



NORTH CAROLINA
Turnpike Authority

Maintenance Rating Program

Triangle Expressway

2014 Third Quarter Report

July - September

1 S. Wilmington Street
Raleigh, NC 27601



Last Updated:
November 14, 2014

CONSULTANT CERTIFICATION OF COMPLETION

October 9, 2014

Mr. Andy Lelewski, PE
NCTA Director of Toll Road Operations
1 South Wilmington Street
Raleigh, NC 27601

NCTA Triangle Expressway Roadway and Facility Maintenance Performance Rating Program

This is to certify that I, Ken M. McEntire, PE am an authorized official representative of the company Asset Management Associates, PLLC, 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, Version 4 September 2013*.

Sincerely,

A handwritten signature in blue ink that reads "Ken M. McEntire". The signature is written in a cursive style and is positioned above the printed name of the signatory.

Ken M. McEntire, PE

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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 2014 Third Quarter Assessment of the Triangle Expressway.

The overall 2014 third quarter maintenance rating of the Triangle Expressway is 88.6, which is below the NCTA target rating of 90. However, as shown in **Table 1**, all five of the five elements assessed achieved a rating greater than or equal to the target rating of 85.

TABLE 1: MRP ELEMENT RESULTS FOR THE 2014 THIRD QUARTER ASSESSMENT		
ELEMENT	MRP Rating	Target Rating
Road Surface	89.9	85
Unpaved Shoulders	92.9	85
Drainage	91.3	85
Roadside	87.6	85
Traffic Control Devices	85.0	85
Overall MRP Performance Rating	88.6	90

As part of the NCTA MRP, this report provides a rolling rating of the latest four quarterly inspections of the Triangle Expressway. The current rolling rating of the Triangle Expressway is 90.8.

This report also provides the results from the facility maintenance services verification process that takes place each quarter. Currently only air conditioning unit, pest control, fire and carbon monoxide alarms and fire extinguishers, security components, and grounding and ground system testing maintenance services are meeting contract expectations.

In addition, the report provides findings of the Green Level Historic District signs inspections. This quarter, all Green Level Historic District signs inspected were found to be in good physical condition. However, overgrown vegetation is continuing to block the visibility of some of these signs.

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 through the use of sampling procedures that capture the level of service being provided for individual asset features. Over time, these ratings will be charted to identify work needs and subsequent necessary

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actions. The evaluations are based on the establishment of threshold conditions that quantify the maximum defect allowed to exist for a characteristic before it is considered unacceptable.

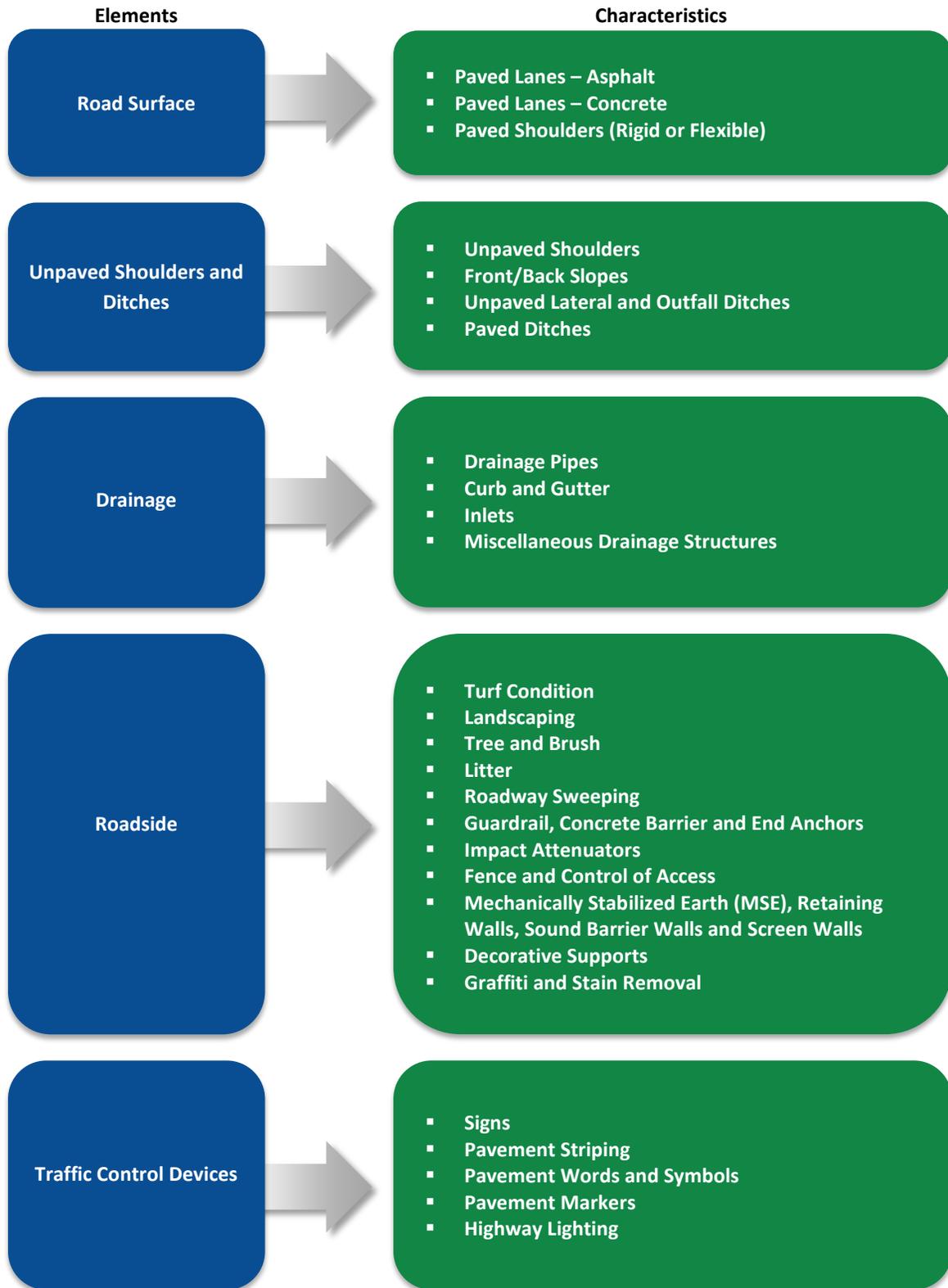
The NCTA performance standards, threshold criteria and maintenance rating program were developed through a collaborative effort by NCTA managers, NCDOT maintenance staff and consultants.

Using this 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 will be used to schedule and prioritize routine maintenance activities and provide uniform maintenance conditions that meet established objectives.

3.0 MRP SURVEY PROCEDURE

Per the NCTA Roadway and Facility Maintenance Performance Standards, roadway assets on NCTA facilities have been grouped into characteristics which then roll up into 5 elements. These elements and their characteristics can be seen on the following page in *Figure 1*:

Figure 1: Maintenance Elements and Characteristics



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Due to some roadway characteristics being of greater importance than others, a weighted system is applied to enable rational calculation of an overall level of service rating. Although one set of weighting factors for all characteristics could serve this purpose, a more useful system consists of two sets of weighting factors: one set that accounts for the importance of individual characteristics within a given maintenance element (1-9) and another set that accounts for the importance of the maintenance elements to the total rating (by % of score). This two-set system reveals deficiencies among characteristics and it shows which maintenance elements are deficient.

The program analysis is accomplished through the use of statistically valid, random sampling procedures that capture the level of service for individual assets with a 95% confidence level in sampling. Inspections are performed during the months of February, May, August, and November to account for dynamic changes in assets during the various seasons. Each maintenance characteristic that was selected for sampling was evaluated according to the criteria developed by the NCTA performance standards. This evaluation was completed with the assistance of NCDOT's State Roadway Maintenance Unit using their electronic data collection tablets.

The evaluations are based on established threshold conditions that quantify the maximum defect allowed to exist for a characteristic before it is considered unacceptable. The ratings are done by comparing existing field conditions to the threshold value. If the characteristic meets or exceeds the threshold, then it is coded as PASSING to meeting the criteria. If it does not meet the criteria then it is coded as FAILING. When the survey is complete, the number of PASSING's and FAILING's are totaled, and a composite number (using from 1 to 100 scale) is produced which represents the level of maintenance currently being provided.

For any given asset, the number assigned as the target level of service represents the percentage of random samples in which the maintenance condition standard corresponding to the activity is to be met or exceeded. For instance, an activity with a level of service rating of 83 means that 83 percent of the sites met the condition standards.

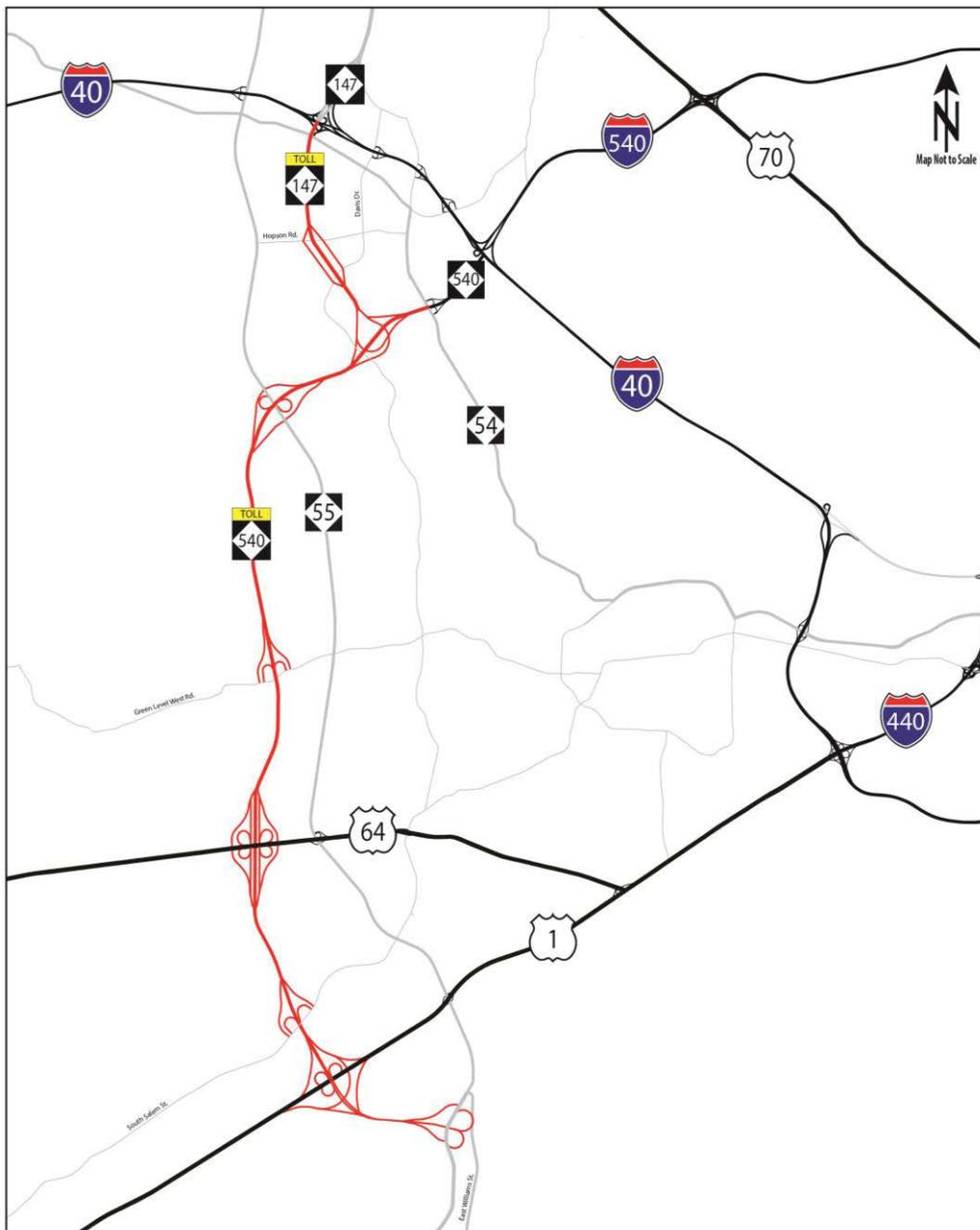
The rolling rating is calculated from a summation of the latest four quarterly inspections rather than taking the straight average of each quarter's rating. This is done to compensate for the event of uneven sample sizes for various assets to produce a more accurate result.

The NCTA's overall target rating score is 90, with each target element level scoring at or above 85 and every target characteristic at or above 80.

4.0 TRIANGLE EXPRESSWAY DESCRIPTION

The Triangle Expressway extends for approximately 18.8 miles from the interchange of I-40 and NC-147 on the north end to the NC-55 Bypass near Holly Springs, North Carolina on the south end (**Figure 2**). It includes an approximately one mile segment on NC-540 extending north from the NC-540 / NC-147 interchange to the NC-54 interchange. The Triangle Expressway consists of ten interchanges and eighteen 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 and modified on the roadway. To ensure the validity of the MRP, there is necessary proactive actions to take that maintain an accurate asset inventory of the Triangle Expressway. These actions include coordination with NCDOT Division maintenance managers and routine field visits.

Prior to the 2014 Third Quarter assessment, no additional asset inventory was updated.

6.0 MRP ASSESSMENT

6.1 Quarterly Results

The overall 2014 third quarter maintenance rating of the Triangle Expressway is 88.6. This score represents the second consecutive quarter where our score is not above our overall Expressway target rating score of 90. All element rating scores are above the desired rating of 85, but many characteristics scored below the minimum rating of 80; Paved Shoulders (77), Paved Ditches (50), Miscellaneous Drainage Structures (72), Turf Condition (61), Impact Attenuators (78), and Pavement Markers (45). The third quarter results can be viewed in **Tables 2 and 3** of this report. It is important to note that these results are only representative of the third quarter sample, one of the four surveys done throughout the year to provide an intermediate snapshot of seasonal conditions. Therefore, they are not a statistically valid representation of the assets' conditions; only the total of all 4 quarter inspections at the end of each calendar year will provide a 95% confidence level in statistical sampling.

Appendix A shows maps of all the assets that were assessed during the third quarter. **Appendix B** shows a list of the individual assets that failed the MRP.

The MRP rating value designated to each element and feature refers to the percentage of elements or features that pass the asset's particular threshold criteria respectively. After developing an inventory and totaling each particular feature, they are assessed based on the established threshold criteria. The sample passed and sample totals are then multiplied by weighted values, which were assigned to each element based on importance. This determines the actual and available rating points. Lastly, an MRP Performance Rating is calculated for each asset and element group based on the ratio of the actual points over the available points. The MRP Performance characteristic rating results for the 2014 third quarter assessments are found in **Table 2**:

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TABLE 2: MRP CHARACTERISTIC RESULTS FOR Q3 2014						
ROAD SURFACE	SAMPLE PASSED	SAMPLE TOTAL	WEIGHTED VALUES	ACTUAL PTS	AVAILABLE PTS	Q3 2014 MRP RATING
Paved Lanes Asphalt	17	18	9	153	162	94
Paved Lanes Concrete	13	13	9	117	117	100
Paved Shoulder	24	31	5	120	155	77
Element Total				390	434	89.9
UNPAVED SHOULDERS AND DITCHES	SAMPLE PASSED	SAMPLE TOTAL	WEIGHTED VALUES	ACTUAL PTS	AVAILABLE PTS	Q3 2014 MRP RATING
Unpaved Shoulder	29	31	9	261	279	94
Front/Back Slopes	27	31	6	162	186	87
Lateral and Outfall Ditches, Unpaved	31	31	6	186	186	100
Ditches, Paved	1	2	5	5	10	50
Element Total				614	661	92.9
DRAINAGE	SAMPLE PASSED	SAMPLE TOTAL	WEIGHTED VALUES	ACTUAL PTS	AVAILABLE PTS	Q3 2014 MRP RATING
Drainage Pipes	33	34	7	231	238	97
Curb and Gutter	25	25	6	150	150	100
Inlets	30	34	7	210	238	88
Misc. Drainage Structure	18	25	4	72	100	72
Element Total				663	726	91.3
ROADSIDE	SAMPLE PASSED	SAMPLE TOTAL	WEIGHTED VALUES	ACTUAL PTS	AVAILABLE PTS	Q3 2014 MRP RATING
Turf Condition	37	61	7	259	427	61
Landscaping	21	26	4	84	104	81
Trees and Brush	31	31	4	124	124	100
Litter	31	31	4	124	124	100
Roadway Sweeping	31	31	5	155	155	100
Guardrail, Concrete Barrier and End Anchors	30	31	9	270	279	97
Impact Attenuators	7	9	9	63	81	78
Fence, Control Access	28	29	7	196	203	97
Retaining Walls and Sound Barrier Walls	16	17	5	80	85	94
Decorative Supports	25	25	5	125	125	100
Graffiti and Stain Removal	31	31	4	124	124	100
Element Total				1604	1831	87.6
TRAFFIC CONTROL DEVICES	SAMPLE PASSED	SAMPLE TOTAL	WEIGHTED VALUES	ACTUAL PTS	AVAILABLE PTS	Q3 2014 MRP RATING
Signs	60	64	7	420	448	94
Pavement Striping	30	31	8	240	248	97
Words and Symbols	30	30	7	210	210	100
Pavement Markers	14	31	9	126	279	45
Highway Lighting	29	32	6	174	192	91
Element Total				1170	1377	85.0

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The overall score is determined by summing the elements multiplied by weighted factors as follows: Road Surface (25%), Unpaved Shoulders (13%), Drainage (15%), Roadside (17%), and Traffic Control Devices (30%).

The overall MRP Performance element rating results for the third quarter are shown in **Table 3**:

TABLE 3: MRP ELEMENT RESULTS FOR Q3 2014	
ELEMENT	Q3 2014 MRP Rating
Road Surface	89.9
Unpaved Shoulders	92.9
Drainage	91.3
Roadside	87.6
Traffic Control Devices	85.0
Overall MRP Performance Rating	88.6

6.2 Analysis and Recommendations

Elements

No elements fell below the NCTA minimum threshold criteria of 85 for the third quarter.

Characteristics

Most characteristics satisfied the NCTA minimum threshold criteria of 80 with the exception of Paved Shoulders, Paved Ditches, Miscellaneous Drainage Structures, Turf Condition, Impact Attenuators, and Pavement Markers. This section focuses on the characteristics that need specific attention and future emphasis in the work plan in order to maintain the desired performance level. Pictures of these failures are included in **Appendix B** of this report.

Paved Shoulder (77 rating – 7 of the 31 assets failed). All 7 assets failed due to joint separation. Most of these failures occurred between the shoulder/curb gutter joints. The picture on the right shows a paved shoulder joint failing due to joint separation between asphalt and concrete; this is located along 540 just south of the NC 55 southbound on ramp.

Figure 3: Paved Shoulder Failures



Paved Ditches (50 rating – 1 of the 2 assets failed). This failure occurred at the paved ditch behind the jersey barrier/wall along NC-147 southbound (towards I-540).

There are only two paved ditches on the Expressway and each are inspected during every quarter. During this inspection, only one of them failed for material accumulation. This can be seen in **Figure 4** below. There has been very heavy rain this summer and it is recommended that the maintenance provider complete a thorough sweep of the paved ditches on the project regularly to remove any debris that may have been washed down.

Figure 4: Paved Ditch Failure



Miscellaneous Drainage (72 rating – 7 of the 25 assets failed). All 7 miscellaneous drainages failed because of obstruction. It is recommended that the maintenance provider plan to routinely clean out these drainage features to remove any debris that may have been washed into the structure or grown up around it.

Figure 5: Miscellaneous Drainage Failures



Turf Condition (61 rating – 24 of the 61 assets failed). All 24 turf areas failed because of bare ground. Some of these can be seen in **Figure 6** below. Many of the bare ground areas previously had active Bermuda and Centipede runners growing that are now dead. It is suspected this was caused by low cutting heights last summer during extreme heat months. With such a noticeable drop over the last few assessments in the turf condition it is recommended that the maintenance provider schedule overseeding of these areas with warm season grasses and possibly add soil enrichment to increase the chances of survival. It is further suggested that mowing heights continue to be closely monitored especially during the months of extreme heat conditions.

Figure 6: Turf Failures



Impact Attenuators (78 rating – 2 of the 9 assets failed). One of the 2 assets failed because of functional damage; the guardrail connected to the impact attenuator had been hit which will affect the functionality of the attenuator. The other impact attenuator failed because the reflective tape along the bulb was not visible during the night time inspection.

Figure 7: Impact Attenuators Failures



Pavement Markers (45 rating – 17 of the 31 assets failed). Out of the 17 linear segments that failed due to pavement markers, 16 did not pass the night time inspection due to lack of markers' reflectivity and 7 of the 17 failed because of missing markers.

The Triangle Expressway saw several rounds of frozen precipitation this past winter where plows removed the non-snowplowable markers from bridge decks. It is recommended that the maintenance provider consider replacing bridge deck markers as soon as practical at the end of each winter season, and prior to the upcoming season at a minimum. With attentive effort toward specific minor deficiencies the overall MRP score can be maintained cost effectively above the 90 percentile threshold.

Figure 8: Pavement Markers Failures



7.0 ROLLING MRP RATING

The current rolling MRP rating of the Triangle Expressway is 90.8. The rolling results can be viewed in ***Tables 4 and 5*** of this report. These results are a collection of the four latest quarterly inspections conducted throughout the year. This score is above our target rating score of 90 for the overall Expressway. All element ratings were above the desired rating of 85. Paved Ditches and Turf Condition are the only two characteristics that scored below the minimum rating of 80 with ratings of 60 and 69, respectively.

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TABLE 4: ROLLING MRP CHARACTERISTIC RESULTS					
ROAD SURFACE	Q4 2013 RATING	Q1 2014 RATING	Q2 2014 RATING	Q3 2014 RATING	ROLLING RATING
Paved Lanes Asphalt	94	91	92	94	93
Paved Lanes Concrete	100	100	100	100	100
Paved Shoulder	80	71	97	77	81
Element Total	91.5	87.6	96.8	89.9	91.4
UNPAVED SHOULDERS AND DITCHES	Q4 2013 RATING	Q1 2014 RATING	Q2 2014 RATING	Q3 2014 RATING	ROLLING RATING
Unpaved Shoulder	98	90	81	94	91
Front/Back Slopes	98	94	94	87	93
Lateral and Outfall Ditches, Unpaved	93	94	97	100	96
Ditches, Paved	100	50	0	50	60
Element Total	96.3	91.5	87.6	92.9	92.4
DRAINAGE	Q4 2013 RATING	Q1 2014 RATING	Q2 2014 RATING	Q3 2014 RATING	ROLLING RATING
Drainage Pipes	95	91	97	97	95
Curb and Gutter	92	84	92	100	92
Inlets	93	97	94	88	93
Misc. Drainage Structure	81	88	84	72	81
Element Total	90.7	91.2	93.3	91.3	92.0
ROADSIDE	Q4 2013 RATING	Q1 2014 RATING	Q2 2014 RATING	Q3 2014 RATING	ROLLING RATING
Turf Condition	81	87	49	61	69
Landscaping	89	92	88	81	88
Trees and Brush	100	100	100	100	100
Litter	100	100	100	100	100
Roadway Sweeping	100	100	100	100	100
Guardrail, Concrete Barrier and End Anchors	97	100	94	97	97
Impact Attenuators	100	100	100	78	95
Fence, Control Access	82	90	93	97	90
Retaining Walls and Sound Barrier Walls	94	88	82	94	90
Decorative Supports	100	100	96	100	99
Graffiti and Stain Removal	100	97	100	100	99
Element Total	92.8	94.6	84.7	87.6	90.0
TRAFFIC CONTROL DEVICES	Q4 2013 RATING	Q1 2014 RATING	Q2 2014 RATING	Q3 2014 RATING	ROLLING RATING
Signs	71	86	89	94	87
Pavement Striping	100	97	90	97	96
Words and Symbols	100	100	93	100	98
Pavement Markers	100	100	71	45	81
Highway Lighting	86	97	88	91	90
Element Total	92.9	94.4	86.1	85.0	89.5

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A summary of the rolling MRP element results is found in **Table 5**:

TABLE 5: ROLLING MRP ELEMENT RESULTS					
ELEMENT	Q4 2013 RATING	Q1 2014 RATING	Q2 2014 RATING	Q3 2014 RATING	RATING
Road Surface	91.5	87.6	96.8	89.9	91.4
Unpaved Shoulders	96.3	91.5	87.6	92.9	92.4
Drainage	90.7	91.2	93.3	91.3	92.0
Roadside	92.8	94.6	84.7	87.6	90.0
Traffic Control Devices	92.9	94.4	86.1	85.0	89.5
Overall MRP Performance Rating	92.6	91.9	89.8	88.6	90.8

8.0 TRIANGLE EXPRESSWAY TOLL FACILITY MAINTENANCE

As part of the Roadside Toll Collection System contract, XEROX is to provide toll facility maintenance for all Toll Zones along the Triangle Expressway. Facility maintenance will include all labor, equipment, materials and incidentals for the maintenance items under contract.

The equipment and services covered by the facilities maintenance agreement include:

- Air Conditioning Equipment
- Electrical Components
- Fire and Carbon Monoxide Alarms and Fire Extinguishers
- Standby Generators
- Security Components
- Toll Facility Vaults
- Pressure Cleaning
- Pest Control
- Grounding and Ground System Testing

Upon completion of any and all services performed on the equipment identified above, XEROX will create a Maintenance Log File with the following detailed information:

- Date of Service Request
- Date of Service Completion
- Date of Regularly Scheduled Maintenance Activities
- Detail of Tasks Performed
- List of Any Issues Found
- List of Any Replacement Parts Required
- Notification to NCTA for Replacement Part Approval

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All maintenance logs will be stored in the CMMS (Computerized Maintenance Management System) database and submitted to NCTA for review. As part of each quarterly inspection, HNTB will review the facility maintenance logs submitted to identify any problems reported during the services provided and ensure XEROX is meeting maintenance contract expectations. Equipment services will meet maintenance contract expectations only if the maintenance logs provided prove that the service has been completed.

8.1 Quarterly Results

Air Conditioning Unit Service Requirements	Status
Monthly Service (Scheduled for July, August and September 2014)	
<ul style="list-style-type: none"> • Replace filters (pleated high efficiency filters shall be used) 	Completed
Semi-Annual Service (Scheduled for November 2014)	
<ul style="list-style-type: none"> • Perform inspection and maintenance checks/cleaning (preventative maintenance) on all air conditioning equipment units. All items in the preventive maintenance inspection shall be checked along with any other item necessary to ensure that each unit is operating properly. <ul style="list-style-type: none"> ○ Clean condenser and evaporator coils on air conditioning units, with industry approved chemicals and methods and per recommendations by the manufacturer. ○ Clean oil air handling units of the air conditioning equipment (per manufacture recommendations) ○ Clean drain pans and condensate lines of the air conditioning equipment. ○ Lubricate all motors required for the air conditioning equipment. ○ Clean inlet and outlet registers for the air conditioning equipment. ○ Check controls and thermostats for proper operation for the air conditioning equipment. ○ Check for leaks and adjust amounts of refrigerant as needed for the air conditioning equipment. ○ Record refrigerant pressures for the air conditioning equipment. ○ Check electrical connections for the air conditioning equipment. ○ Check for vibrations and noises stemming from the air conditioning equipment. ○ Check all belts and belt pulleys and replace worn belts for the air conditioning equipment. 	N/A

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Electrical Components Service Requirements	Status
Monthly Service (Scheduled for July, August and September 2014)	
<ul style="list-style-type: none"> • Electrical Distribution Equipment <ul style="list-style-type: none"> ○ Inspect electrical distribution equipment for warning signs, wear, or malfunction. ○ Inspect enclosures in electrical distribution equipment for damage, unauthorized openings, and corrosion of metallic objects. Repair and paint to match as required. Inspect air passages and remove any blockage. ○ Inspect, investigate, and solve conditions in which the electrical distribution equipment produces unusual odors. ○ As electrical distribution equipment is operated and tested, listen, investigate, and mitigate conditions for unusual noises. ○ Inspect electrical distribution equipment grounding components such as conductors and connections. Inspect insulators for damage. ○ Inspect liquid immersed electrical distribution equipment for leaks and damage. ○ Inspect indicating lights on electrical distribution equipment for correct illumination. ○ Remove debris, dirt, insect nests, and other foreign objects from all components, housings, cabinets, panels, etc. of the electrical distribution equipment. ○ Verify operation of space heaters and control thermostat of electrical distribution equipment. Check thermostat set point for proper setting. 	Not Completed
Annual Service (Scheduled for November 2014)	
<ul style="list-style-type: none"> • Electrical Distribution System <ul style="list-style-type: none"> ○ Inspect electrical connections in the electrical distribution system for degradation. ○ Torque all electrical connections in the electrical distribution system to design value. ○ Verify the grounding of the equipment and associated neutral where applicable for the electrical distribution system. ○ Conduct infrared test on all main current carrying equipment in the electrical distribution system for hot spots that may indicate overheat conditions or loose connections. ○ Using calibrated test instruments, calibrate ammeters, voltmeters, etc. Verify continuity of metering selector switch contacts with ohmmeter. ○ Change filters on Main Distribution Panel in the electrical distribution system at site 6-1 and 7-2. ○ Inspect electronic power meter on Main Distribution Panels in the electrical distribution system for proper operation. • Low Voltage Panel Boards <ul style="list-style-type: none"> ○ Inspect electrical insulation of low voltage panel boards for discoloration and degradation. ○ Service low voltage panel board circuit breakers per manufacturers' recommendations. ○ Inspect low voltage panel board breakers' current carrying components for discoloration that may indicate overheating. ○ Perform insulation resistance test on each phase-to-phase and phase-to-ground for the low voltage panel boards using a megohmmeter. ○ Prove low voltage panel board circuit breaker operation by actuation of each associated protective device. ○ Verify low voltage panel board Surge Protection Device (SPD) is functioning (lights). ○ Measure and record neutral currents for low voltage panel boards. • Automatic Transfer Switches <ul style="list-style-type: none"> ○ Inspect, operate, adjust, and lubricate mechanical linkages for the automatic transfer switches. ○ Verify operation of mechanical interlocks of automatic transfer switches. ○ Inspect and dress current carrying contacts in accordance with manufacturer's recommendations for the automatic transfer switches. ○ Test automatic transfer switches. Perform insulation resistance test on each phase-to-phase and phase-to-ground using a megohmmeter. ○ Perform contact resistance test for automatic transfer switches. ○ Prove correct operation of the transfer switches by manually initiating transfers in 	N/A

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Electrical Components Service Requirements	Status
<ul style="list-style-type: none">○ both directions.○ Simulate the automatic conditions requiring automatic transfer switches to transfer in both directions.○ Verify generator start on transfer for automatic transfer switches.○ Verify correct indicating light operation for automatic transfer switches.○ Verify equipment alarms – critical monitoring system for automatic transfer switches.● Safety Switches (Disconnects)<ul style="list-style-type: none">○ Inspect, operate, adjust, and lubricate mechanical linkages for safety switches.○ Verify operation of mechanical interlocks for safety switches.○ Inspect and dress current carrying contacts for safety switches in accordance with manufacturer’s recommendations.○ Test safety switches. Perform insulation resistance test on each phase-to-phase and phase-to-ground using a megohmmeter on each critical load switch.○ Perform contact resistance test on each critical load switch.	

