



NORTH CAROLINA
Turnpike Authority

Maintenance Rating Program

Triangle Expressway

2015 First Quarter Report

1 S. Wilmington Street
Raleigh, NC 27601



Last Updated:
April 27, 2015

CONSULTANT CERTIFICATION OF COMPLETION

April 10, 2015

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, appearing to read "Ken M. McEntire".

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 2015 First Quarter Assessment of the Triangle Expressway.

The overall 2015 first quarter maintenance rating of the Triangle Expressway is 92.0, which is above the NCTA target rating of 90. As shown in **Table 1**, all elements assessed with the exception of Traffic Control Devices (84.4) achieved a rating greater than or equal to the target rating of 85.

TABLE 1: MRP ELEMENT RESULTS FOR THE 2015 FIRST QUARTER ASSESSMENT		
ELEMENT	MRP Rating	Target Rating
Road Surface	98.8	85
Unpaved Shoulders	100.0	85
Drainage	93.0	85
Roadside	88.1	85
Traffic Control Devices	84.4	85
Overall MRP Performance Rating	92.0	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 maintenance rating of the Triangle Expressway is 89.6.

TABLE 2: MRP ROLLING ELEMENT RESULTS					
ELEMENT	Q2 2014 RATING	Q3 2014 RATING	Q4 2014 RATING	Q1 2015 RATING	ROLLING RATING
Road Surface	96.8	89.9	93.3	98.8	95.4
Unpaved Shoulders	87.6	92.9	94.6	100.0	94.9
Drainage	93.3	91.3	82.5	93.0	90.0
Roadside	84.7	87.6	83.2	88.1	86.0
Traffic Control Devices	86.1	85.0	82.1	84.4	84.4
Overall MRP Performance Rating	89.8	88.6	86.8	92.0	89.6

This report also provides the results from the annual facility maintenance services verification process. Currently all 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 were found to be in good physical condition, and the landscaped areas around the signs were well maintained.

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 then be charted to identify work needs and subsequent necessary 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.

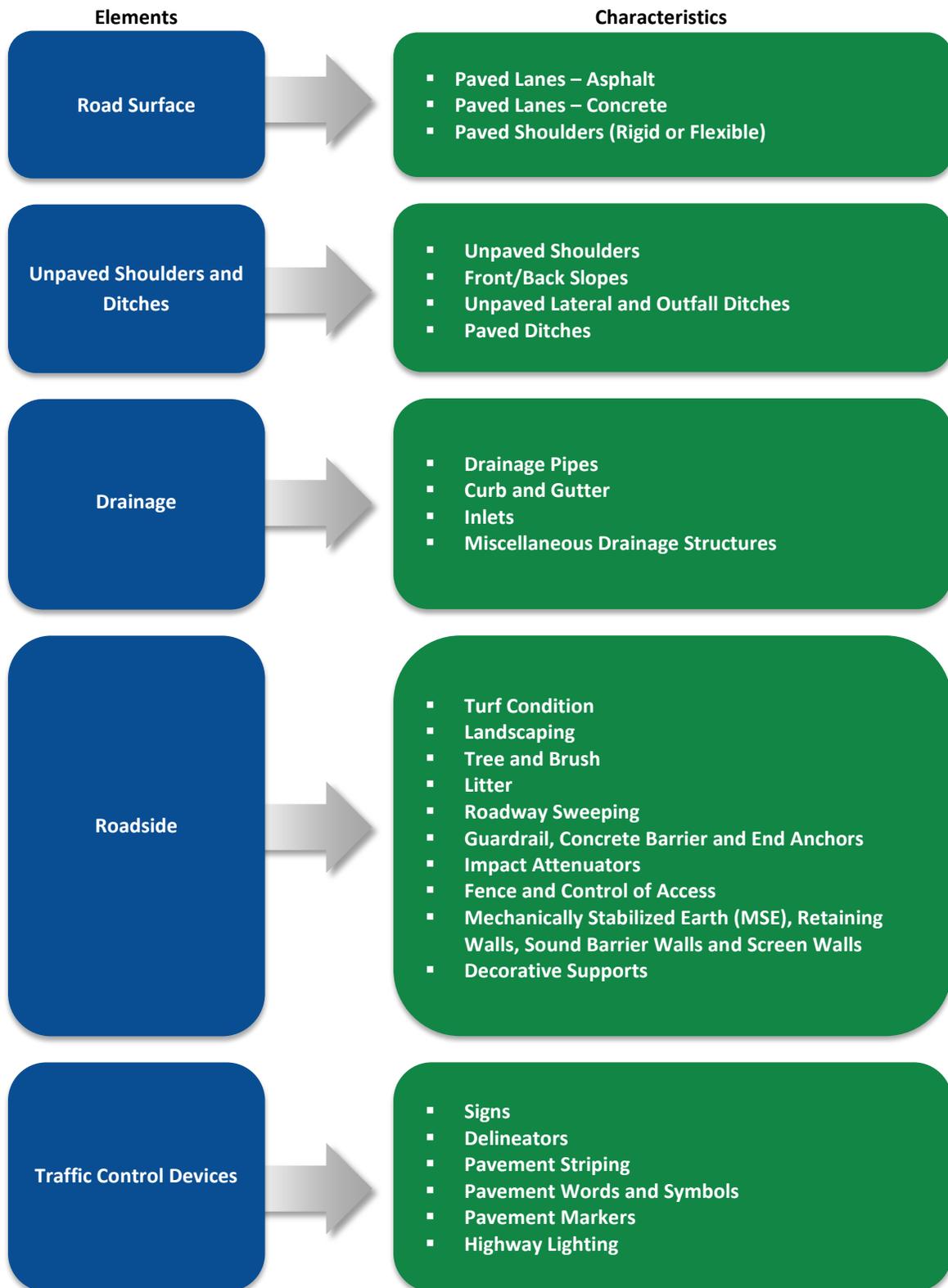
The NCTA performance standards, threshold criteria and maintenance rating program were developed through a collaborative effort by NCTA managers, NCDOT maintenance staff, and consultants.

