NORTH CAROLINA
Turnpike Authority

Maintenance Rating Program

Triangle Expressway

2020 Fourth Quarter and Annual Report

1 S. Wilmington Street
Raleigh, NC 27601

Last Updated:
February 05, 2021

CONSULTANT CERTIFICATION OF COMPLETION

February 5, 2021

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

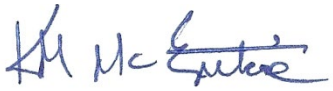
NCTA Triangle Expressway Roadway Maintenance Performance Rating Program; Q4, FY 2020 Rating

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.



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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 2020 Fourth Quarter Assessment of the Triangle Expressway.

The overall 2020 fourth quarter maintenance rating of the Triangle Expressway was 90.7, 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 2020 Fourth Quarter Assessment

Element	MRP Rating	Target Rating
Road Surface	96.2[1]	85.0
Unpaved Shoulders and Ditches	98.8	85.0
Drainage	87.6	85.0
Roadside	89.1	85.0
Traffic Control Devices	85.2[1]	85.0
Overall MRP Performance Rating	**90.7[1]**	**90.0**

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

This report also provides a summary and analysis of the 2020 Annual Assessment of the Triangle Expressway, which considers the results of all four quarterly inspections conducted in 2020 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 2020 annual maintenance rating of the Triangle Expressway was 91.5, 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 2020 Annual Assessment

Element	Q1 2020 Rating	Q2 2020 Rating	Q3 2020 Rating	Q4 2020 Rating	Annual Rating
Road Surface	94.9	93.8	96.3[1]	96.2[1]	95.2[2]
Unpaved Shoulders and Ditches	98.7	92.5	96.5	98.8	96.6
Drainage	91.9	92.5	89.2	87.6	90.3
Roadside	94.7	91.7	91.1	89.1	91.6
Traffic Control Devices	90.4	87.0	84.0[1]	85.2[1]	86.8[2]
Overall MRP Performance Rating	**93.6**	**91.0**	**90.7[1]**	**90.7[1]**	**91.5[2]**

[1]Excludes asphalt surface pavement condition as well as markers, striping, and symbols on mainline NC-147 and ramps/loops.
[2]Excludes the third and fourth quarter ratings for characteristics listed above.

In addition, the report provides findings of the Green Level Historic District signs inspection. This quarter, two of three signs were inspected. One sign has been temporarily removed due to a nearby redevelopment project. Both signs were found to be in good physical condition, and the landscaped areas around the signs were maintained in accordance with NCTA MRP standards.

2.0 INTRODUCTION

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

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

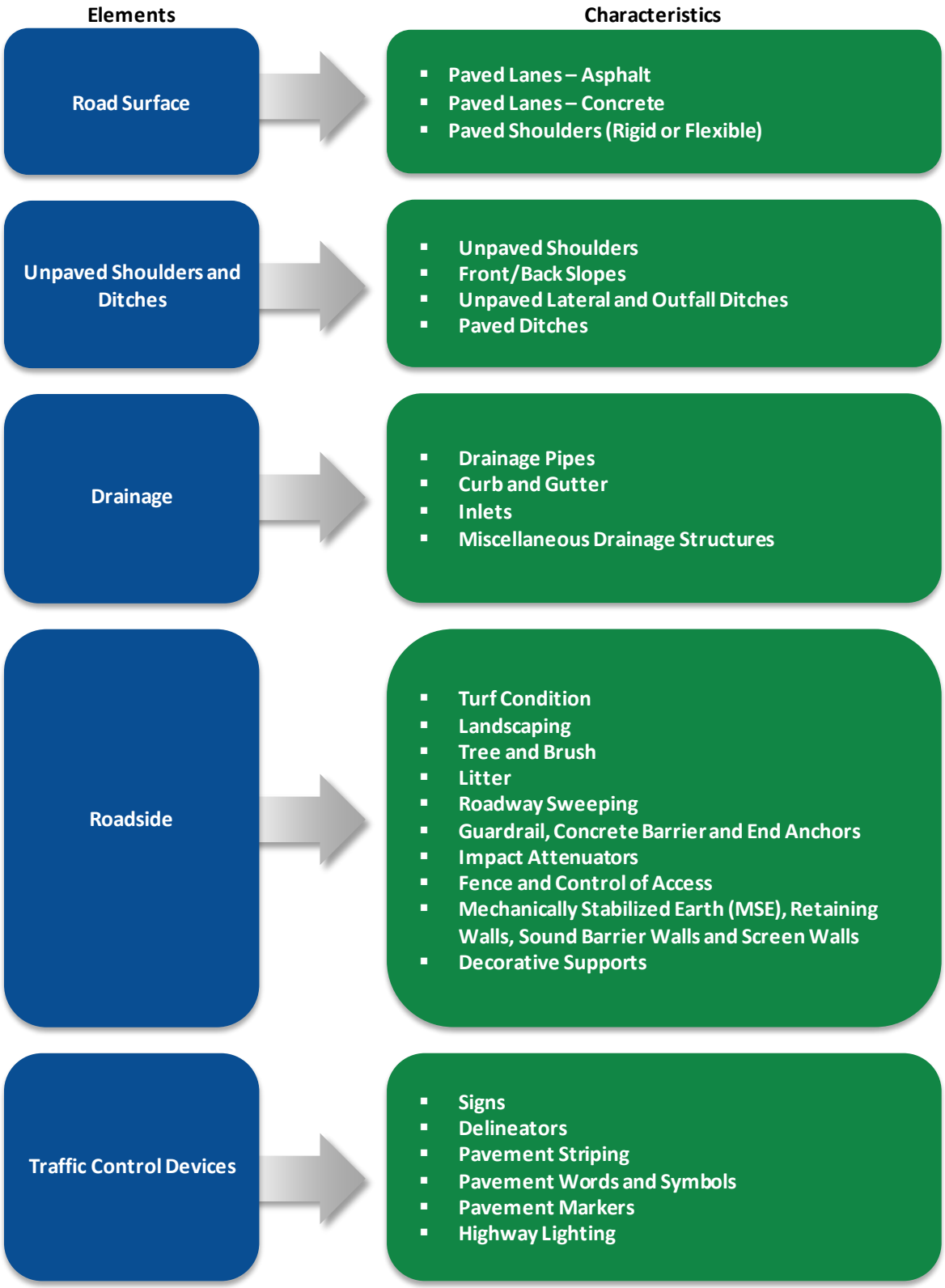
The NCTA performance standards, threshold criteria, and maintenance rating program were developed through a collaborative effort by NCTA managers, NCDOT maintenance staff, and consultants.

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

3.0 MRP PROCEDURE

Per the *NCTA Roadway and Facility Maintenance Performance Standards V6*, roadway assets or characteristics on NCTA facilities have been grouped into elements. These elements and corresponding characteristics 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:

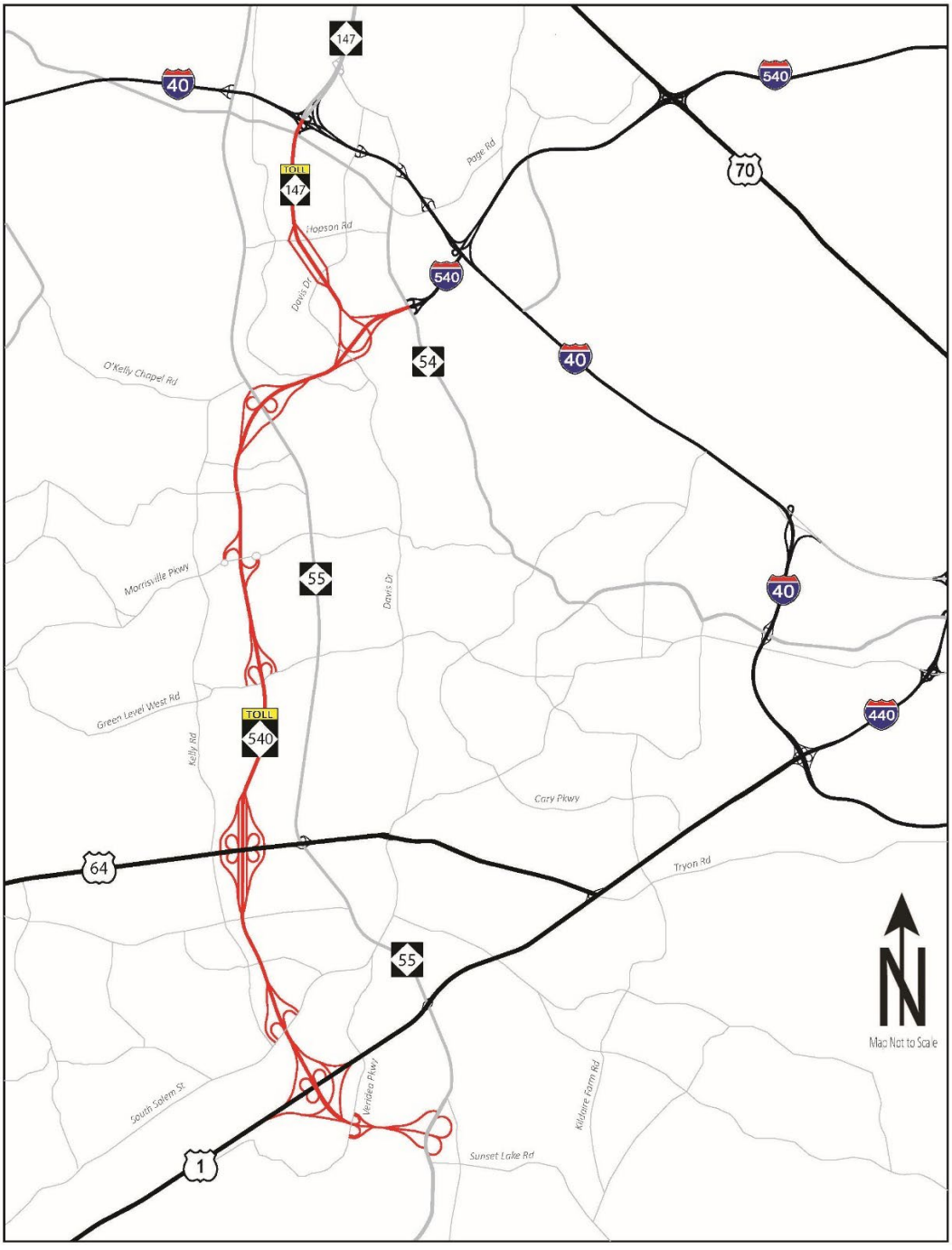
Road Surface =	**25%**
Unpaved Shoulders =	**13%**
Drainage =	**15%**
Roadside =	**17%**
Traffic Control Devices =	**30%**
Total	**100%**

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 twelve interchanges and twenty-two all-electronic toll collection zones.

Figure 2: Triangle Expressway Map



5.0 TRIANGLE EXPRESSWAY ASSET INVENTORY UPDATE

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

During this quarter assets on Toll NC 540 near McCrimmon Parkway were removed from the inventory due to the Morrisville Parkway Interchange toll zone construction project. Also, during this quarter assets on Toll NC 540 exit ramps to and from NC-55 Bypass were removed from the inventory due to the Complete 540 construction project. ***Table 3*** presents the updated number of assets that are currently available for inspections.

Table 3: Asset Inventory

Assets	Total Inventory	2020 Eligible Inventory
Barriers	801	743
Curb and Gutter	428	393
Decorative Supports	297	279
Drainage	1180	1105
Misc. Drainage	221	221
Fences	508	472
Highway Lighting	435	398
Impact Attenuators	47	45
Inlets	1126	1080
Linear Segments	795	767
Plant Beds	266	262
Paved Ditches	2	2
Pavement Symbols	638	602
Signs	1215	1096
Tree and Brush	603	539
Turf	1074	1039
Walls	88	85

6.0 MRP FOURTH QUARTER ASSESSMENT

6.1 Quarterly Results

The overall 2020 fourth quarter maintenance rating of the Triangle Expressway was 90.7, exceeding NCTA's target overall rating of 90. All elements assessed achieved ratings above the target rating of 85 established for element groups. Turf Condition (62), Pavement Striping/Markings (65), and Highway Lighting (78) are characteristics that scored below the target rating of 80.

During this year, NCTA let a resurfacing project to improve asphalt pavement condition as well as the condition of pavement striping, characters, symbols, and markers on mainline NC-147 and asphalt surface ramps/loops throughout Triangle Expressway. Due to this ongoing project, the Paved Lanes Asphalt, Paved Shoulder, Pavement Striping, Pavement Characters and Symbols, and Pavement Markers characteristics were only inspected on pavement surfaces not included in the resurfacing project contract. Once this project is completed next year, the characteristics rating for the entire facility will resume and will be included in the Road Surface element rating, Traffic Control Devices element rating and overall scoring.

It is important to note that these results are only representative of the 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 2020

Element	Q4 2020 MRP Rating
Road Surface	96.2[1]
Unpaved Shoulders and Ditches	98.8
Drainage	87.6
Roadside	89.1
Traffic Control Devices	85.2[1]
Overall MRP Performance Rating	**90.7[1]**

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

Table 5: MRP Characteristic Results for Q4 2020						
Road Surface	**Sample Passed**	**Sample Total**	**Weighted Values**	**Actual Pts**	**Available Pts**	**Q4 Rating**
Paved Lanes Asphalt	2	2	9	18	18	100[1]
Paved Lanes Concrete	23	24	9	207	216	96
Paved Shoulder	25	26	5	125	130	96[1]
Element Total				**350**	**364**	**96.2[1]**
Unpaved Shoulders and Ditches	**Sample Passed**	**Sample Total**	**Weighted Values**	**Actual Pts**	**Available Pts**	**Q4 Rating**
Unpaved Shoulder	33	34	9	297	306	97
Front/Back Slopes	34	34	6	204	204	100
Lateral and Outfall Ditches, Unpaved	34	34	6	204	204	100
Ditches, Paved	2	2	5	10	10	100
Element Total				**715**	**724**	**98.8**
Drainage	**Sample Passed**	**Sample Total**	**Weighted Values**	**Actual Pts**	**Available Pts**	**Q4 Rating**
Drainage Pipes	28	32	7	196	224	88
Curb and Gutter	27	29	6	162	174	93
Inlets	31	36	7	217	252	86
Misc. Drainage Structure	24	29	4	96	116	83
Element Total				**671**	**766**	**87.6**
Roadside	**Sample Passed**	**Sample Total**	**Weighted Values**	**Actual Pts**	**Available Pts**	**Q4 Rating**
Turf Condition	32	52	7	224	364	62
Landscaping	23	25	4	92	100	92
Trees and Brush	29	30	4	116	120	97
Litter	33	34	4	132	136	97
Roadway Sweeping	34	34	5	170	170	100
Guardrail, Concrete Barrier, and End Anchors	31	32	9	279	288	97
Impact Attenuators	9	9	9	81	81	100
Fence, Control Access	35	39	7	245	273	90
Retaining Walls and Sound Barrier Walls	14	15	5	70	75	93
Decorative Supports	30	30	5	150	150	100
Graffiti and Stain Removal	41	44	4	164	176	93
Element Total				**1723**	**1933**	**89.1**
Traffic Control Devices	**Sample Passed**	**Sample Total**	**Weighted Values**	**Actual Pts**	**Available Pts**	**Q4 Rating**
Signs	33	35	7	231	245	94
Delineators	30	34	3	90	102	88
Pavement Striping/Marking	17	26	8	136	208	65[1]
Words and Symbols	27	31	7	189	217	87[1]
Pavement Markers	25	26	9	225	234	96[1]
Highway Lighting	25	32	6	150	192	78
Element Total				**1021**	**1198**	**85.2[1]**

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

Additionally, ***Appendix A*** includes maps that present the location of all assets assessed during the 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 (98.8) and Road Surface (96.2) achieved scores higher than 95 this quarter. Drainage (87.6), Roadside (89.1), and Traffic Control Devices (85.2) experienced a decrease in rolling rating and scored a quarter rating below 90. All elements, with the exception of Traffic Control Devices (85.2), continued to obtain a rolling rating greater than 90.

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

Characteristics

This quarter, all but three characteristic, Turf Condition (62), Pavement Striping/Markings (65), and Highway Lighting (78), 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***.