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Fire and Carbon Monoxide Alarms and Fire Extinguishers Service Requirements	Status
Monthly Service (Scheduled for July, August and September 2014)	
<ul style="list-style-type: none"> • Test smoke detector per manufacture’s specification. • Test carbon monoxide detector per manufacture’s specification. • Visual inspection of all for fire and carbon monoxide alarms and fire extinguishers. • Clean smoke detectors using a vacuum cleaner attachment to remove dust and cobwebs. If possible, carefully vacuum inside the unit as well. • Clean carbon monoxide detectors using a vacuum cleaner attachment to remove dust and cobwebs. If possible, carefully vacuum inside the unit as well. Retest test/silence button after each cleaning. 	Completed
Annual Service (Scheduled for November 2014)	
<ul style="list-style-type: none"> • Fire and carbon monoxide alarm detector maintenance check. • Check charge on fire extinguisher. • Replace batteries for fire and carbon monoxide alarms. 	N/A
Every Two (2) Year Service (Phases I & II Scheduled for September 2014, Phase III Scheduled for January 2015)	
<ul style="list-style-type: none"> • Replace carbon monoxide detectors. 	Completed
Every Five (5) Year Service (Phases I & II Scheduled for August 2017, Phase III Scheduled for January 2018)	
<ul style="list-style-type: none"> • Re-fill and conduct a hydrostatic test on fire extinguishers. 	N/A

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Standby Generators Service Requirements	Status
Weekly Service	
<ul style="list-style-type: none"> • Exercise cycle run for standby generators for twenty (20) minutes. • Visual inspection of standby generators for obvious issues. • Verify the exercise cycle for standby generators has run. 	Not Completed
Monthly Service (Scheduled for July, August and September 2014)	
<ul style="list-style-type: none"> • Visual inspection of all devices for standby generators. • Perform standby generator inspections. • Check all standby generator systems for leaks. • Engine <ul style="list-style-type: none"> ○ Test low oil pressure (LOP) safety – record seconds to shut down. ○ Test high engine temperature (HET) safety – record seconds to shut down. ○ Test over speed (O/S) safety – record seconds to shut down. ○ Check pre-alarms if applicable. ○ Check over crank (O/C) item – record seconds to shut down. ○ Check cycle cranker time. ○ Check noises or leaks. • Oil System <ul style="list-style-type: none"> ○ Check oil filter and gaskets. • Cooling system <ul style="list-style-type: none"> ○ Check general condition. ○ Sample and test anti-freeze and add if needed. ○ Check coolant level. ○ Pressure test system. ○ Check and replace belts and hoses if needed. • Exhaust System <ul style="list-style-type: none"> ○ Visually check for leaks, corrosion and check condensation trap and muffler condition. ○ Drain condensation if possible. • Fuel System <ul style="list-style-type: none"> ○ Check for leaks; check all visible connections and flexible hoses. Replace flexible hoses if needed. ○ Adjust carburetor as needed. ○ Service air filters as needed. ○ Clear debris from around engine from grass or other foreign sources. ○ Check tanks to ensure they meet EPA requirements for standby generators. ○ Keep monthly log of fuel tank inspect reports. • Generators <ul style="list-style-type: none"> ○ Visually inspect generator condition, check slip rings and commutator for wear, check lubrication of rear generator bearing. ○ Check diode heat sinks. • Battery <ul style="list-style-type: none"> ○ Check specific gravity and load test. ○ Check water level. ○ Clean terminals and posts and coat with inhibitor. ○ Check battery charge. ○ Replace all batteries at the end of the contract. • Ignition System <ul style="list-style-type: none"> ○ Check all wires. ○ Inspect plugs and electronic ignition. ○ Lubricate upper and lower bearing. ○ Set timing as needed. • Accessories <ul style="list-style-type: none"> ○ Lubricate all hinges, door locks and cover snaps. Test locks and replace or repair as needed. ○ Inspect annunciator. 	Not Completed

Maintenance Rating Program for the Triangle Expressway

Third Quarter, July – September 2014

Standby Generators Service Requirements	Status
<ul style="list-style-type: none"> ○ Inspect battery charger. ○ Adjust battery charger – AMP-MA ○ Adjust annunciator battery lights. ○ Inspect tanks for rust and corrosion; prepare and paint all areas showing signs of rust or corrosion. ○ Prepare and paint any areas on the generator enclosure showing signs of rust or corrosion. 	
Quarterly Service (Scheduled for August 2014)	
<ul style="list-style-type: none"> ● Testing <ul style="list-style-type: none"> ○ Check unit under actual or full load as approved by the NCTA. This check should be performed after hours or during weekends. ○ Adjust voltage and frequency under actual load. ○ Adjust clock exerciser, day, time, load, no load. ○ Test delay start, pick up, transfer, cool down, transition and preheat. ○ Calibrate Under Voltage (UV) sensors, generator sensor, and Over Voltage (OV) sensors. ○ Record load per leg, voltage, hertz, oil pressure, and water temperature. ○ Check battery charging system. ○ Test transfer switch relays for proper operation including loss of single phase power. ○ Provide certification of proper operation. ○ Load test the Generator as recommended by the equipment manufacturer. ○ Annual 2 hour Load Bank test per manufacturer recommendation. ○ Provide load test reports. ○ Visually check for leaks. 	Not Completed
Semi-Annual Service (Scheduled for August 2014)	
<ul style="list-style-type: none"> ● Oil System <ul style="list-style-type: none"> ○ Change engine oil. ○ Change oil filter and gaskets. ○ Visually check for leaks. 	Completed
Annual Service (Scheduled for November 2014)	
<ul style="list-style-type: none"> ● Annual 2 hour Load Bank test per manufacturer recommendation. <ul style="list-style-type: none"> ○ Provide load test reports. ○ Visually check for leaks. ● Replace batteries. ● Replace filters annually. 	N/A

Maintenance Rating Program for the Triangle Expressway

Third Quarter, July – September 2014

Security Components Service Requirements	Status
Quarterly Service (Scheduled for September 2014)	
<ul style="list-style-type: none">• Check all locks on security components are in working order.• Lubricate all security component locks per manufacturer’s recommendations.• Verify keys for all security component locks can be located.• Note and report any lock tampering.	Completed

Maintenance Rating Program for the Triangle Expressway

Third Quarter, July – September 2014

Toll Facility Vaults Service Requirements	Status
Weekly Service	
<ul style="list-style-type: none"> • Clear and remove all debris, litter, etc. inside toll facility vaults and out. • Remove cobwebs and insect nests from walls, corners and ceilings of all toll facility vaults. • Clean exterior door jambs, frames and transoms in all entrances. 	Not Completed
Quarterly Service (Scheduled for July 2014)	
<ul style="list-style-type: none"> • Inspect the toll facility vaults for cracks in panels at sharp angles near doors and openings and at panel connection joints. • Inspect coatings for peeling on doors where concrete was cracking. • Inspect the floor coatings for chipping and wear. • Inspect for rust stains found around cracks, or exposed reinforcing steel, or other causes for concern. • Look at door and vault seals, caulking, exposed backer bar, or door jamb seals missing or damaged. 	Completed
Annual Service (Scheduled for October 2014)	
<ul style="list-style-type: none"> • Inspection by and report on condition from a qualified structural engineer. 	N/A

Maintenance Rating Program for the Triangle Expressway

Third Quarter, July – September 2014

Pressure Cleaning Service Requirements	Status
Semi-Annual Service (Scheduled for December 2014)	
<ul style="list-style-type: none">• Provide all labor, materials, tools, equipment and incidentals (including water if not available at the facility) necessary to perform the work as specified. Use cleaners, degreasing agents and other approved means to remove all dirt, oil, tar, exhaust residue, spider webs and egg sacs, mud dauber nests, wasp and bee nests and any other deposit or film which may be present on the exterior of the vaults. Streaking of surfaces will not be allowed and manual scrubbing may be required in order to attain the desired results.• Materials Safety Data Sheets (MSDS) for all chemicals used shall be submitted by ACS. All chemical agents and additives must be approved by NCTA prior to beginning any work.• Protect all NCTA equipment during the time that cleaning is in progress. ACS shall be responsible for any and all damages caused by their Contractor's operations to either NCTA property or to the public moving through the facilities. No equipment, vehicles or materials may be stored at any NCTA facility.• Upon completion of each day's work, ACS shall ensure that the toll zone or facility being cleaned is free from debris caused by the work and remove and dispose of such debris off NCTA right-of-way.• The cleaning equipment shall be independently powered and capable of attaining adequate pressure and temperature to perform a job that meets the desired cleaning results. The equipment must also be designed to apply approved cleaning agents to surfaces to be cleaned in a volume sufficient to attain the desired cleaning results. Chemical cleaners that are used on surfaces in areas of plants and grass shall not be harmful to vegetation. Care shall also be taken to avoid any damage to existing grass, plants, shrubs and trees by equipment or personnel. Any plants or foliage damaged shall be replaced with equal or better plantings at no cost to the NCTA.	N/A

Maintenance Rating Program for the Triangle Expressway

Third Quarter, July – September 2014

Pest Control Service Requirements	Status
Quarterly Service (Scheduled for August 2014)	
<ul style="list-style-type: none">• Insect control includes those measures which are necessary to suppress general household insects within and around the facilities by using properly registered and labeled pesticide products and approved devices.• Rodent control includes those measures necessary to suppress populations of rats and mice that become a nuisance within or around the NCTA premises and equipment. There shall be no signs of infestations.• The program for the control of general pests shall be continually in effect. There shall be no signs of infestations.• Treat all areas of the facility to eliminate those pests mentioned above. These areas include, but are not limited to, vaults (interior and exterior perimeter which extends for a distance of fifteen feet (15') around the vaults), toll cabinets, emergency generators, and storage facilities.• Protect NCTA equipment during the time the work is underway. All materials for pest control shall conform to federal, state and local ordinances and precautions shall be used to avoid accident or injury to the employees and prevent damage to the facilities.	Completed

Maintenance Rating Program for the Triangle Expressway

Third Quarter, July – September 2014

Grounding and Ground System Testing Service Requirements	Status
Semi-Annual Service (Scheduled for August 2014)	
<ul style="list-style-type: none"> • Testing <ul style="list-style-type: none"> ○ Perform testing of ground rods at each toll zone and facility as directed by the NCTA to determine the resistance of each ground rod. Document, certify, correct and provide a report of Ground Resistance Test for the results of all tests performed. ○ For all ground rods exceeding 25 ohms (unless otherwise specified), furnish and install 5/8" x 10' copper clad ground rods or ground rod segments as necessary to achieve the grounding requirements until ground resistance of 25 ohms (unless otherwise specified) or less is achieved. ○ Furnish and install exothermic weld connections, Cadweld by ERICO approved equal as necessary to achieve the testing requirements. ○ Perform testing and provide and certify a report of Ground Resistance Test at each toll zone grounding system upon completion of installation of new ground rod(s). 	Completed

8.2 Analysis and Recommendations

As part of the third quarter inspection, HNTB reviewed the July, August and September maintenance logs provided by XEROX. According to these logs, air conditioning unit, pest control, fire and carbon monoxide alarms and fire extinguishers, security components, and grounding and ground system testing services were completed and are therefore meeting all maintenance contract expectations.

However, the logs submitted this quarter showed that electrical components, standby generators and toll facility vaults services were only partially completed. No maintenance logs were submitted for the month of July as proof of completion of the monthly electrical components services, monthly and weekly standby generator services and weekly toll facility vaults maintenance services. Also, no maintenance logs were submitted as proof of completion of the standby generator quarterly service. Due to the lack of documentation proving that all scheduled services were completed, electrical components, standby generators, and toll facility vaults services are failing to meet maintenance contract expectations.

During the services provided this quarter, the only problems reported by XEROX in the maintenance logs submitted were found during the toll facility vaults quarterly service and the September standby generator monthly service. While no non-working items were reported during the toll-facility vaults services, all vaults were reported to have cracks in the wall panel, roof panel, floor, or sidewalk. Out of the twelve vaults inspected, two were reported to have water leakage. During the September standby generators monthly service, three units were reported to have problems. In unit 3-2 the AST lock was found broken, in unit 7-2 a damaged wire was found and the heater in unit 8-1 was not working at the time of the inspection. A status update of the repair to these issues will be provided in the next MRP report.

9.0 GREEN LEVEL HISTORIC DISTRICT SIGNS

The four (4) Green Level Historic District signs and surrounding landscaped areas were installed as part of the Triangle Expressway construction projects. 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.

9.1 Analysis and Recommendations

As part of each quarterly inspection, assessors also visit the four Green Level Historic District signs to conduct a visual inspection of the sign to ensure they are in good standing.

These signs were visually inspected as part of this quarterly inspection and were found to all be in good condition. However, the landscaped areas surrounding the signs continue to contain numerous weeds and have started to look unsightly and overgrown. In several instances, part or all of the sign's visibility has become blocked by vegetation, which can be seen in *Figure 9*.

Figure 9: Green Level West Historic District Signs



10.0 CONCLUSION

This report represents the 2014 third quarter and the current rolling rating assessment of the Triangle Expressway. **The NCTA's target rating for an overall score is 90, the element level should not be below an 85, and no feature/characteristic should be below an 80.**

The third quarter 2014 score is **88.6** and the rolling rating score is **90.8**. Both scores are down by several points from the previous assessment of 89.8 and 92.1 respectively. While the rolling rating score is still within the established parameters, this assessment marks the second time that the overall quarter score has dropped below a 90. All elements were above the minimum rating of 85, and several characteristics fell below the minimum threshold of 80; Paved Shoulders (77), Paved Ditches (50), Miscellaneous

Maintenance Rating Program for the Triangle Expressway

Third Quarter, July – September 2014

Drainage Structures (72), Turf Condition (61), Impact Attenuators (78), and Pavement Markers (45) for the 2014 Third Quarter, and Paved Ditches (60) and Turf Condition (69) for the rolling rating assessment.

The maintenance provider should plan to remove any debris that may have been washed down onto the paved ditches due to the subsequent heavy rains on a consistent basis. Also, pavement markers should be checked and reapplied after the inclement weather season and prior to the start of the next season.

Turf Condition is failing for both the third quarter and for the rolling rating score, and needs the most attention. It is recommended that over seeding of these areas occur with warm season turf seed such as Bermuda grass, and that the cycles of mowing and trimming are maintained with special attention toward preventing scalping the turf from low cutting heights.

Additionally, it should be noted that while Pavement Striping has scored a 97 for the 2014 Third Quarter and a 96 for the rolling rating the lifespan of epoxy paint pavement markings are 3 to 5 years and some of the Triangle Expressway is approaching this time period. Preparations should be made in the budget and work schedule to plan for this work.

This quarter, only air conditioning unit, pest control, fire and carbon monoxide alarms and fire extinguishers, security components, and grounding and ground system testing maintenance services met contract expectations. Due to lack of documentation proving that the scheduled maintenance services were completed, electrical components, standby generators and toll facility vaults services failed to meet contract expectations. It is recommended for XEROX to develop a more efficient method of creating maintenance logs that meet NCTA's expectations. Also, it is recommended that XEROX follows closely the maintenance logs' scheduled due dates to allow for NCTA to receive the required logs in a timely manner.

All Green Level Historic District signs inspected were found to be in good condition. However, overgrown vegetation is continuing to block some of these signs. In order to avoid vegetation from covering these signs it is recommended to increase the maintenance service frequency of the landscaped areas surrounding the signs.

Overall, the Triangle Expressway is being maintained well and in a manner consistent with other toll facilities in the United States.

Appendix A

Triangle Expressway 2014 Third Quarter Asset Assessment Locations

Appendix A: Triangle Expressway 2014 Third Quarter Asset Assessment Locations

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

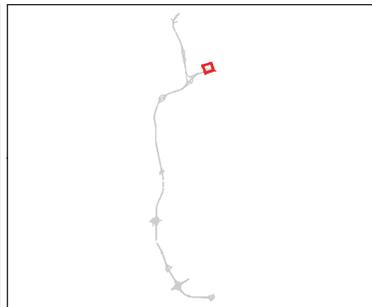
- Guardrail, Concrete Barrier and End Anchors – BR
- Curb and Gutter – CG
- Decorative Supports – DS
- Drainage Pipes – DP
- Misc. Drainage Structures – MDP
- Fence and Control of Access – FN
- Graffiti - GF
- Highway Lighting – HL
- Impact Attenuators – IA
- Inlets – IN
- Landscaping – PB
- Linear Samples – LS
 - Paved Lanes – Asphalt
 - Paved Lanes – Concrete
 - Paved Shoulders
 - Unpaved Shoulders
 - Front/Back Slopes
 - Unpaved Lateral and Outfall Ditches
 - Litter
 - Roadway Sweeping
 - Pavement Striping
 - Pavement Markers
- 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

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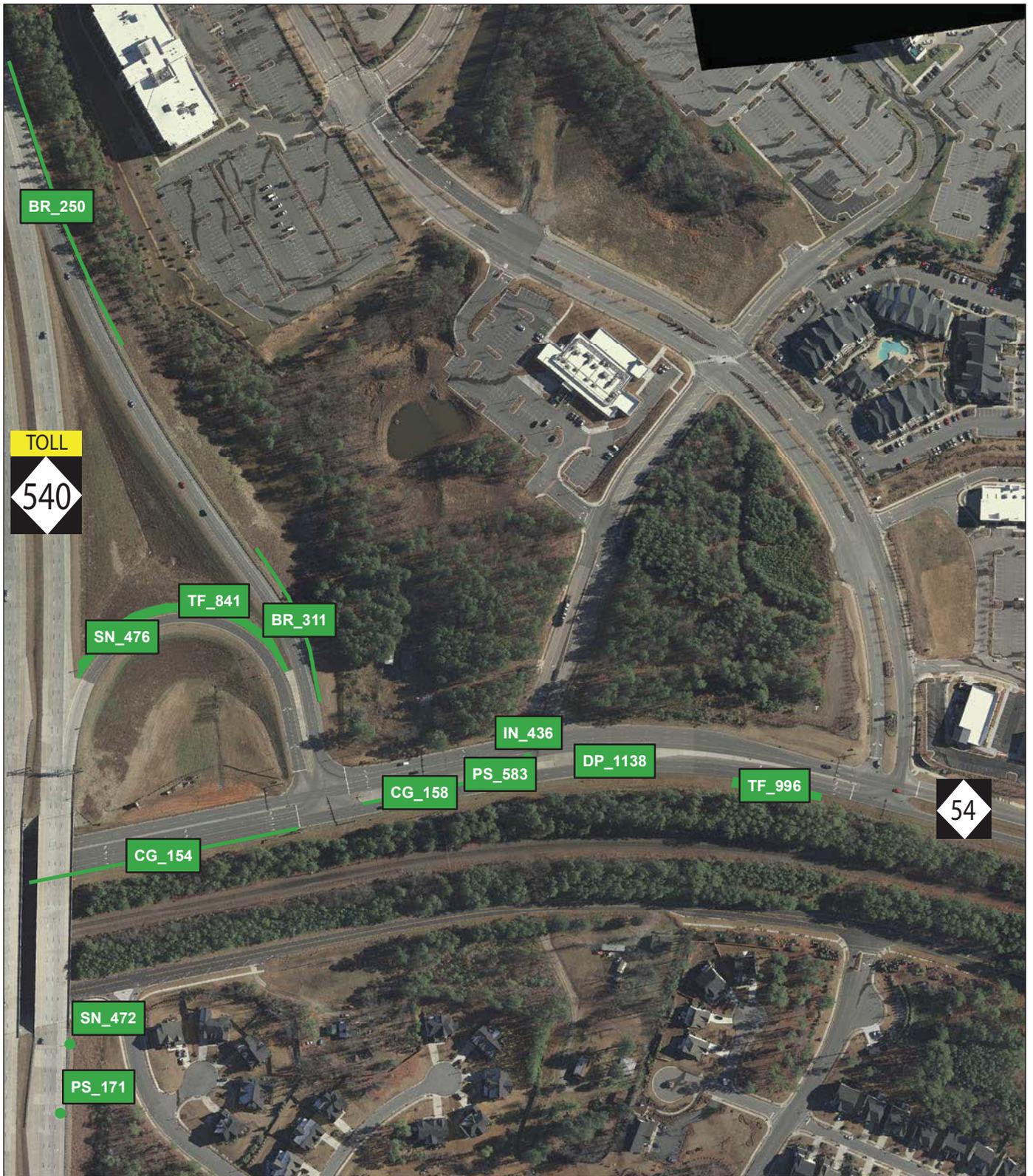


Legend

- Passing Asset
- Failing Asset



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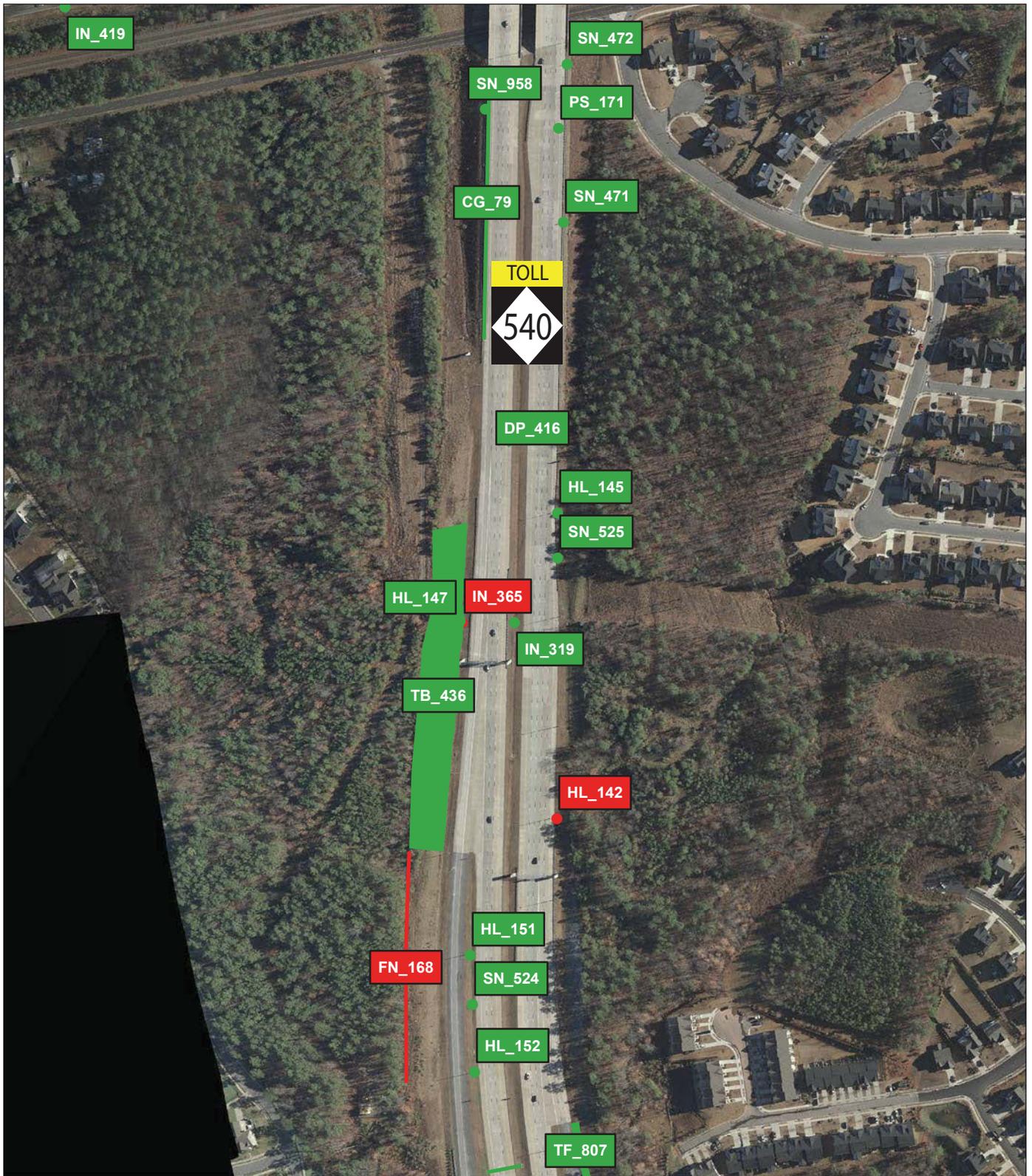


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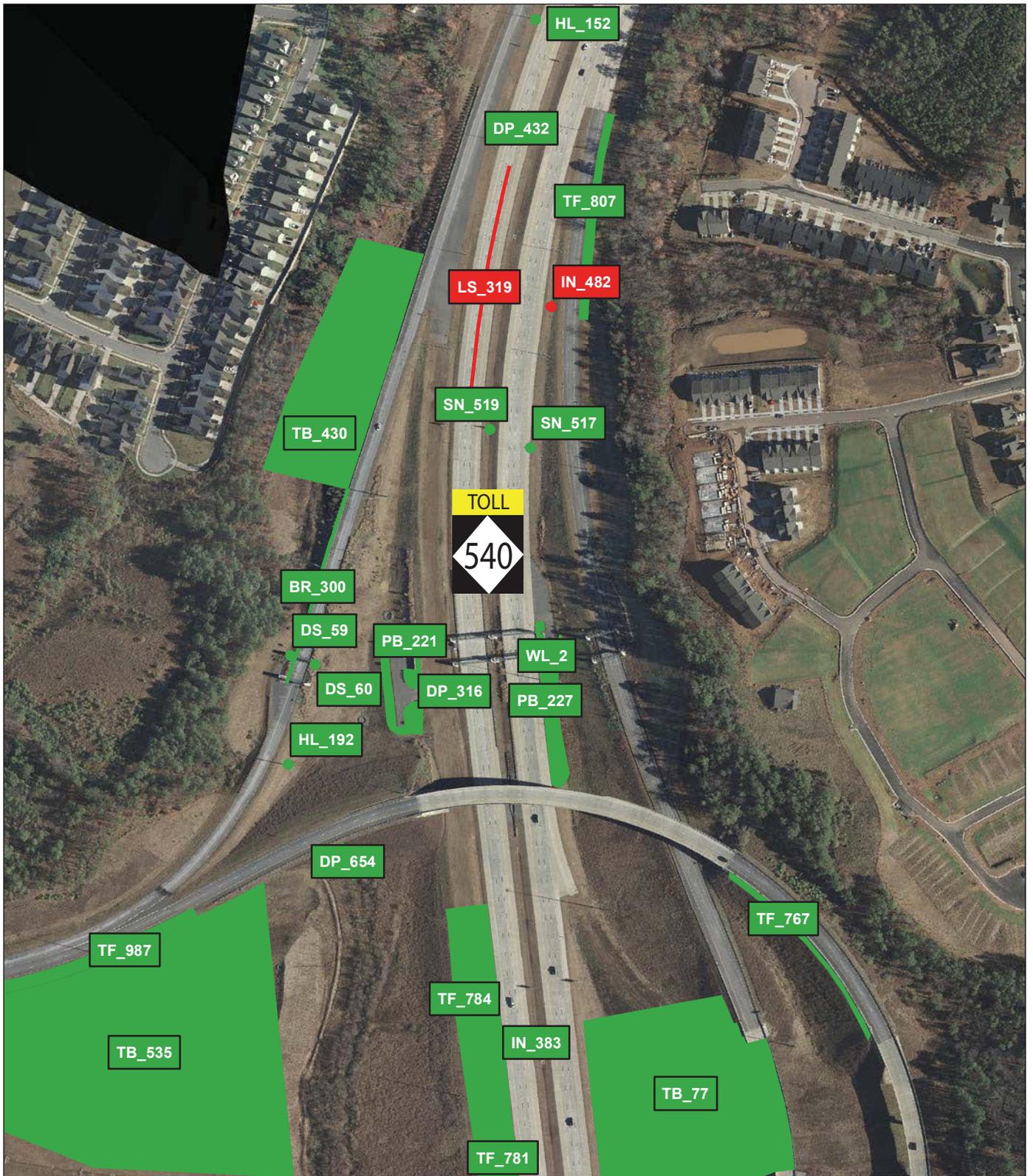