Using 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 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 weighting 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 is selected for sampling is evaluated according to the criteria described in the NCTA performance standards. This evaluation is completed using 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. If it does not meet the criteria then it is coded as NOT PASSING. When the survey is complete, the number of PASSING and NOT PASSING characteristics are totaled, and a composite number (using from 1 to 100 scale) is produced. This number represents the level of maintenance currently being provided.

For any given asset, the number assigned as the target level of service rating 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 cumulative rolling annual 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 scoring at or above 80.

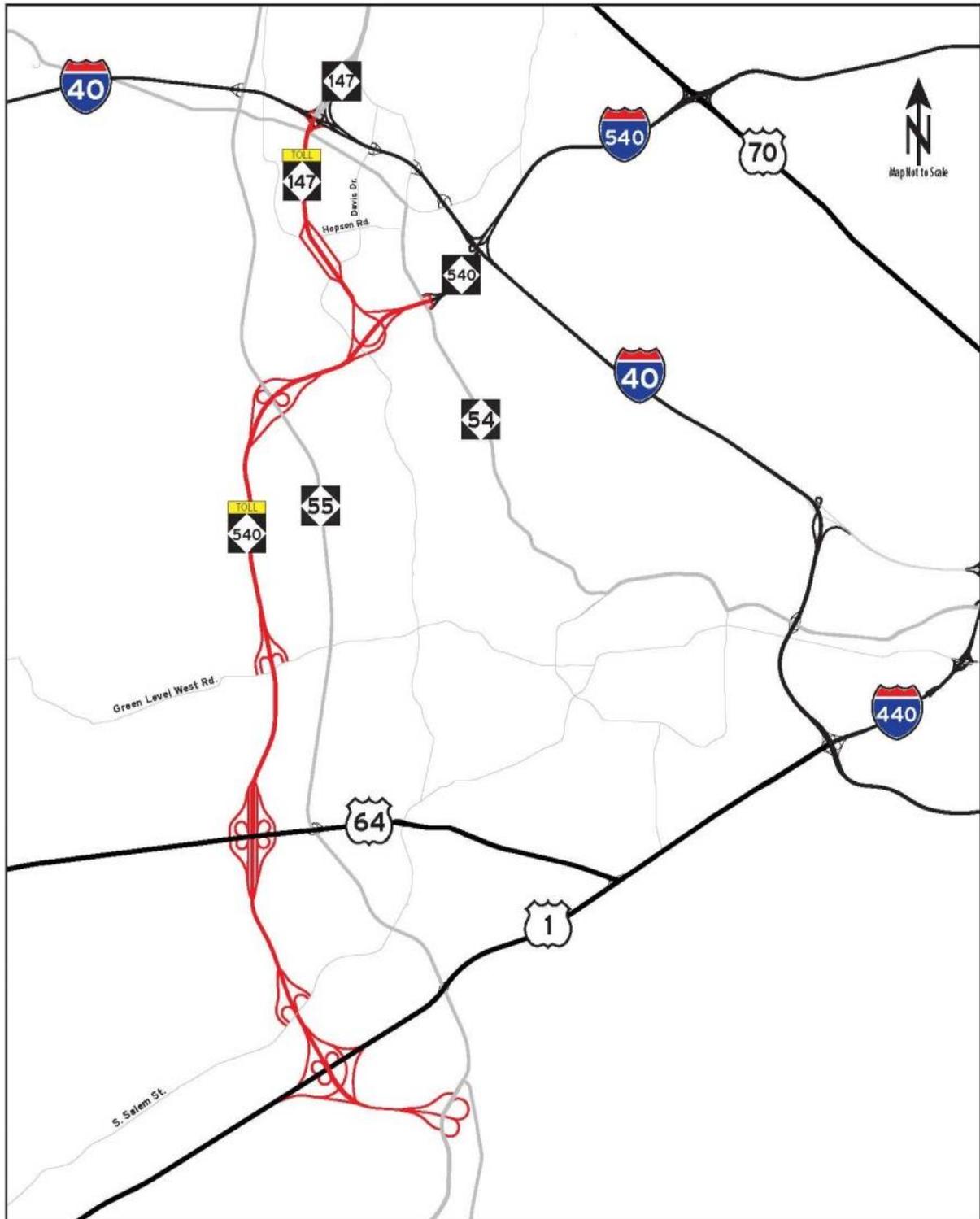
4.0 TRIANGLE EXPRESSWAY DESCRIPTION

The Triangle Expressway extends for approximately 18.8 miles from the interchange of I-40 and NC-147 in Durham to the NC-55 Bypass near Holly Springs (**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.

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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 are 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 2015 First Quarter assessment, no additional asset inventory was updated. However, it was discovered that delineators were inadvertently removed from the past 2013 and 2014 MRP quarterly reports. For this reason, delineators have been included in this first quarter assessment of 2015.

6.0 MRP ASSESSMENT

6.1 Quarterly Results

The overall 2015 first quarter maintenance rating of the Triangle Expressway is 92.0, and is above the overall target rating score of 90. All element rating scores but one are above the target rating of 85; Traffic Control Devices scored 84.4. Four characteristics scored below the minimum rating of 80: Miscellaneous Drainage Structures (75), Turf Condition (54), MSE/Retaining Walls, Sound Barrier Walls and Screen Walls (79), and Pavement Markers (64). It is important to note that these results are only representative of the first 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 first 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 2015 first quarter assessments are found in **Table 3**.