Turf Condition (62 rating – 32 of the 52 assets did not pass): All the turf sections that did not pass inspection were due to bare ground. Two of the sections that did not pass inspection are presented in ***Figure 3***.

Figure 3: Turf Condition 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. Some areas will require scarifying of the soil as these areas are heavily compacted and inundated with aggregate.

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:
    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.

Pavement Striping (65 rating – 17 of the 26 assets passed): There were 9 pavement striping/marking segments that did not pass inspection, these segments were identified as missing sections, not meeting the required line width, or not reflecting during the nighttime inspection. Two of the pavement striping and marking segments that did not pass inspection are presented in ***Figure 4***.

Figure 4: Pavement Striping Inspection Results Sample

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

Maintenance Program:

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

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

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

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

Highway Lighting (78 rating – 25 of the 32 assets failed). Out of the 7 highway lights that did not pass inspection, 6 had damaged or open electrical access and 1 had a missing rodent screen. Two of these highway lights are presented in ***Figure 5***.

Figure 5: Highway Lighting Inspection Results Sample

To increase future highway lighting ratings, it is recommended that all damaged highway lights noted during the inspection be repaired and/or replaced in accordance with the *NCTA Roadway and Facility Maintenance Standards V6*, referenced below. Additional care should be taken to ensure all access panels are properly secured to prevent rodent and other animal intrusion.

Highway Lighting Maintenance Program Standards:

1) Replace any light poles damaged by traffic within 5 days or within 14 days if any foundations need pouring.

Highway Lighting Maintenance and Evaluation Standards:
Highway and Sign Lighting do not meet the maintenance standards when any of the following criteria is observed:

1) Any electrical inspection plate, access panel cover, exposed electrical wire, or pull box cover are not properly secured in place.
2) More than 10% of the poles are damaged or missing.
3) Rodent screen protection is not in place.

7.0 MRP ANNUAL 2020 ASSESSMENT

7.1 Annual Results

The 2020 annual maintenance rating of the Triangle Expressway was 91.5, 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 2020 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 2020

Element	Q1 2020 Rating	Q2 2020 Rating	Q3 2020 Rating	Q4 2020 Rating	Annual Rating
Road Surface	94.9	93.8	96.3[1]	96.2[1]	95.2[2]
Unpaved Shoulders and Ditches	98.7	92.5	96.5	98.8	96.6
Drainage	91.9	92.5	89.2	87.6	90.3
Roadside	94.7	91.7	91.1	89.1	91.6
Traffic Control Devices	90.4	87.0	84.0[1]	85.2[1]	86.8[2]
Overall MRP Performance Rating	**93.6**	**91.0**	**90.7[1]**	**90.7[1]**	**91.5[2]**

[1]Excludes asphalt surface pavement condition as well as markers, striping, and symbols on mainline NC-147 and ramps/loops.
[2]Excludes the third and fourth quarter ratings for characteristics listed above.

Table 7: MRP Rolling Element Results					
Road Surface	**Q1 2020 RATING**	**Q2 2020 RATING**	**Q3 2020 RATING**	**Q4 2020 RATING**	**ROLLING RATING**
Paved Lanes Asphalt	83	91	100[1]	100[1]	91[2]
Paved Lanes Concrete	100	95	94	96	96
Paved Shoulder	97	94	96[1]	96[1]	96[2]
Element Total	**94.9**	**93.8**	**96.3[1]**	**96.2[1]**	**95.2[2]**
Unpaved Shoulders and Ditches	**Q1 2020 RATING**	**Q2 2020 RATING**	**Q3 2020 RATING**	**Q4 2020 RATING**	**ROLLING RATING**
Unpaved Shoulder	97	84	94	97	93
Front/Back Slopes	100	100	100	100	100
Lateral and Outfall Ditches, Unpaved	100	97	97	100	98
Ditches, Paved	100	100	100	100	100
Element Total	**98.7**	**92.5**	**96.5**	**98.8**	**96.6**
Drainage	**Q1 2020 RATING**	**Q2 2020 RATING**	**Q3 2020 RATING**	**Q4 2020 RATING**	**ROLLING RATING**
Drainage Pipes	91	91	91	88	90
Curb and Gutter	100	100	100	93	98
Inlets	91	94	82	86	88
Misc. Drainage Structure	83	82	83	83	83
Element Total	**91.9**	**92.5**	**89.2**	**87.6**	**90.3**
Roadside	**Q1 2020 RATING**	**Q2 2020 RATING**	**Q3 2020 RATING**	**Q4 2020 RATING**	**ROLLING RATING**
Turf Condition	88	80	82	62	78
Landscaping	100	100	88	92	95
Trees and Brush	100	97	97	97	98
Litter	84	91	91	97	91
Roadway Sweeping	100	100	100	100	100
Guardrail, Concrete Barrier and End Anchors	97	91	100	97	96
Impact Attenuators	100	100	100	100	100
Fence, Control Access	90	90	88	90	89
Retaining Walls and Sound Barrier Walls	93	73	80	93	85
Decorative Supports	100	100	100	100	100
Graffiti and Stain Removal	100	100	82	93	94
Element Total	**94.7**	**91.7**	**91.1**	**89.1**	**91.6**
Traffic Control Devices	**Q1 2020 RATING**	**Q2 2020 RATING**	**Q3 2020 RATING**	**Q4 2020 RATING**	**ROLLING RATING**
Signs	94	97	86	94	93
Delineators	100	84	94	88	92
Pavement Striping/Marking	88	88	74[1]	65[1]	79[2]
Words and Symbols	90	90	79[1]	87[1]	87[2]
Pavement Markers	94	81	89[1]	96[1]	90[2]
Highway Lighting	81	81	88	78	82
Element Total	**90.4**	**87.0**	**84.0[1]**	**85.2[1]**	**86.8[2]**

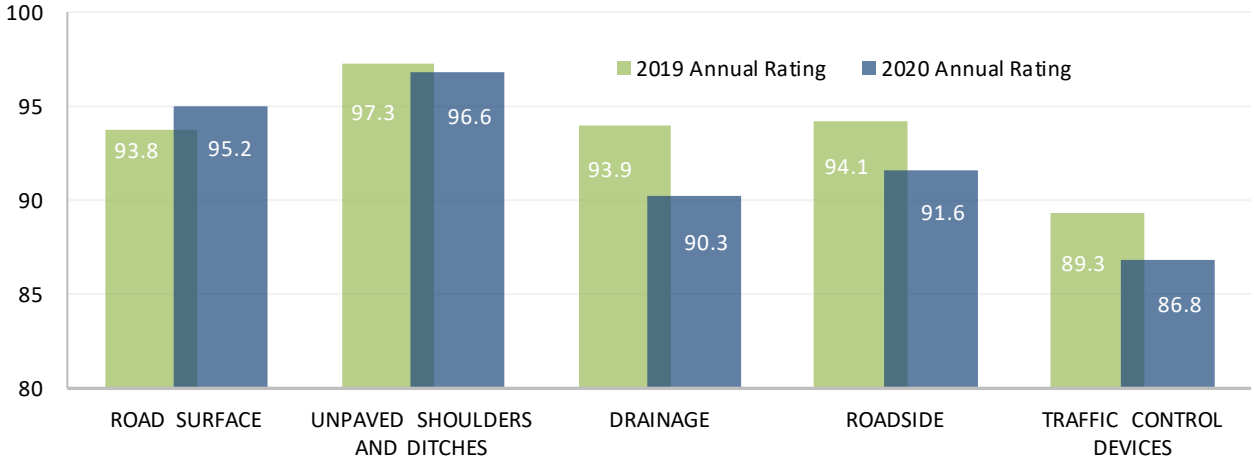
[1]Excludes asphalt surface pavement condition as well as markers, striping, and symbols on mainline NC-147 and ramps/loops.

[2]Excludes the third and fourth quarter ratings for characteristics listed above.

7.2 Annual Analysis and Recommendations

Based on the combined results of all four quarterly inspections conducted in 2020, all elements exceeded NCTA's threshold criteria of 85. In addition, all characteristics, apart from Turf Condition (78) and Pavement Striping/Marking (79), exceeded the target threshold criteria of 80. See ***Figure 6*** shows the comparison in annual ratings from 2019 to 2020.

Figure 6: Annual Rating Comparison Chart



Road Surface (95.2) was the element with the most significant increase from the 2019 annual rating with a difference of 1.4 points. Unpaved Shoulders and Ditches (96.6) continued to receive a rating greater than 95. Drainage (90.3) was the element with the most significant decrease in rating from the 2019 annual rating with a difference of 3.6 points. Both Drainage Pipes (90) and Inlets (88) decreased by more than 8 points from the 2019 annual rating though did not receive any quarter ratings below 80. Curb and Gutters (98) and Miscellaneous Drainage Structures (83) both increased in rating.

Roadside (91.6) decreased in rating from the 2019 annual rating by 2.5 points. Both Turf Condition (78) and Retaining Walls and Sound Barrier Walls (85) received one quarter rating below 80. Decorative Supports (100) experienced the most significant increase in rating from 2019 annual rating, increasing by 13.0 points. This increase is attributed to the resurfacing contract let in early 2020 and the removal of the paint scaling criteria from the maintenance inspection program.

Traffic Control Devices (86.8) decreased in rating by 2.5 points from the 2019 annual rating. While both the characteristic rating for Pavement Striping/Markings (79) and Highway Lighting (82) decreased by 8.8 and 6.5 points, respectively, Pavement Markers (90) increased in rating by 3.8 points from the 2019 annual rating. Pavement Striping/Marking (88) received a rating less than 80 in two 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 7*** shows the two signs assessed and the area of the third sign.

Figure 7: Green Level West Historic District Signs, Landscape Areas

9.0 CONCLUSION

This report presents the 2020 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 2020 overall rating was **90.7** and the annual rating was **91.5**, both ratings exceeded the target rating of 90.

All element ratings were above the target ratings for the quarter and annual assessment. Road Surface (95.2) was the only element to experience an increase in rating compared to the previous annual rating. Unpaved Shoulders and Ditches (96.6) rating decreased by 0.7 points, Drainage (90.3) rating decreased by 3.6 points, Roadside (91.6) rating decreased by 2.5 points, and Traffic Control Devices (86.8) rating decreased by 2.5 points.

During the fourth quarter assessment, all but three characteristics met or exceeded the target rating of 80. These characteristics were Turf Condition (62), Pavement Striping (65), and Highway Lighting (78). All but two characteristics in the annual assessment met or exceeded the rolling target rating of 80. These characteristics were Turf Condition (78) and Pavement Striping (79). Repaving of asphalt lanes began in 2020 and is scheduled to continue into 2021, 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 perform routine patrols of highway lighting for open electrical panels. 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 2020 Fourth Quarter Asset Assessment Locations

Appendix A: Triangle Expressway 2020 Fourth 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 Attenutators – IA
- Inlets – IN
- Landscaping – PB
- Linear Samples – LS
    - Paved Lanes – Asphalt
    - Paved Lanes – Concrete
    - Paved Shoulders
    - Unpaved Shoulders
    - Front/Back Slopes
    - Unpaved Lateral and Outfall Ditches
    - Litter
    - Roadway Sweeping
    - Pavement Striping/Markings
    - Pavement Markers
    - Delineators
- Paved Ditches – PD
- Pavement Words and Symbols – PS
- Signs – SN
- Tree and Brush – TB
- Turf Condition – TF
- MSE/Retaining Walls, Sound Barrier Walls, and Screen Walls – WL

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations

Legend

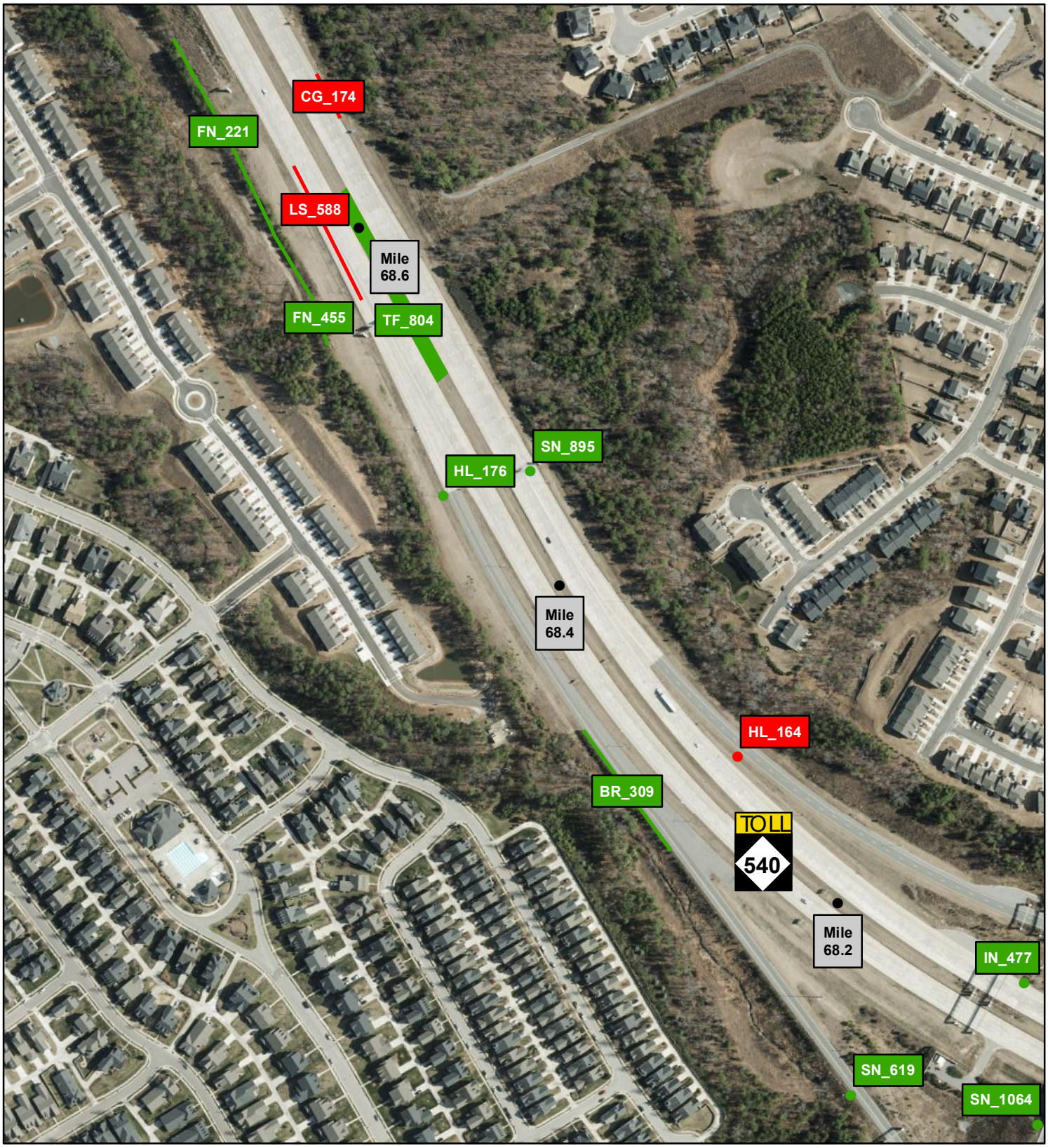
Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