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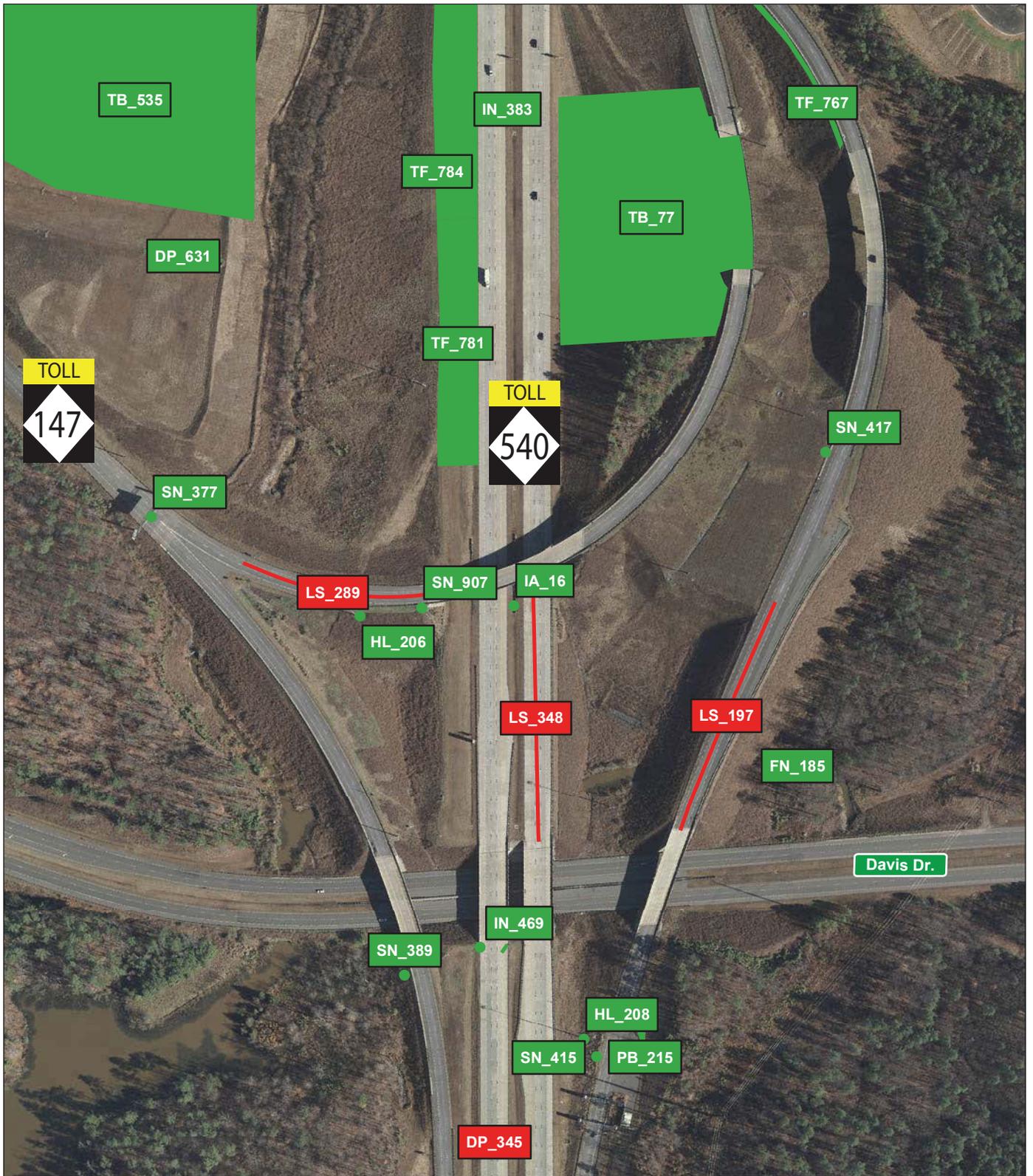


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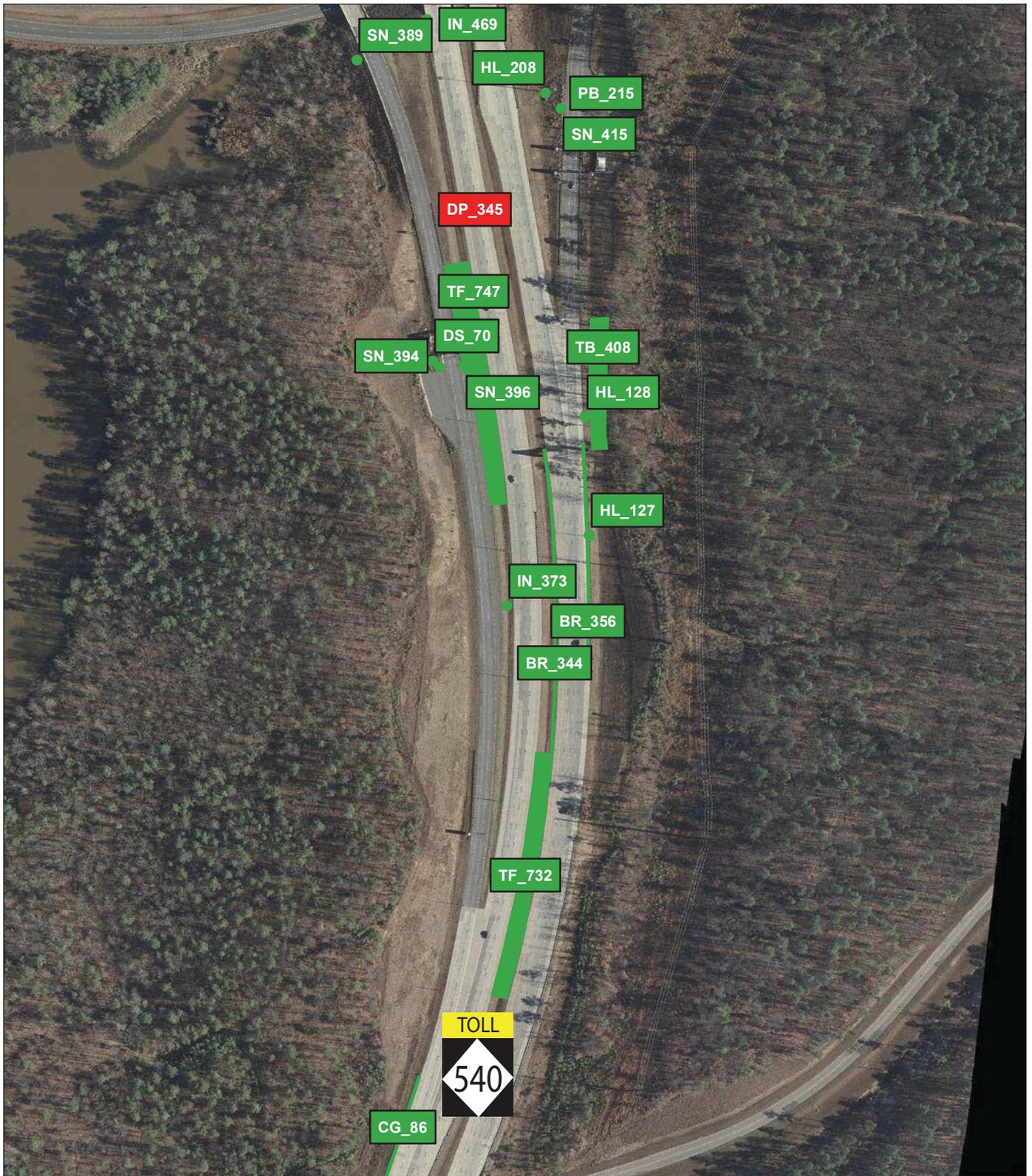


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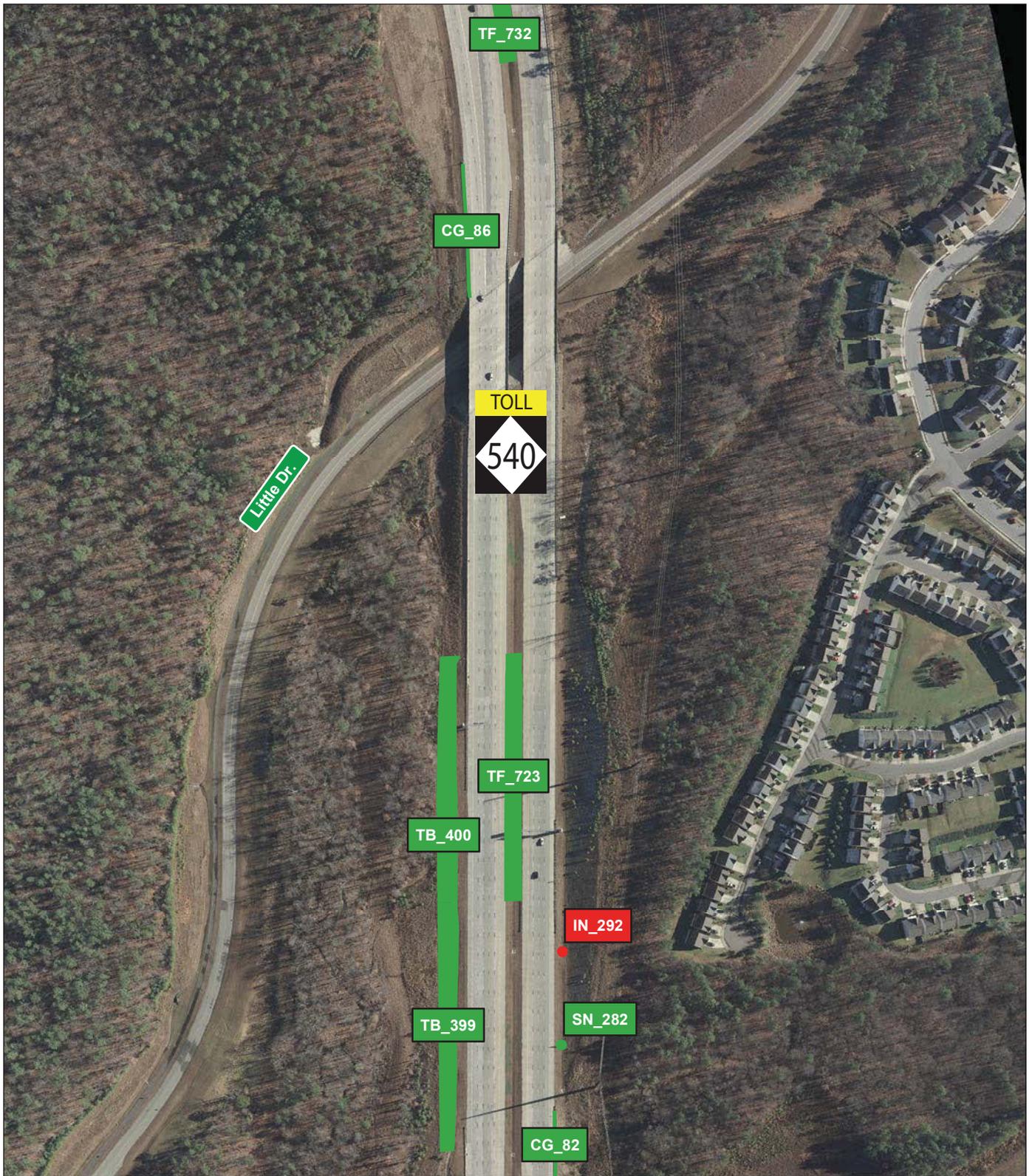


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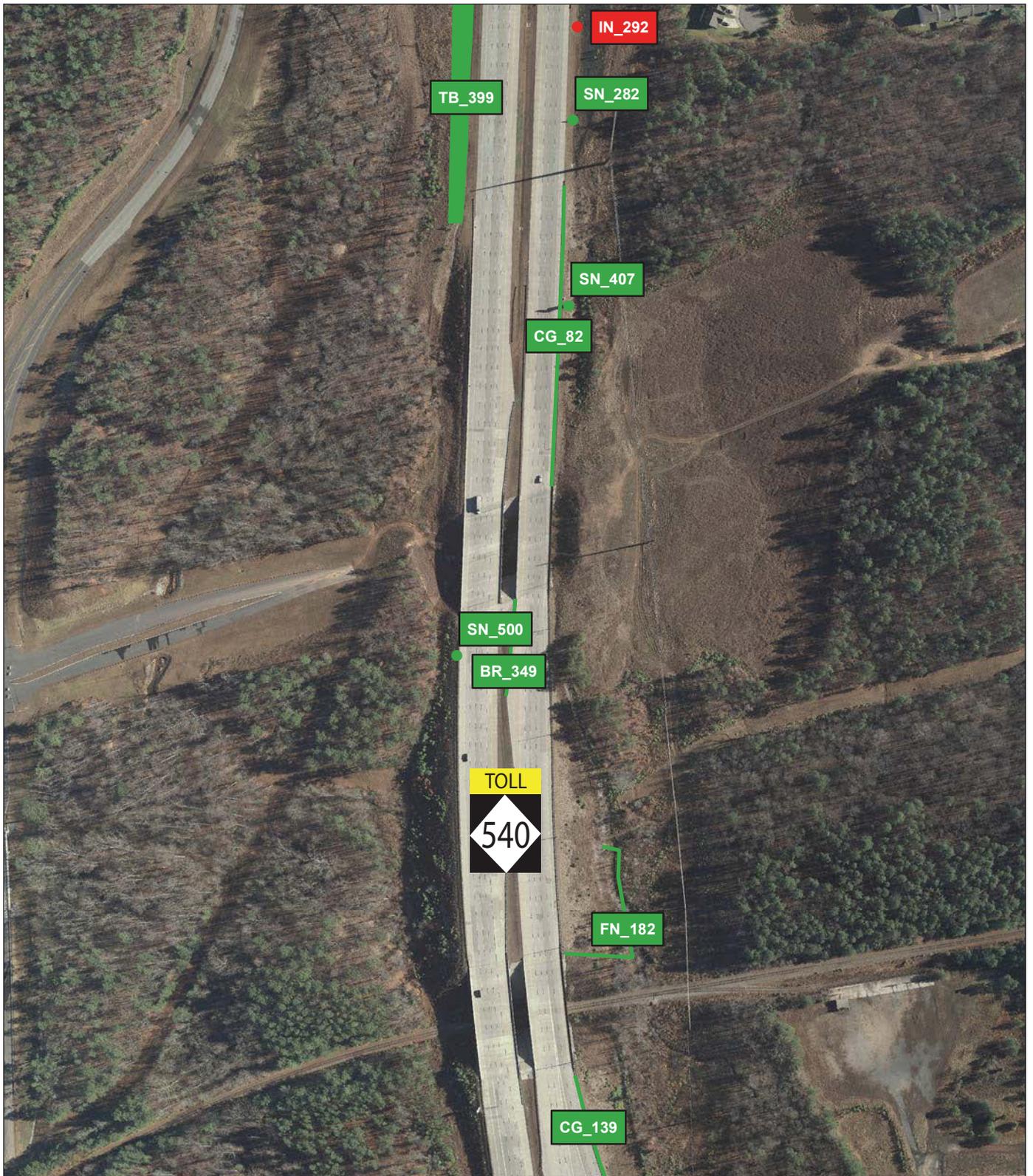


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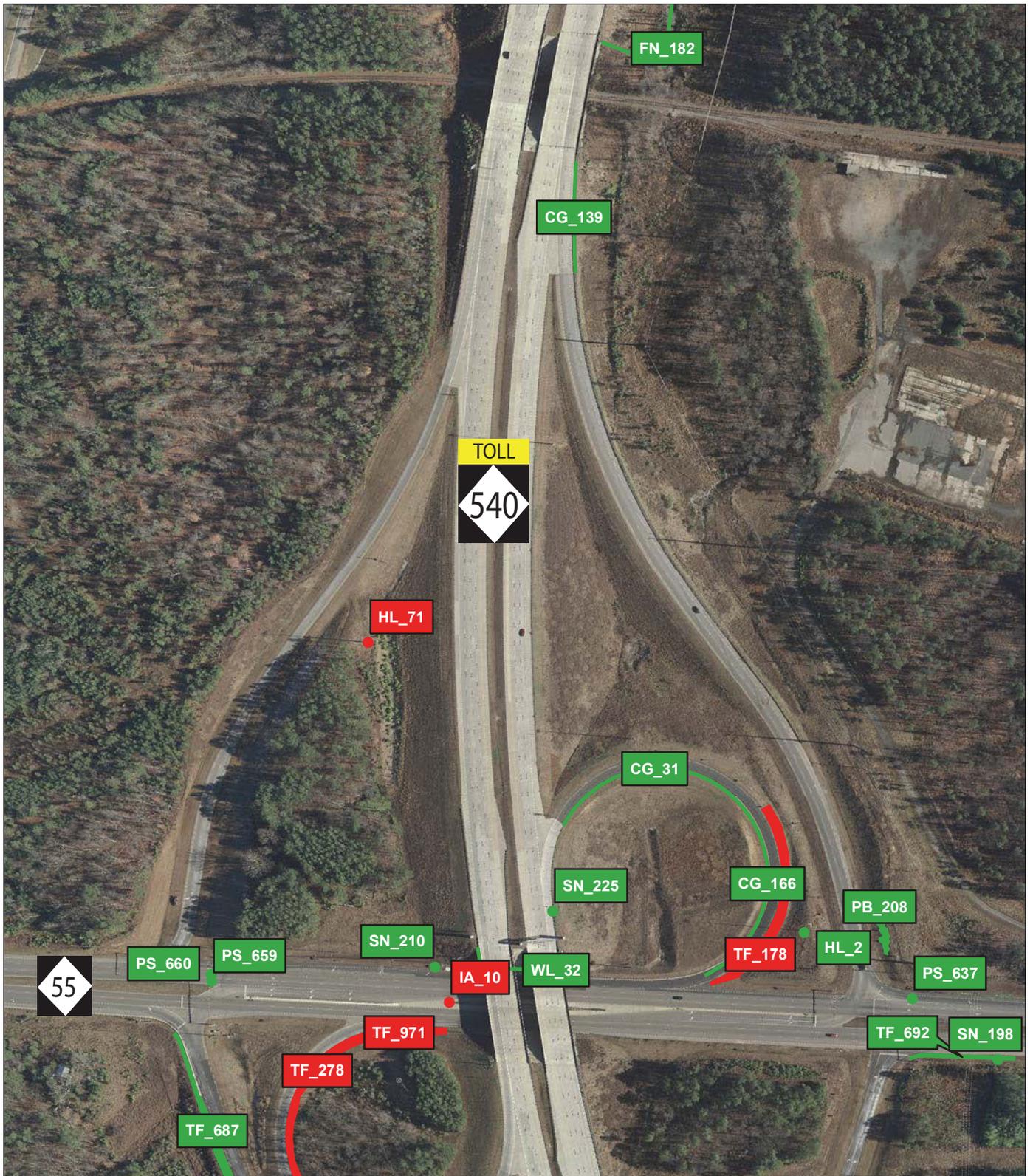


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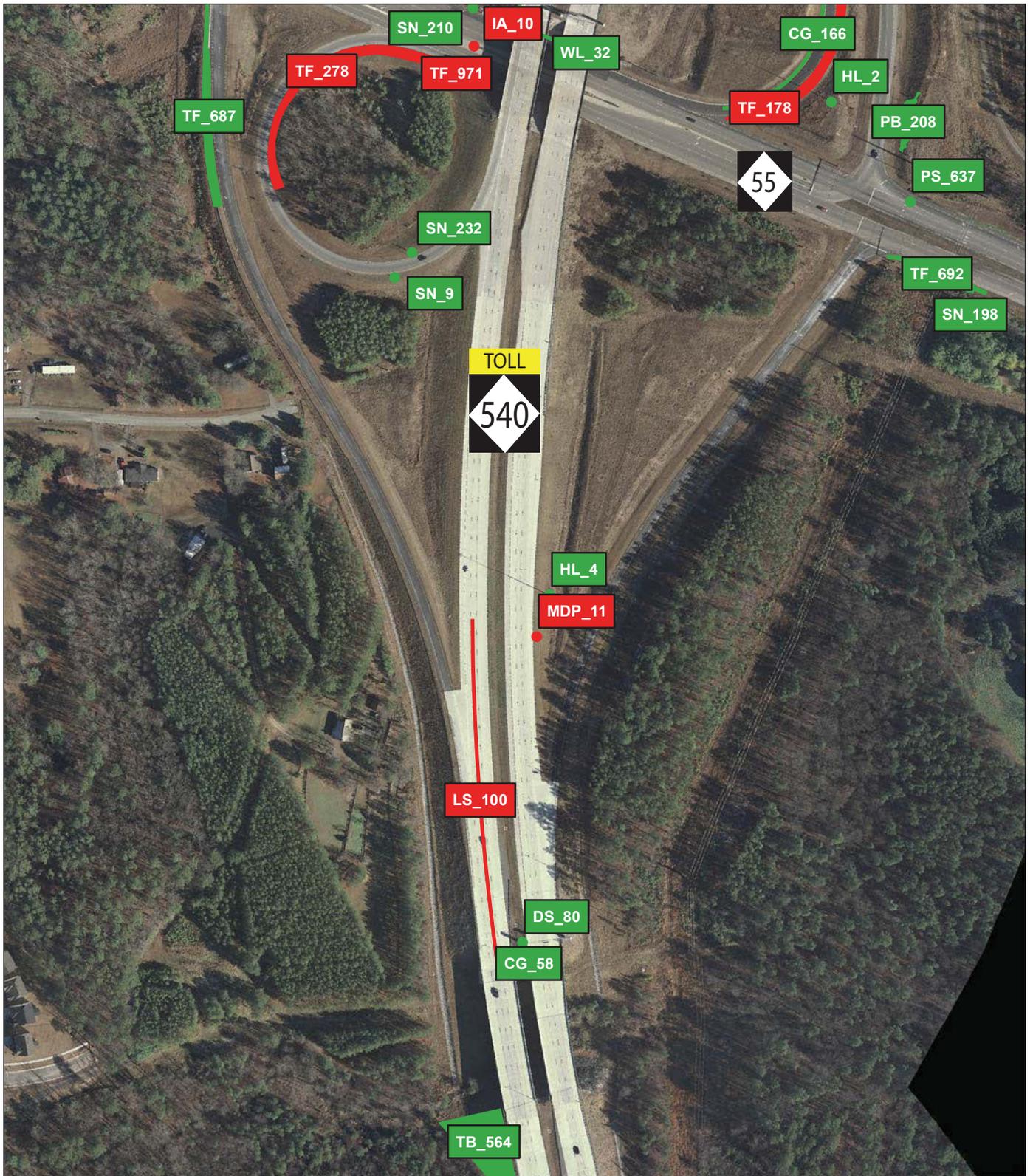


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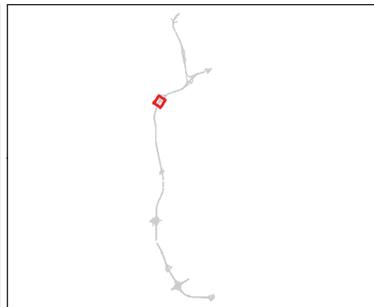


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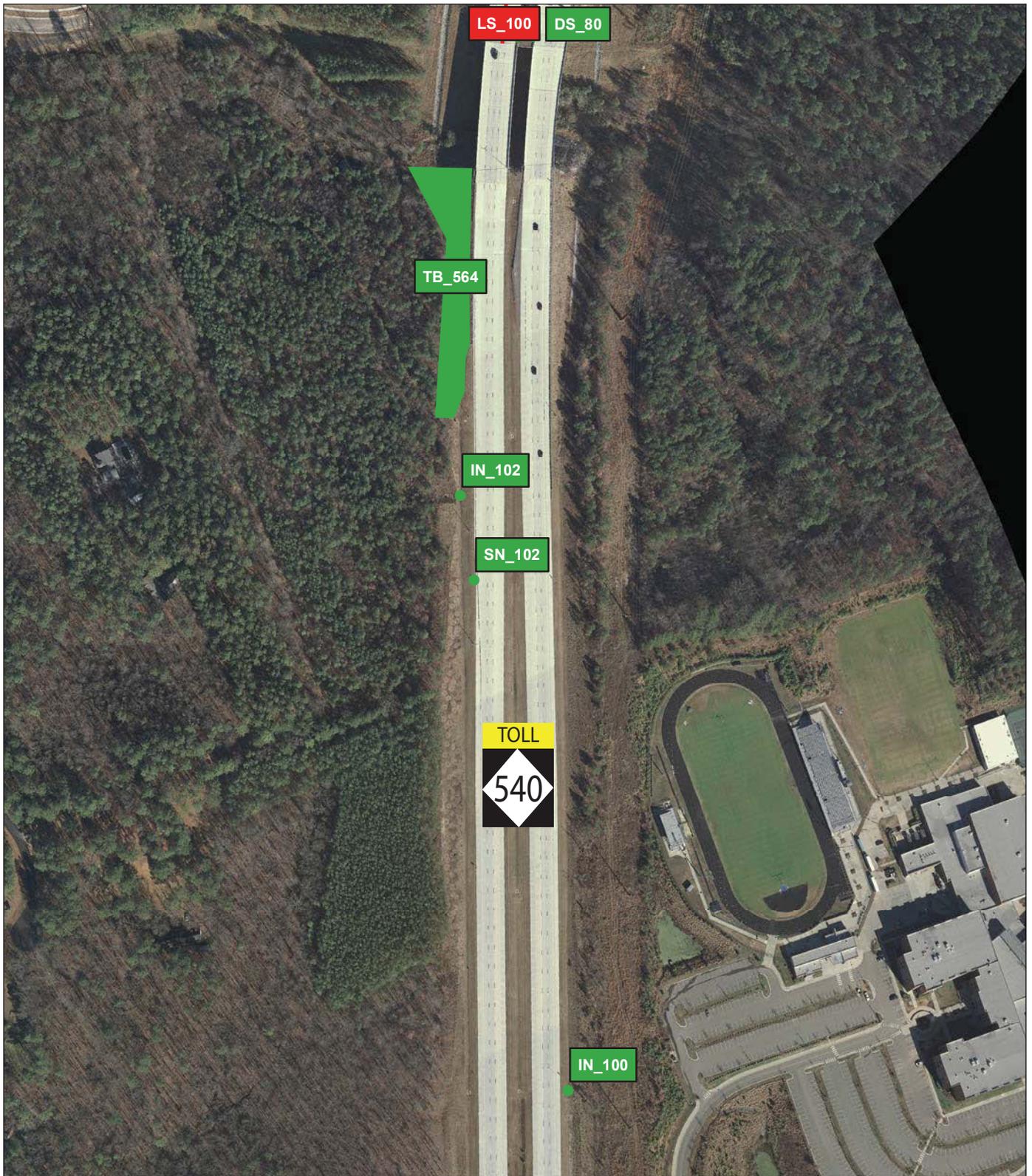