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TABLE 3: MRP CHARACTERISTIC RESULTS FOR Q1 2015						
ROAD SURFACE	SAMPLE PASSED	SAMPLE TOTAL	WEIGHTED VALUES	ACTUAL PTS	AVAILABLE PTS	Q1 2015 MRP RATING
Paved Lanes Asphalt	24	24	9	216	216	100
Paved Lanes Concrete	35	35	9	315	315	100
Paved Shoulder	57	59	5	285	295	97
Element Total				816	826	98.8
UNPAVED SHOULDERS AND DITCHES	SAMPLE PASSED	SAMPLE TOTAL	WEIGHTED VALUES	ACTUAL PTS	AVAILABLE PTS	Q1 2015 MRP RATING
Unpaved Shoulder	59	59	9	531	531	100
Front/Back Slopes	59	59	6	354	354	100
Lateral and Outfall Ditches,	59	59	6	354	354	100
Ditches, Paved	2	2	5	10	10	100
Element Total				1249	1249	100.0
DRAINAGE	SAMPLE PASSED	SAMPLE TOTAL	WEIGHTED VALUES	ACTUAL PTS	AVAILABLE PTS	Q1 2015 MRP RATING
Drainage Pipes	32	34	7	224	238	94
Curb and Gutter	25	25	6	150	150	100
Inlets	33	34	7	231	238	97
Misc. Drainage Structure	24	32	4	96	128	75
Element Total				701	754	93.0
ROADSIDE	SAMPLE PASSED	SAMPLE TOTAL	WEIGHTED VALUES	ACTUAL PTS	AVAILABLE PTS	Q1 2015 MRP RATING
Turf Condition	40	74	7	280	518	54
Landscaping	31	32	4	124	128	97
Trees and Brush	31	31	4	124	124	100
Litter	58	59	4	232	236	98
Roadway Sweeping	58	59	5	290	295	98
Guardrail, Concrete Barrier	31	31	9	279	279	100
Impact Attenuators	9	9	9	81	81	100
Fence, Control Access	29	29	7	203	203	100
Retaining, Sound, Screen Walls	15	19	5	75	95	79
Decorative Supports	24	25	5	120	125	96
Graffiti and Stain Removal	59	59	4	236	236	100
Element Total				2044	2320	88.1
TRAFFIC CONTROL DEVICES	SAMPLE PASSED	SAMPLE TOTAL	WEIGHTED VALUES	ACTUAL PTS	AVAILABLE PTS	Q1 2015 MRP RATING
Signs	34	34	7	238	238	100
Delineators	39	43	3	117	129	91
Pavement Striping	51	59	8	408	472	86
Words and Symbols	30	30	7	210	210	100
Pavement Markers	38	59	9	342	531	64
Highway Lighting	26	27	6	156	162	96
Element Total				1465	1736	84.4

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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 first quarter is shown in **Table 4**:

TABLE 4: MRP ELEMENT RESULTS FOR Q1 2015	
ELEMENT	Q1 2015 MRP Rating
Road Surface	98.8
Unpaved Shoulders	100.0
Drainage	93.0
Roadside	88.1
Traffic Control Devices	84.4
Overall MRP Performance Rating	92.0

6.2 Analysis and Recommendations

Elements

Traffic Control Devices was the only element that fell below the NCTA minimum threshold criteria of 85 for the first quarter by less than 1 point (84.4).

Characteristics

Most characteristics satisfied the NCTA minimum threshold criteria of 80 with the exception of Miscellaneous Drainage Structures, Turf Condition, MSE/Retaining Walls, Sound Barrier Walls and Screen Walls, 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.

Miscellaneous Drainage Structures (75 rating – 8 of the 32 assets failed). All 8 miscellaneous drainage structures failed because of obstruction (**Figure 3**). Out of the 8 obstruction failures, 1 occurred because of debris blocking the outlet and 7 occurred due to standing water from ditch line backing up into the outlet. In order to prevent these failures from occurring, it is recommended for the maintenance provider to routinely clean out ditches near these drainage features to allow for the continuous flow of water, as well as remove any vegetation or debris that has washed into or grown up around the structure.

Figure 3: Miscellaneous Drainage Failures



Turf Condition (54 rating – 34 of the 74 assets failed). All 34 turf areas failed because of bare ground. Two of the failing turf areas can be seen in **Figure 4**. Many of the bare ground areas previously had active Bermuda and Centipede runners growing that are now dead. It is suspected this condition was originally caused by low cutting heights during the summer of 2013. With such a noticeable drop over the last few assessments in the turf condition and no noticeable improvement in scores, 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 4: Turf Failures



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MSE/Retaining Walls, Sound Barrier Walls and Screen Walls (79 rating – 4 of the 19 assets failed). The retaining wall and sound wall failures were related to spalls and joint separation. Two of these failures can be seen in *Figure 5*. In order to avoid further deterioration of these walls, it is recommended that the maintenance provider seal all spalls and joints immediately. It is also recommended that all joint failures be closely monitored as these failures could be related to foundation settlement or slope instability, which would impact the integrity of the structure.

Figure 5: MSE/Retaining Walls, Sound Barrier Walls and Screen Walls Failures



Pavement Markers (64 rating – 21 of the 59 assets failed). All 21 pavement marker failures are due to missing markers and insufficient reflectivity during nighttime inspections (*Figure 6*).

During the past several years the Triangle Expressway has seen several rounds of frozen precipitation where plows have 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. Additionally, it should be noted that pavement markers have an average life of 3 years when reflectivity begins to diminish below acceptable levels. The northern section of the Triangle Expressway (Toll NC 147) was opened in December of 2011 and replacement of the existing markers should be scheduled this year.

Figure 6: Pavement Markers Failures



7.0 ROLLING MRP RATING

The current rolling maintenance rating of the Triangle Expressway is 89.6, and is just below the target overall rating score of 90. These results are a collection of the four latest quarterly inspections conducted throughout the year. The cumulative rolling results can be viewed in **Tables 5 and 6** of this report.

All element ratings are above the desired rating of 85 with the exception of Traffic Control Devices (84.4). Also, Paved Ditches (63), Miscellaneous Drainage Structures (66), Turf Condition (53), and Pavement Markers (60) scored below the minimum characteristic rating of 80.