A1

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



Legend

Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations

Legend

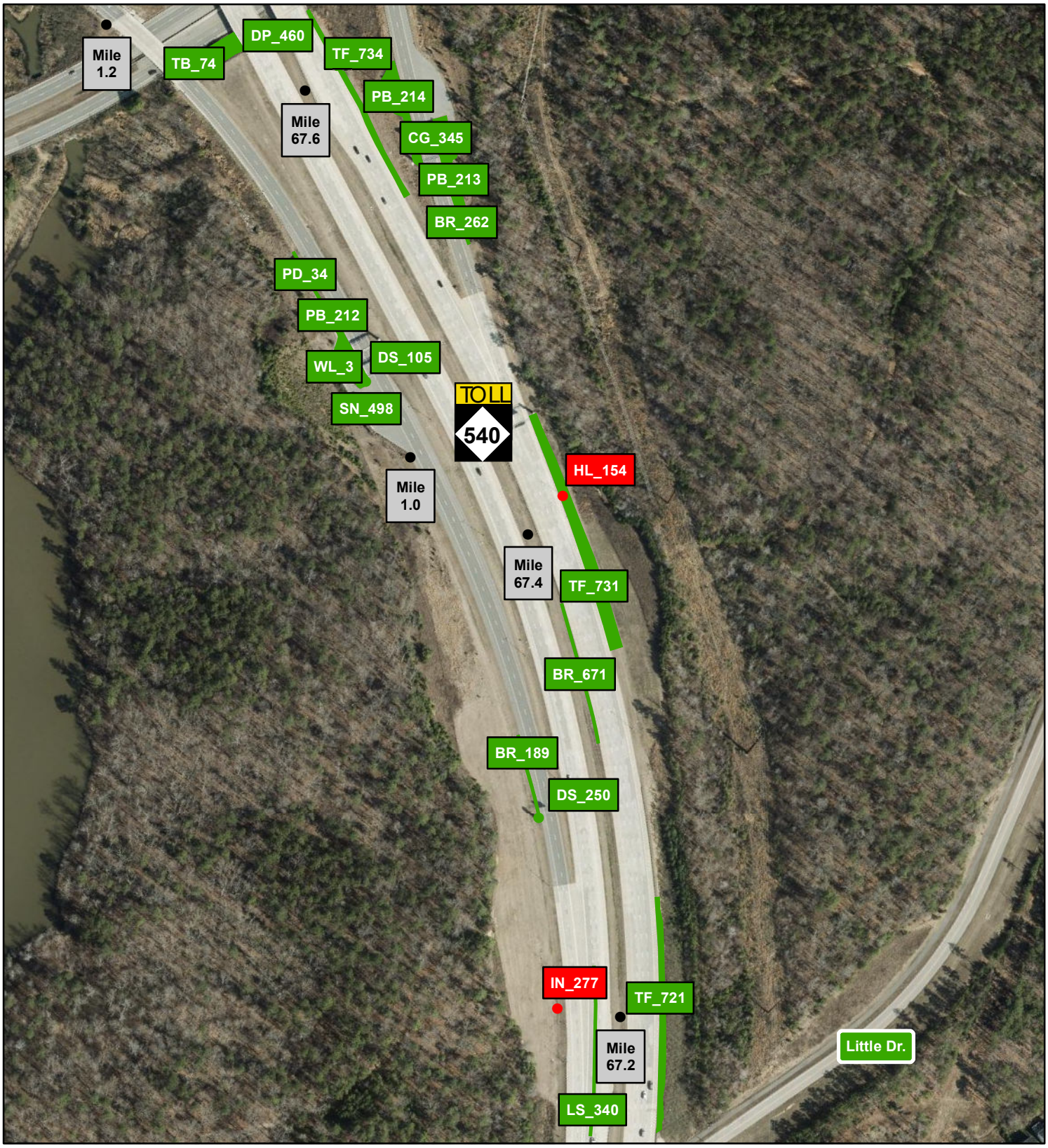
Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

A3

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



Legend

Failing Asset

Passing Asset

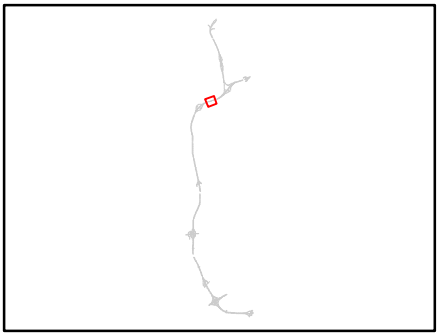
NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations

Legend

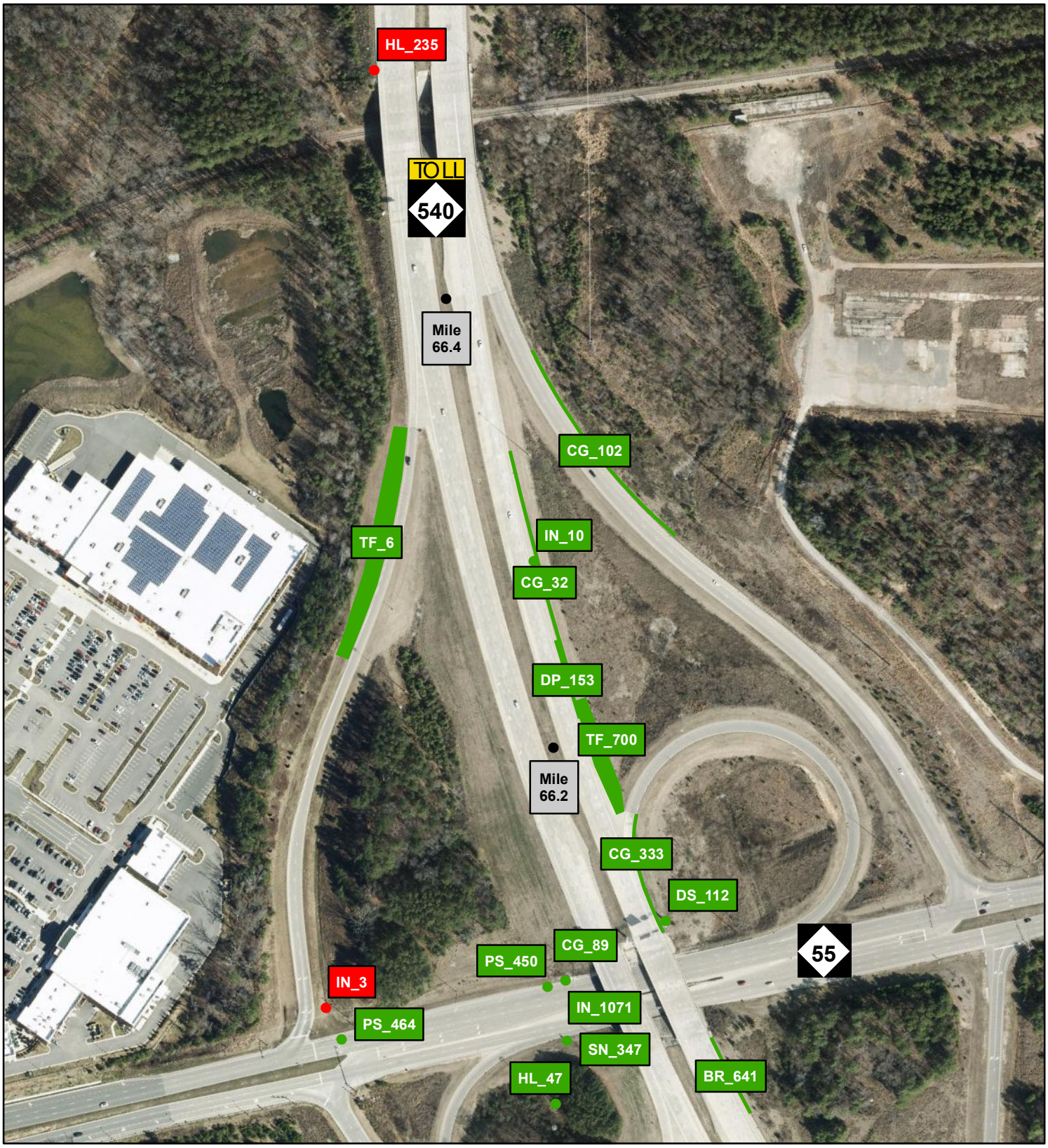
Failing Asset

Passing Asset



NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



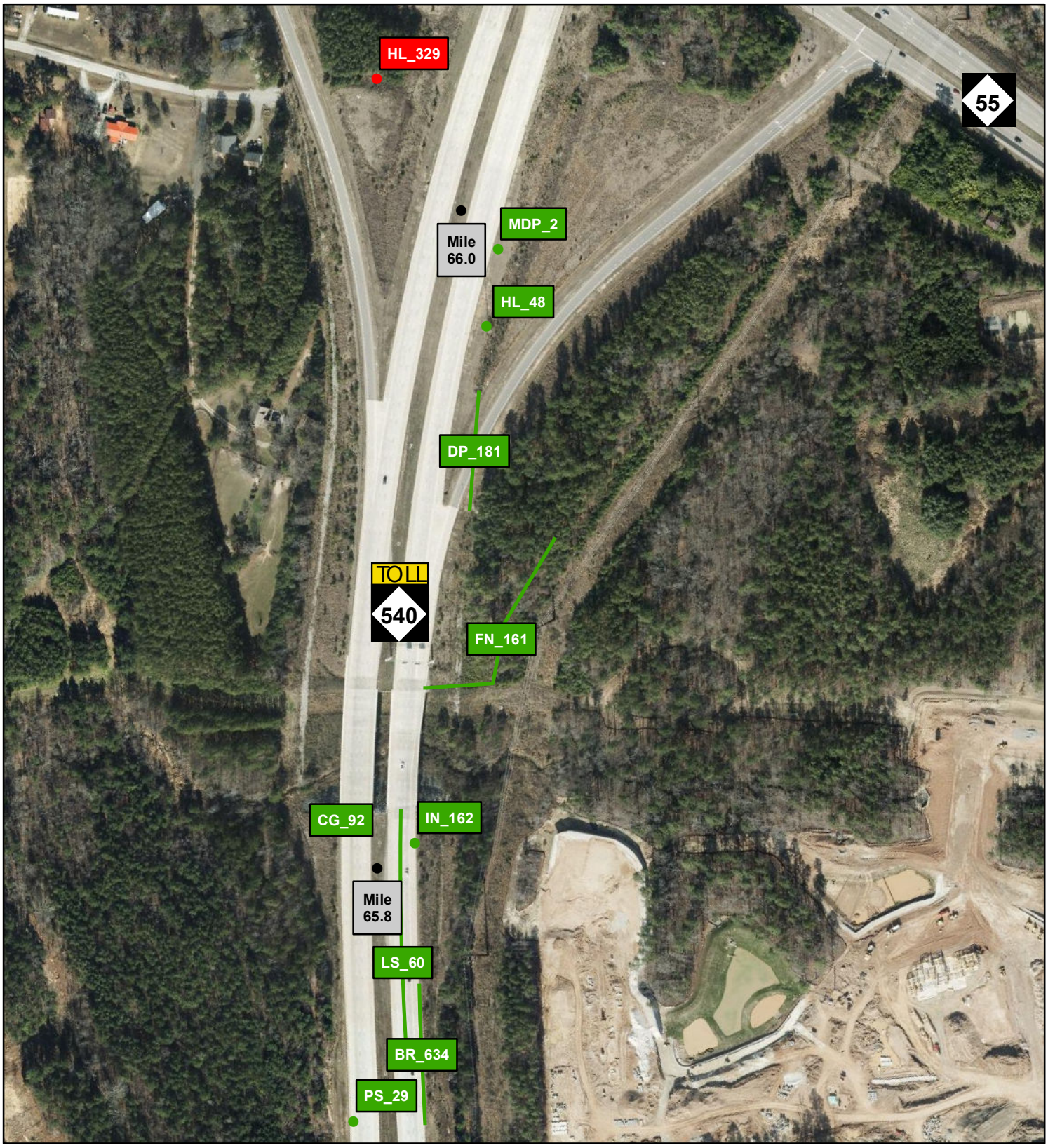
Legend

Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



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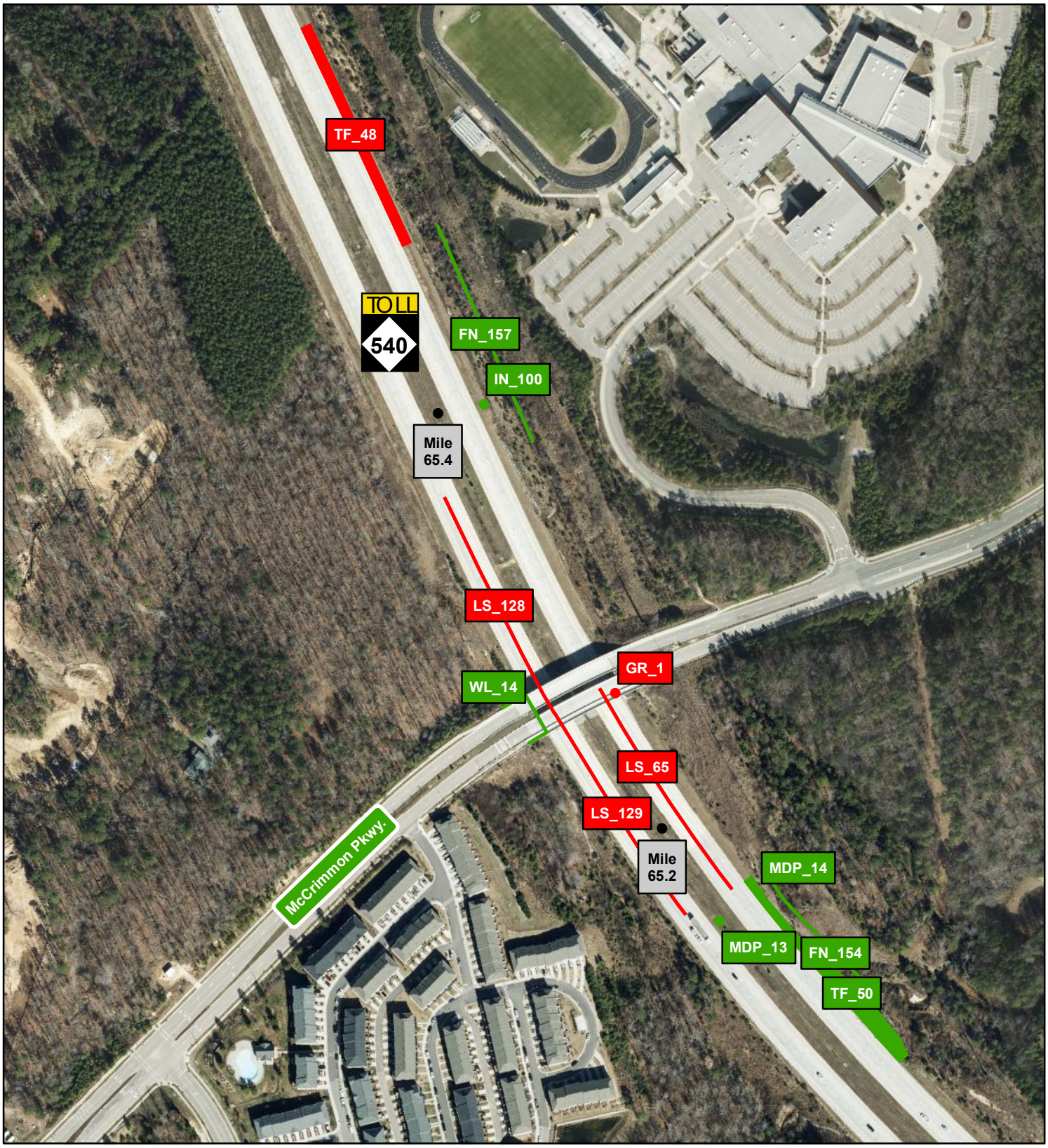
Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