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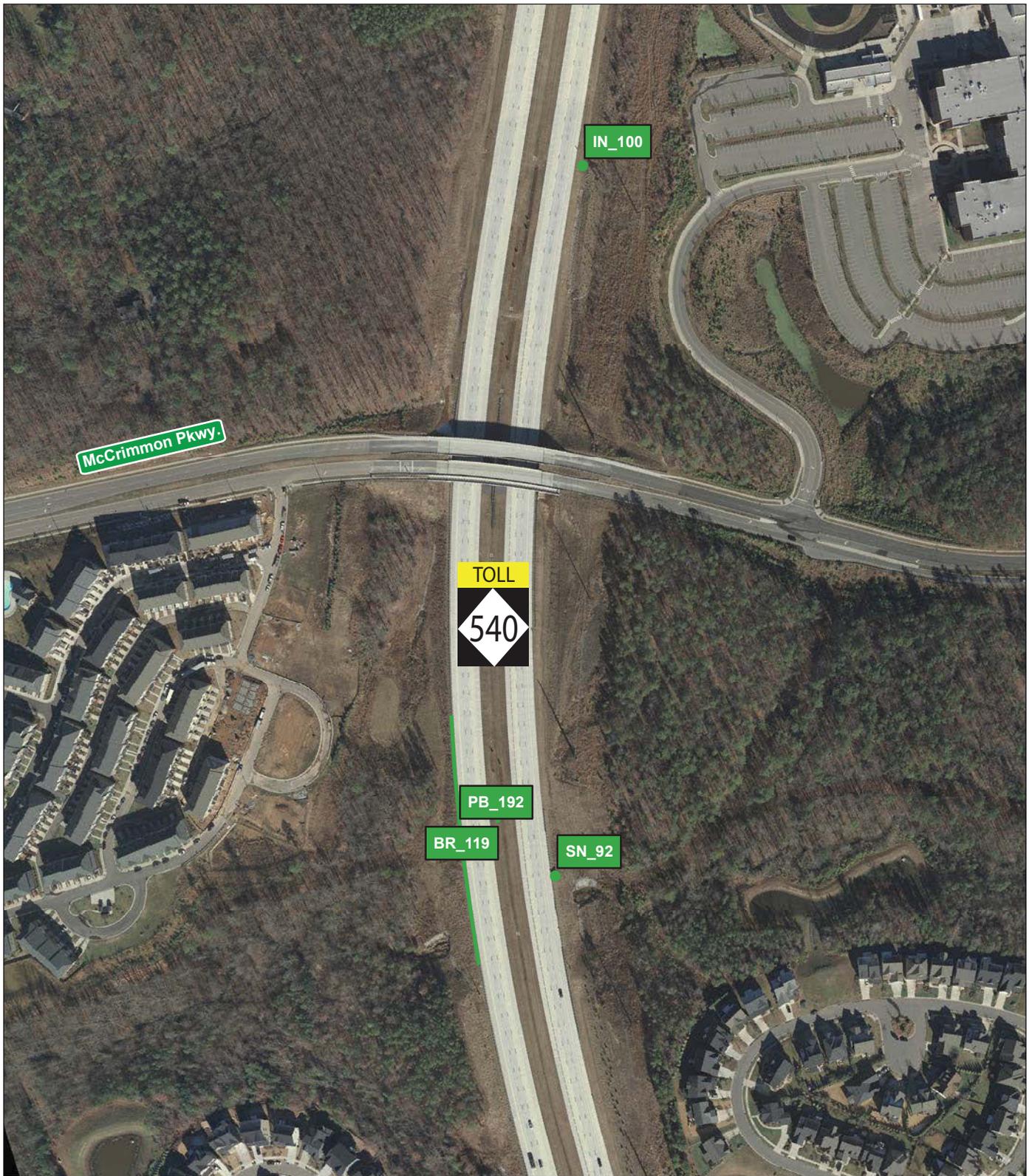


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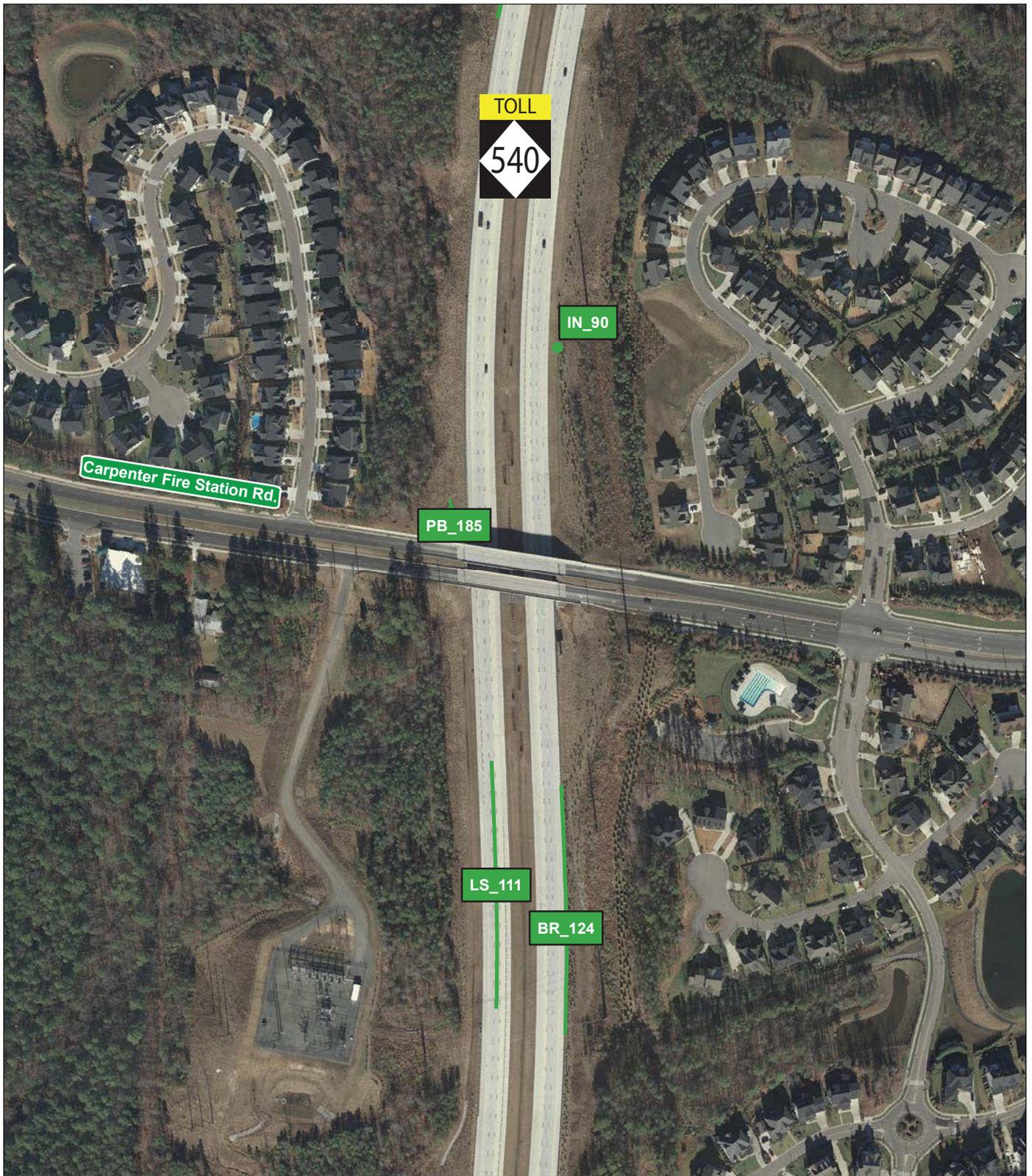


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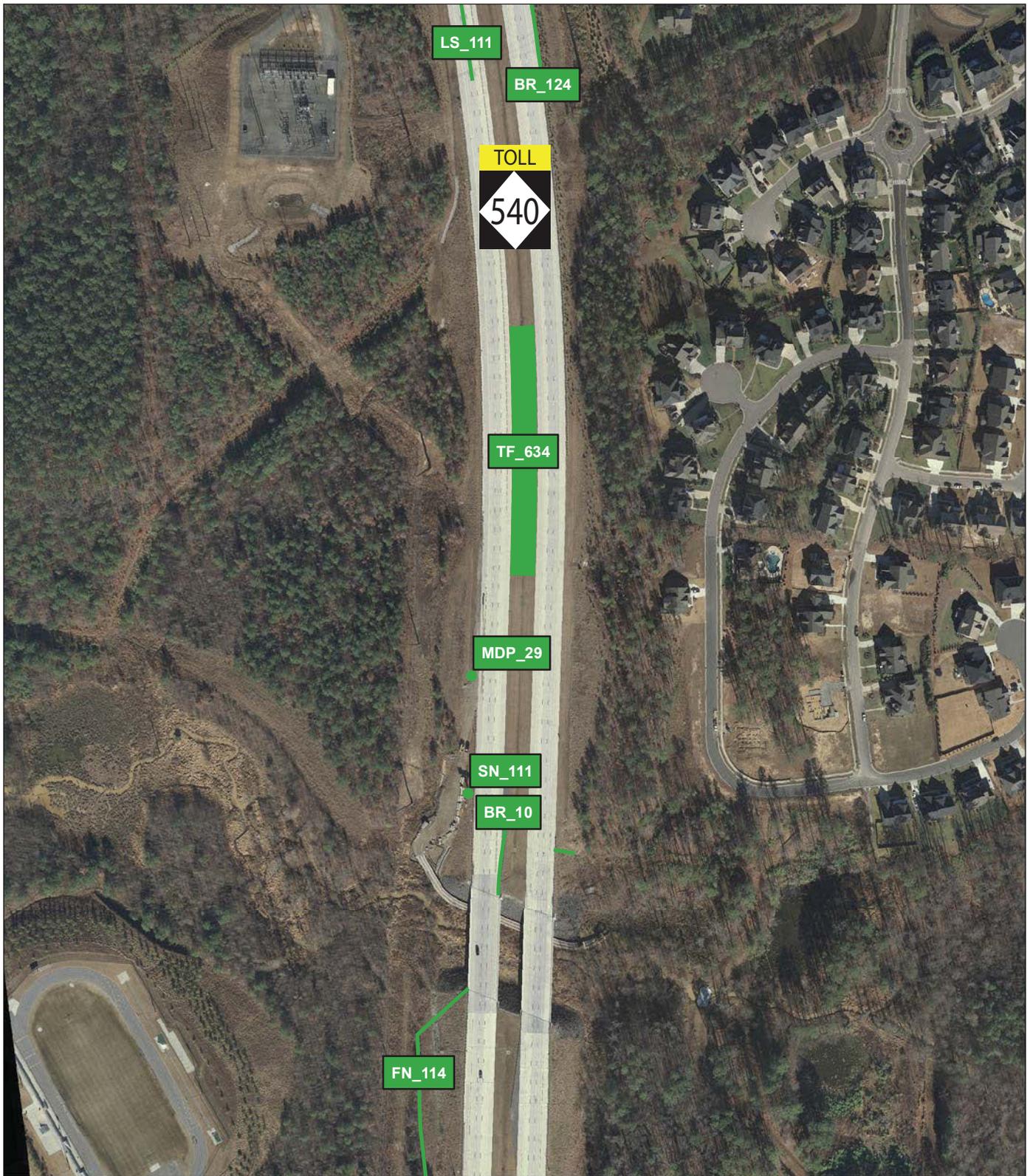


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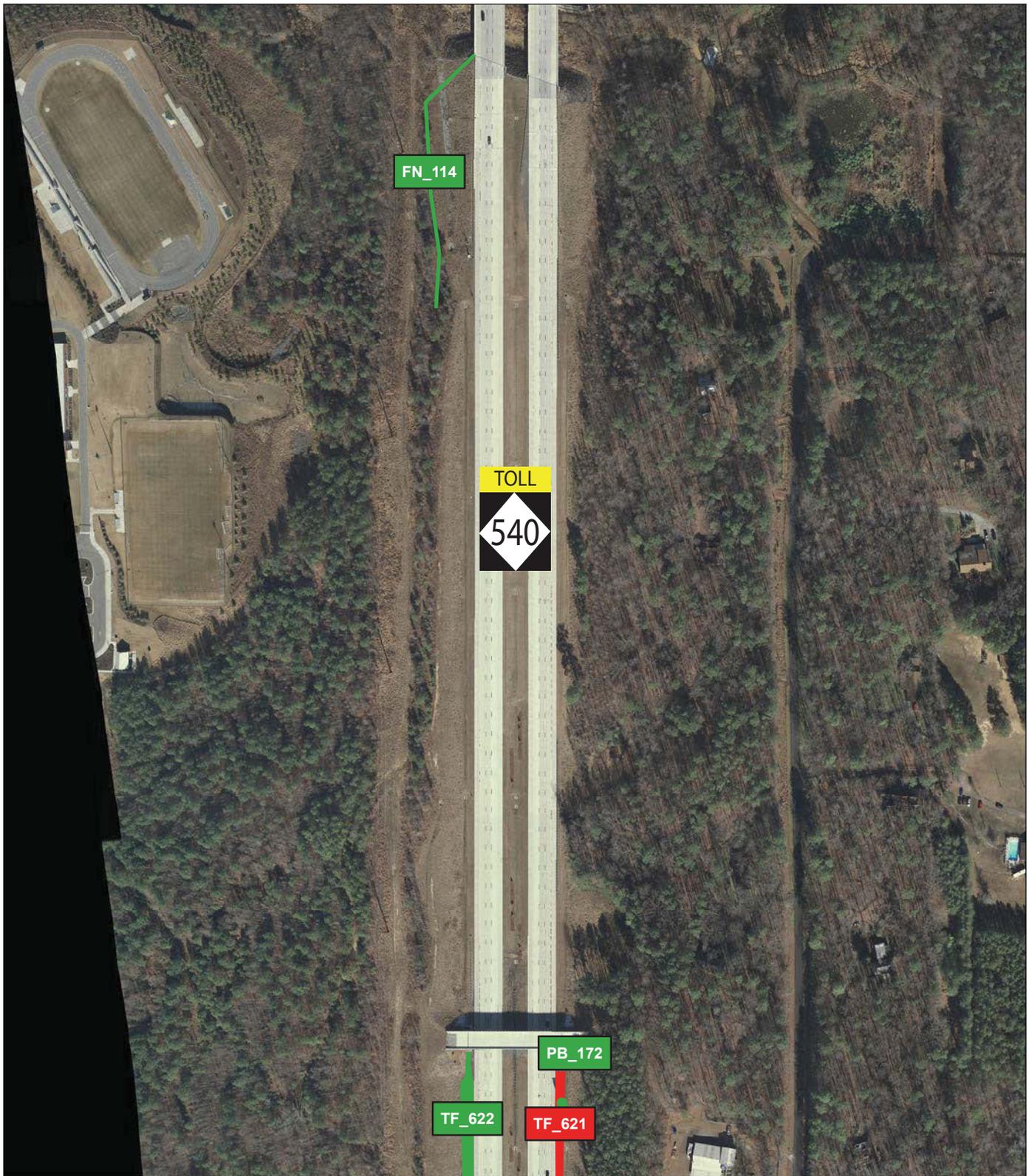


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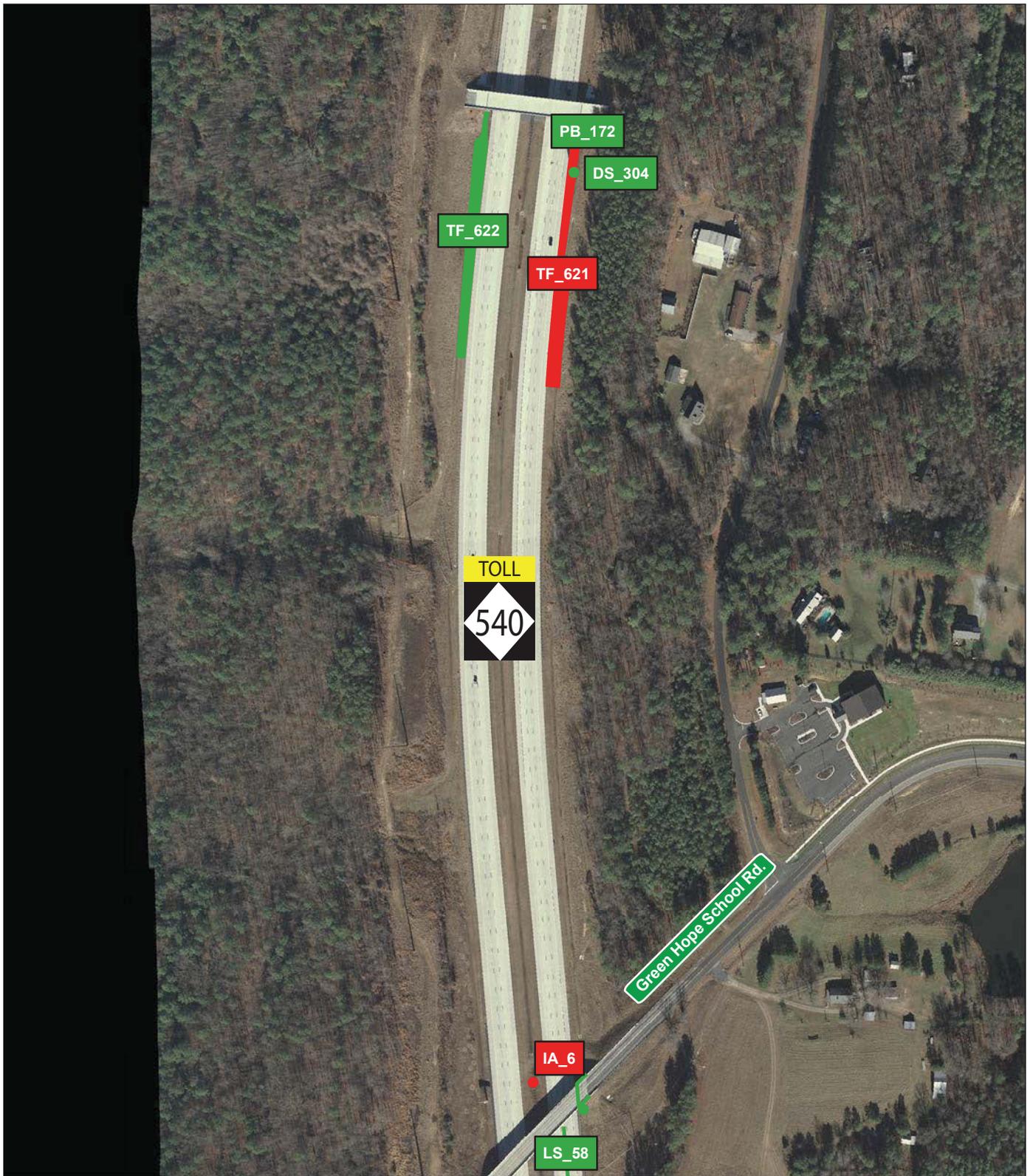


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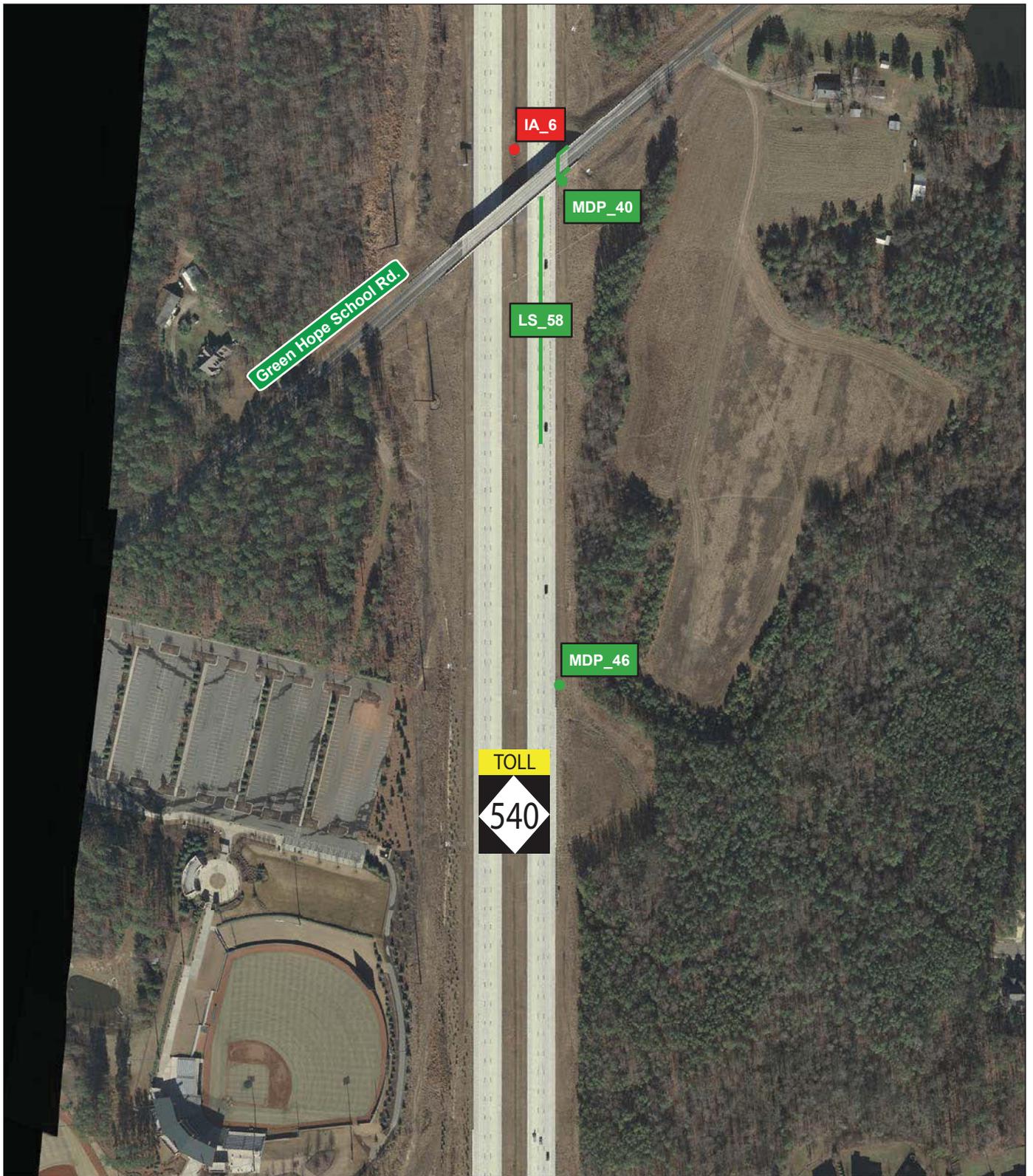


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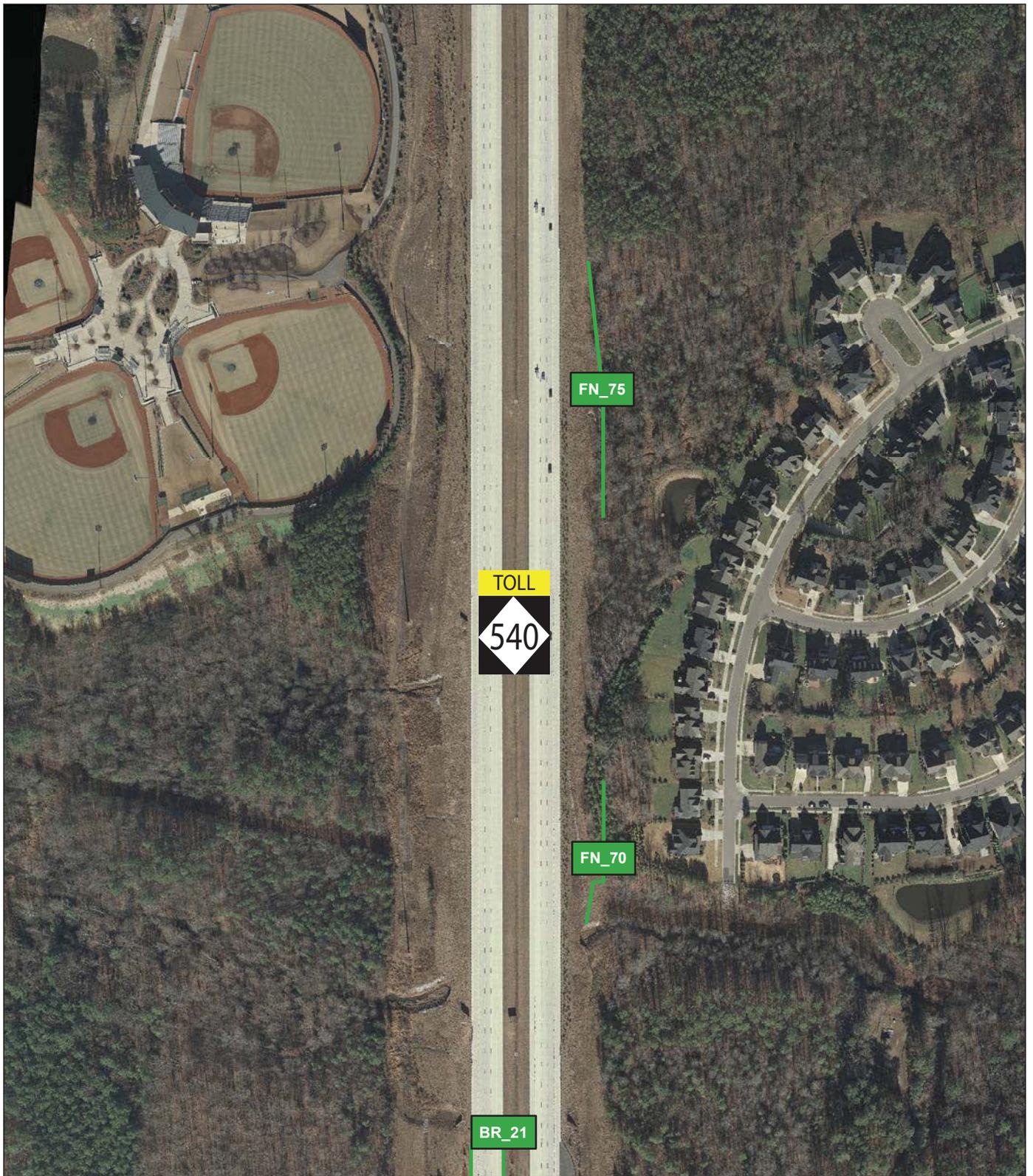


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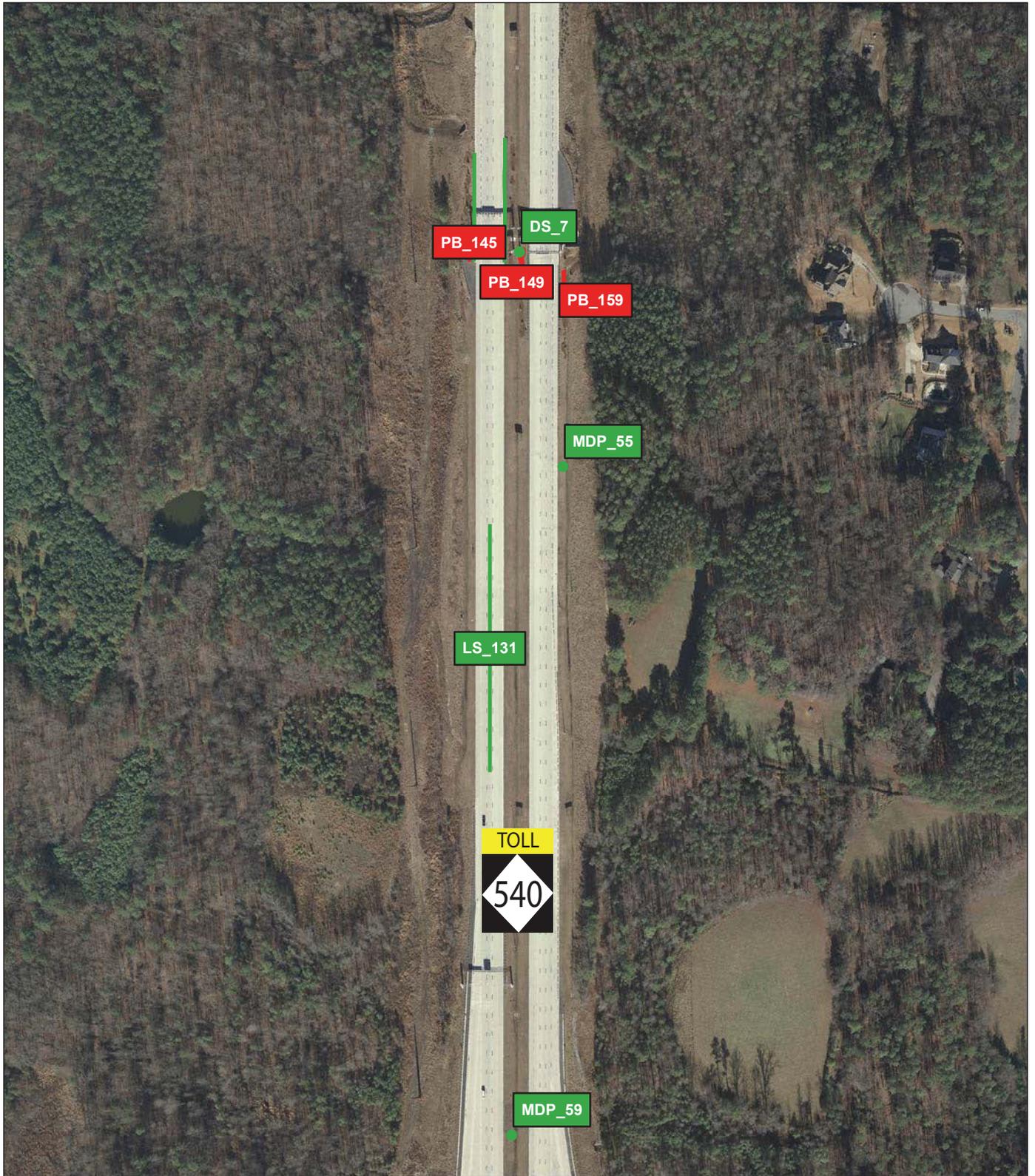