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TABLE 5: MRP ROLLING CHARACTERISTIC RESULTS					
ROAD SURFACE	Q2 2014 RATING	Q3 2014 RATING	Q4 2014 RATING	Q1 2015 RATING	ROLLING RATING
Paved Lanes Asphalt	92	94	100	100	97
Paved Lanes Concrete	100	100	94	100	99
Paved Shoulder	97	77	87	97	91
Element Total	96.8	89.9	93.3	98.8	95.4
UNPAVED SHOULDERS AND DITCHES	Q2 2014 RATING	Q3 2014 RATING	Q4 2014 RATING	Q1 2015 RATING	ROLLING RATING
Unpaved Shoulder	81	94	94	100	93
Front/Back Slopes	94	87	97	100	95
Lateral and Outfall Ditches, Unpaved	97	100	94	100	98
Ditches, Paved	0	50	100	100	63
Element Total	87.6	92.9	94.6	100.0	94.9
DRAINAGE	Q2 2014 RATING	Q3 2014 RATING	Q4 2014 RATING	Q1 2015 RATING	ROLLING RATING
Drainage Pipes	97	97	97	94	96
Curb and Gutter	92	100	84	100	94
Inlets	94	88	88	97	92
Misc. Drainage Structure	84	72	32	75	66
Element Total	93.3	91.3	82.5	93.0	90.0
ROADSIDE	Q2 2014 RATING	Q3 2014 RATING	Q4 2014 RATING	Q1 2015 RATING	ROLLING RATING
Turf Condition	49	61	46	54	53
Landscaping	88	81	81	97	87
Trees and Brush	100	100	100	100	100
Litter	100	100	100	98	99
Roadway Sweeping	100	100	81	98	95
Guardrail, Concrete Barrier and End Anchors	94	97	100	100	98
Impact Attenuators	100	78	100	100	94
Fence, Control Access	93	97	97	100	97
Retaining, Sound, Screen Walls	82	94	88	79	86
Decorative Supports	96	100	96	96	97
Graffiti and Stain Removal	100	100	97	100	99
Element Total	84.7	87.6	83.2	88.1	86.0
TRAFFIC CONTROL DEVICES	Q2 2014 RATING	Q3 2014 RATING	Q4 2014 RATING	Q1 2015 RATING	ROLLING RATING
Signs	89	94	94	100	93
Delineators	N/A	N/A	N/A	91	91
Pavement Striping	90	97	68	86	86
Words and Symbols	93	100	97	100	98
Pavement Markers	71	45	55	64	60
Highway Lighting	88	91	97	96	93
Element Total	86.1	85.0	82.1	84.4	84.4

N/A - As discussed in Section 5 delineators were omitted from previous assessments and were added back in during this quarter.

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A summary of the rolling annual MRP element results is found in **Table 6**:

TABLE 6: MRP ROLLING ELEMENT RESULTS					
ELEMENT	Q2 2014 RATING	Q3 2014 RATING	Q4 2014 RATING	Q1 2015 RATING	ROLLING RATING
Road Surface	96.8	89.9	93.3	98.8	95.4
Unpaved Shoulders	87.6	92.9	94.6	100.0	94.9
Drainage	93.3	91.3	82.5	93.0	90.0
Roadside	84.7	87.6	83.2	88.1	86.0
Traffic Control Devices	86.1	85.0	82.1	84.4	84.4
Overall MRP Performance Rating	89.8	88.6	86.8	92.0	89.6

8.0 TRIANGLE EXPRESSWAY TOLL FACILITY MAINTENANCE

As part of the Roadside Toll Collection System contract, XEROX provides toll facility maintenance for all toll zones along the Triangle Expressway. Facility maintenance includes 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 provides 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 are stored in the CMMS (Computerized Maintenance Management System) database and submitted to NCTA through Constructware for review. As part of each quarterly inspection, HNTB reviews the facility maintenance logs to identify any problems reported and ensure XEROX is meeting maintenance contract expectations. Equipment services 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 January, February and March 2015)	
<ul style="list-style-type: none"> • Replace filters (pleated high efficiency filters shall be used) 	Completed
Semi-Annual Service (Scheduled for May 2015)	
<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 January, February and March 2015)	
<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. 	Completed
Annual Service (Scheduled for November 2015)	
<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.	N/A

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Fire and Carbon Monoxide Alarms and Fire Extinguishers Service Requirements	Status
Monthly Service (Scheduled for January, February and March 2015)	
<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 February 2015)	
<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. 	Completed
Every Two (2) Year Service (Scheduled for September 2016)	
<ul style="list-style-type: none"> • Replace carbon monoxide detectors. 	N/A
Every Five (5) Year Service (Scheduled for February 2017)	
<ul style="list-style-type: none"> • Re-fill and conduct a hydrostatic test on fire extinguishers. 	N/A

Maintenance Rating Program for the Triangle Expressway

First Quarter, January – March 2015

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. 	Completed
Monthly Service (Scheduled for January, February and March 2015)	
<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 cranks 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. ○ Inspect battery charger. 	Completed

Maintenance Rating Program for the Triangle Expressway

First Quarter, January – March 2015

Standby Generators Service Requirements	Status
<ul style="list-style-type: none"> ○ 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. 	Completed
Quarterly Service (Scheduled for February 2015)	
<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. 	Completed
Semi-Annual Service (Scheduled for May 2015)	
<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. 	N/A
Annual Service (Scheduled for November 2015)	
<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

First Quarter, January – March 2015

Security Components Service Requirements	Status
Quarterly Service (Scheduled for March 2015)	
<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

First Quarter, January – March 2015

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. 	Completed
Quarterly Service (Scheduled for January 2015)	
<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 2015)	
<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

First Quarter, January – March 2015

Pressure Cleaning Service Requirements	Status
Semi-Annual Service (Scheduled for June 2015)	
<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

First Quarter, January – March 2015

Pest Control Service Requirements	Status
Quarterly Service (Scheduled for March 2015)	
<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

First Quarter, January – March 2015

Grounding and Ground System Testing Service Requirements	Status
Semi-Annual Service (Scheduled for February 2015)	
<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 first quarter inspection, HNTB reviewed the January, February and March maintenance logs provided by XEROX. According to these logs all scheduled maintenance services were completed and are therefore meeting all maintenance contract expectations.

