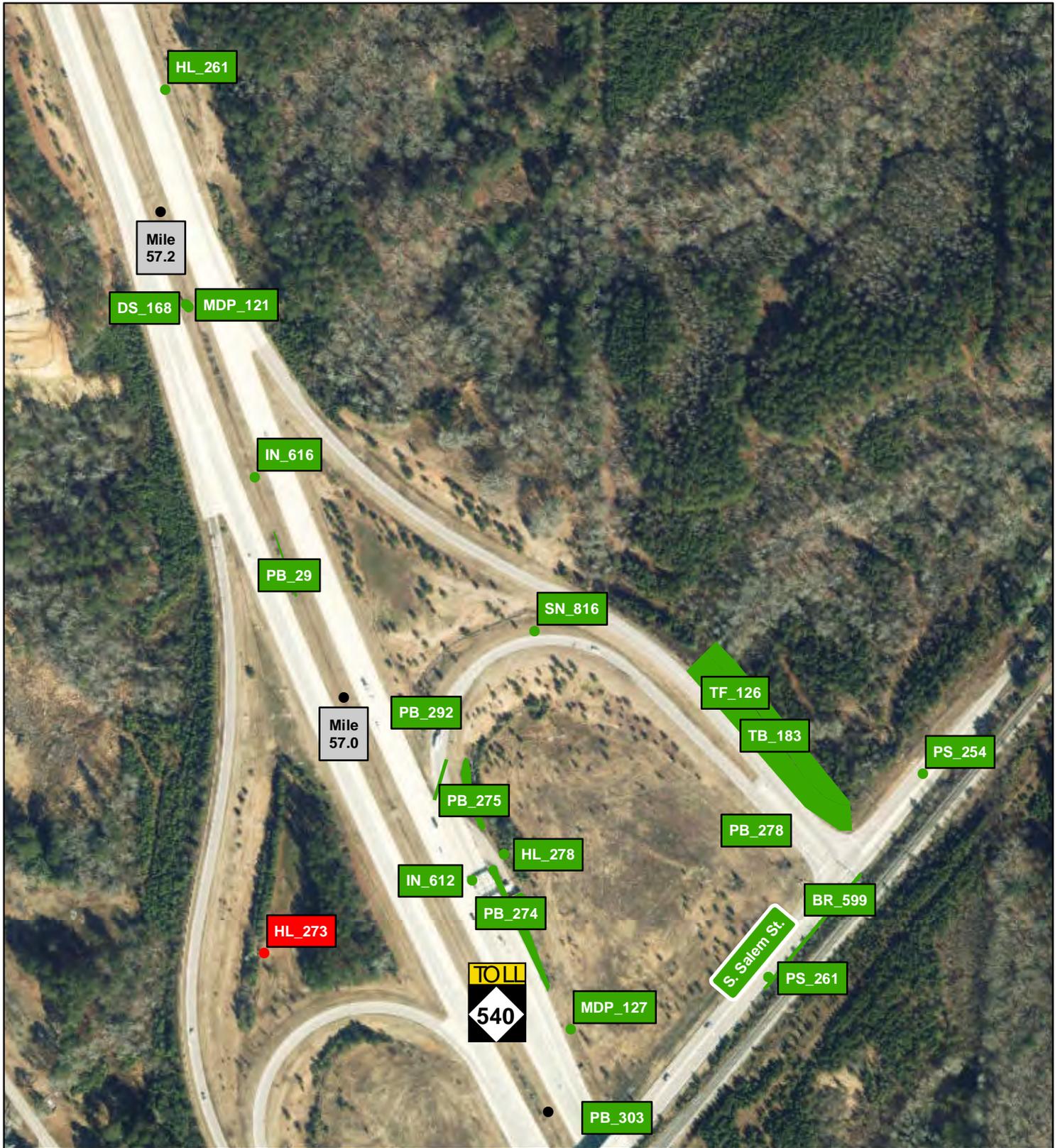






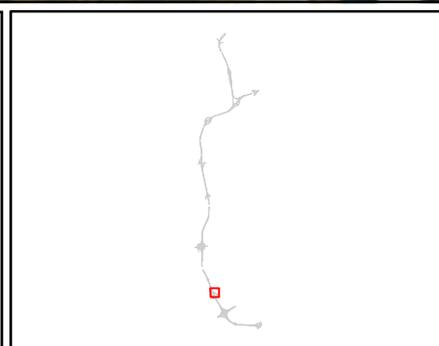
A20

Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset



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A21

Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations