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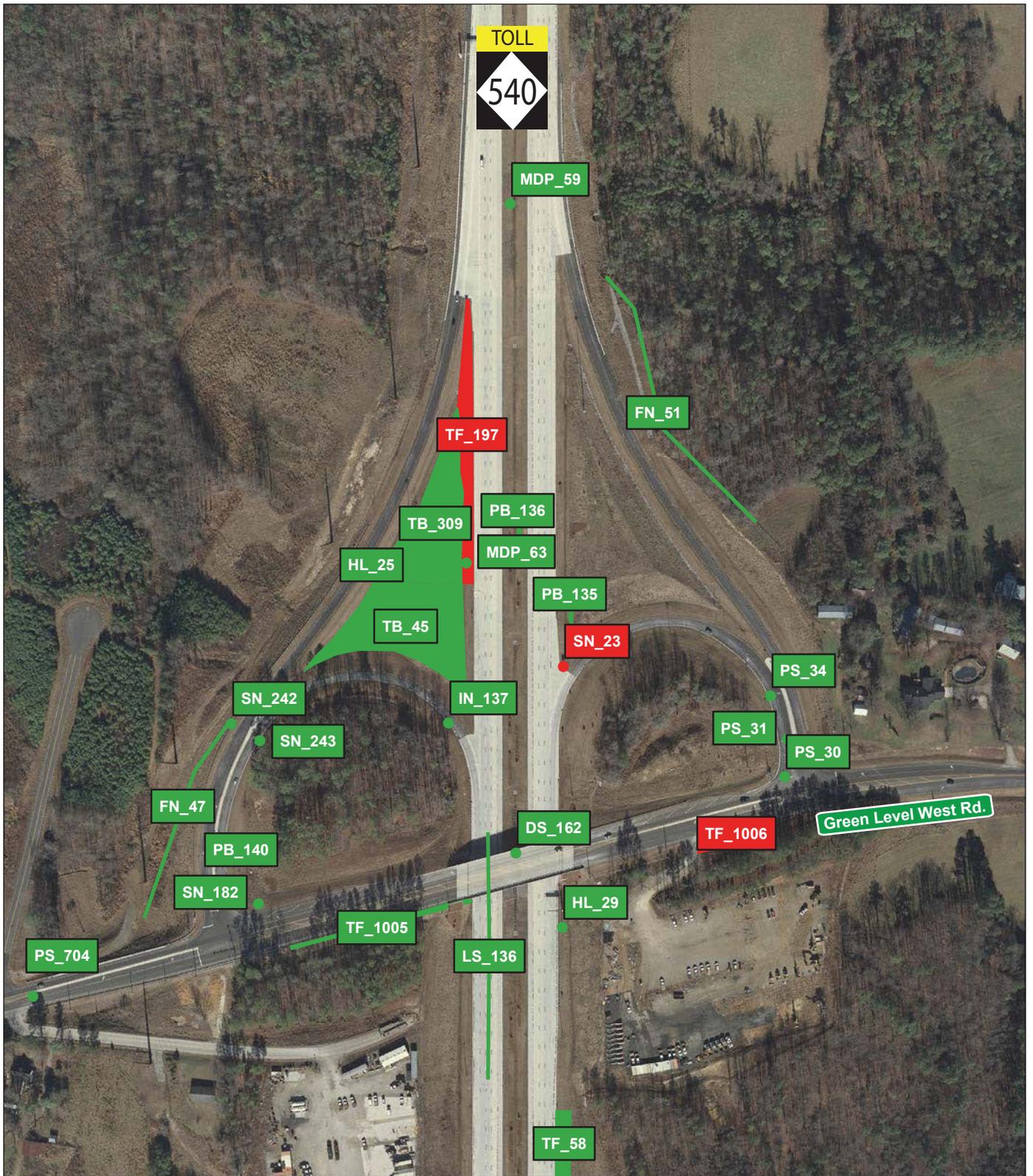


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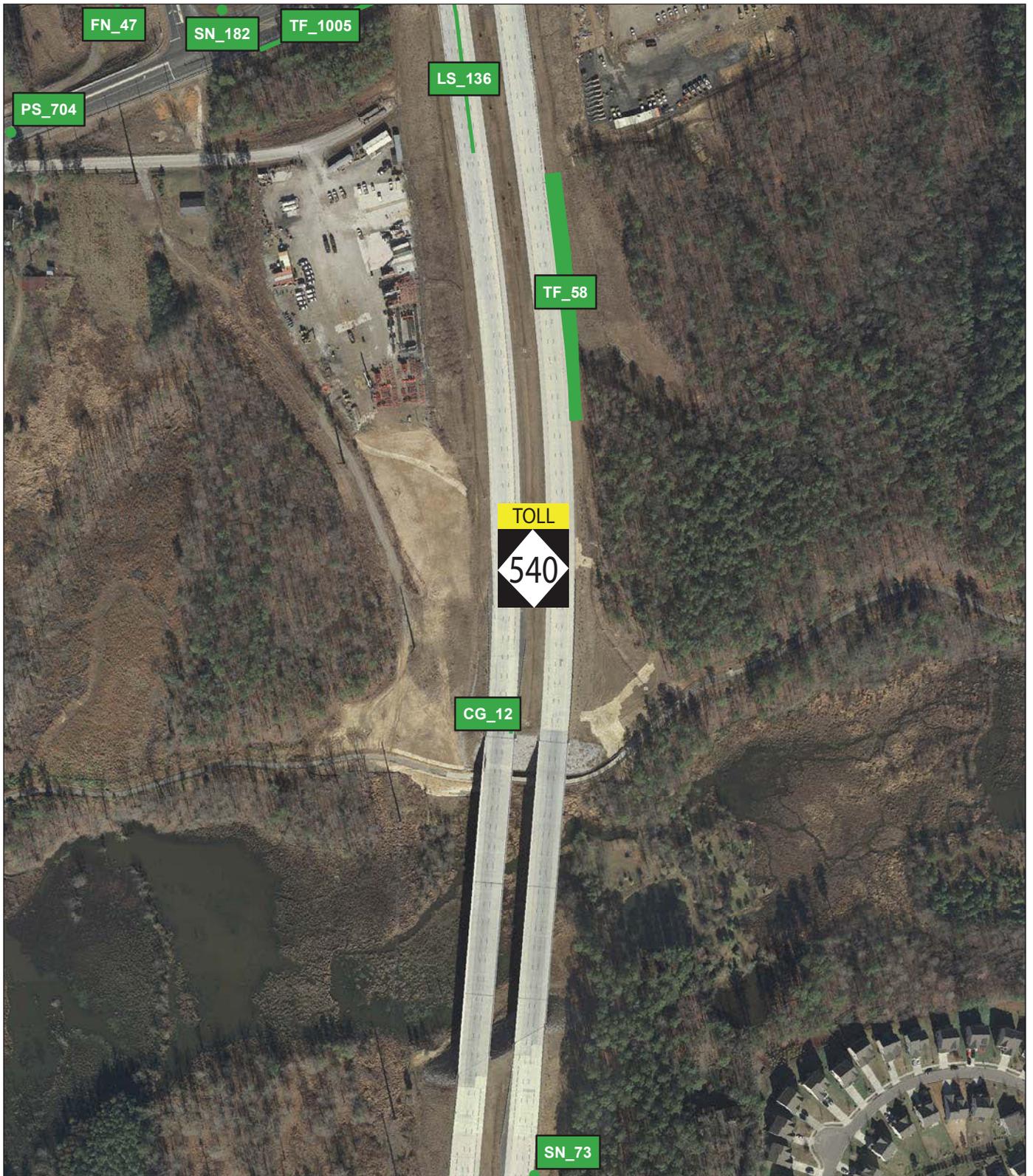


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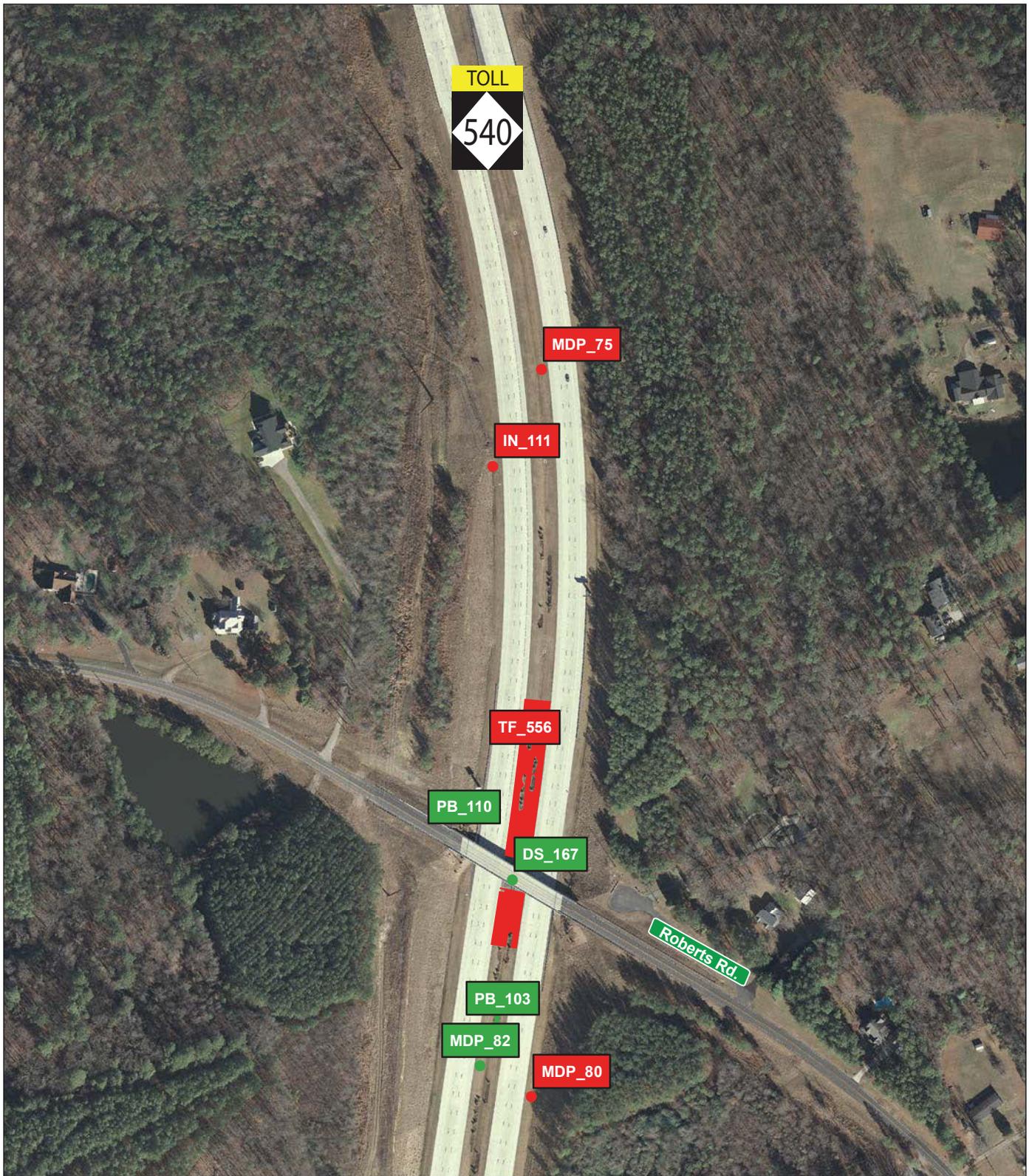


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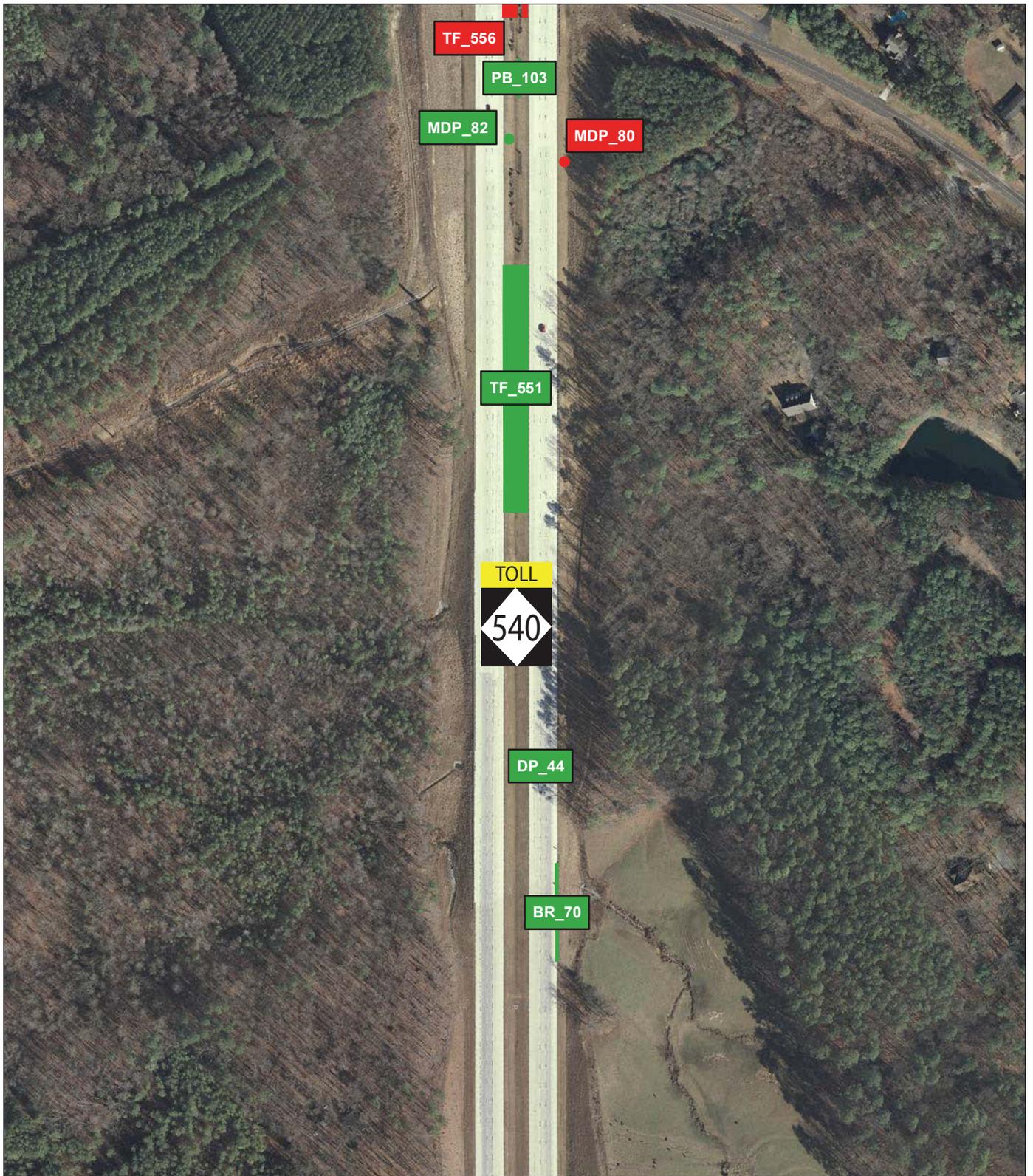


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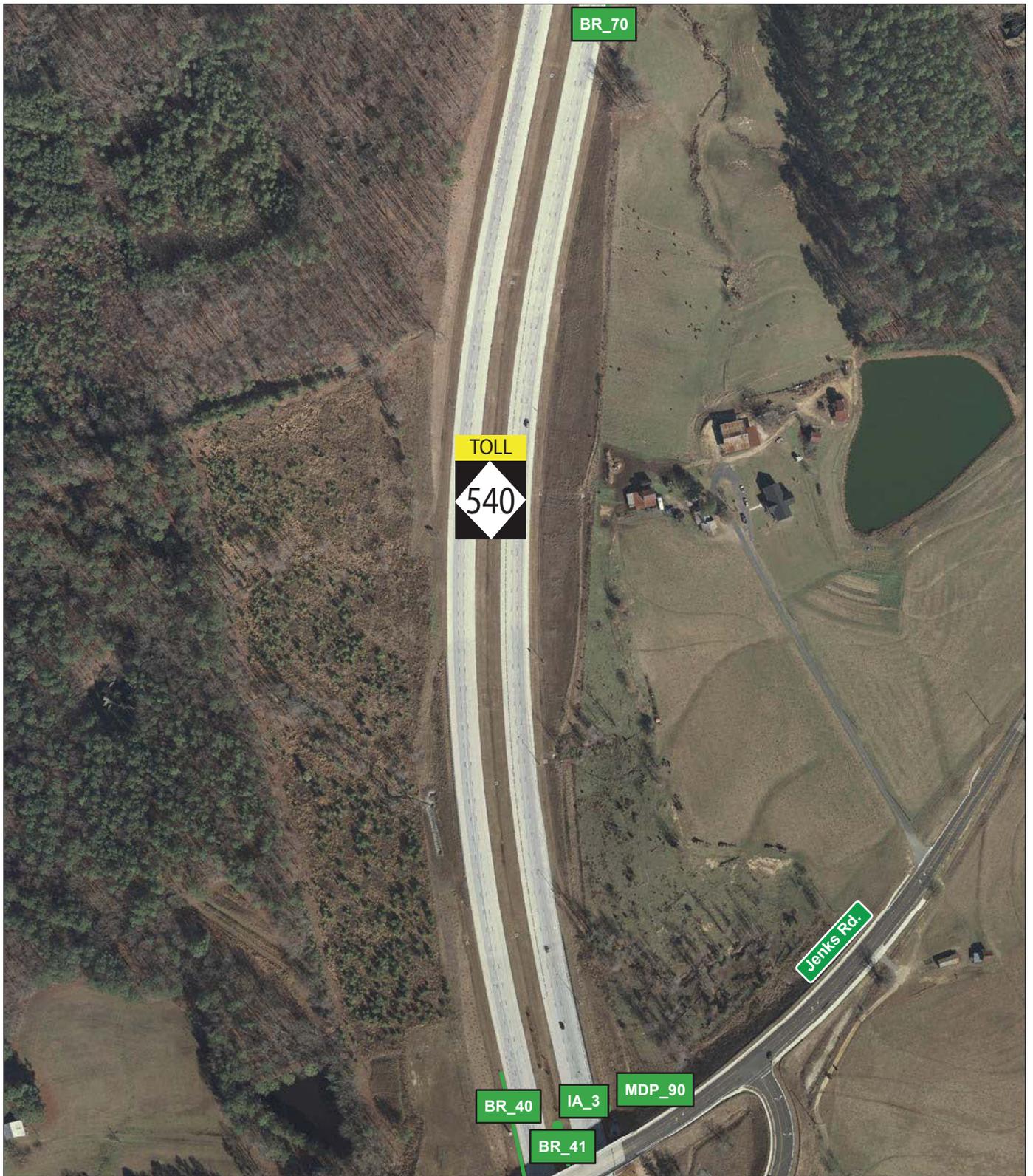


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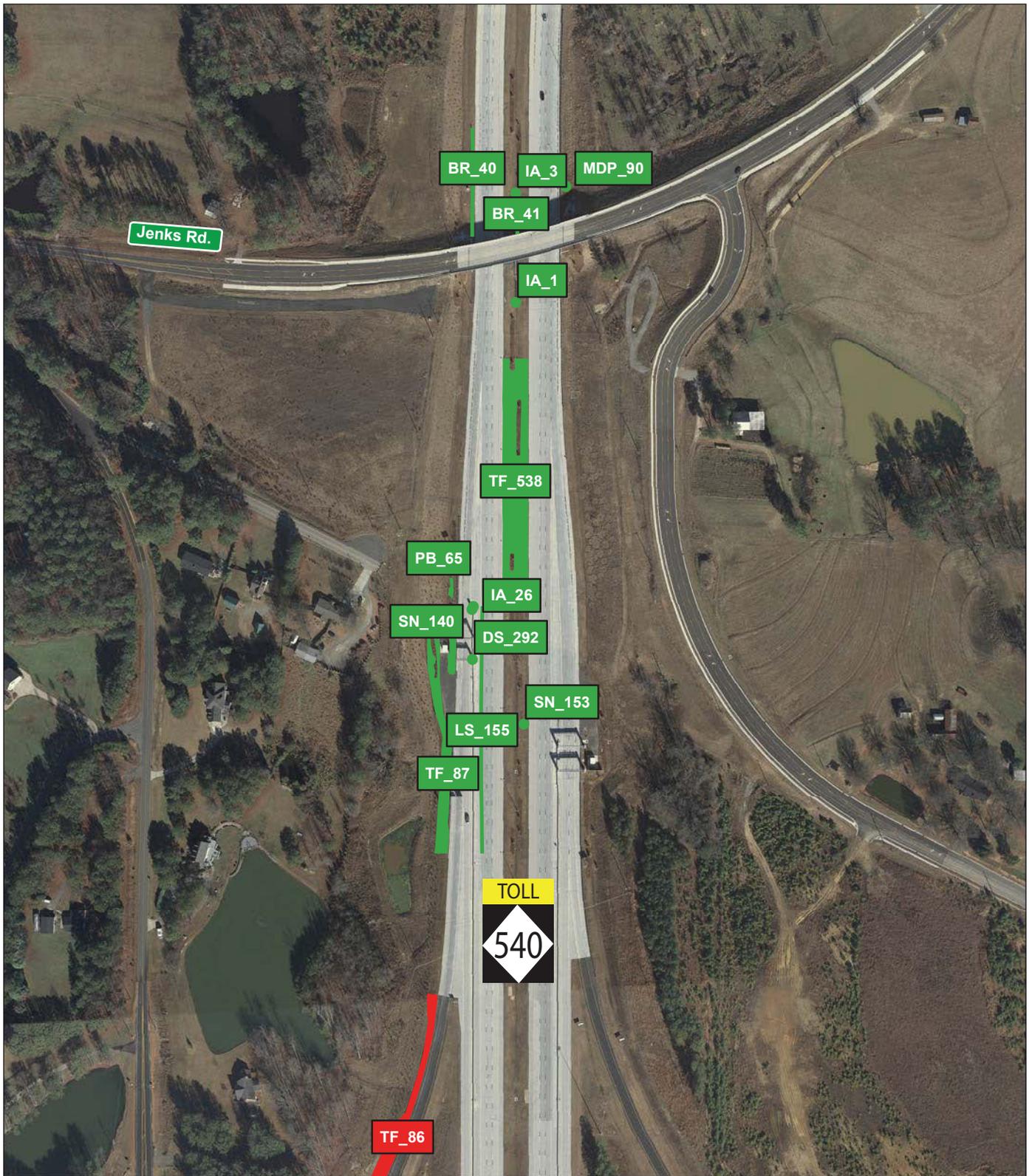


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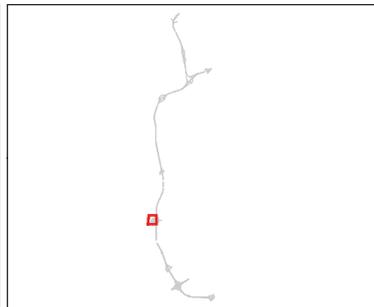


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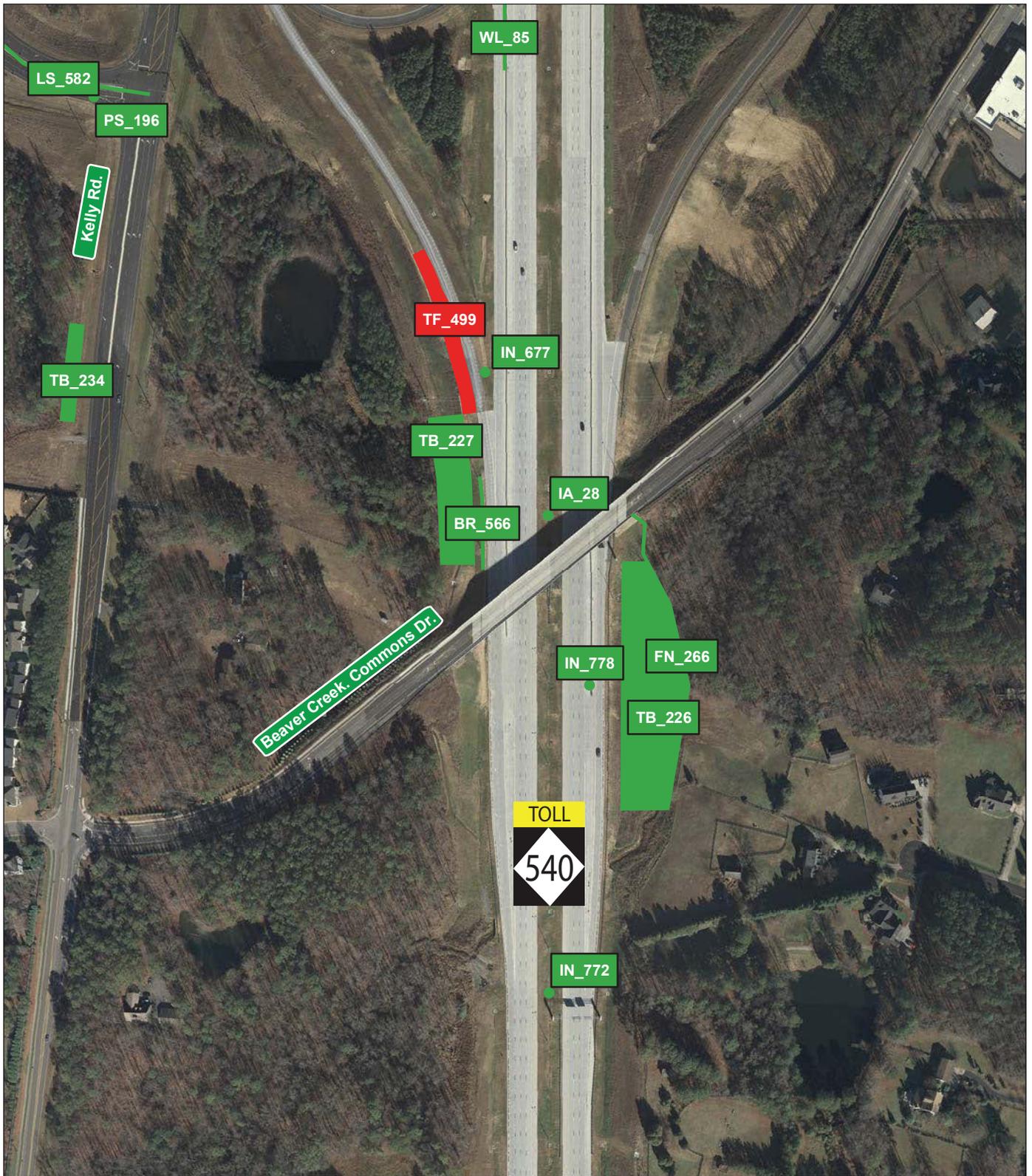