While no non-working items were reported during the quarterly toll-facility vaults services, all vaults were reported to have cracks in the wall panel, roof panel, floor, or sidewalk. Out of the thirteen vaults inspected, one was reported to have water leakage. NCTA has been notified of all cracks and moisture problems on toll facility vaults reported during this quarter.

Additionally, during the monthly and quarterly standby generators services four units were reported to have problems. Moisture was found on the transfer switch of unit 1-1 and the negative battery clamp of unit 6-2 was not functioning properly. Also, unit 3-2 surged after warmed up and the battery charger of unit 8-2 was found to be weak at the time of the inspection. The problems noted at units 1-1 and 6-2 have been addressed, while units 3-2 and 8-2 will continue to be monitored.

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 visit the four Green Level Historic District signs to conduct a visual inspection of each sign to ensure they are in good standing. During this quarterly inspection, all signs were found to be in good condition, with the landscaped areas being well maintained. **Figure 7** shows two of these signs.

Figure 7: Green Level West Historic District Signs



10.0 CONCLUSION

This report presents the 2015 first quarter and the current cumulative rolling annual 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 first quarter 2015 score is 92.0 and the cumulative rolling annual score is 89.6. The rating for the quarter is up from previous assessments, and is currently above the target rating of 90, while the rolling annual score is only 0.4 points below the established parameter.

This quarter all elements were above the minimum rating of 85 for both the quarterly and rolling annual score, except for Traffic Control Devices (84.4). Miscellaneous Drainage Structures (75), Turf Condition (54), MSE/Retaining Walls, Sound Barrier Walls, and Screen Walls (79), and Pavement Markers (64) fell below the minimum threshold of 80. Also, based on the cumulative rolling assessment scores, Paved Ditches (63), Miscellaneous Drainage Structures (66), Turf Condition (53), and Pavement Markers (60) fell below the minimum threshold of 80.

In order to improve this quarter's substandard scores, it is recommended that the maintenance provider continue to plan to remove any ditch debris on a consistent basis. Also, pavement markers should be checked and reapplied after the seasons of inclement weather.

Turf Condition is continuing to fail for both the quarterly and the cumulative rolling 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 low cutting heights.

Maintenance Rating Program for the Triangle Expressway

First Quarter, January – March 2015

Additionally, routine attention and planning should be given to the nighttime visibility program. While Pavement Striping has scored an 86 for both the 2015 first quarter and the rolling rating, the lifespan of epoxy paint and pavement markers is 3 to 5 years. Pavement markers and striping were placed in some sections of the Triangle Expressway approximately 3 years ago and therefore preparations should be made in the budget and work schedule for this work.

In the toll facility maintenance annual verification process, all maintenance services were completed and therefore met contract obligations.

All Green Level Historic District signs inspected during the first quarter were found to be in good condition. Also, the landscaped areas surrounding the signs are being well maintained; preserving sign visibility and aesthetic appearance.

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 2015 First Quarter Asset Assessment Locations

Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations

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

- Guardrail, Concrete Barrier and End Anchors – BR
- Curb and Gutter – CG
- Decorative Supports – DS
- Drainage Pipes – DP
- Misc. Drainage Structures – MDP
- Fence and Control of Access – FN
- Graffiti - GF
- Highway Lighting – HL
- Impact Attenuators – IA
- Inlets – IN
- Landscaping – PB
- Linear Samples – LS
 - Paved Lanes – Asphalt
 - Paved Lanes – Concrete
 - Paved Shoulders
 - Unpaved Shoulders
 - Front/Back Slopes
 - Unpaved Lateral and Outfall Ditches
 - Litter
 - Roadway Sweeping
 - Pavement Striping/Markings
 - Pavement Markers
 - Delineators
- Paved Ditches – PD
- Pavement Words and Symbols – PS
- Signs – SN
- Tree and Brush – TB
- Turf Condition – TF
- MSE/Retaining Walls, Sound Barrier Walls, and Screen Walls – WL

Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations



Legend

-  Passing Asset
-  Failing Asset

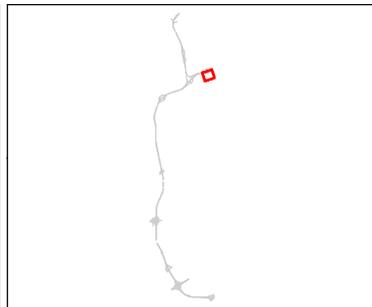


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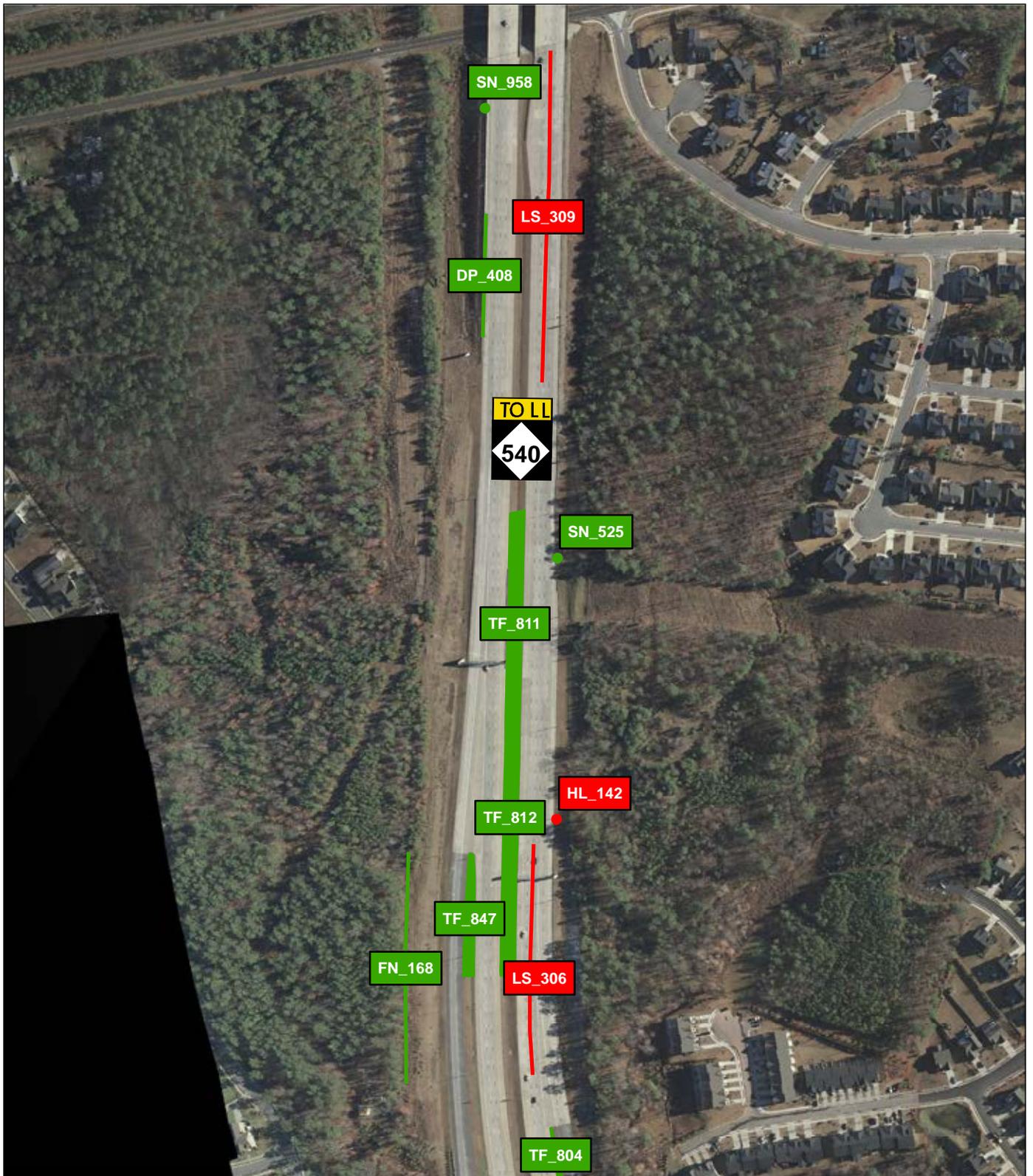


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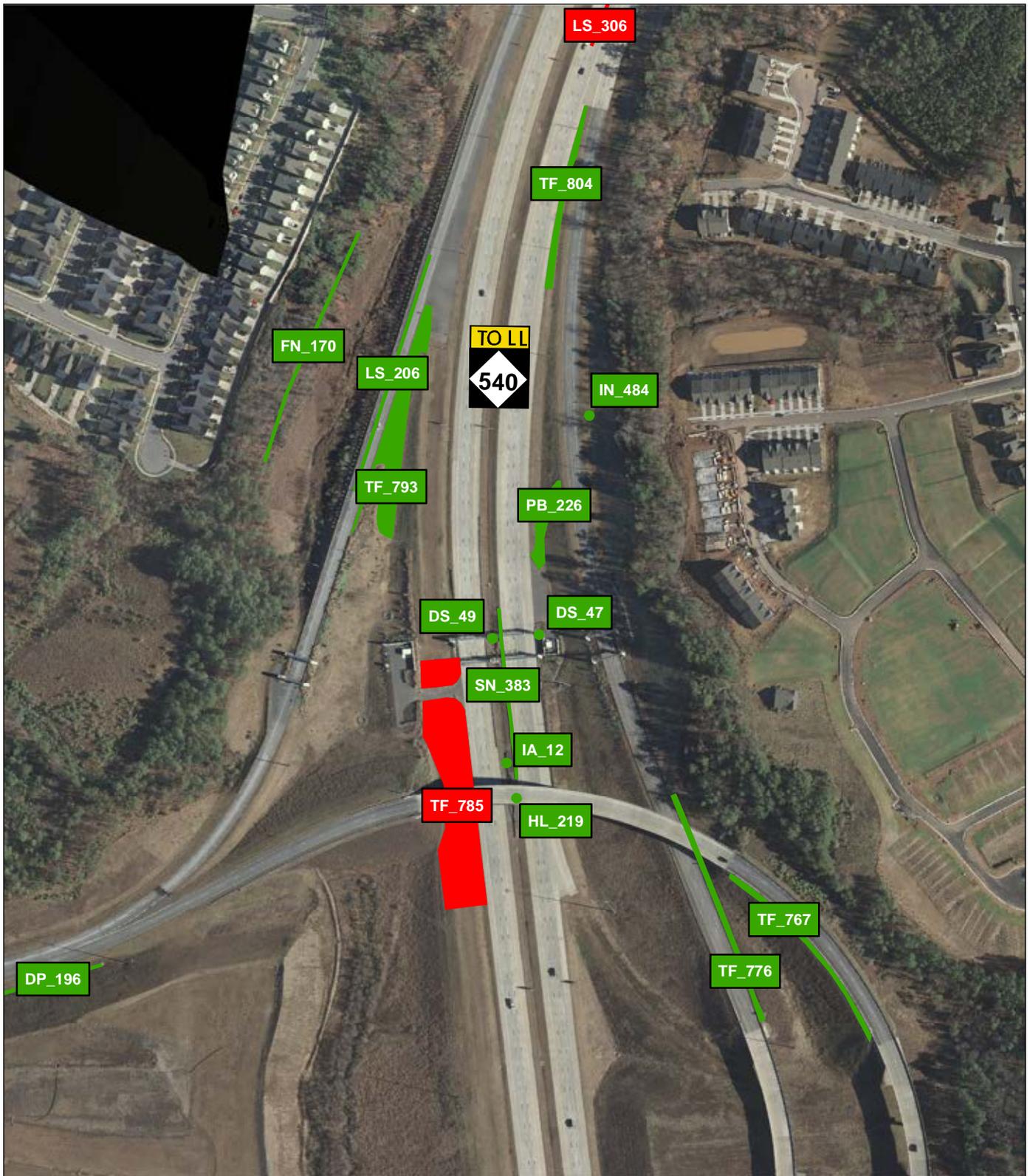