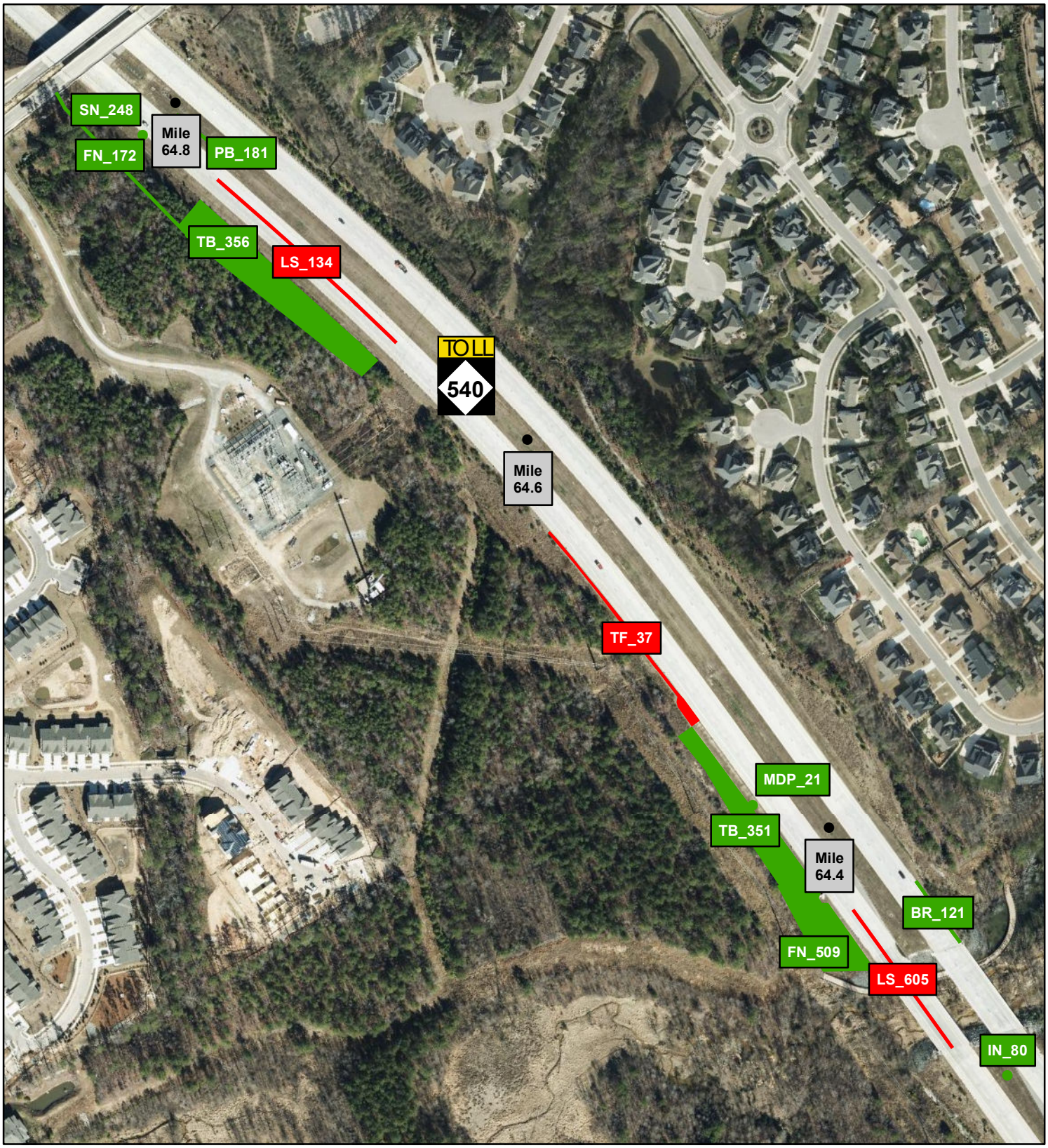
Legend

Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



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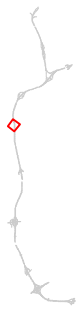
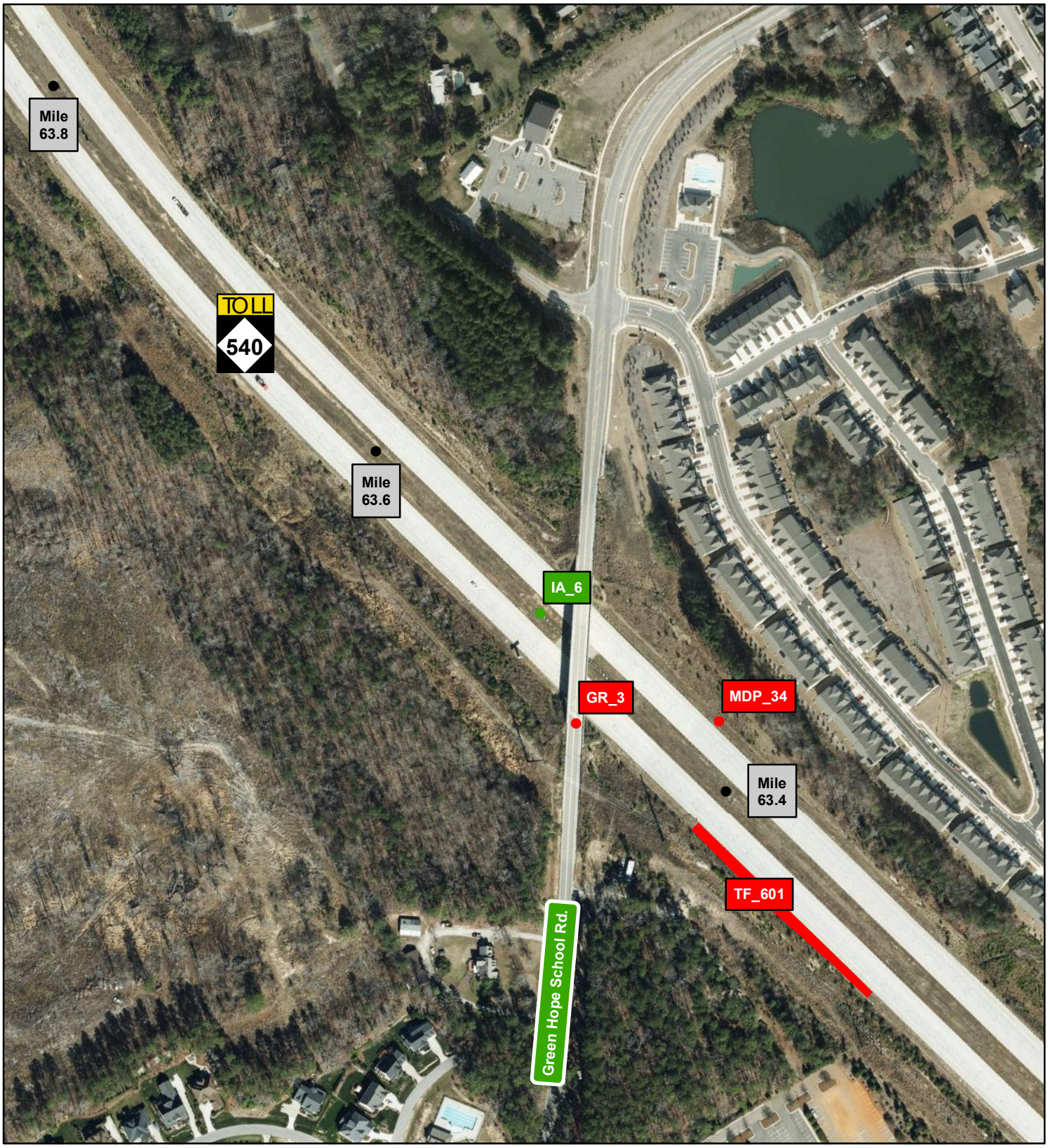
Passing Asset



NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



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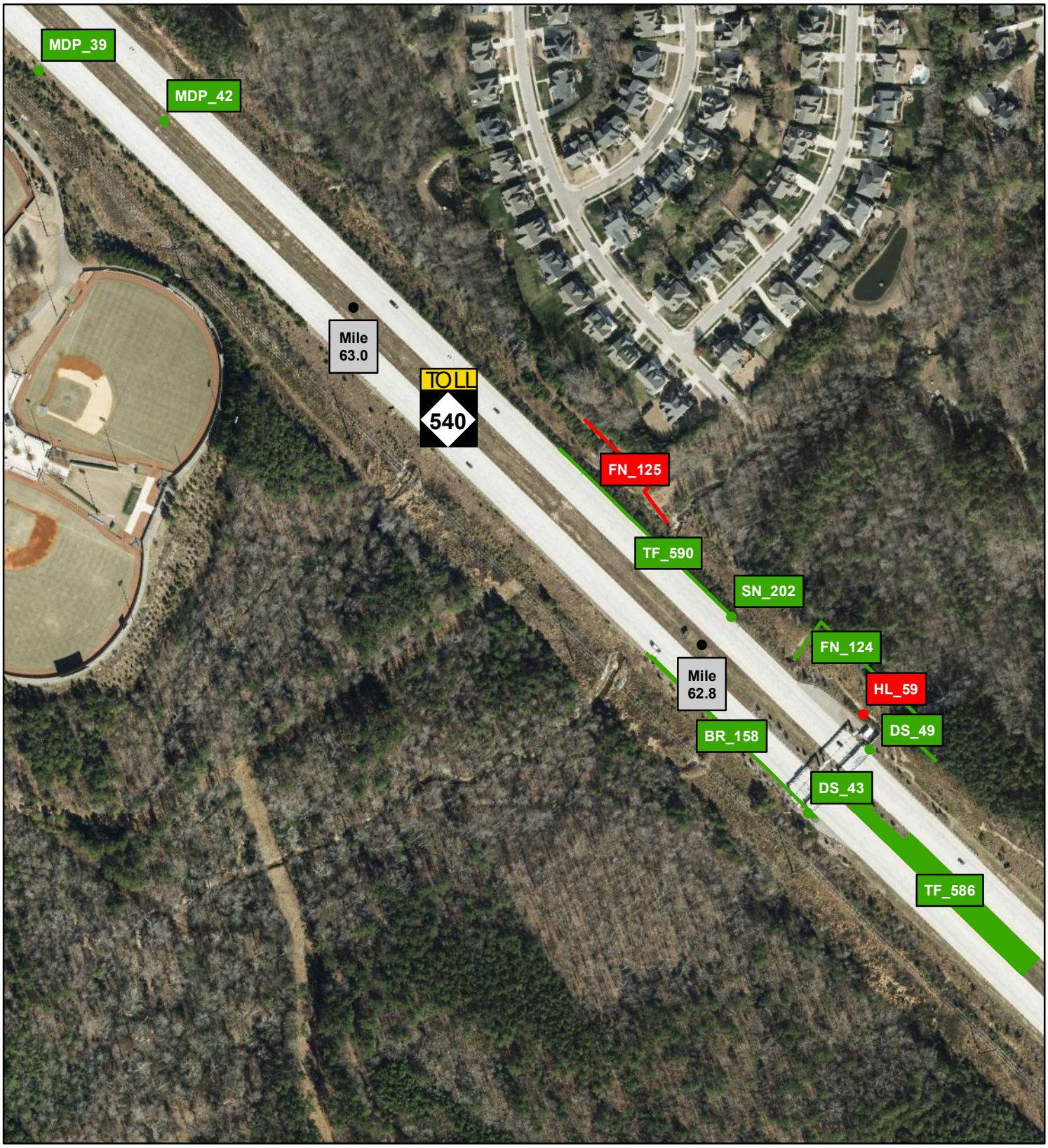
Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



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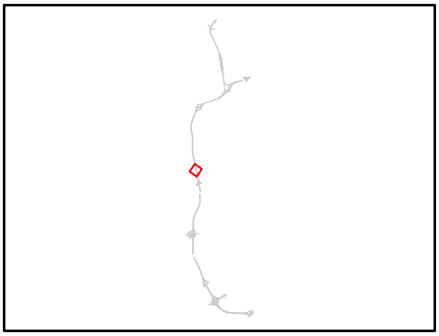


NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations

Legend

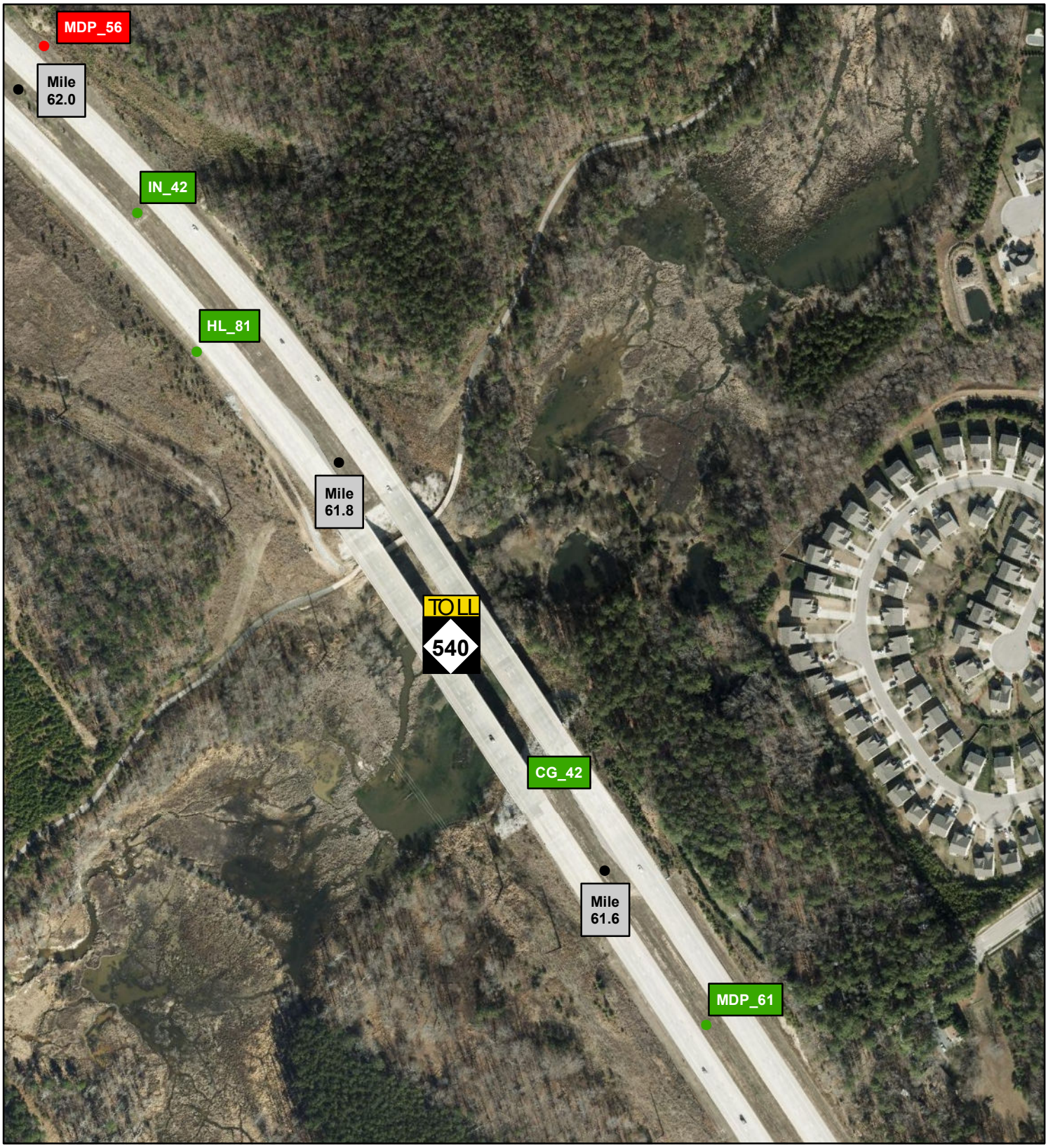
Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