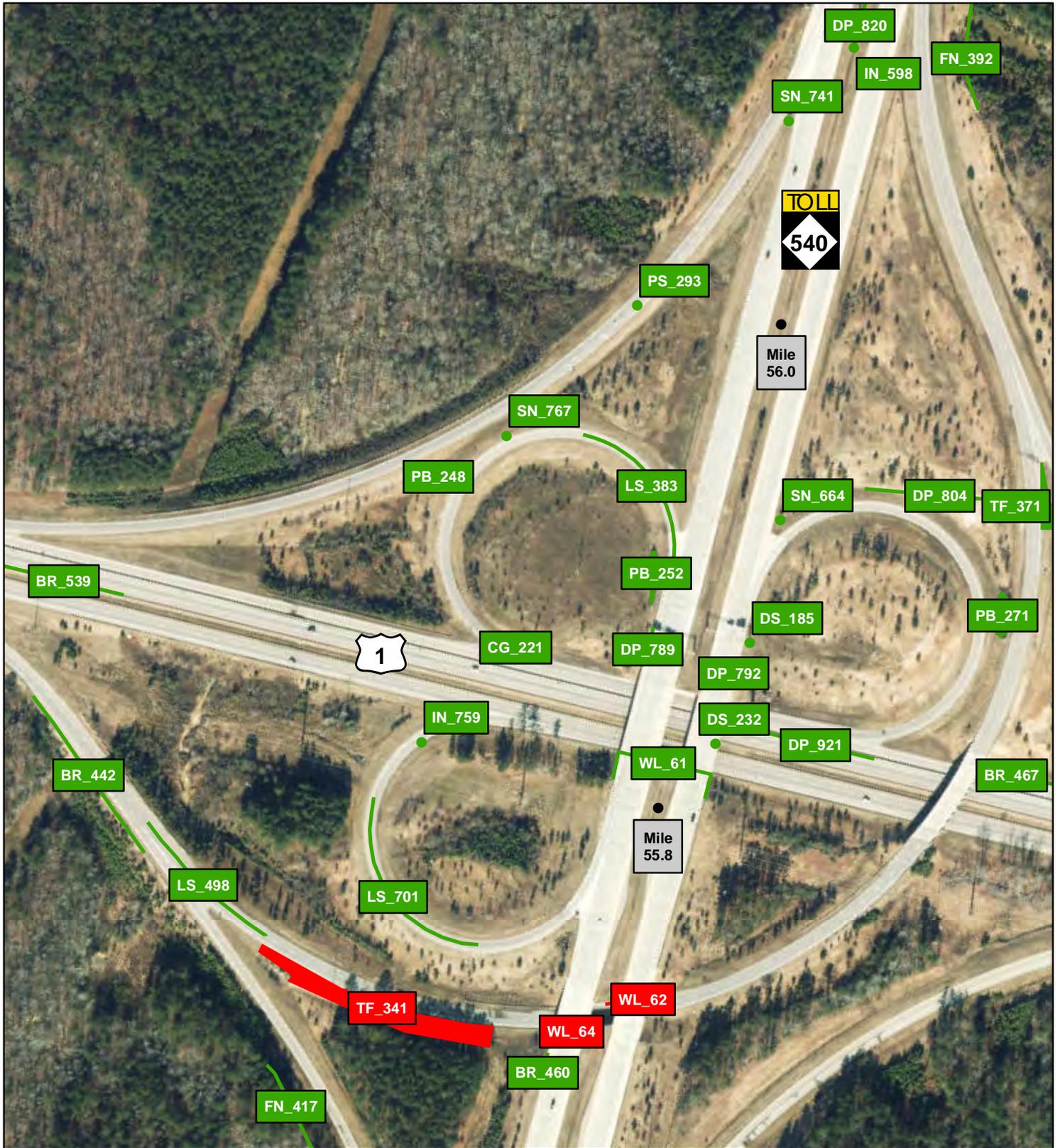


Legend

-  Failing Asset
-  Passing Asset



Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset



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A23

Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations

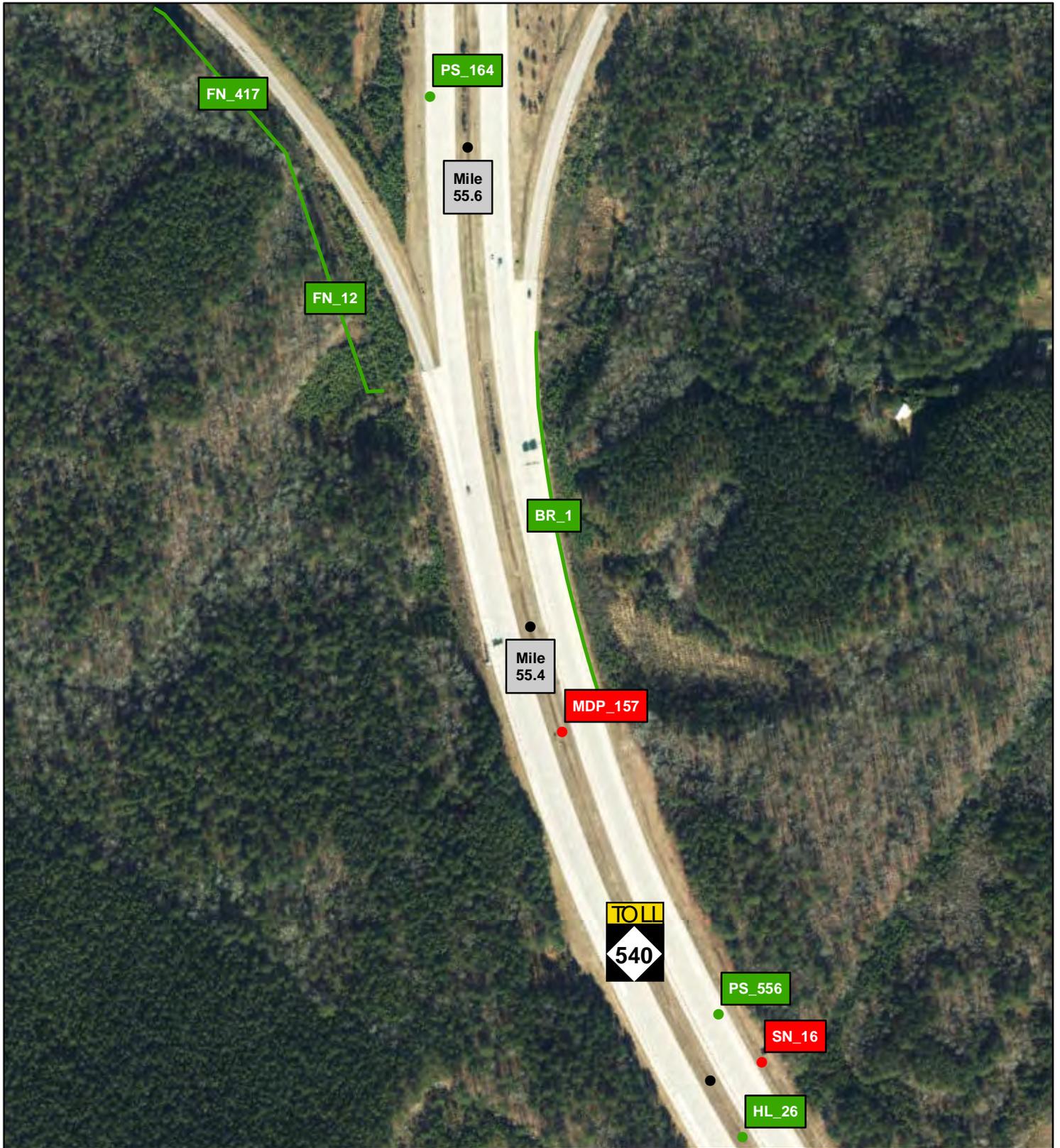


Legend

-  Failing Asset
-  Passing Asset

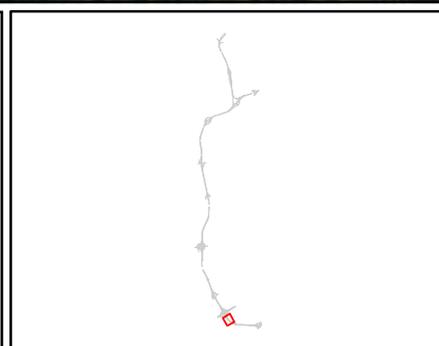


Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