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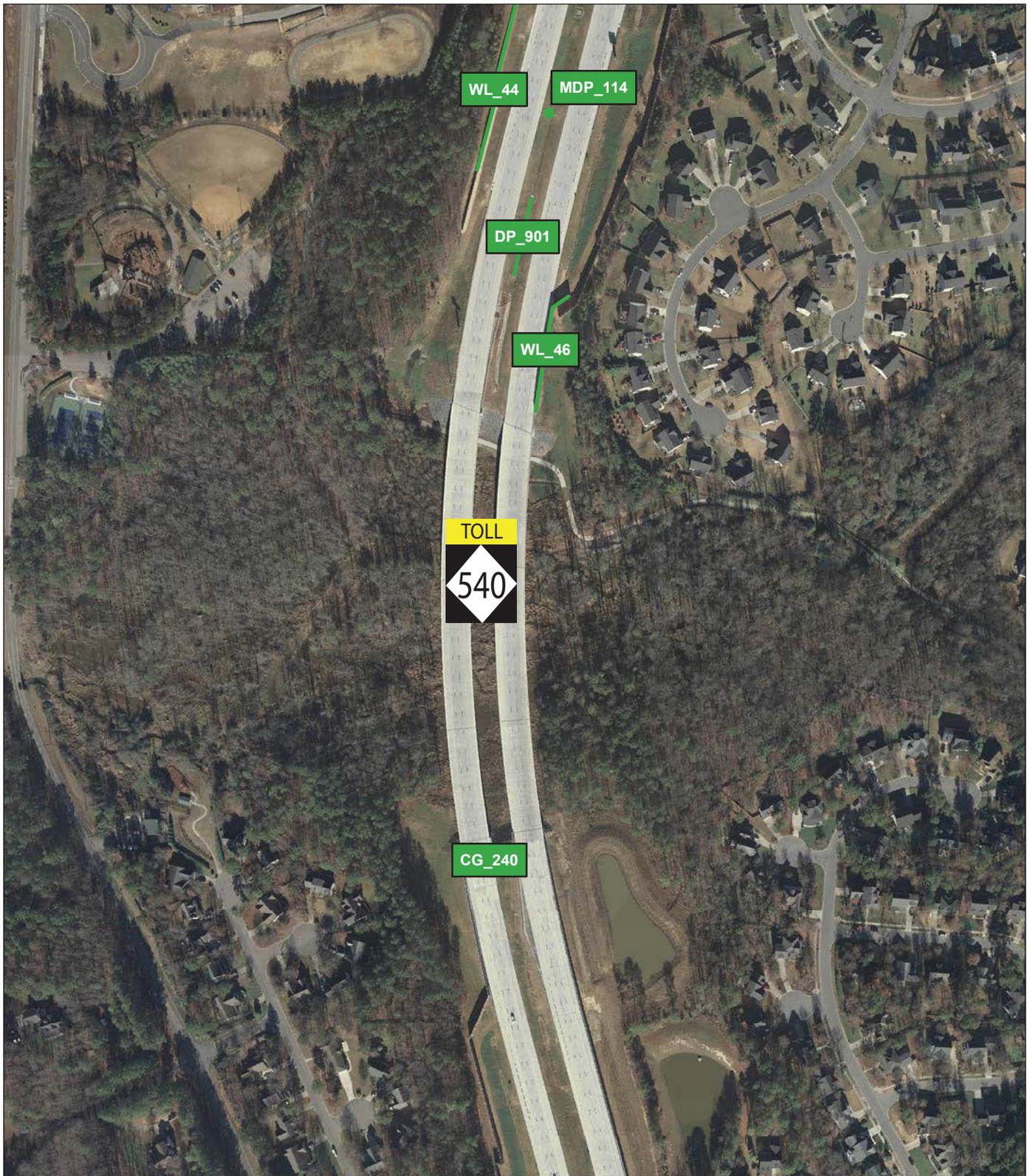


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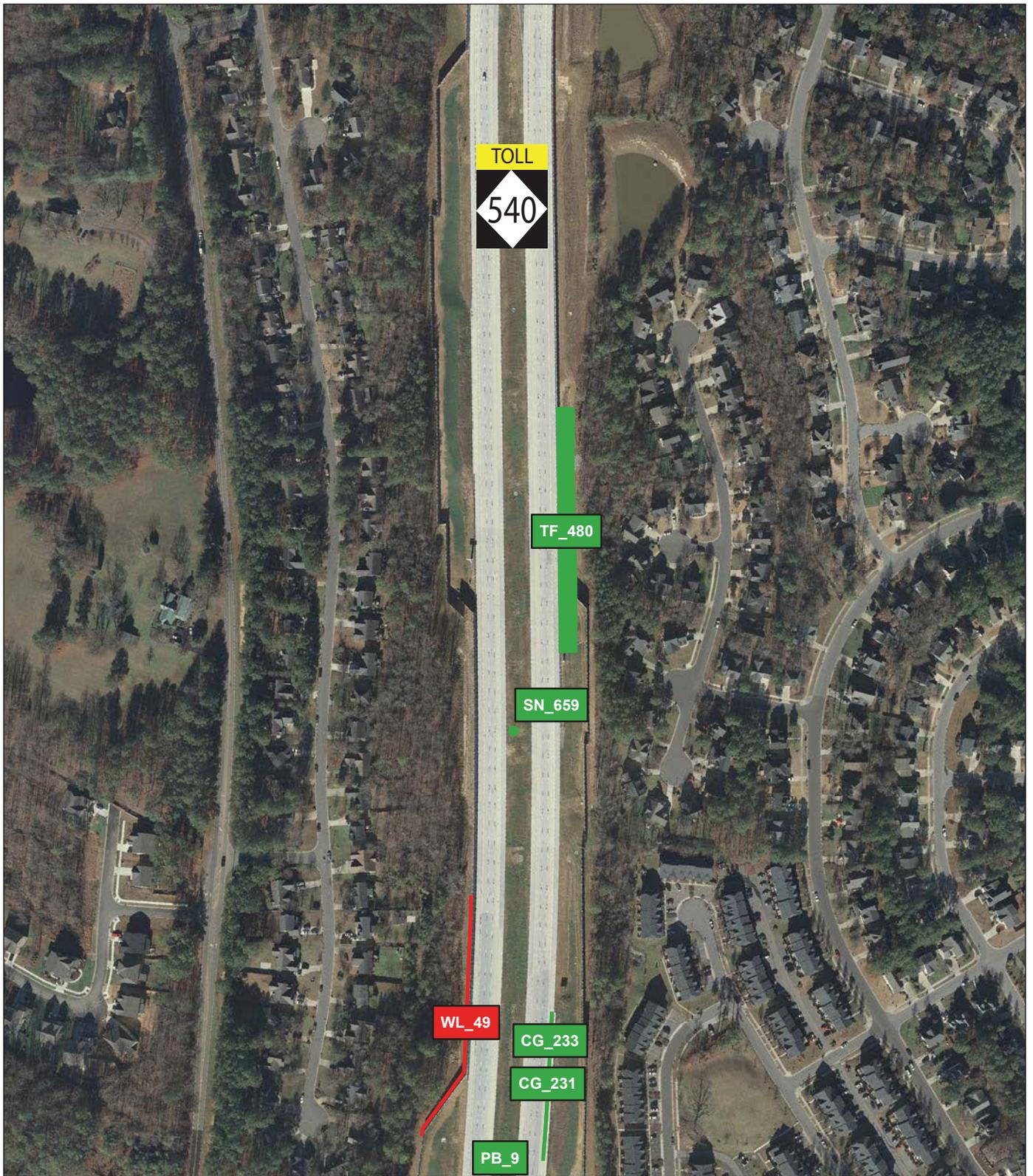


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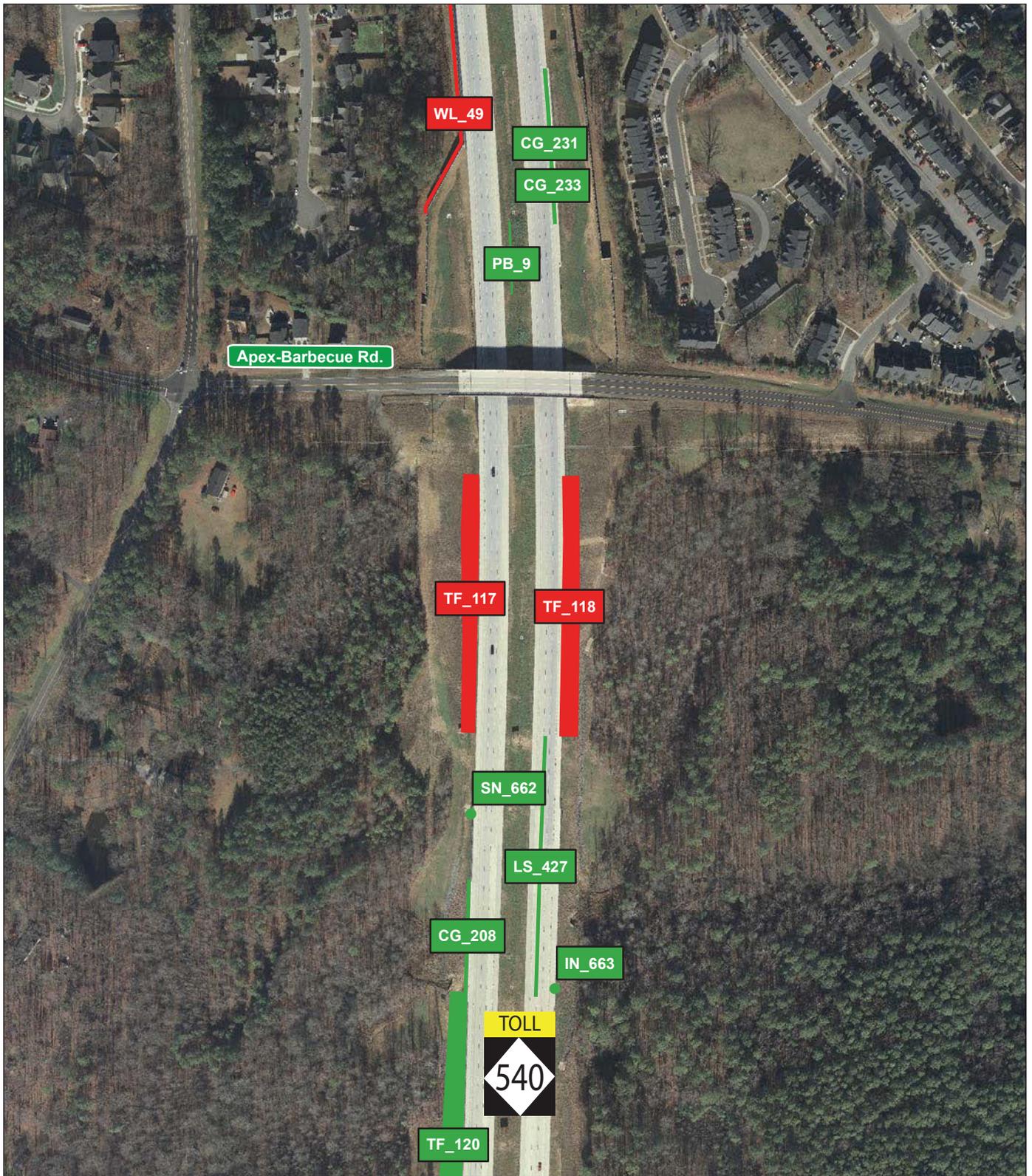


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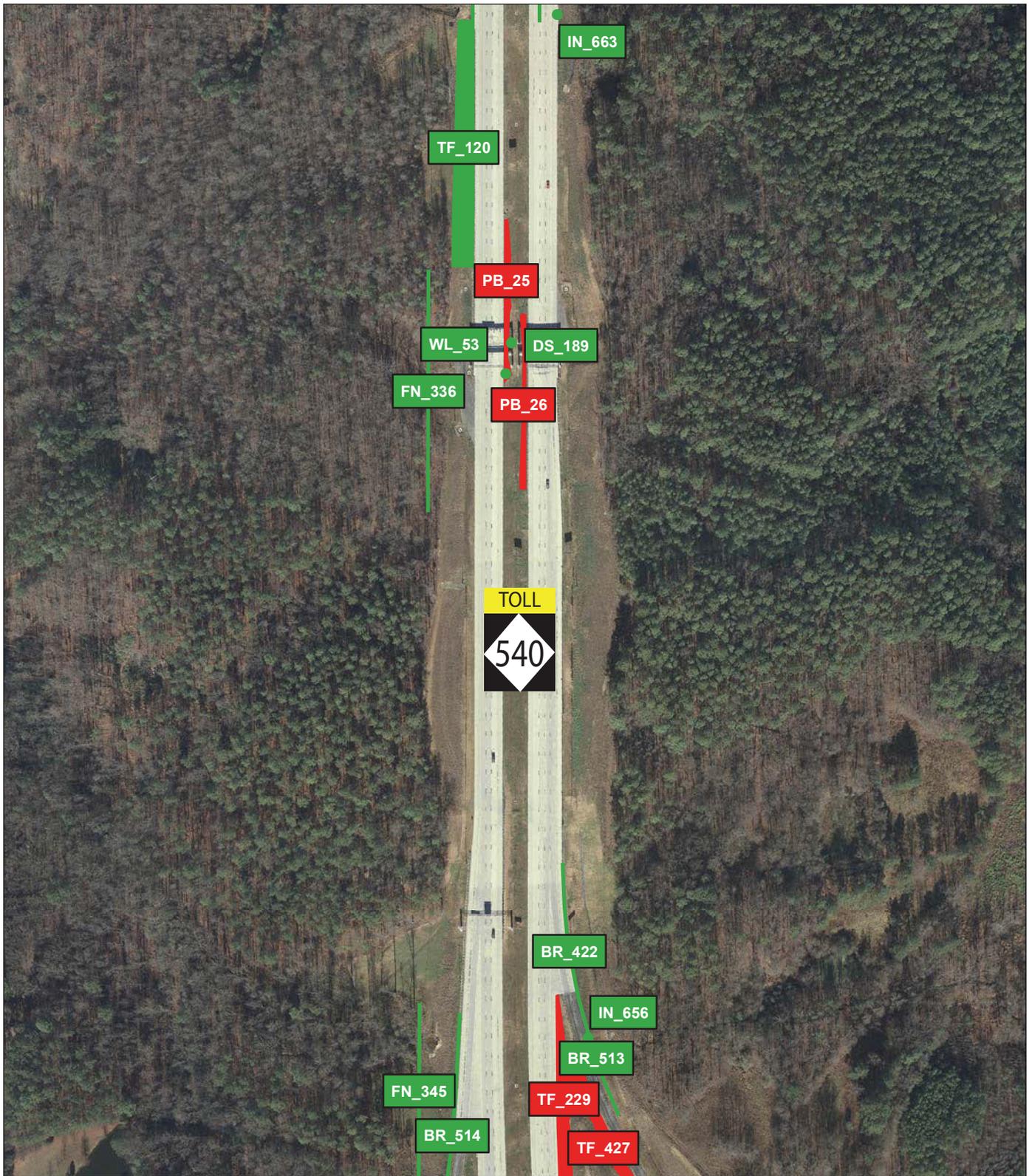


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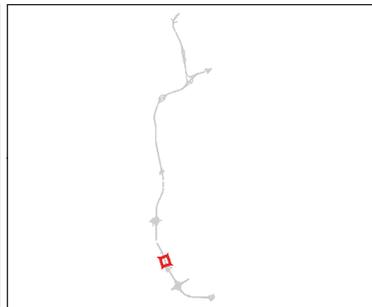