A12

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



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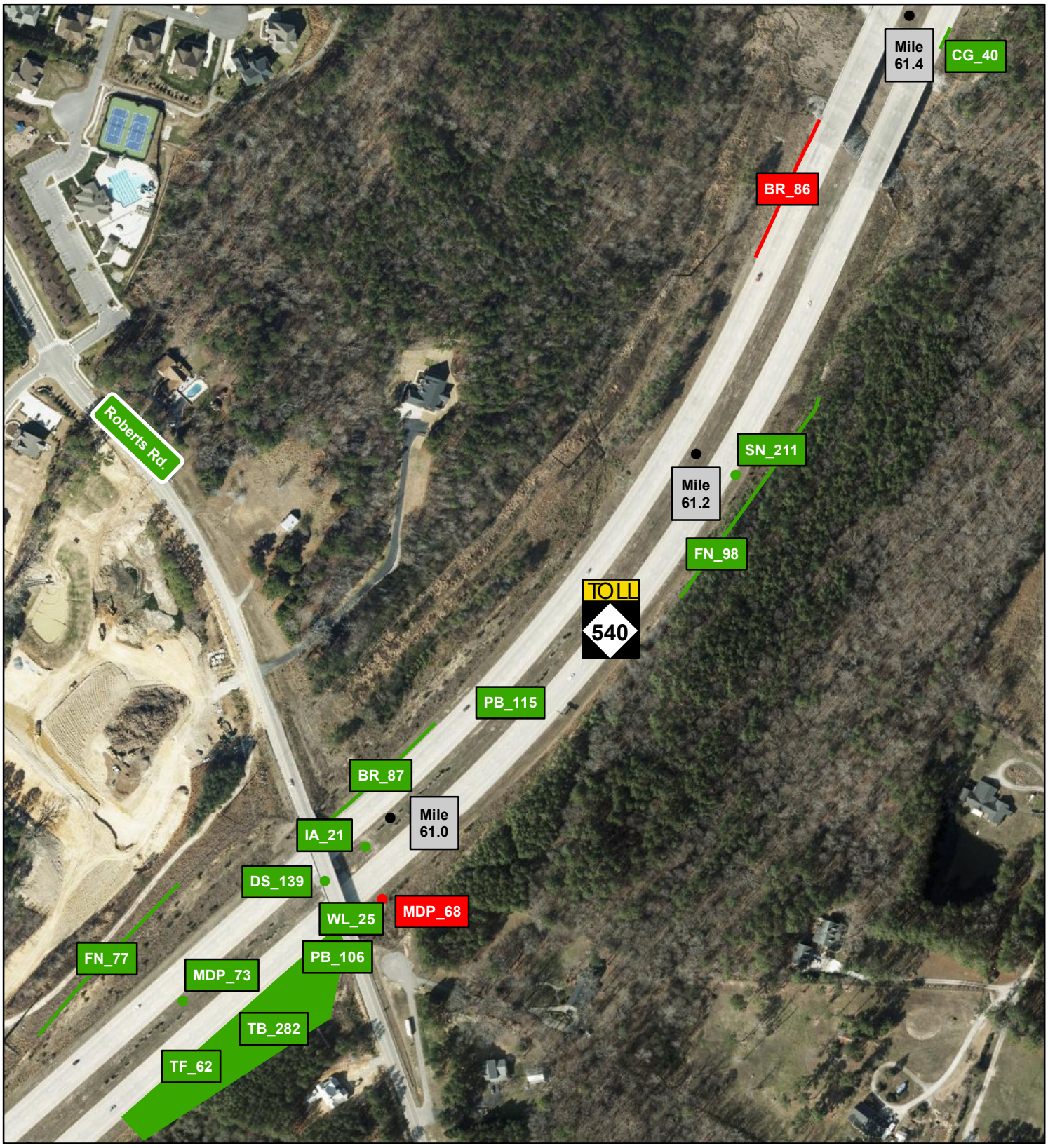
Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



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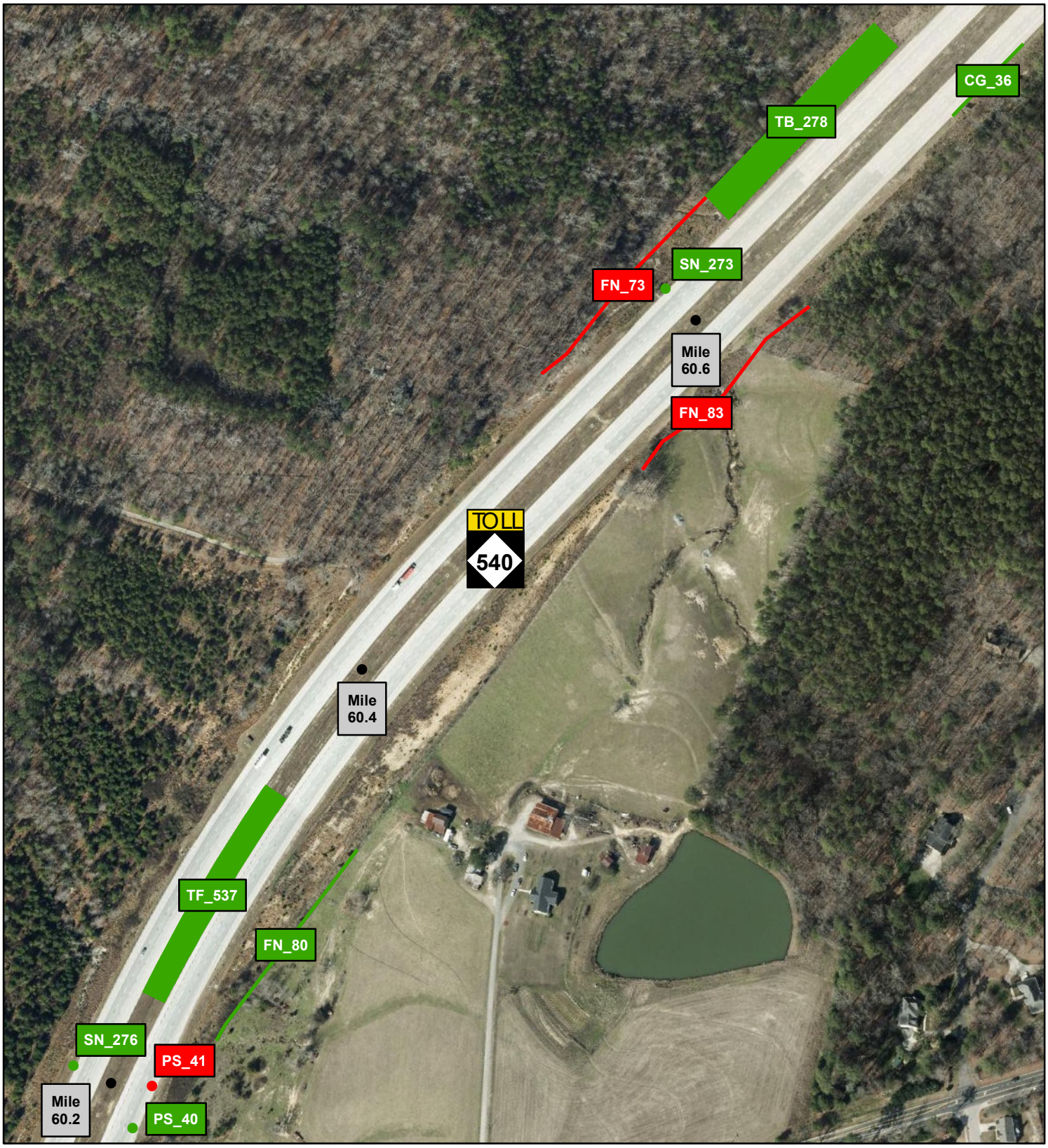
Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



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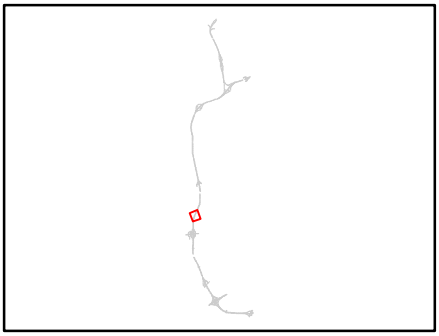
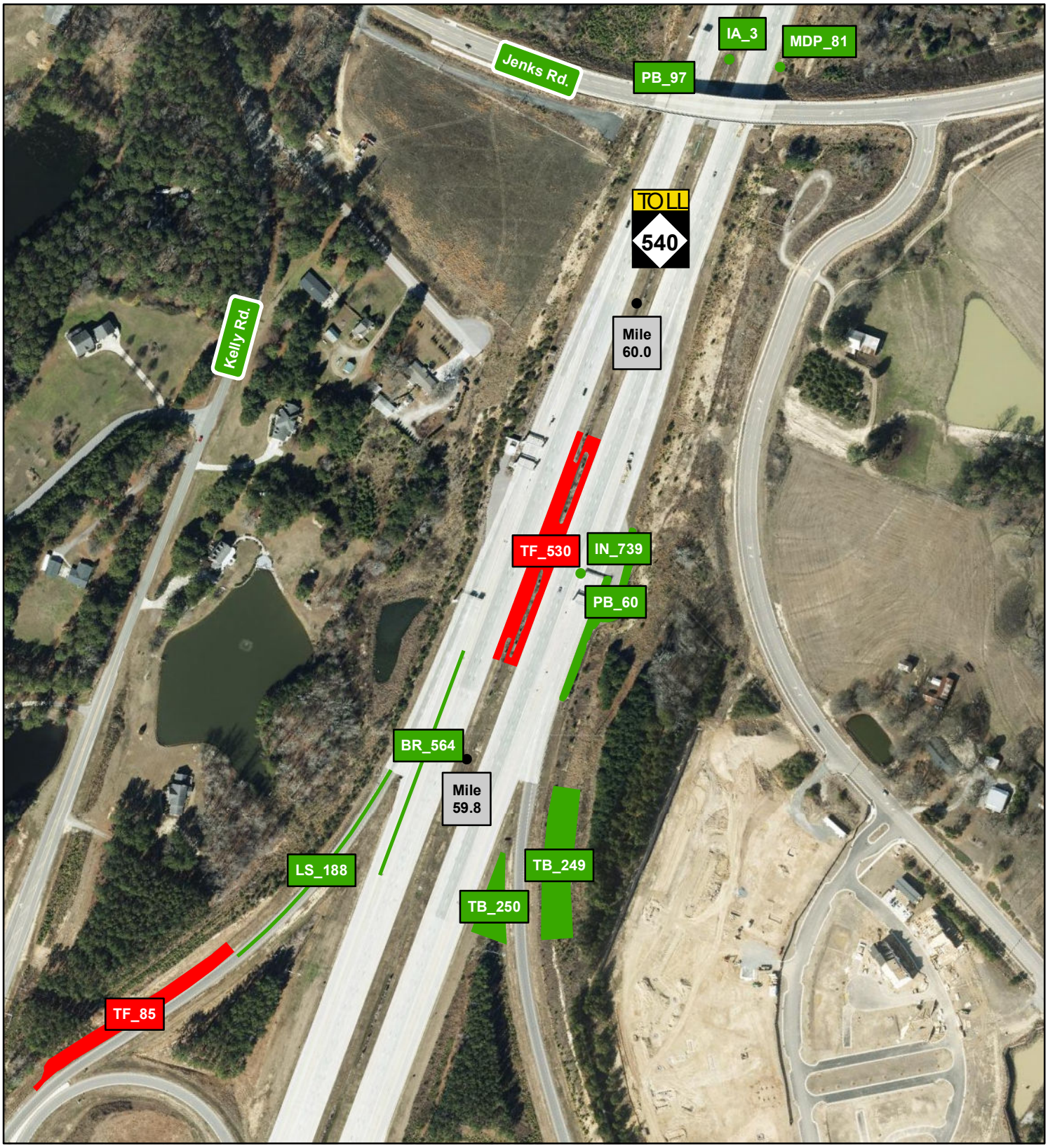


NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



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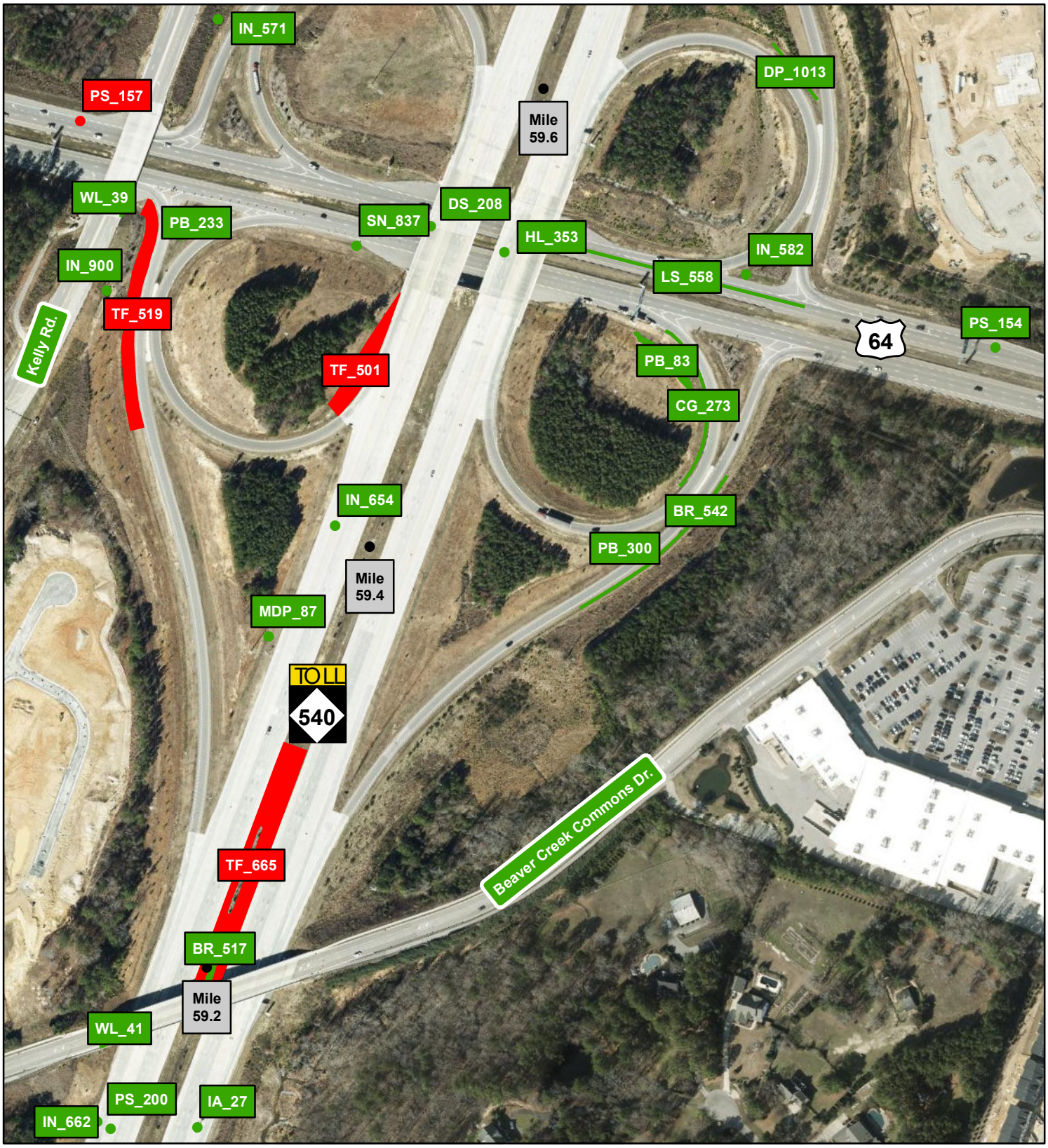
Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



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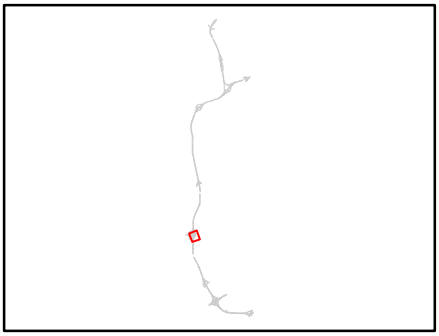
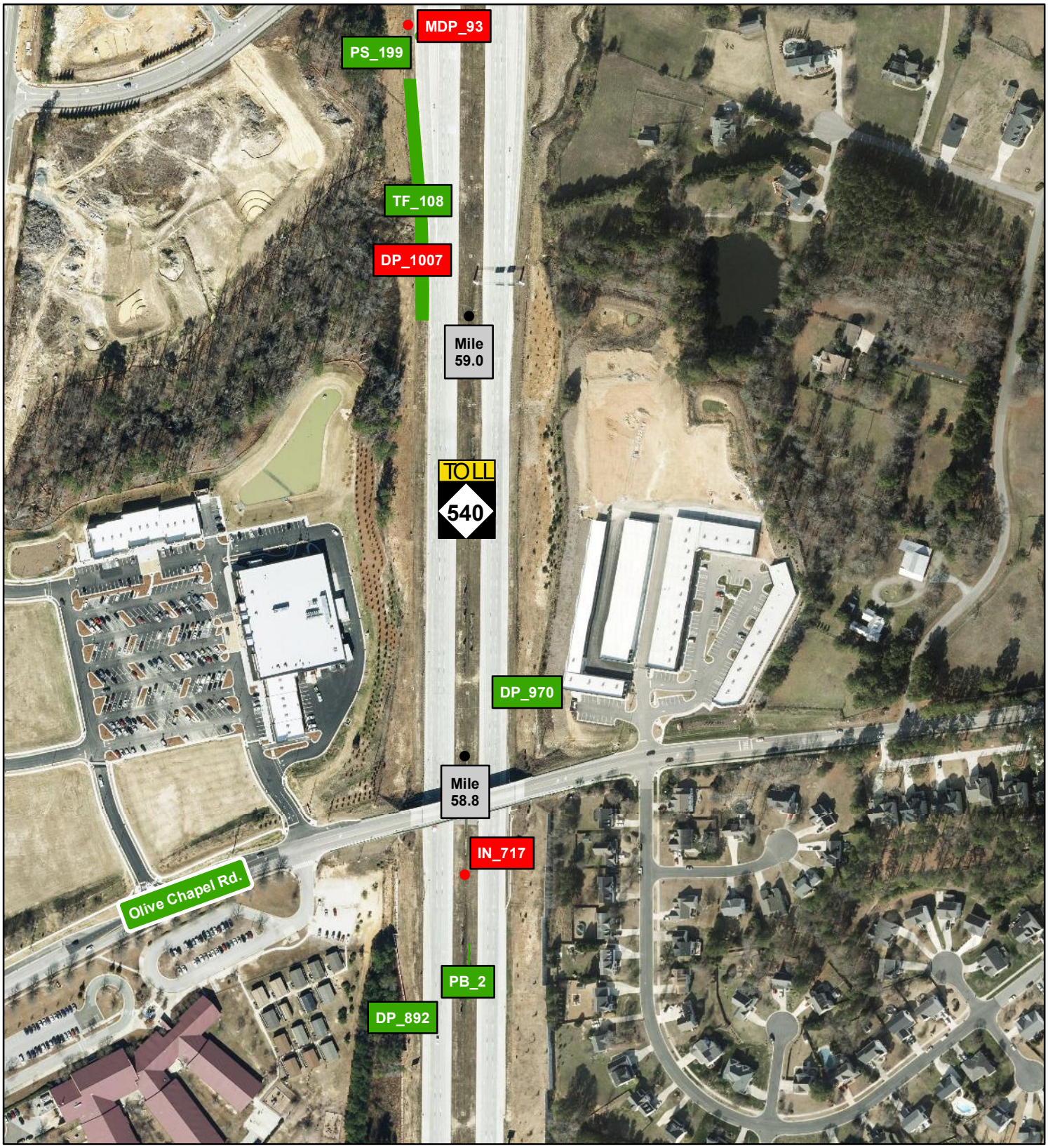


NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



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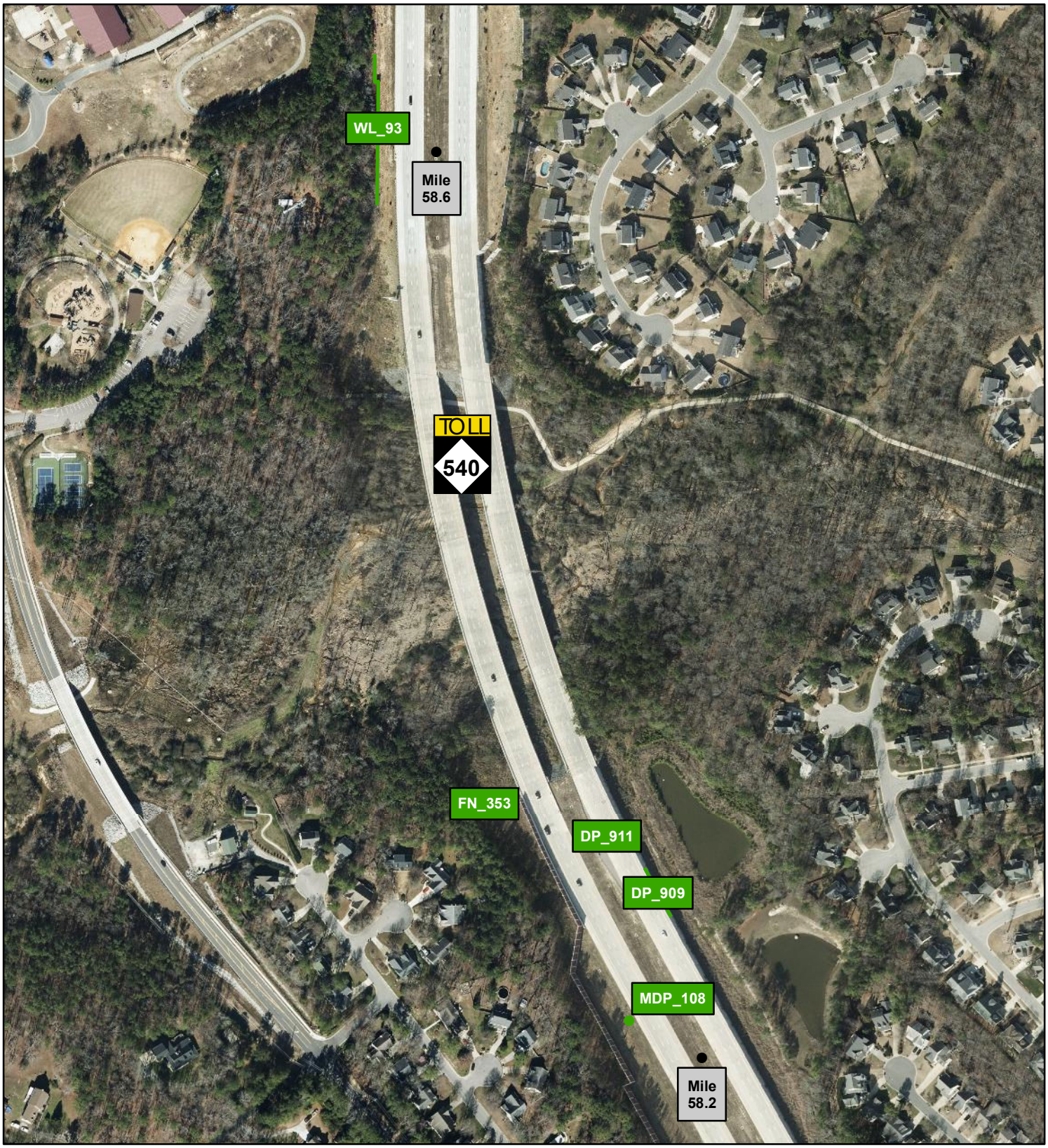
Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



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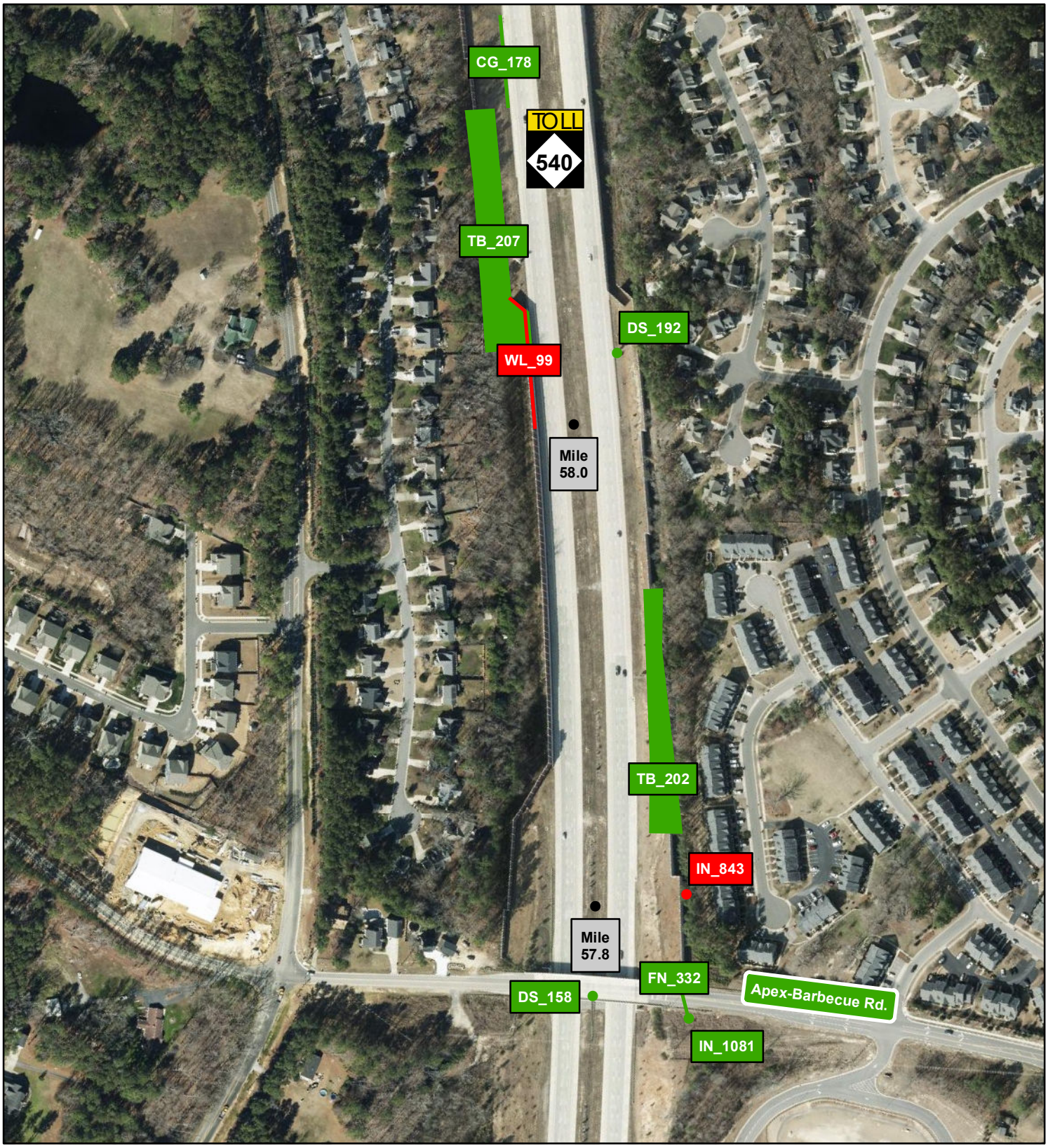
Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



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Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations

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Failing Asset

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NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations

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Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations

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Passing Asset

NORTH CAROLINA Turnpike Authority

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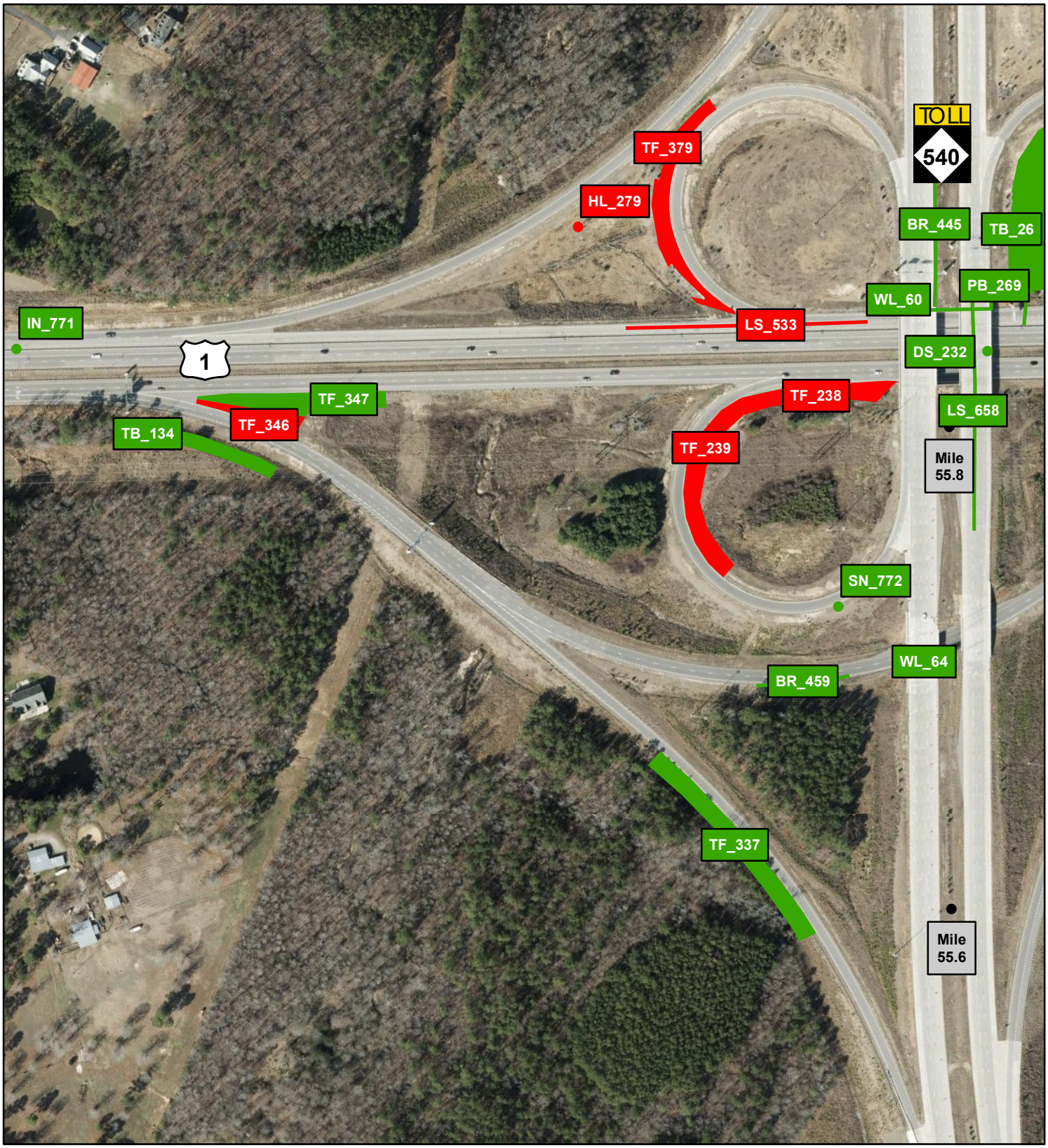

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Failing Asset

Passing Asset

NORTH CAROLINA
Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations

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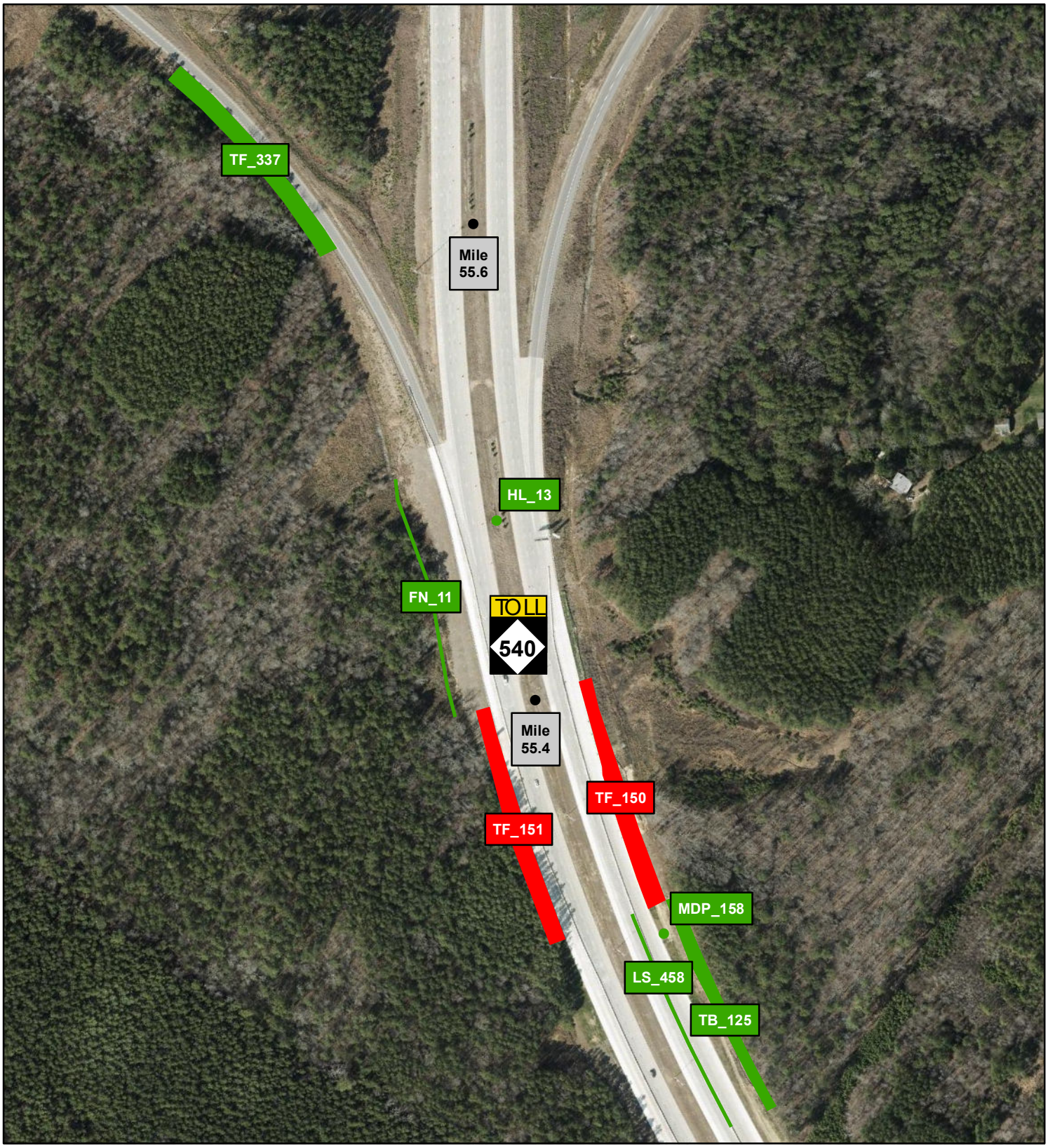
Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