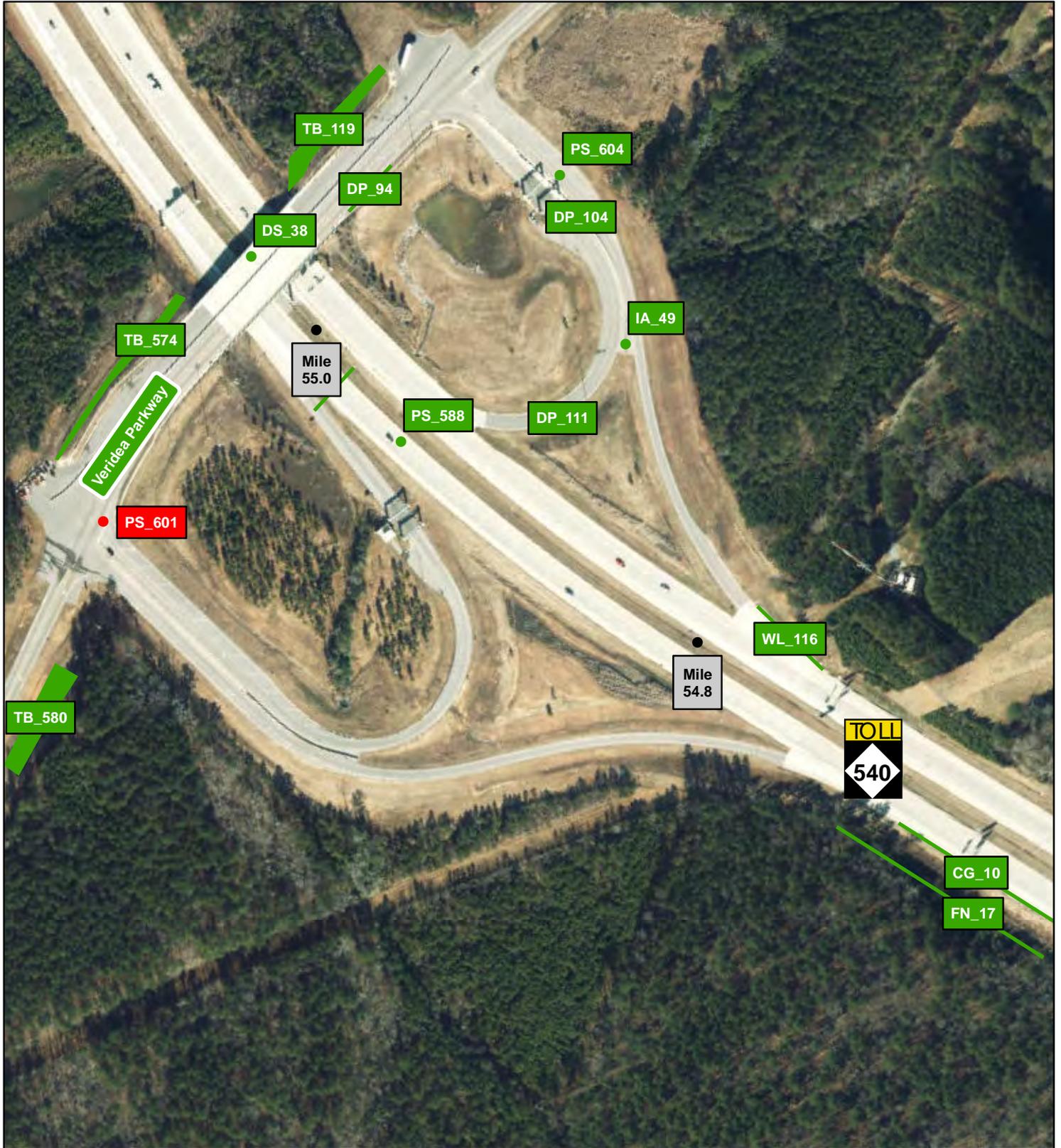
Legend

-  Failing Asset
-  Passing Asset



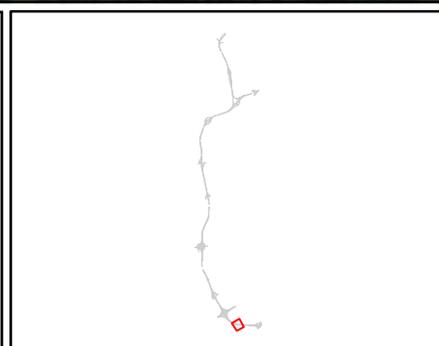

A25

Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset

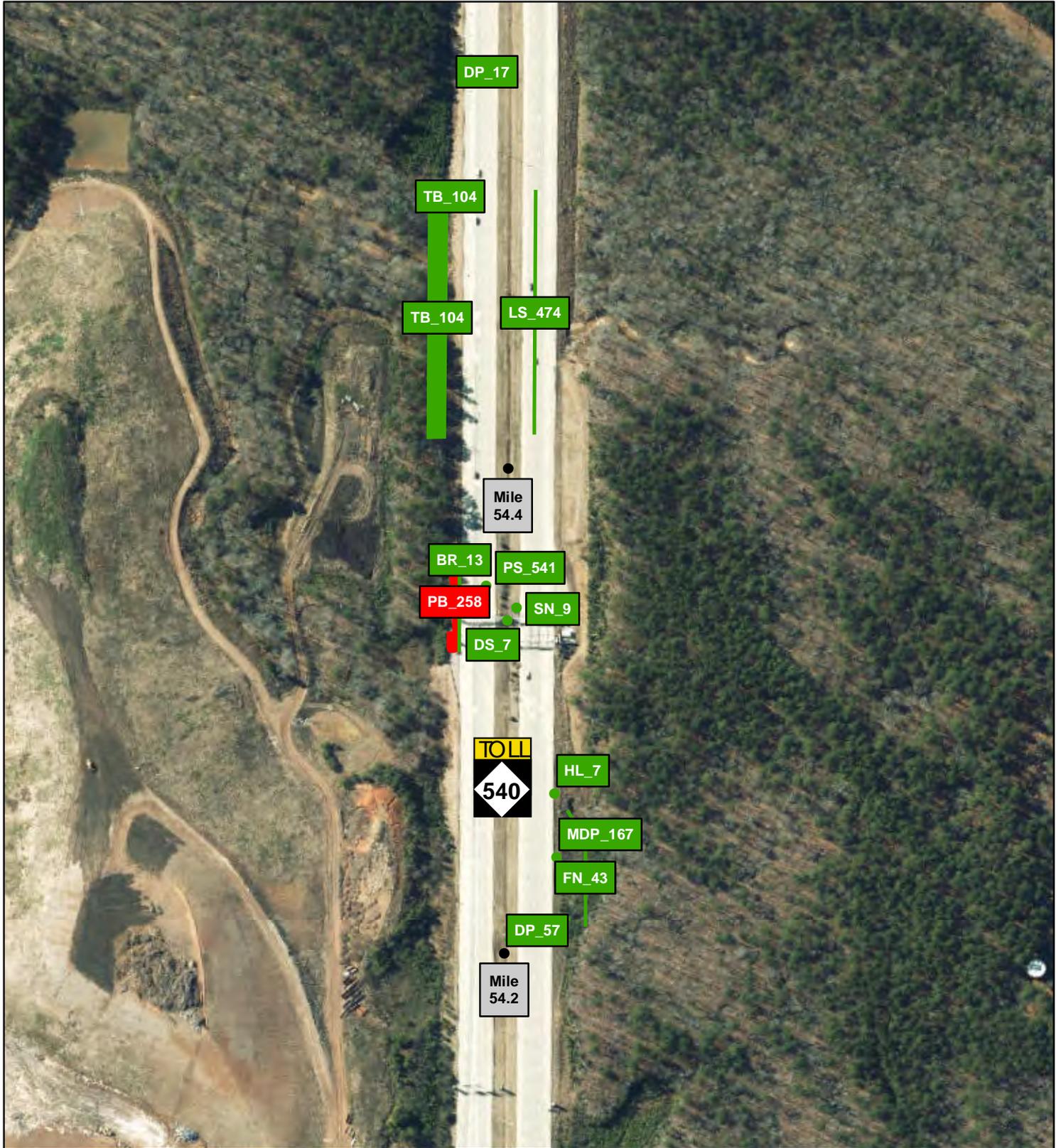






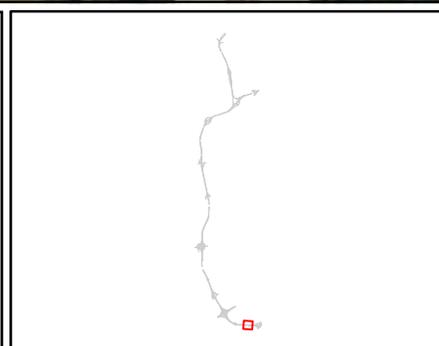