Appendix A: Triangle Expressway 2014 Third Quarter Asset Assessment Locations

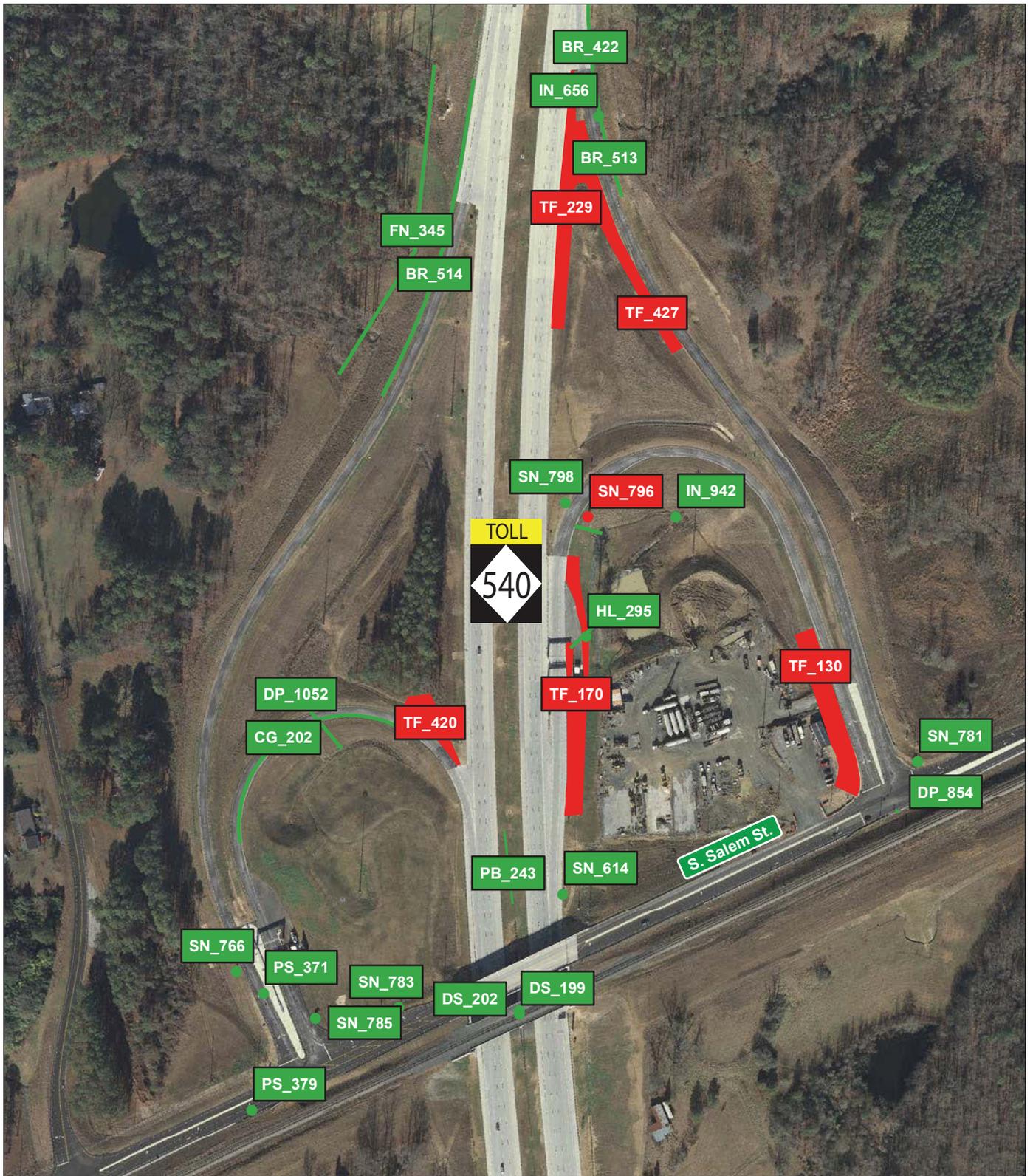


Legend

-  Passing Asset
-  Failing Asset



Appendix A: Triangle Expressway 2014 Third Quarter Asset Assessment Locations

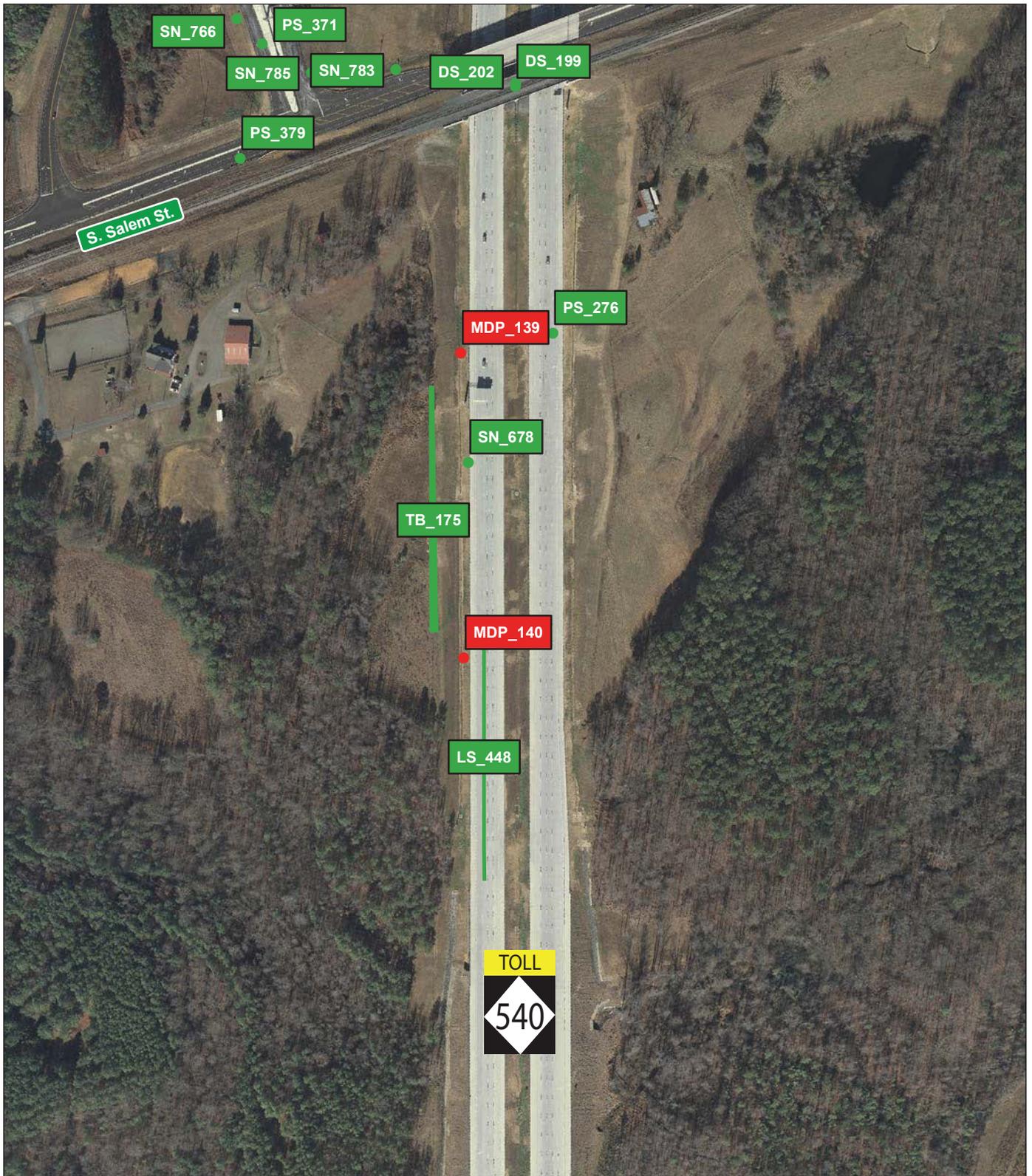


Legend

- Passing Asset
- Failing Asset



Appendix A: Triangle Expressway 2014 Third Quarter Asset Assessment Locations



Legend

- Passing Asset
- Failing Asset



Appendix A: Triangle Expressway 2014 Third Quarter Asset Assessment Locations



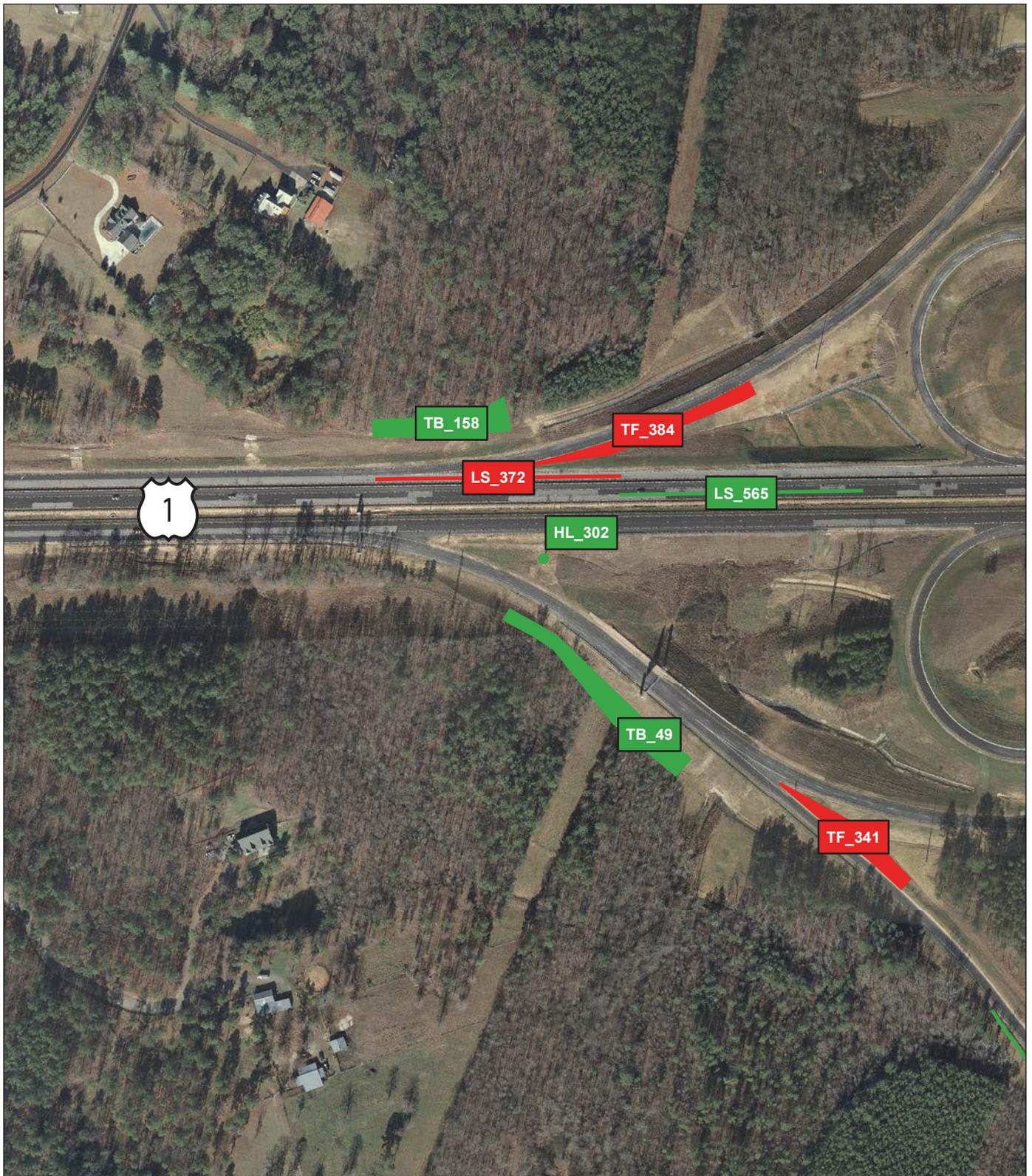
Legend

-  Passing Asset
-  Failing Asset



NORTH CAROLINA
Turnpike Authority

Appendix A: Triangle Expressway 2014 Third Quarter Asset Assessment Locations

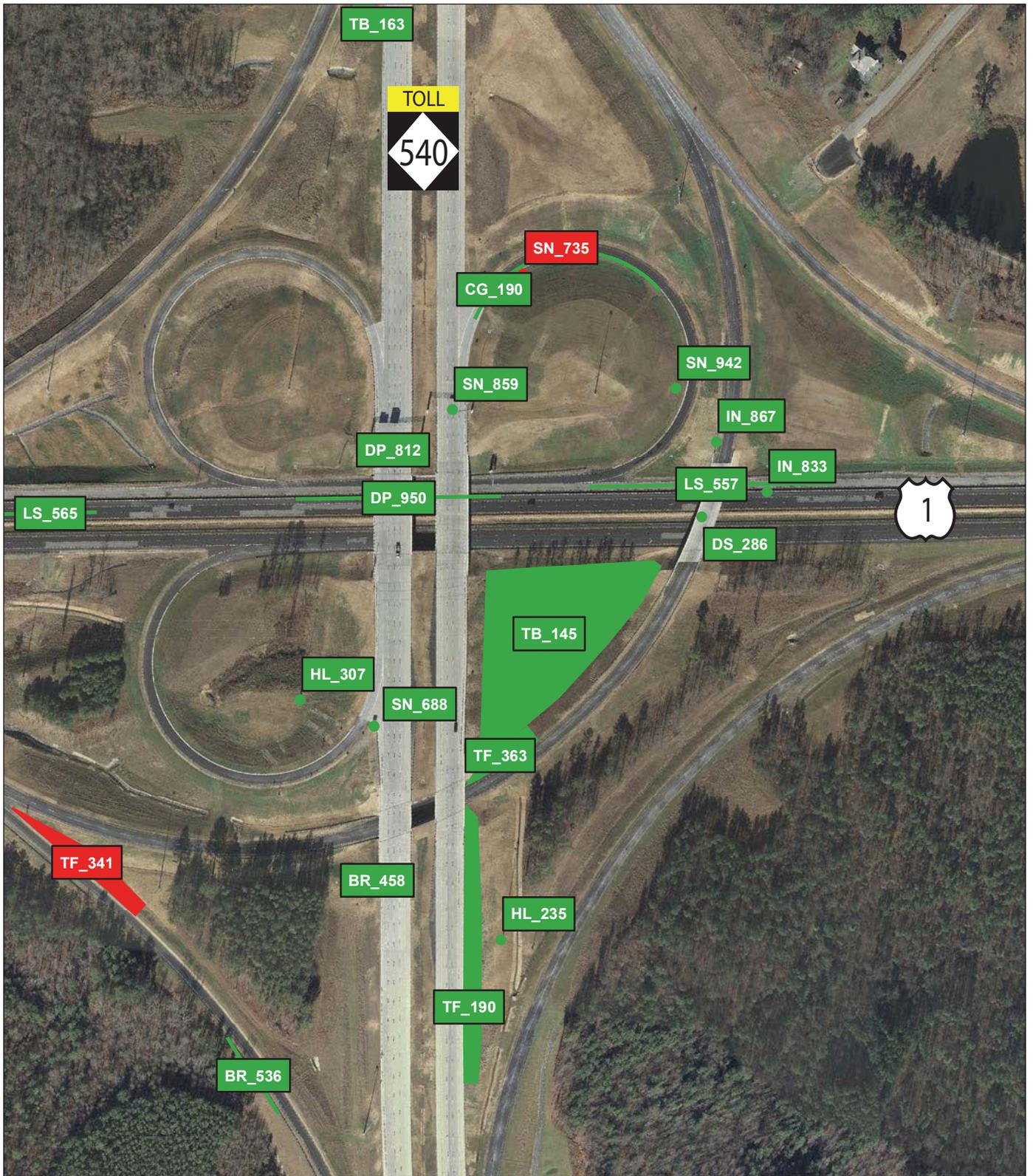


Legend

-  Passing Asset
-  Failing Asset



Appendix A: Triangle Expressway 2014 Third Quarter Asset Assessment Locations



Legend

- Passing Asset
- Failing Asset



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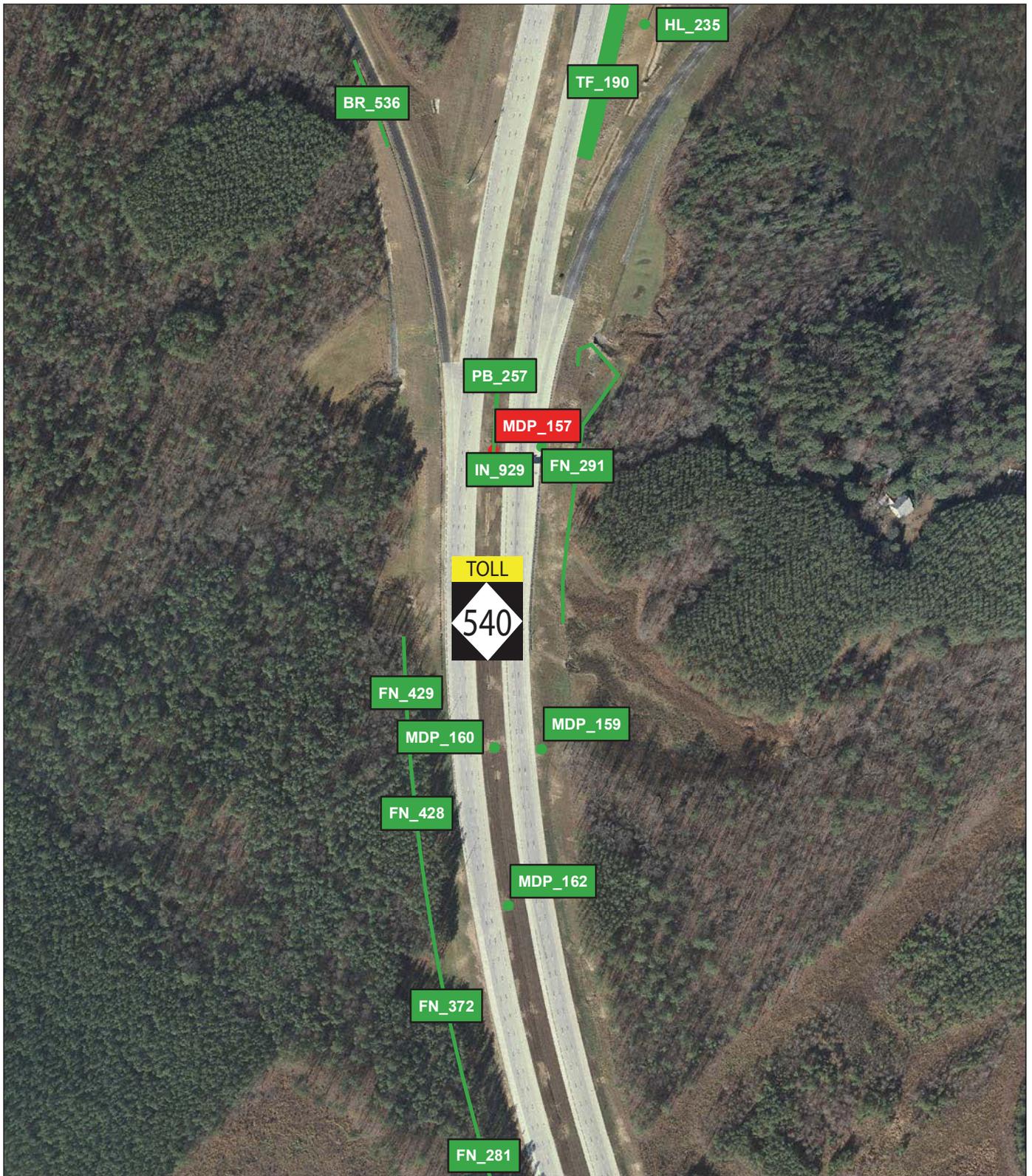


Legend

-  Passing Asset
-  Failing Asset

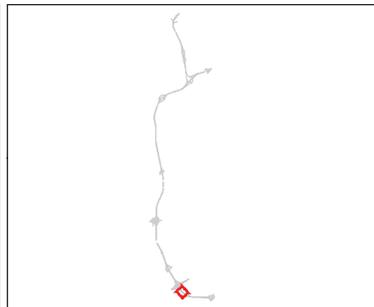


Appendix A: Triangle Expressway 2014 Third Quarter Asset Assessment Locations

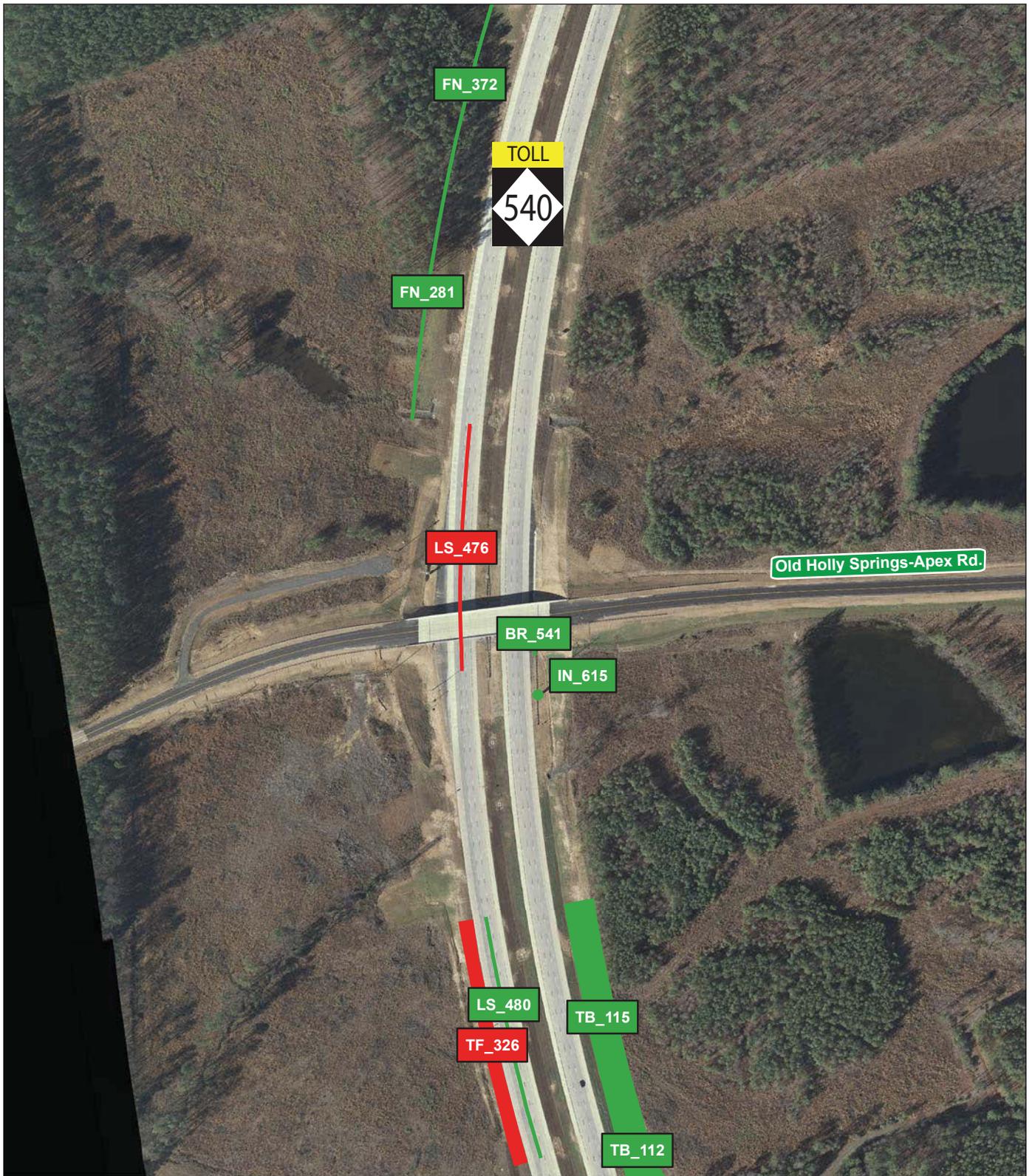


Legend

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-  Failing Asset



Appendix A: Triangle Expressway 2014 Third Quarter Asset Assessment Locations

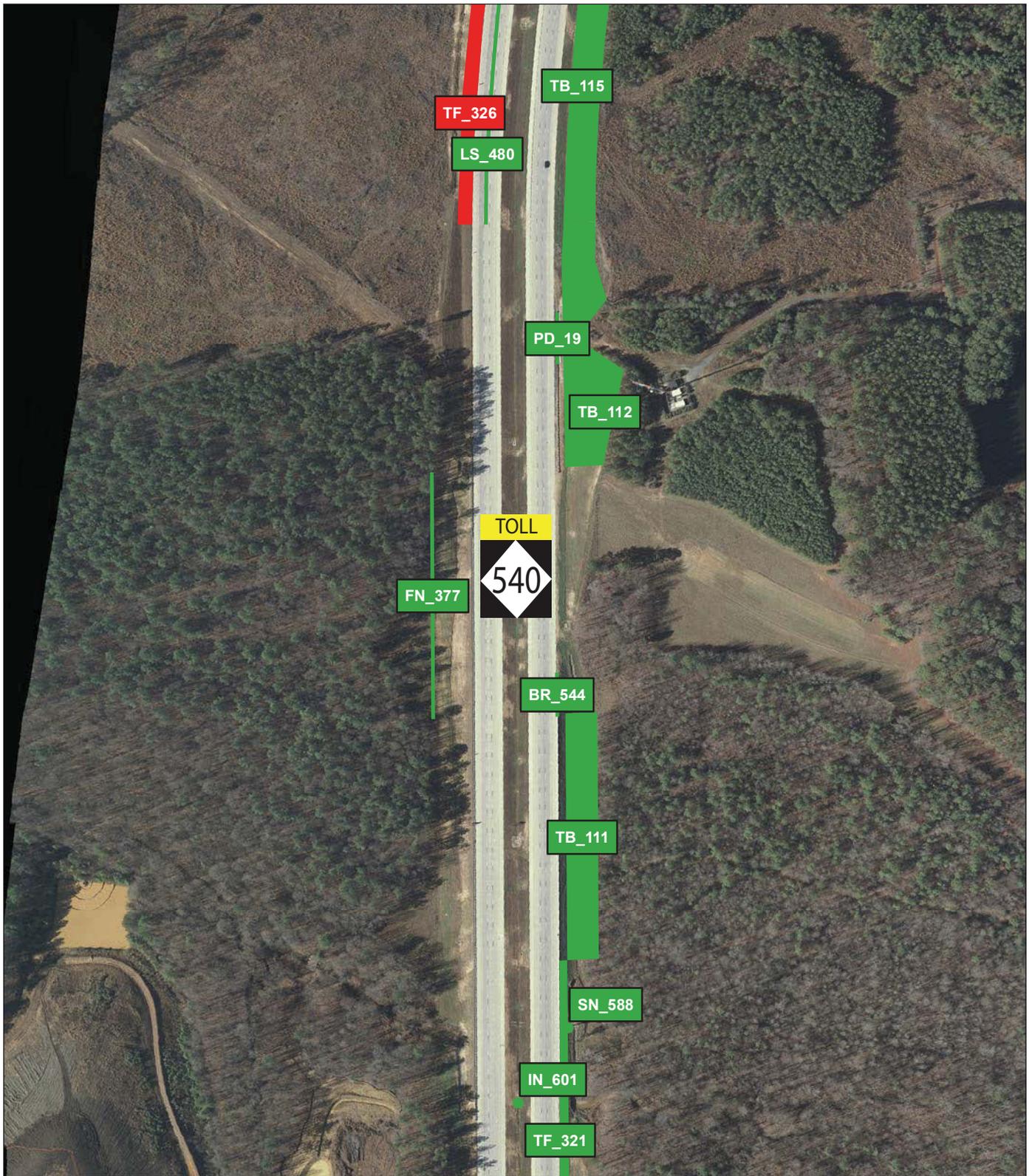


Legend

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Appendix A: Triangle Expressway 2014 Third Quarter Asset Assessment Locations

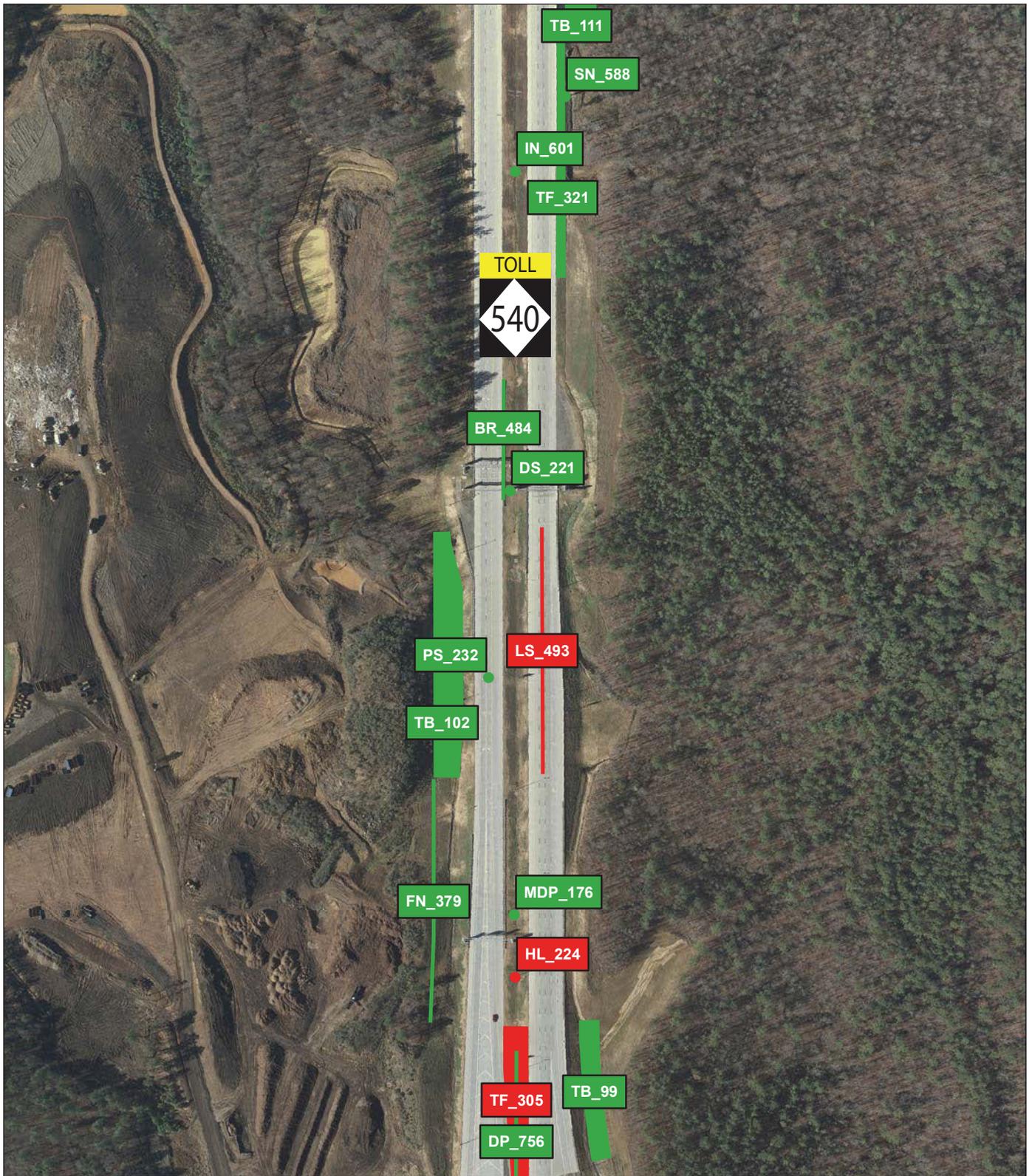


Legend

-  Passing Asset
-  Failing Asset

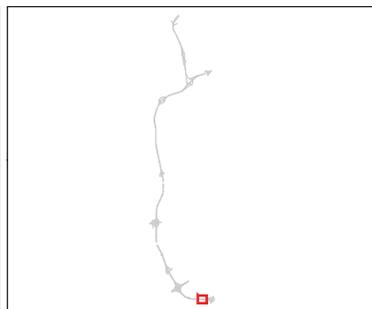


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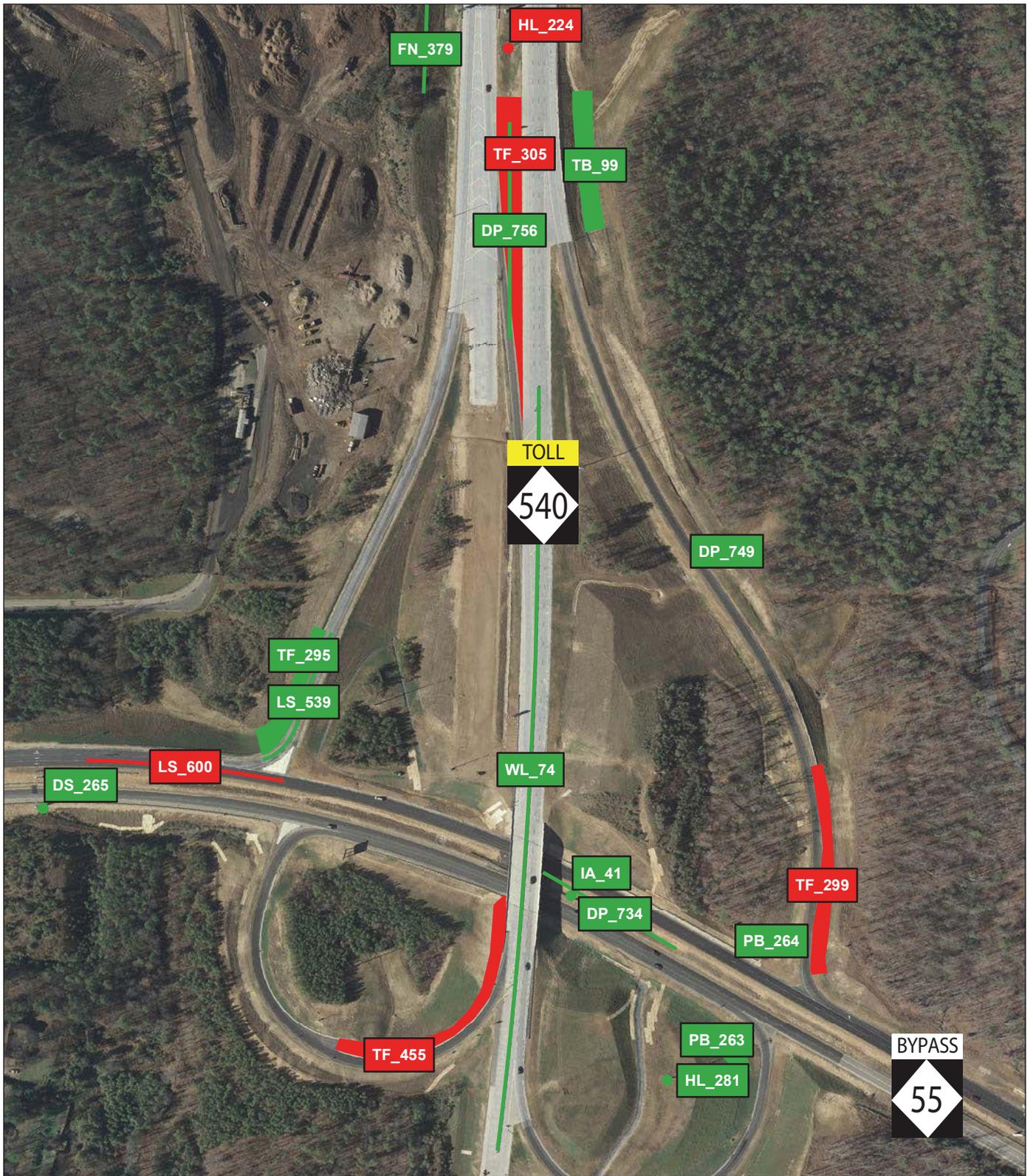


Legend

- Passing Asset
- Failing Asset

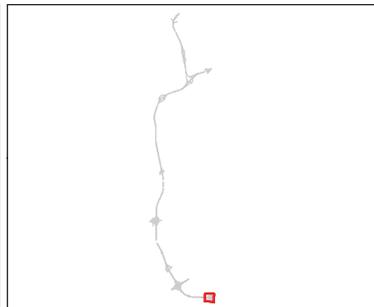


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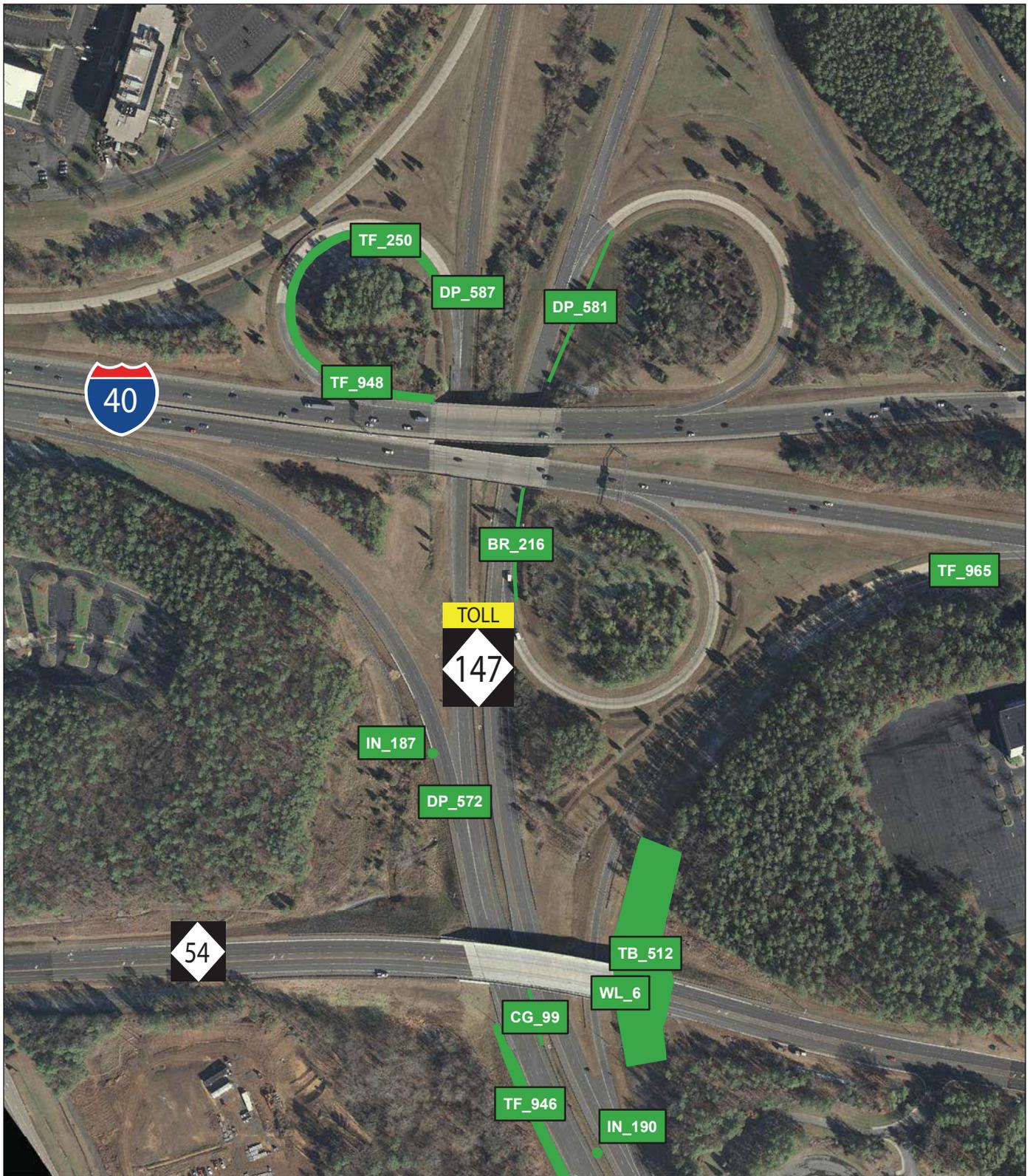


Legend

- Passing Asset
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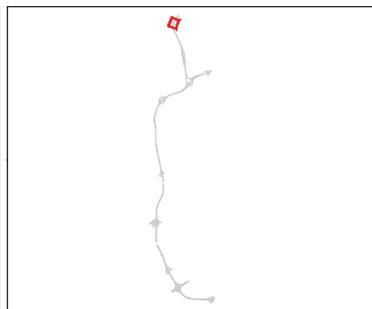