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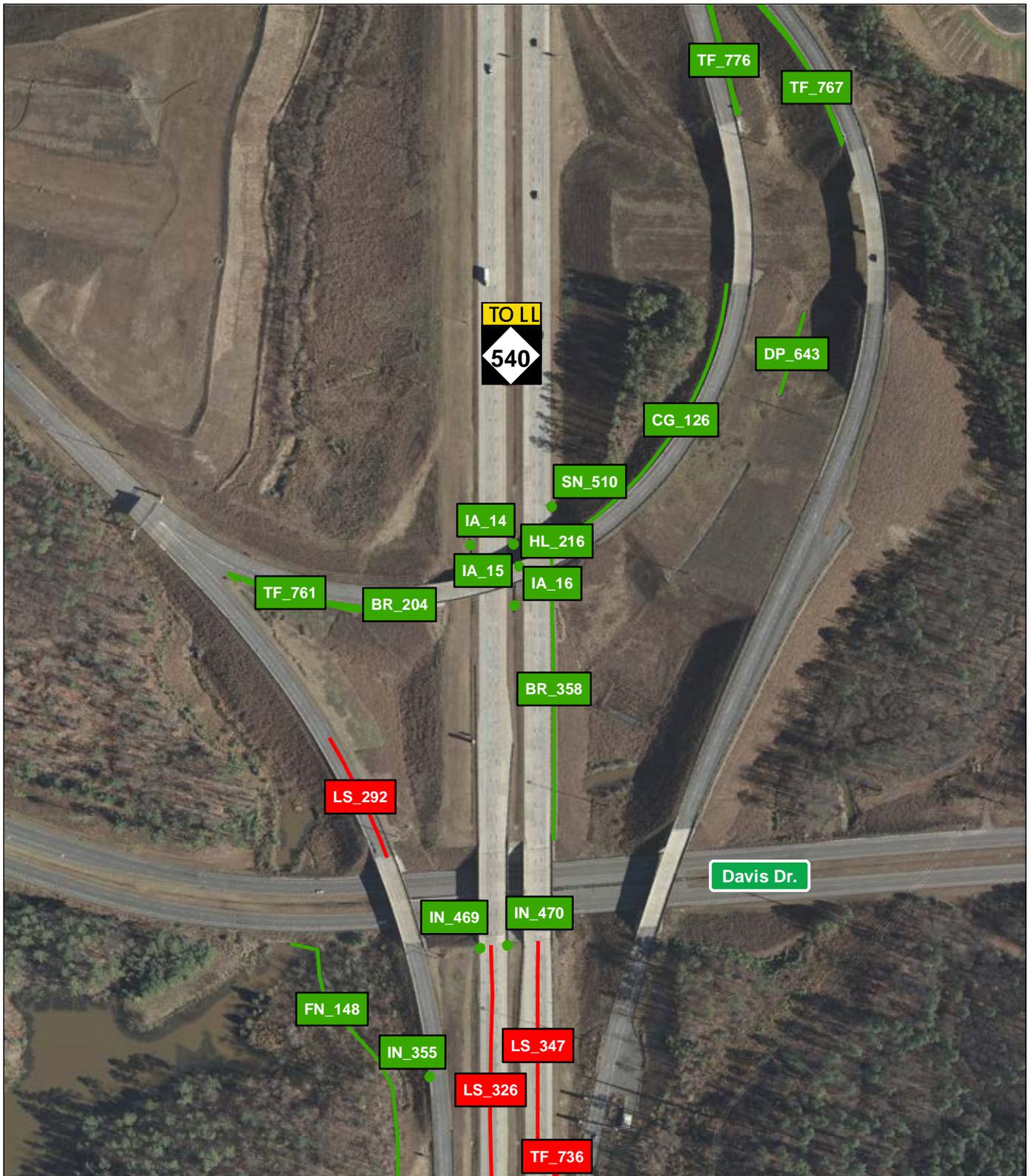