A26

Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

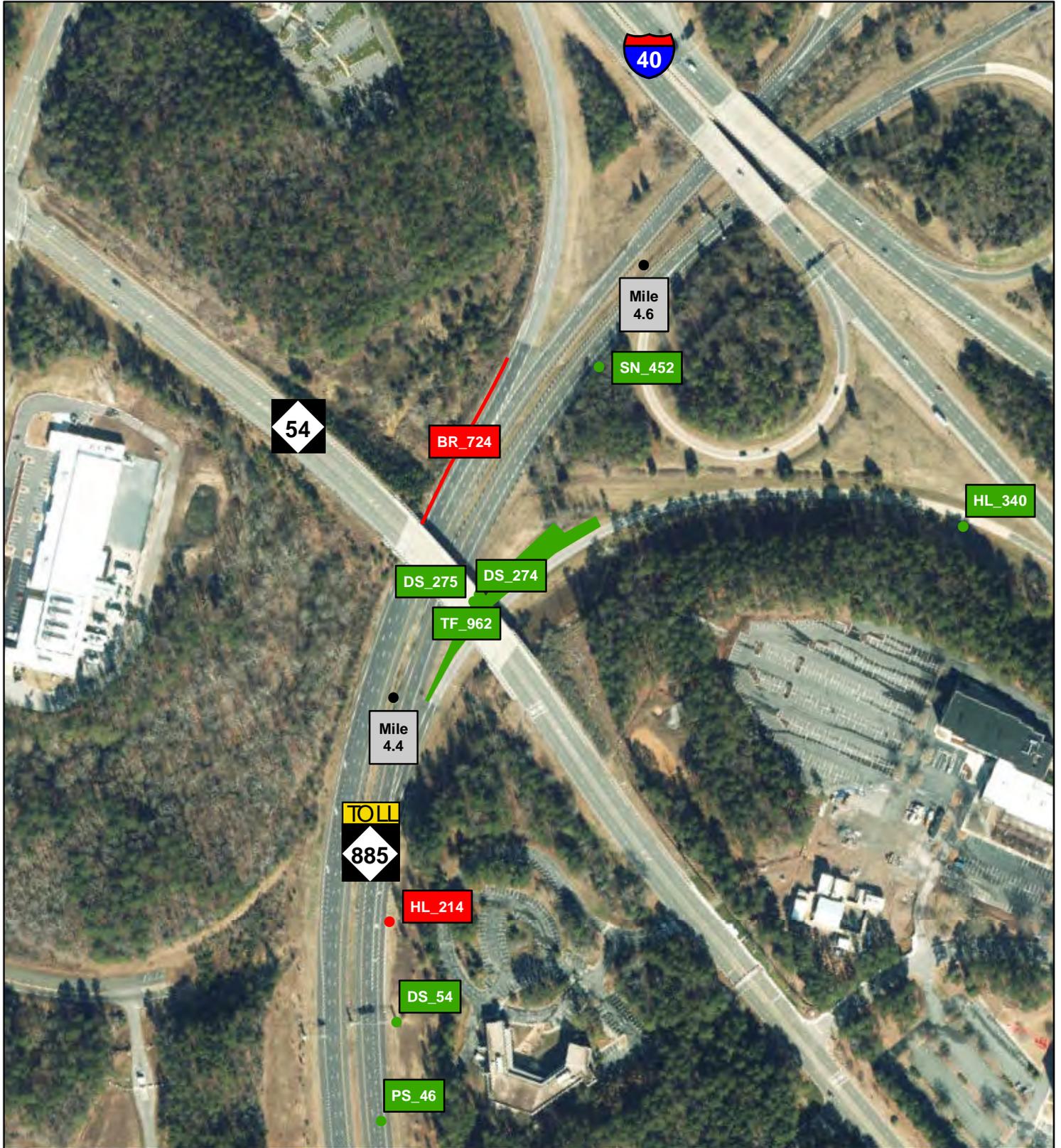
- Failing Asset
- Passing Asset



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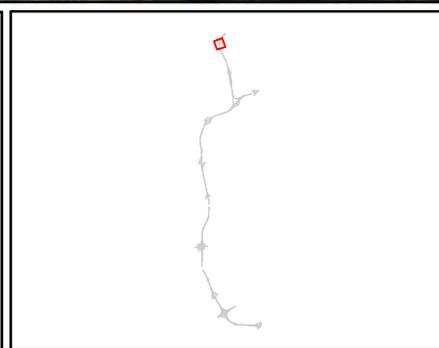
A27

Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset







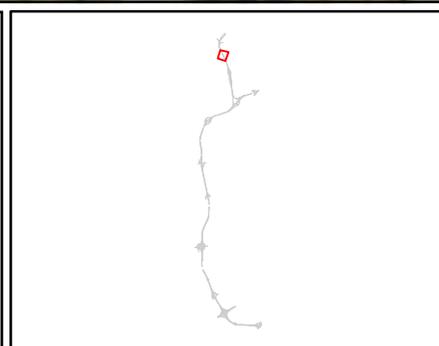
A28

Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset



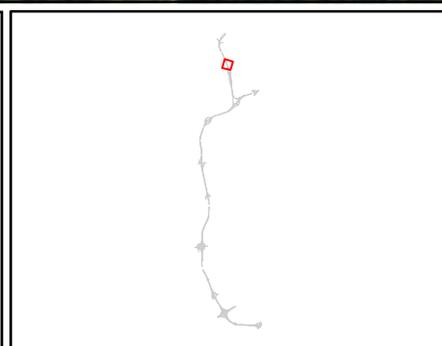

A29

Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

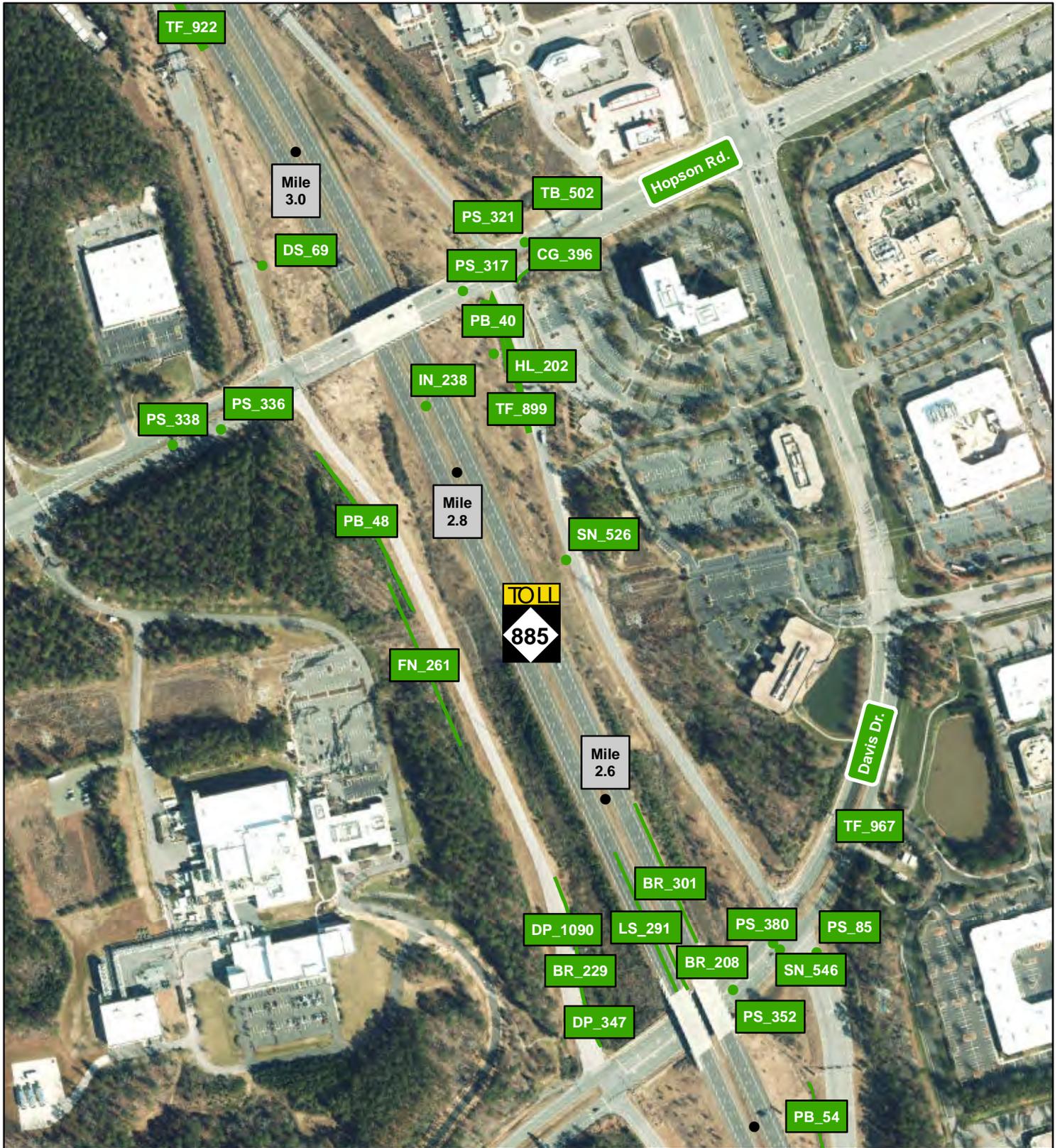
-  Failing Asset
-  Passing Asset



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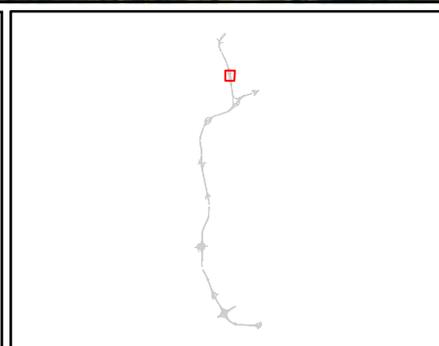
A30

Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

- Failing Asset
- Passing Asset







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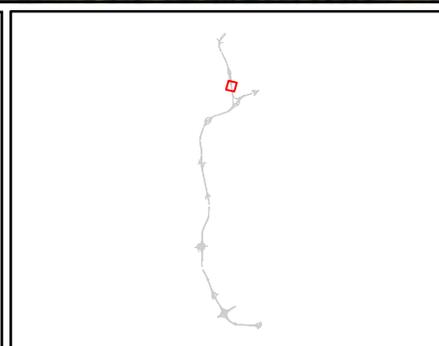
A31

Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

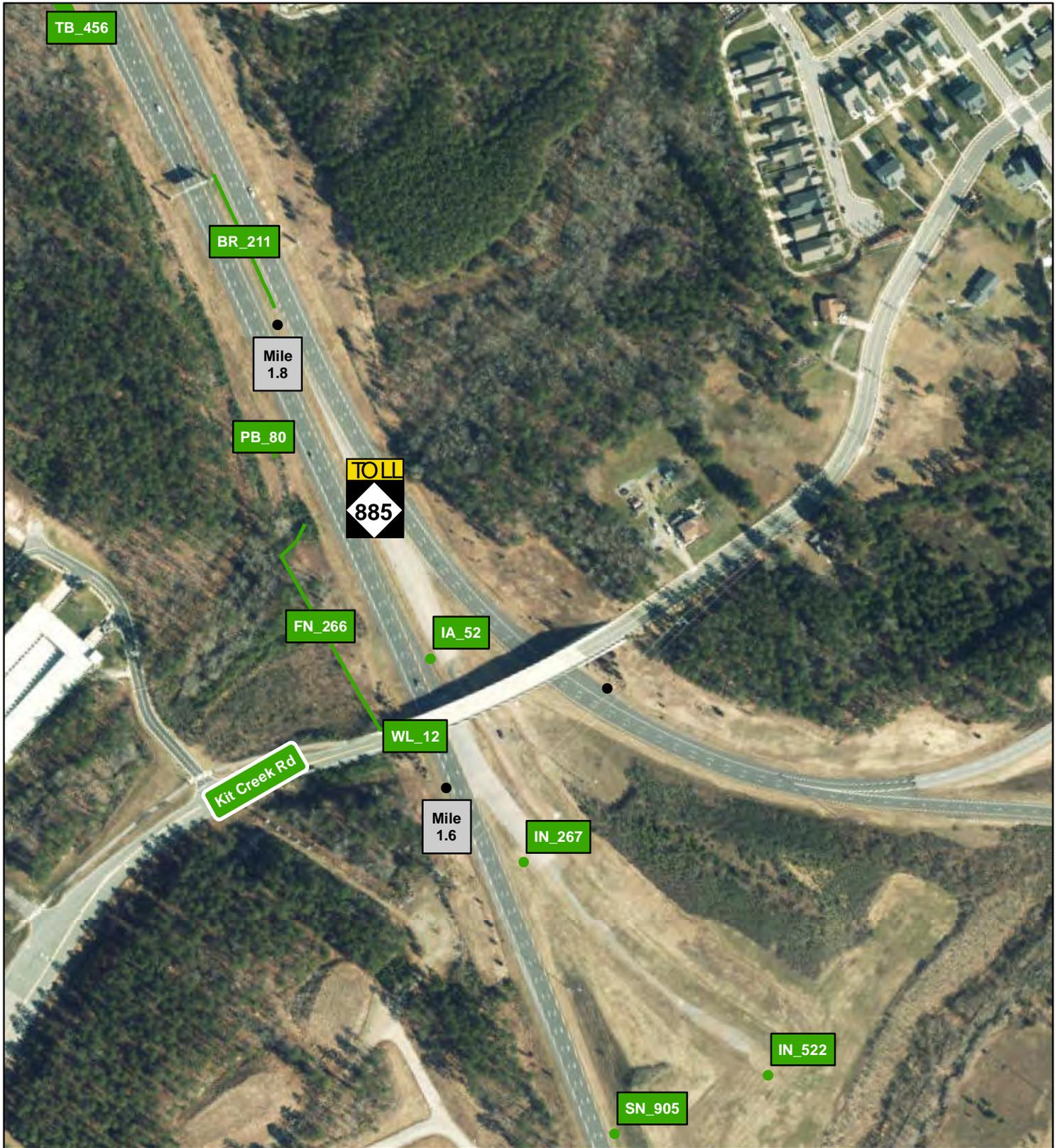
-  Failing Asset
-  Passing Asset




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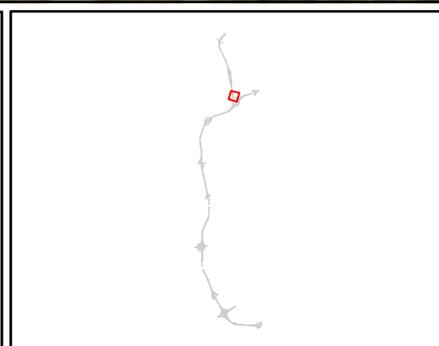
A32

Appendix A: Triangle Expressway 2023 Third Quarter Asset Assessment Locations



Legend

-  Failing Asset
-  Passing Asset




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A33

Appendix B

Triangle Expressway 2023 Third Quarter Table Results of Assets Failing MRP

Appendix B: Triangle Expressway 2023 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. 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)	13
Front/Back Slopes (LS)	14
Unpaved Lateral and Outfall Ditches (LS)	14
Litter (LS).....	15
Roadway Sweeping (LS).....	15
Pavement Striping (LS)	16
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)	24

Guardrail, Concrete Barrier, and End Anchors (BR)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Guardrail	BR_121	Missing Parts		A9
2	Guardrail	BR_724	Missing Parts		A28
3	Guardrail	BR_807	Missing Parts		A33

Curb and Gutter (CG)

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

Decorative Supports (DS)

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

Drainage Pipes (DP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Drain	DP_1201	Obstruction		A10

Misc. Drainage Structure (MDP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Shoulder Drain	MDP_12	Rodent Screen/ Obstruction		A8
2	Shoulder Drain	MDP_23	Obstruction		A10
3	Shoulder Drain	MDP_40	Rodent Screen		A11
4	Shoulder Drain	MDP_157	Obstruction		A25

Fence and Control of Access (FN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Woven	FN_193	Hole		A11
2	Woven	FN_400	Hole		A24
3	Woven	FN_462	Height		A4
4	Woven	FN_467	Hole		A6

Graffiti (GR)

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

Highway Lighting (HL)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Single Roadway	HL_214	Missing Parts		A28
2	High Mast	HL_273	Rodent Screen		A21
3	Single Roadway	HL_423	Part Damage		A11

Impact Attenuators (IA)

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

Inlets (IN)

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

Landscaping (PB)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Plant Bed	PB_155	Overgrown		A12