Appendix A: Triangle Expressway 2014 Third Quarter Asset Assessment Locations

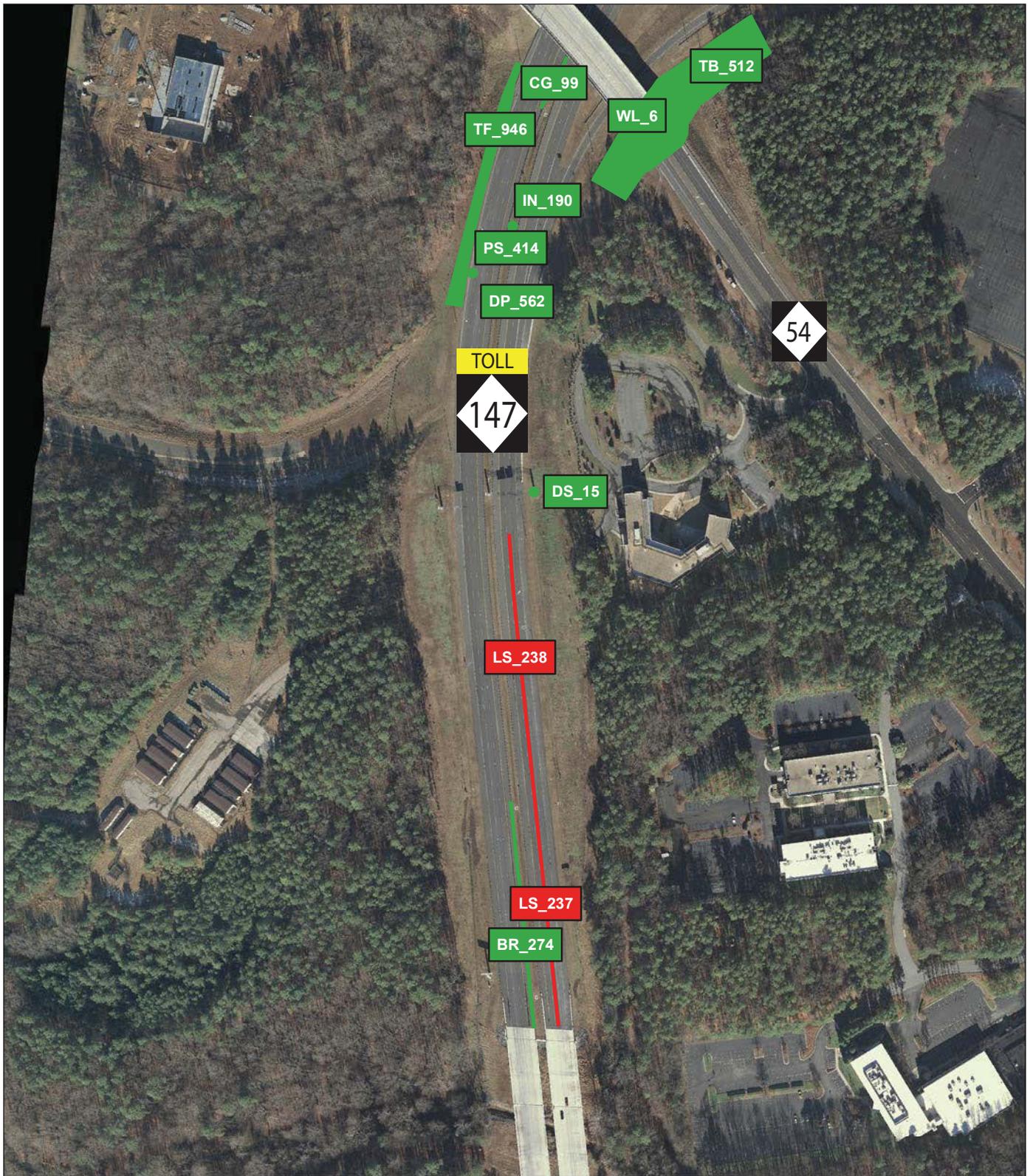


Legend

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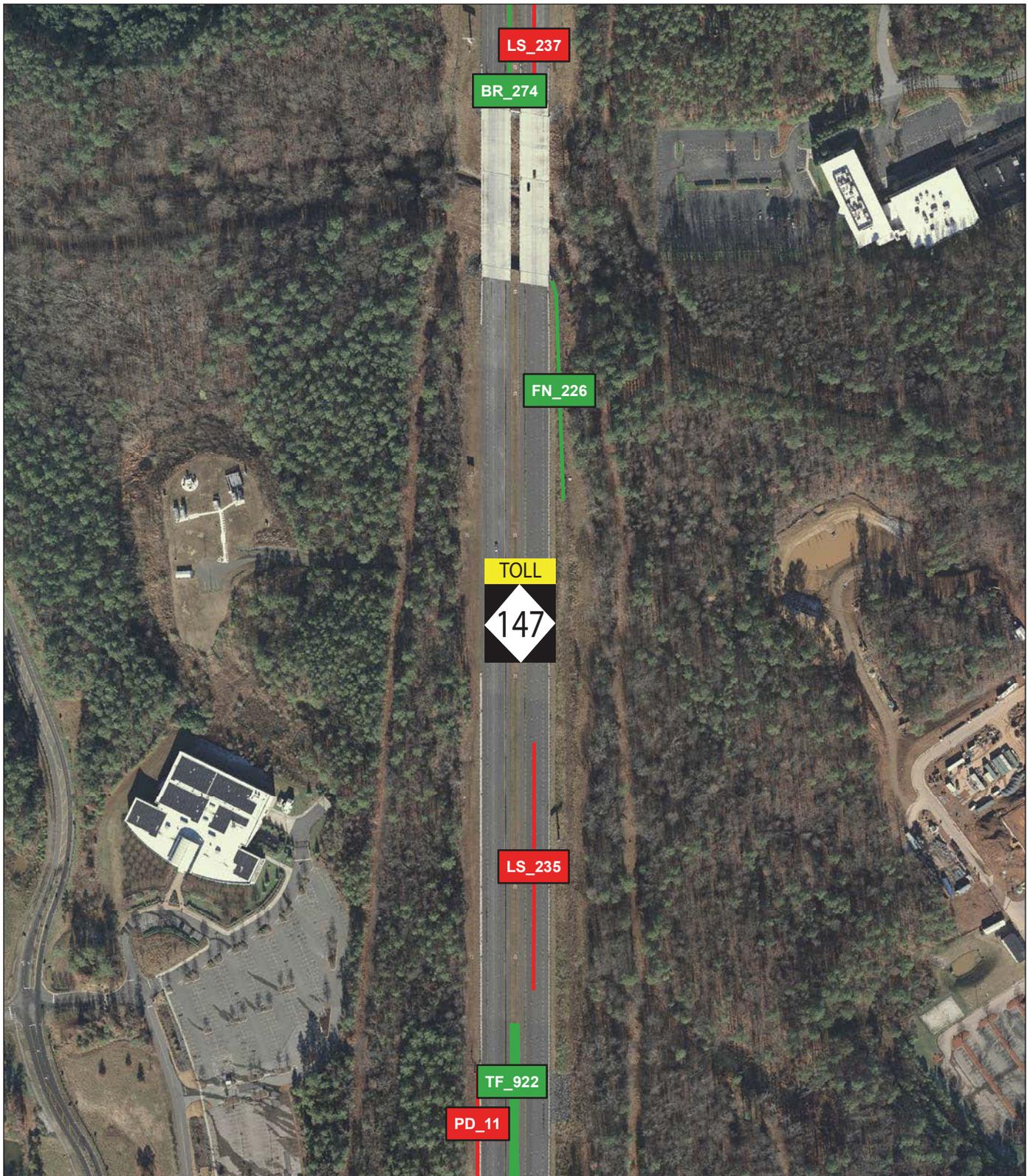


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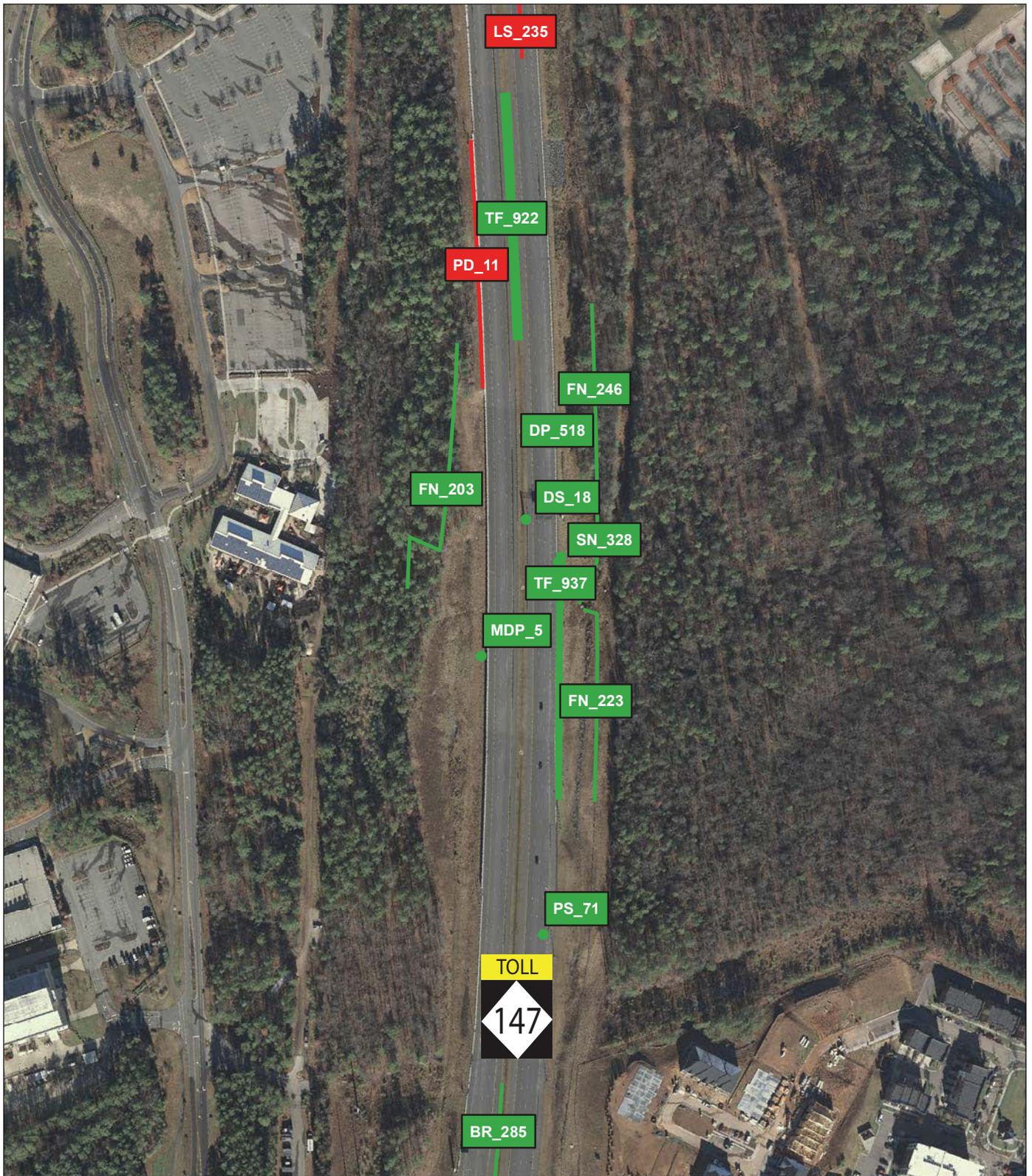


Legend

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-  Failing Asset



Appendix A: Triangle Expressway 2014 Third Quarter Asset Assessment Locations



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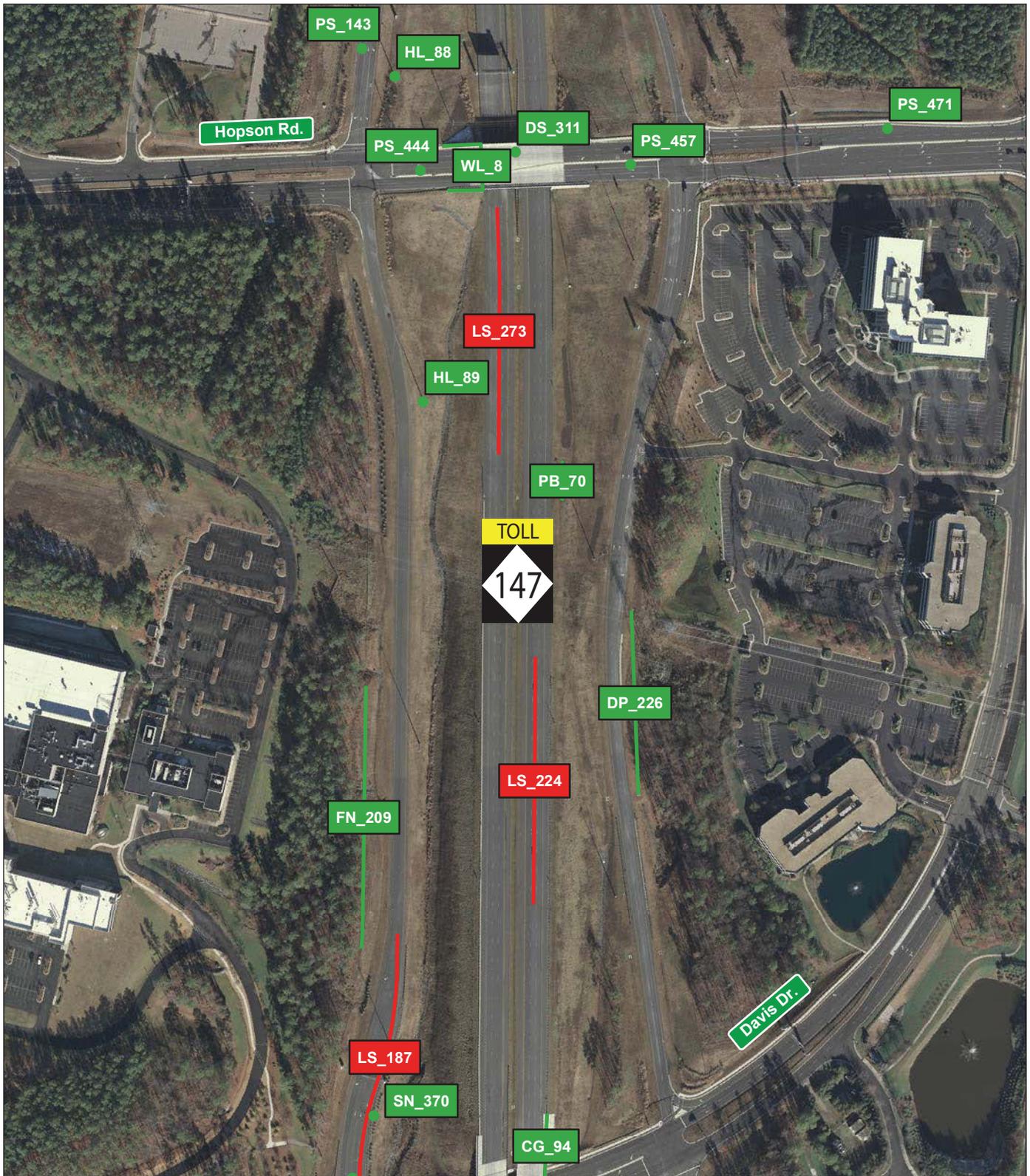


Legend

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-  Failing Asset

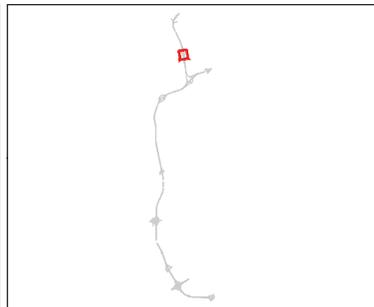


Appendix A: Triangle Expressway 2014 Third Quarter Asset Assessment Locations

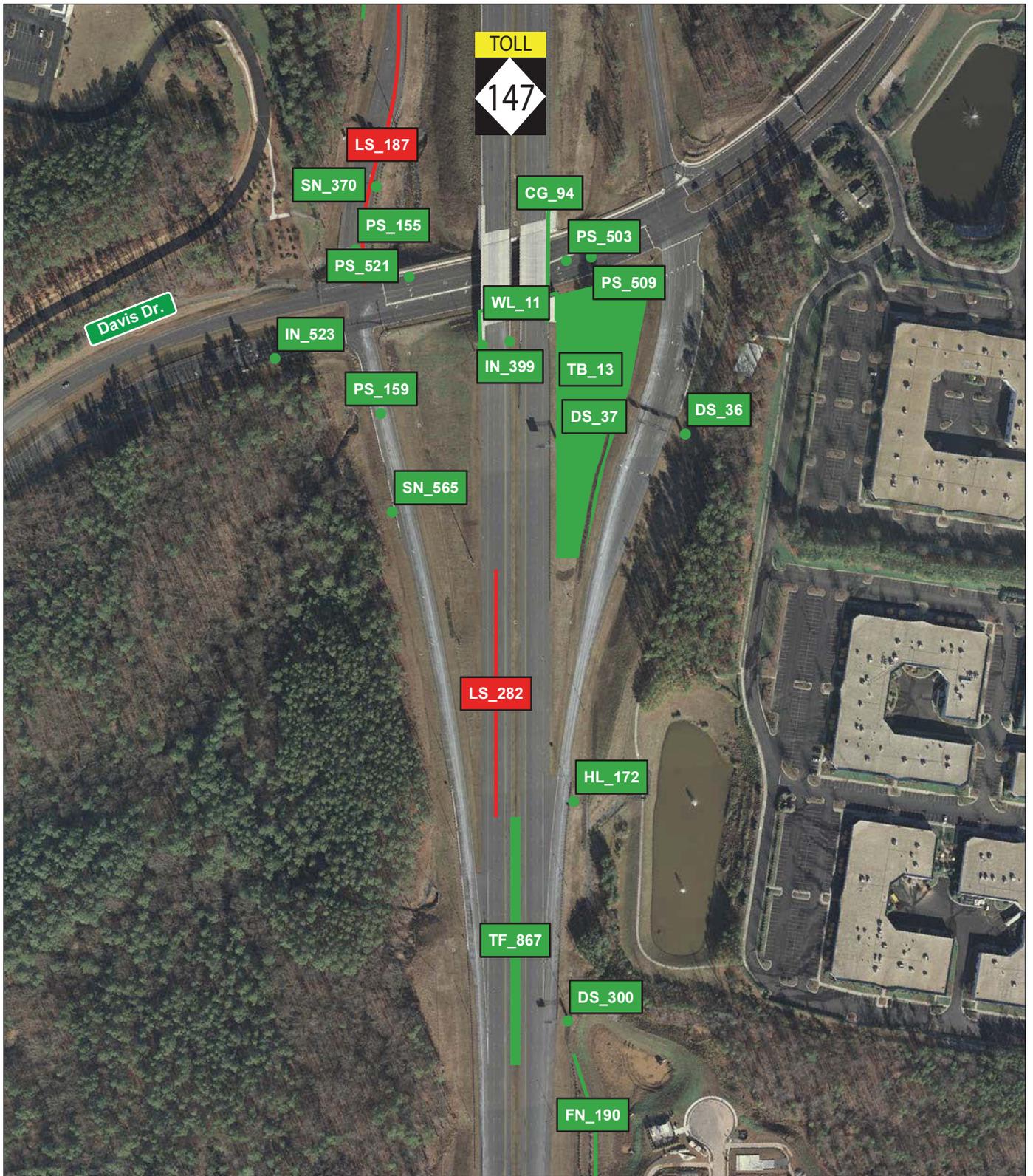


Legend

- Passing Asset
- Failing Asset



Appendix A: Triangle Expressway 2014 Third Quarter Asset Assessment Locations



Legend

- Passing Asset
- Failing Asset



Appendix A: Triangle Expressway 2014 Third Quarter Asset Assessment Locations

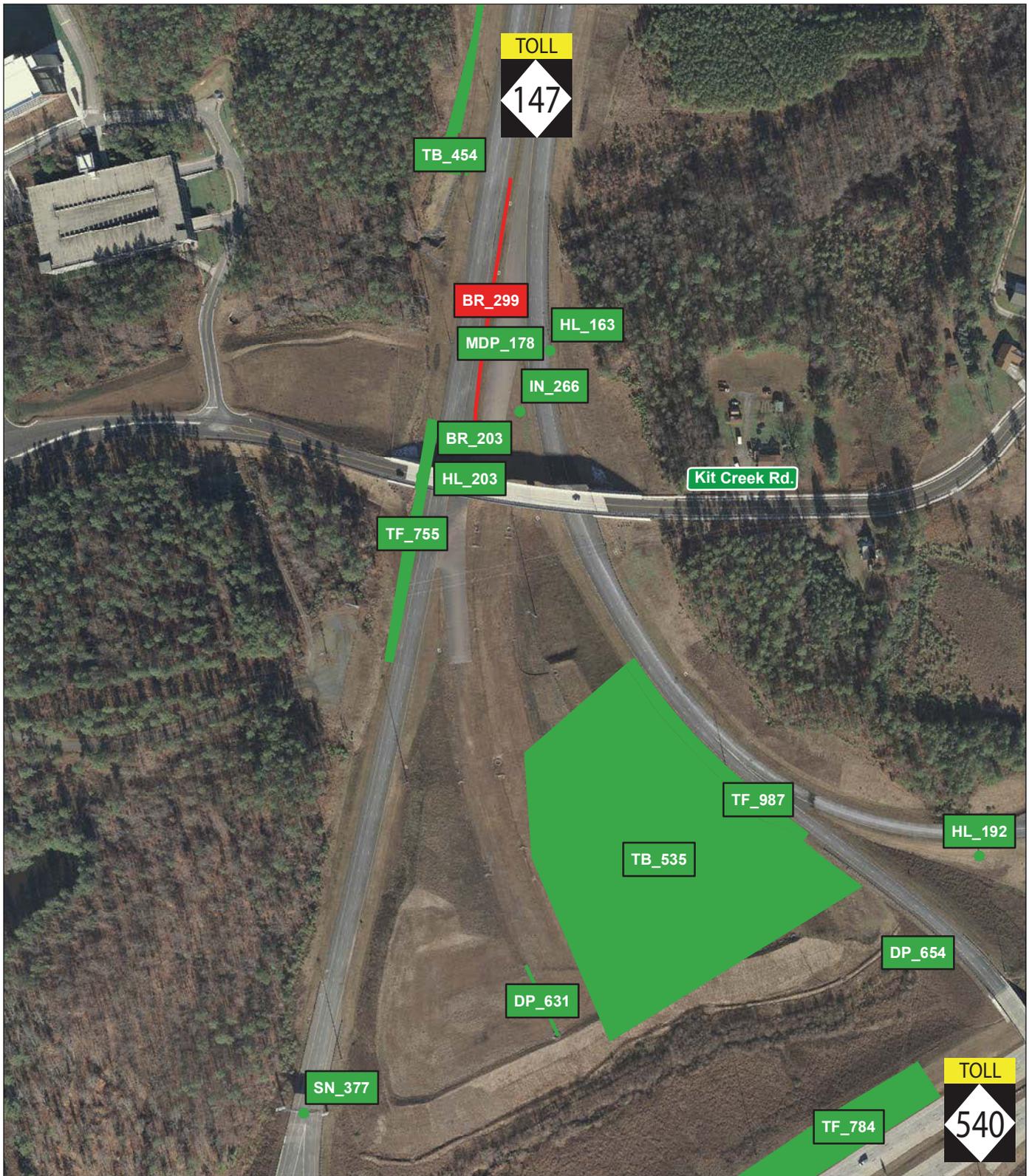


Legend

-  Passing Asset
-  Failing Asset



Appendix A: Triangle Expressway 2014 Third Quarter Asset Assessment Locations



Legend

- Passing Asset
- Failing Asset



Appendix B

Triangle Expressway 2014 Third Quarter Table Results of Assets Failing MRP

Appendix B: Triangle Expressway 2014 Third Quarter Table Results of Assets Failing MRP

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

Guardrail, Concrete Barrier and End Anchors (BR)..... 3

Curb and Gutter (CG) 4

Decorative Supports (DS)..... 5

Drainage Pipes (DP)..... 6

Miscellaneous Drainage Structures (MDP) 7

Fence and Control of Access (FN) 9

Graffiti (GR)..... 10

Highway Lighting (HL) 11

Impact Attenuators (IA) 12

Inlets (IN)..... 13

Landscaping (PB) 14

Paved Lanes – Asphalt (LS)..... 16

Paved Lanes – Concrete (LS) 17

Paved Shoulders (LS)..... 18

Unpaved Shoulders (LS) 20

Front/Back Slopes (LS) 21

Unpaved Lateral and Outfall Ditches (LS) 22

Litter (LS)..... 23

Roadway Sweeping (LS) 24

Pavement Striping (LS)..... 25

Pavement Markers (LS)..... 26

Paved Ditches (PD)..... 28

Pavement Words and Symbols (PS)..... 29

Signs (SN) 30

Tree and Brush (TB)..... 31

Turf Condition (TF)..... 32

MSE/Retaining Walls, Sound Barrier Walls and Screen Walls (WL)..... 38

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

Guardrail, Concrete Barrier and End Anchors (BR)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Guardrail	BR_299	Functional Damage		A54, A55

Curb and Gutter (CG)

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

Decorative Supports (DS)

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

Drainage Pipes (DP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Cross Pipe	DP_345	Obstruction		A6, A7

Miscellaneous Drainage Structures (MDP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Shoulder Drain	MDP_11	Obstruction		A11
2	Shoulder Drain	MDP_70	Obstruction		A23
3	Shoulder Drain	MDP_75	Obstruction		A24
4	Shoulder Drain	MDP_80	Obstruction		A24, A25

Miscellaneous Drainage Structures (MDP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Shoulder Drain	MDP_139	Obstruction		A37
6	Shoulder Drain	MDP_140	Obstruction		A37
7	Shoulder Drain	MDP_157	Obstruction		A42

Fence and Control of Access (FN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Woven	FN_168	Vegetation Compressing Fence		A4

Graffiti (GR)

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

Highway Lighting (HL)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	High Mast	HL_71	Nighttime Failure	Not Available for Nighttime Failure.	A10
2	Single Roadway	HL_142	Part Damage		A4
3	Double Roadway	HL_224	Nighttime Failure	Not Available for Nighttime Failure.	A45, A46

Impact Attenuators (IA)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Gating Attenuator	IA_6	Functional Damage		A17, A18
2	Gating Attenuator	IA_10	Nighttime Failure	Not Available for Nighttime Failure.	A10, A11

Inlets (IN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Inlet	IN_111	Obstruction		A24
2	Inlet	IN_292	Obstruction		A8, A9
3	Inlet	IN_365	Obstruction		A4
4	Inlet	IN_482	Obstruction		A5

Landscaping (PB)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Plant Bed	PB_25	Covered by Weed		A35
2	Plant Bed	PB_26	Covered by Weed		A35
3	Plant Bed	PB_145	Unhealthy		A20
4	Plant Bed	PB_149	Unhealthy and Covered by Weed		A20

Landscaping (PB)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Plant Bed	PB_159	Unhealthy and Covered by Weed		A20

Paved Lanes – Asphalt (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_299	Pothole		A2

Paved Lanes – Concrete (LS)

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

Paved Shoulders (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_100	Paved Shoulder Joint		A11, A12
2	Asphalt	LS_197	Paved Shoulder Joint		A6
3	Asphalt	LS_224	Paved Shoulder Joint		A52
4	Asphalt	LS_235	Paved Shoulder Joint		A49, A50

Paved Shoulders (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Concrete	LS_348	Paved Shoulder Joint		A6
6	Concrete	LS_476	Paved Shoulder Joint		A43
7	Concrete	LS_493	Paved Shoulder Joint		A45

Unpaved Shoulders (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Unpaved Shoulder	LS_372	Elevation Deviation		A39
2	Unpaved Shoulder	LS_476	Buildup		A43

Front/Back Slopes (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Slope	LS_228	Slope Failure		A51
2	Slope	LS_273	Slope Failure		A51, A52
3	Slope	LS_282	Slope Failure		A53
4	Slope	LS_493	Slope Failure		A45

Unpaved Lateral and Outfall Ditches (LS)

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

Litter (LS)

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

Roadway Sweeping (LS)

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

Pavement Striping (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_348	Nighttime Line Visibility	Not Available for Nighttime Failure.	A6

Pavement Markers (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_100	Reflective Markers and Missing Markers		A11, A12
2	Asphalt	LS_187	Reflective Markers	Not Available for Nighttime Failure.	A52, A53
3	Asphalt	LS_197	Reflective Markers and Missing Markers		A6
4	Asphalt	LS_224	Reflective Markers	Not Available for Nighttime Failure.	A52
5	Asphalt	LS_228	Reflective Markers	Not Available for Nighttime Failure.	A51
6	Asphalt	LS_235	Reflective Markers	Not Available for Nighttime Failure.	A49, A50
7	Asphalt	LS_237	Reflective Markers and Missing Markers		A48, A49
8	Asphalt	LS_238	Reflective Markers	Not Available for Nighttime Failure.	A48
9	Asphalt	LS_273	Reflective Markers	Not Available for Nighttime Failure.	A51, A52
10	Asphalt	LS_289	Reflective Markers and Missing Markers		A6

Pavement Markers (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
11	Asphalt	LS_299	Reflective Markers, Missing Markers and Continuous Marker		A2
12	Concrete	LS_319	Reflective Markers	Not Available for Nighttime Failure.	A5
13	Concrete	LS_348	Missing Markers		A6
14	Concrete	LS_476	Reflective Markers	Not Available for Nighttime Failure.	A43
15	Concrete	LS_493	Reflective Markers	Not Available for Nighttime Failure.	A45
16	Asphalt	LS_553	Reflective Markers	Not Available for Nighttime Failure.	A41
17	Asphalt	LS_600	Reflective Markers, Missing Markers and Continuous Marker		A46

Paved Ditches (PD)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Paved Ditch	PD_11	Material Accumulation		A49, A50

Pavement Words and Symbols (PS)

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

Signs (SN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Exit	SN_23	Height Requirement		A21
2	Other	SN_494	Height Requirement		A2
3	Speed Limit Ramp	SN_735	Height Requirement		A40
4	Speed Limit Ramp	SN_796	Leaning		A36

Tree and Brush (TB)

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

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Turf	TF_86	Bareground		A27, A28, A29
2	Turf	TF_117	Bareground		A34
3	Turf	TF_118	Bareground		A34
4	Turf	TF_130	Bareground		A36

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Turf	TF_170	Bareground		A36
6	Turf	TF_178	Bareground		A10, A11
7	Turf	TF_181	Bareground		A28, A29
8	Turf	TF_197	Bareground		A21

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
9	Turf	TF_229	Bareground		A35, A36
10	Turf	TF_278	Bareground		A10, A11
11	Turf	TF_299	Bareground		A46
12	Turf	TF_305	Bareground		A45, A46

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
13	Turf	TF_326	Bareground		A43, A44
14	Turf	TF_341	Bareground		A39, A40
15	Turf	TF_384	Bareground		A39
16	Turf	TF_420	Bareground		A36

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
17	Turf	TF_427	Bareground		A35, A36
18	Turf	TF_455	Bareground		A46
19	Turf	TF_499	Bareground		A30
20	Turf	TF_517	Bareground		A29

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
21	Turf	TF_556	Bareground		A24, A25
22	Turf	TF_621	Bareground		A16, A17
23	Turf	TF_971	Bareground		A10, A11
24	Turf	TF_1006	Bareground		A21

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

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Bridge Wall	WL_49	Cracked joint		A33, A34