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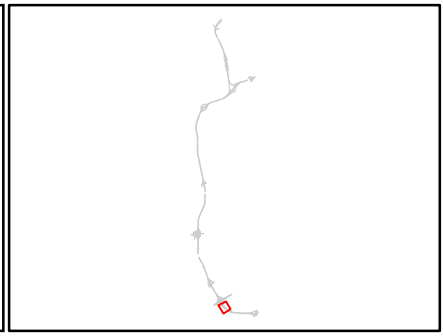
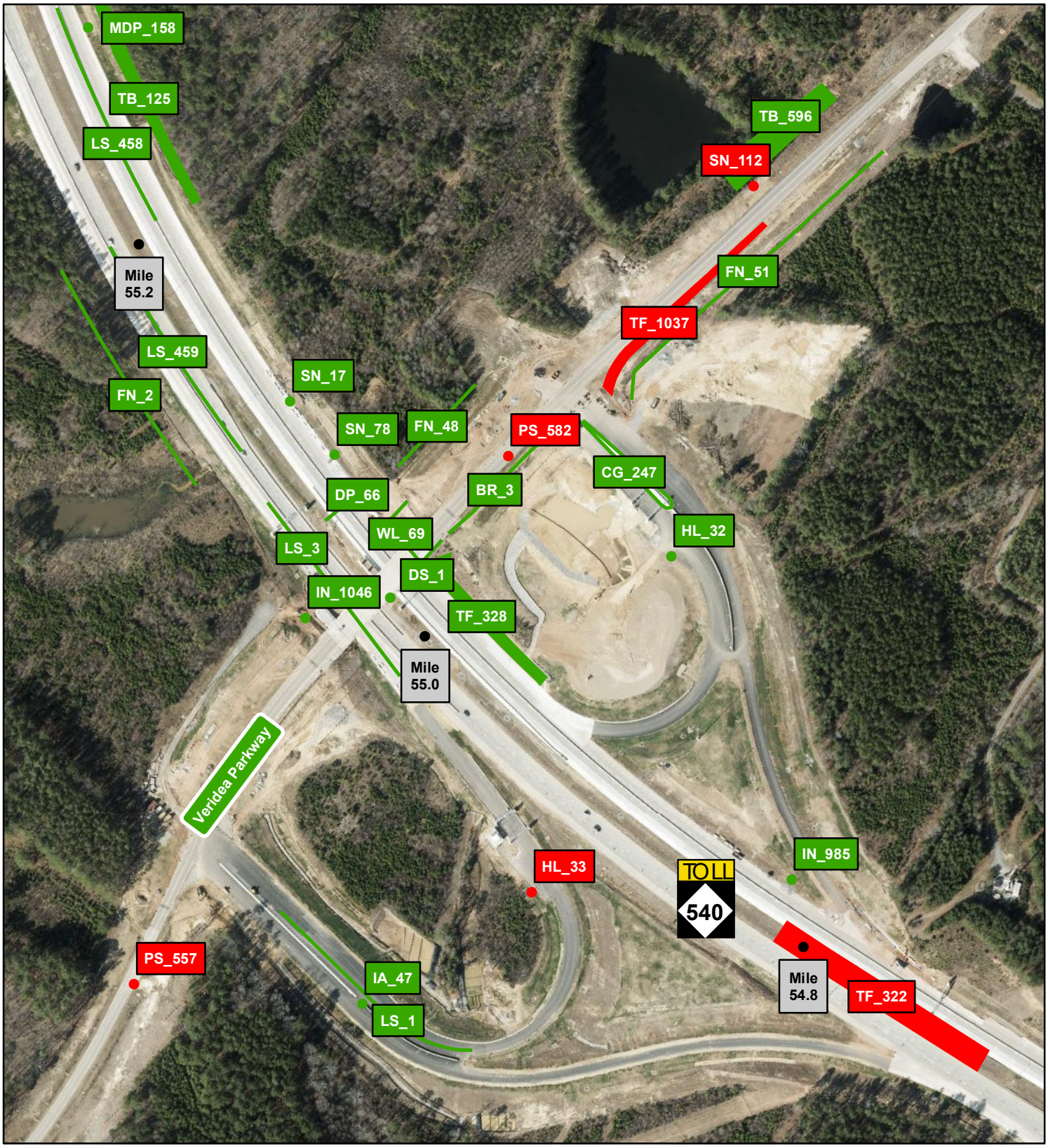


NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



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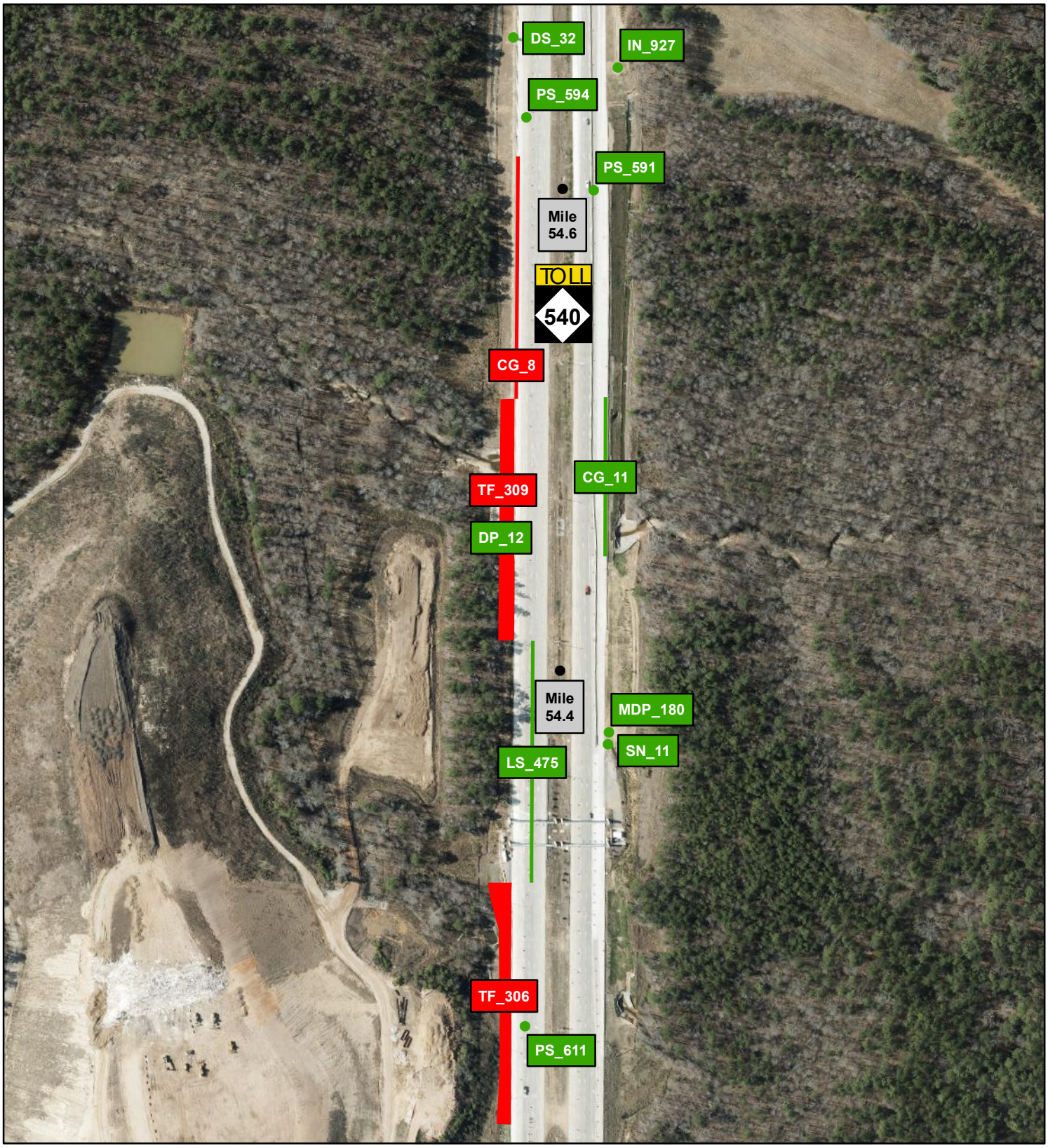
Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



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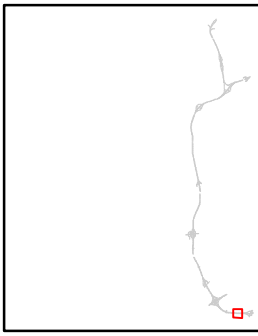
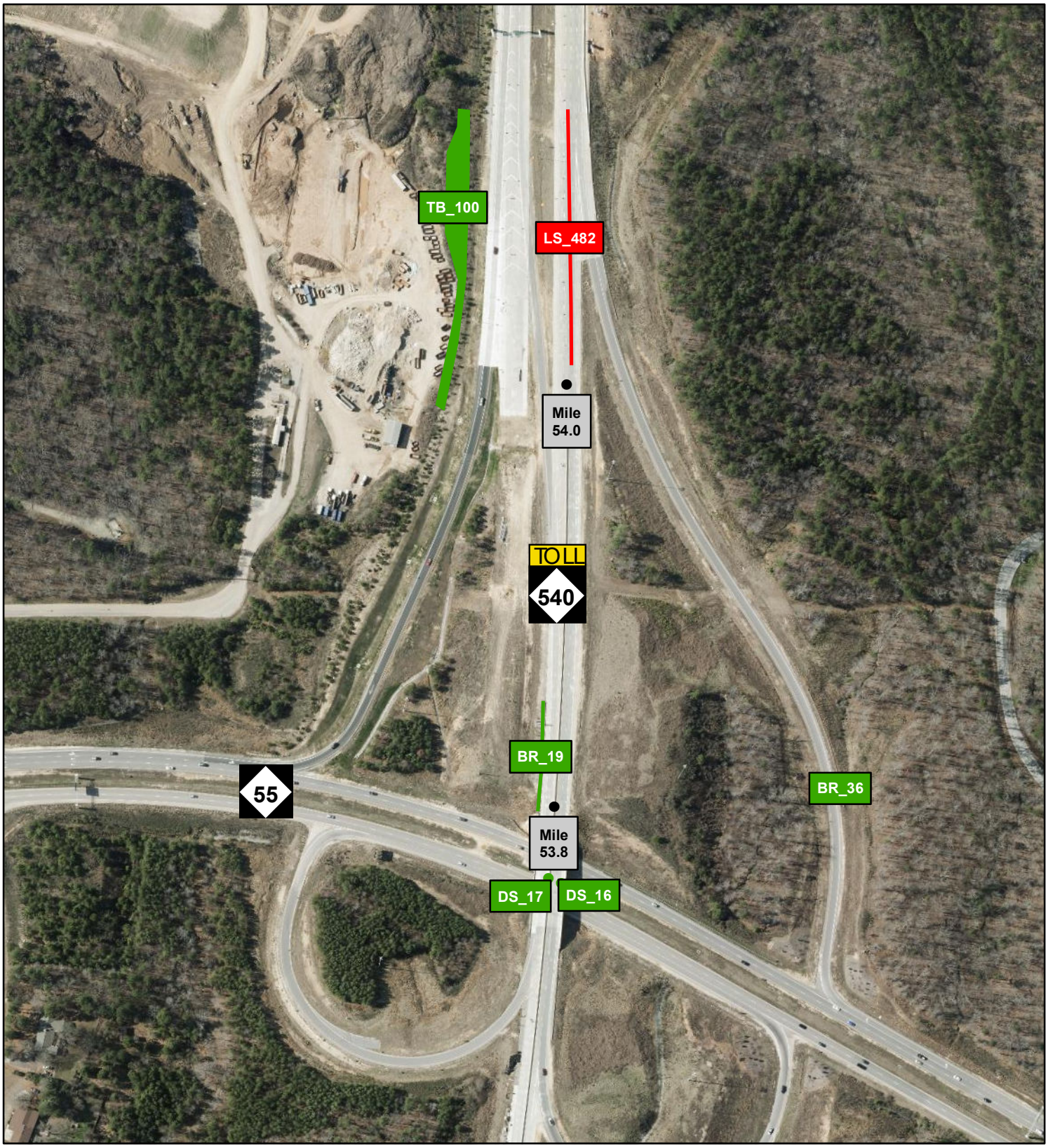
Passing Asset



NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



Legend

Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations

Legend

Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations

Legend

Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

A31

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations

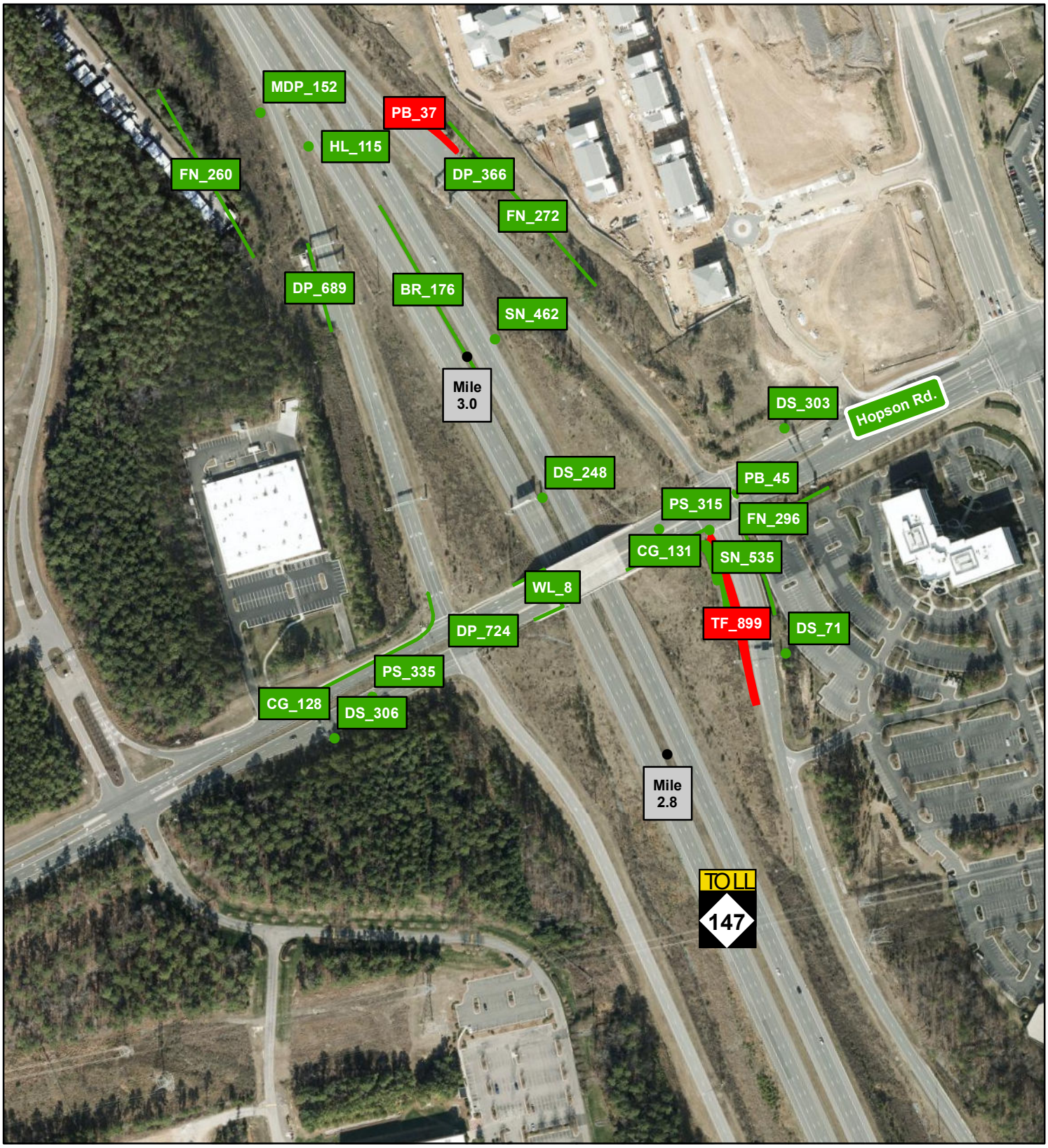
Legend

Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



Legend

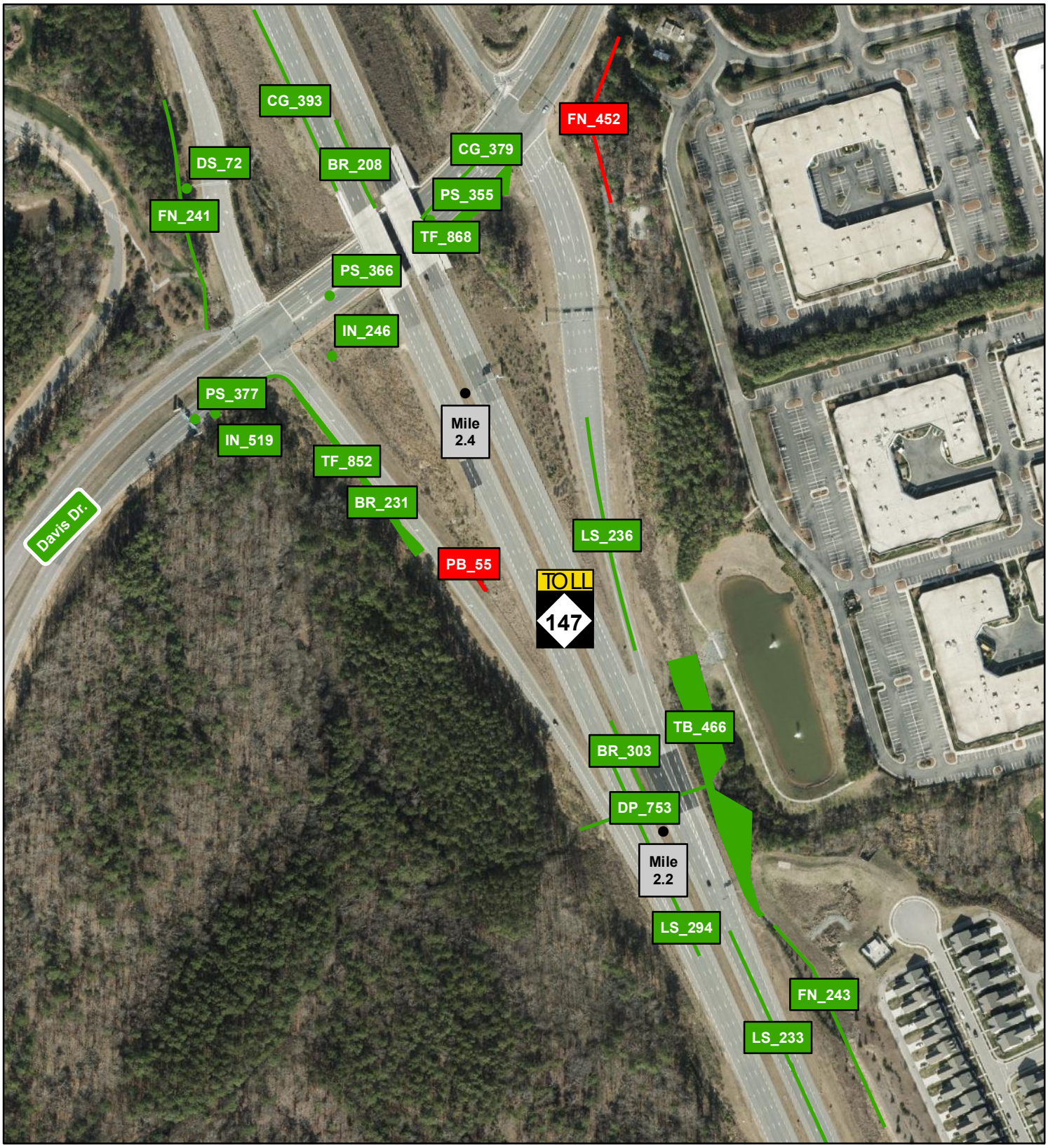
Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

A33

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



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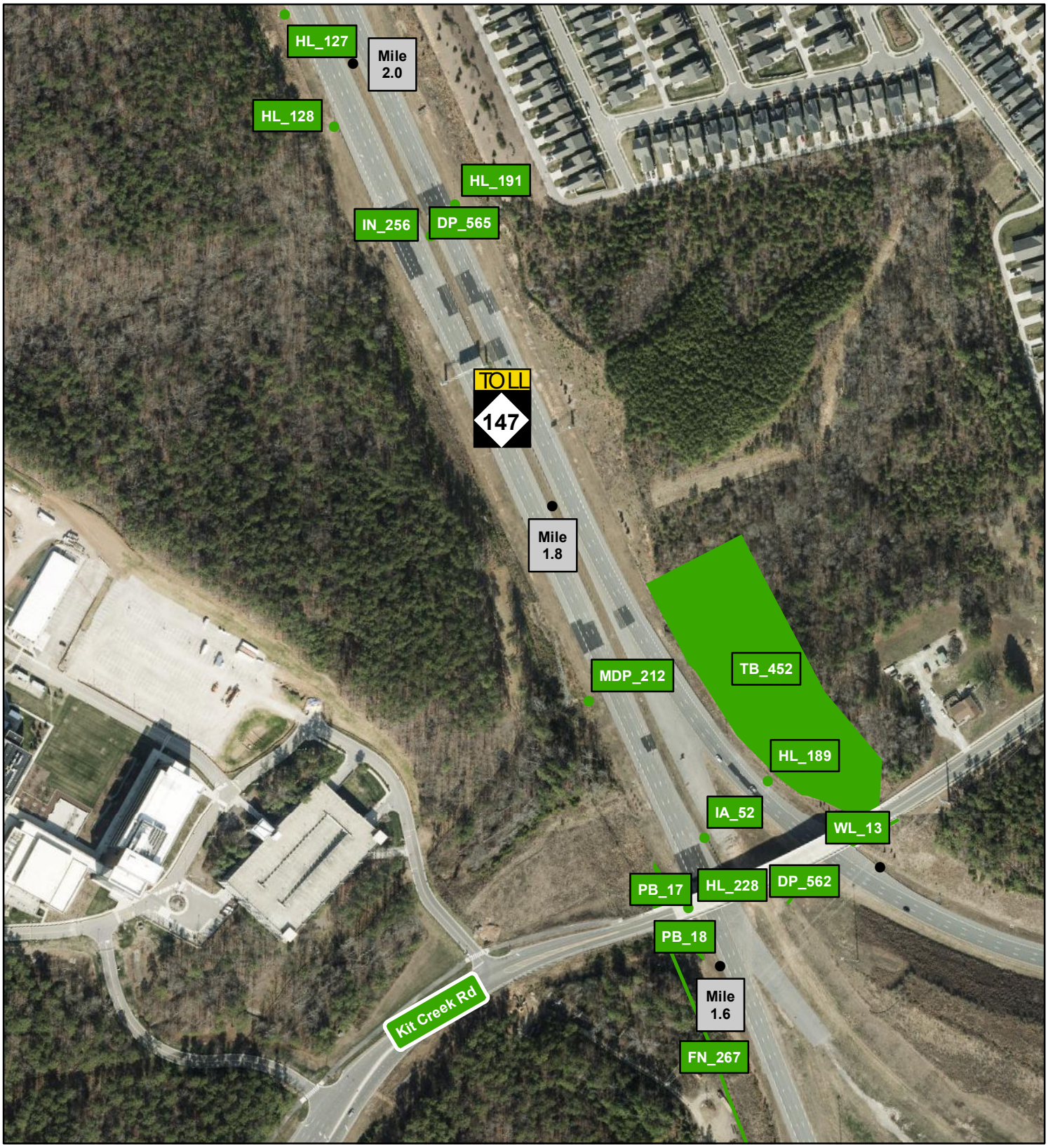
Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2020 Fourth Quarter Asset Assessment Locations



Legend

Failing Asset

Passing Asset

NORTH CAROLINA Turnpike Authority

Appendix B

Triangle Expressway 2020 Fourth Quarter Table Results of Assets Failing MRP

Appendix B: Triangle Expressway 2020 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)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Guardrail	BR_86	Functional Damage		A14

Curb and Gutter (CG)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Curb and Gutter	CG_8	Settlement		A28
2	Curb and Gutter	CG_174	Misalignment		A2

Decorative Supports (DS)

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

Drainage Pipes (DP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Drain	DP_408	Obstruction		A1
2	Drain	DP_440	Obstruction, Erosion		A5
3	Drain	DP_786	Erosion, Water Infiltration, End Protection		A25
4	Drain	DP_1007	Obstruction		A18

Misc. Drainage Structure (MDP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Shoulder Drain	MDP_34	Rodent Screen		A10
2	Shoulder Drain	MDP_54	Rodent Screen		A12
3	Shoulder Drain	MDP_56	Obstruction		A13
4	Shoulder Drain	MDP_68	Obstruction		A14

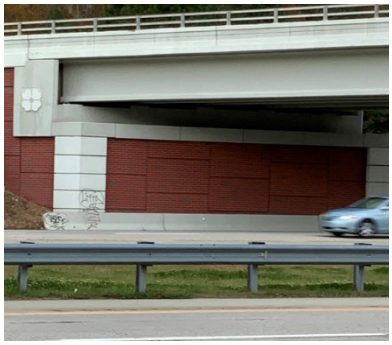
Misc. Drainage Structure (MDP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Shoulder Drain	MDP_221	Rodent Screen		A32

Fence and Control of Access (FN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Woven	FN_73	Hole Height		A15
2	Woven	FN_83	Fence Hole		A15
3	Woven	FN_125	Fence Hole		A11
4	Chain Link	FN_452	Hole Height		A34

Graffiti (GR)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Bridge Wall	GR_1	Graffiti		A8
2	Bridge Support	GR_2	Graffiti		A3
3	Bridge Wall	GR_3	Graffiti		A10

Highway Lighting (HL)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Single Roadway	HL_33	Part Damage		A27
2	Single Roadway	HL_59	Part Damage		A11
3	Single Roadway	HL_154	Part Damage		A4
4	Double Roadway	HL_164	Part Damage		A2

Highway Lighting (HL)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Single Roadway	HL_235	Part Damage		A6
6	High Mast	HL_279	Rodent Screen		A24
7	High Mast	HL_329	Part Damage		A7

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_3	Obstruction, Surface Damage		A6
2	Inlet	IN_277	Eroded Area		A4
3	Inlet	IN_304	Eroded Area		A3
4	Inlet	IN_717	Surface Damage		A18

Inlets (IN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Inlet	IN_843	Obstruction		A20

Landscaping (PB)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Plant Bed	PB_37	Health		A33
2	Plant Bed	PB_55	Weeds		A34

Paved Lanes – Asphalt (LS)

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

Paved Lanes – Concrete (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_342	Joint Seal Damage		A5

Paved Shoulders (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_533	Unsealed Cracks		A24

Unpaved Shoulders (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_533	Drop-Off		A24

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
This asset did not produce any failures.					

Litter (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_342	Litter – 3CF		A5

Roadway Sweeping (LS)

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

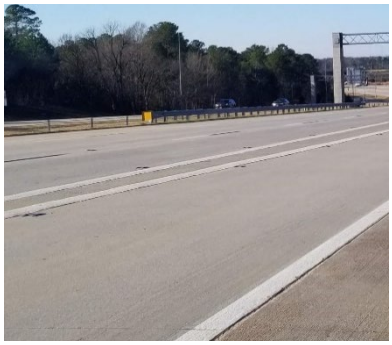
Pavement Striping (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_65	Line Missing		A8
2	Concrete	LS_90	Line Missing		A12
3	Concrete	LS_94	Line Missing		A12
4	Concrete	LS_128	Nighttime Reflectivity	Not Available for Nighttime Failure	A8
5	Concrete	LS_129	Line Missing		A8

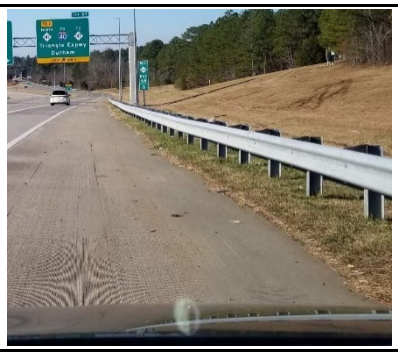
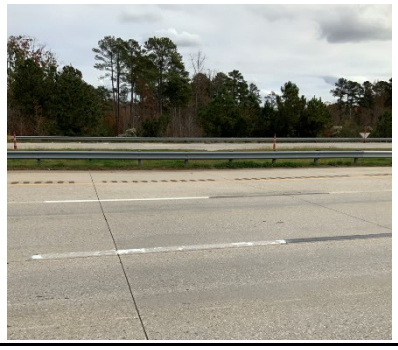
Pavement Striping (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
6	Concrete	LS_134	Line Missing		A9
7	Concrete	LS_429	Line Missing		A21
8	Concrete	LS_482	Line Missing		A29
9	Concrete	LS_605	Line Missing		A9

Pavement Markers (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_588	Nighttime Reflectivity		A2

Delineators (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_351	Missing & Nighttime Reflectivity		A5
2	Asphalt	LS_533	Missing & Nighttime Reflectivity		A24
3	Concrete	LS_588	Missing & Nighttime Reflectivity		A2
4	Concrete	LS_605	Missing & Nighttime Reflectivity		A9

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_41	Daytime Assessment		A15
2	Right Turn	PS_157	Nighttime Reflectivity		A17
3	Thru and Right	PS_557	Daytime Assessment		A27
4	Thru and Right	PS_582	Nighttime Reflectivity	Not Available for Nighttime Failure	A27

Signs (SN)

#	Sign Type	Object ID	Failure Type	Photo	GIS Reference Page
1	NC Route	SN_112	Surface Damage		A27
2	Mile Post	SN_667	Missing Parts		A23

Tree and Brush (TB)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Tree and Brush	TB_173	Sight Distance		A23

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Turf	TF_37	Bare Ground		A9
2	Turf	TF_48	Bare Ground		A8
3	Turf	TF_85	Bare Ground		A16
4	Turf	TF_93	Bare Ground		A22

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Turf	TF_150	Bare Ground		A26
6	Turf	TF_151	Bare Ground		A26
7	Turf	TF_238	Bare Ground		A24
8	Turf	TF_239	Bare Ground		A24

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
9	Turf	TF_306	Bare Ground		A28
10	Turf	TF_322	Bare Ground		A27
11	Turf	TF_346	Bare Ground		A24
12	Turf	TF_379	Bare Ground		A24

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
13	Turf	TF_409	Bare Ground		A22
14	Turf	TF_469	Bare Ground		A22
15	Turf	TF_501	Bare Ground		A17
16	Turf	TF_519	Bare Ground		A17

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
17	Turf	TF_601	Bare Ground		A10
18	Turf	TF_665	Bare Ground		A17
19	Turf	TF_899	Bare Ground		A33
20	Turf	TF_1037	Bare Ground		A27

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

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Sound Wall	WL_99	Unsealed Joints		A20