2	Plant Bed	PB_258	Weeds		A27

Paved Lanes – Asphalt (LS)

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

Paved Lanes – Concrete (LS)

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

Paved Shoulders (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_680	Drop off		A12

Unpaved Shoulders (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_387	Drop off		A24
2	Concrete	LS_620	Drop off		A17

Front/Back Slopes (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_618	Slope Deviation		A17

Unpaved Lateral and Outfall Ditches (LS)

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

Litter (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_442	Litter		A22

Roadway Sweeping (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_27	Material Accumulation		A6

Pavement Striping (LS)

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

Pavement Markers (LS)

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

Delineators (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_387	Missing, Nighttime Reflectivity		A24
2	Asphalt	LS_719	Missing, Nighttime Reflectivity		A6

Paved Ditches (PD)

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

Pavement Words and Symbols (PS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Stop Bar	PS_601	Daytime Assessment		A26

Signs (SN)

#	Sign Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Hospital	SN_16	Slip Base		A25
2	Mile Post	SN_231	Leaning		A8

Tree and Brush (TB)

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

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Turf	TF_82	Bare Ground		A17
2	Turf	TF_172	Bare Ground		A24
3	Turf	TF_341	Bare Ground		A23
4	Turf	TF_478	Bare Ground		A18

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Turf	TF_749	Bare Ground		A32
6	Turf	TF_1061	Bare Ground		A10

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

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Sound Wall	WL_49	Unsealed Cracks/Joints		A19
2	Bridge Wall	WL_62	Vegetation		A23
3	Bridge Wall	WL_64	Unsealed Cracks/Joints		A23
4	Sound Wall	WL_96	Unsealed Cracks/Joints		A19

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

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Sound Wall	WL_119	Unsealed Cracks/Joints		A30