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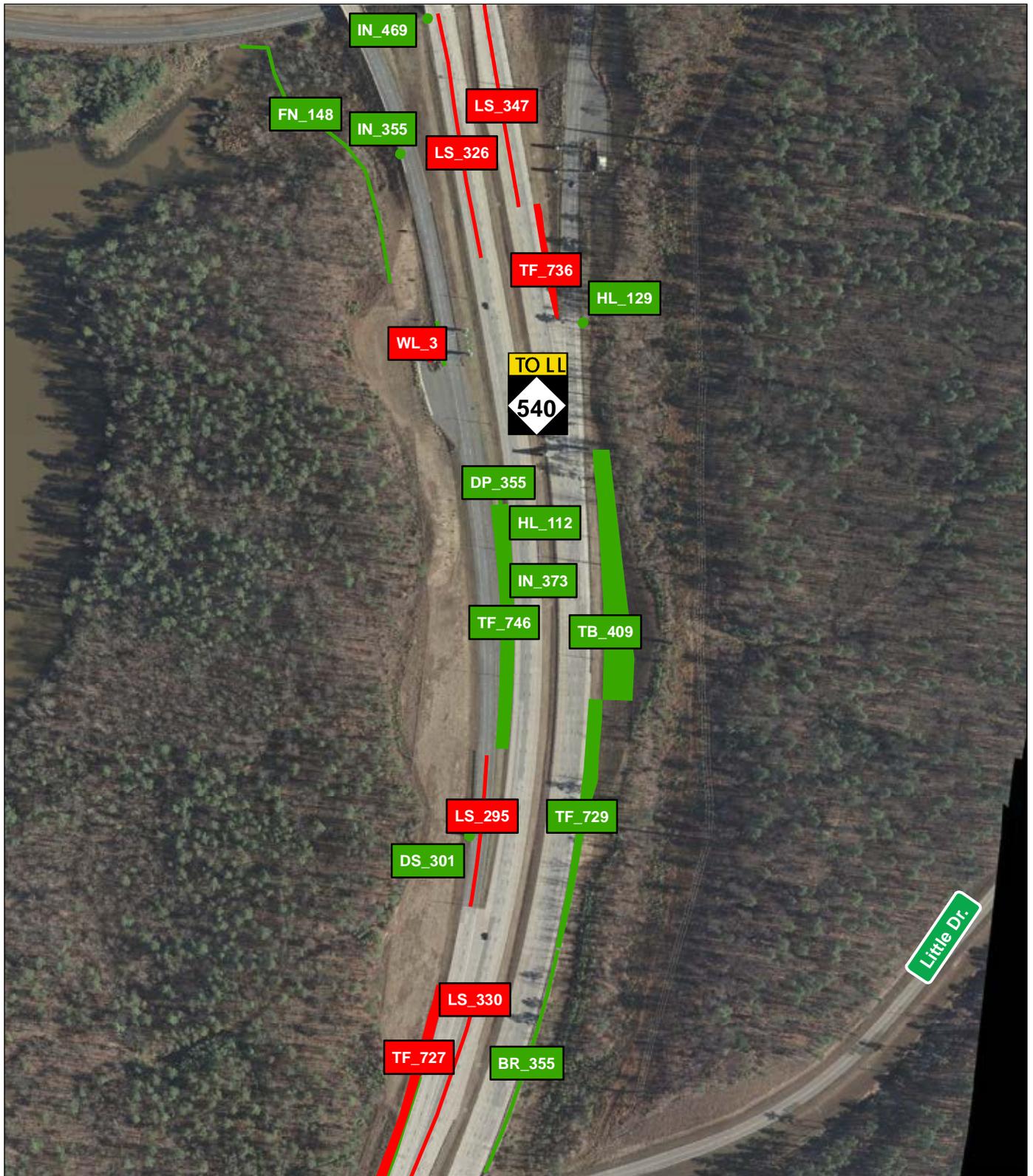


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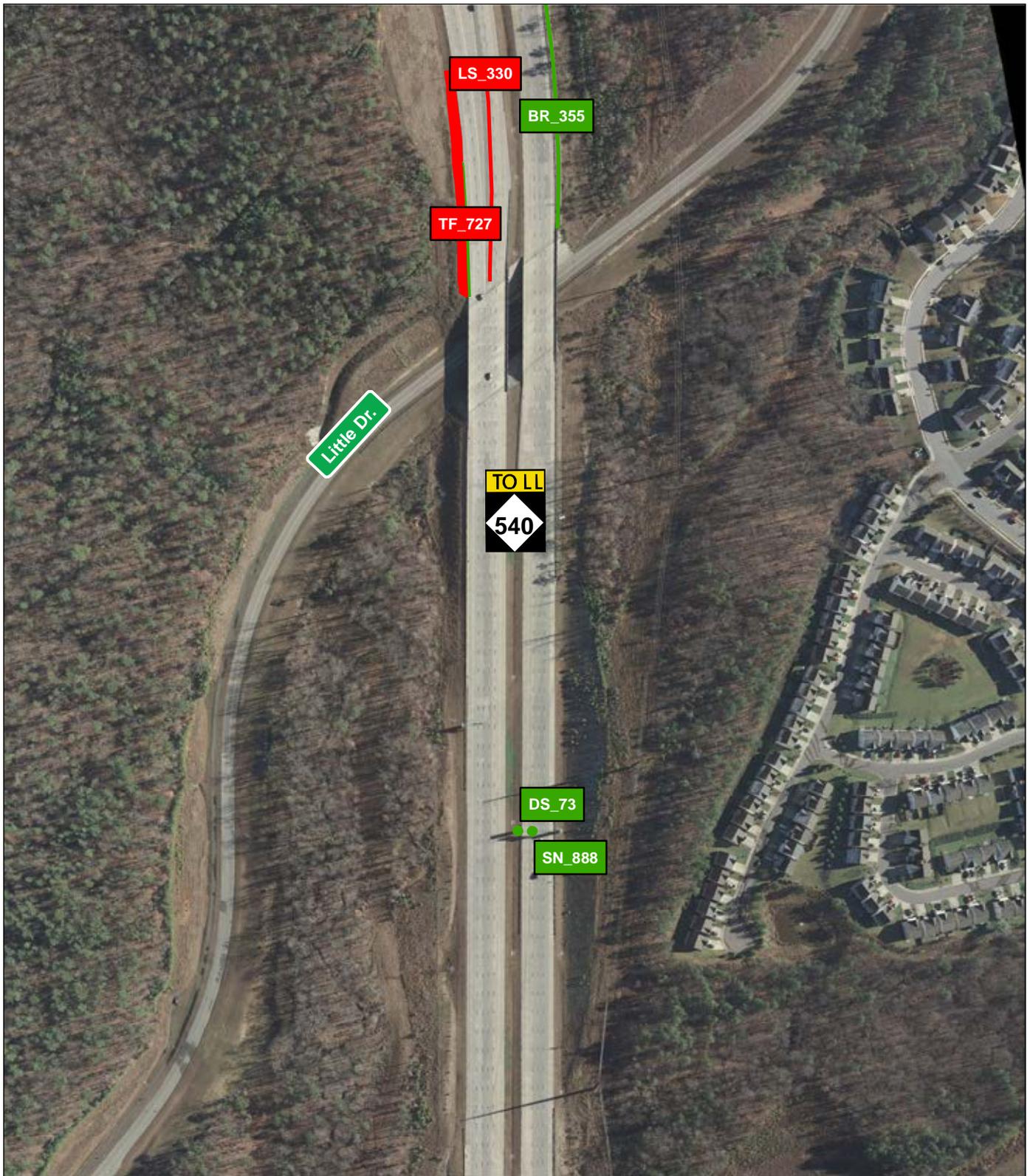


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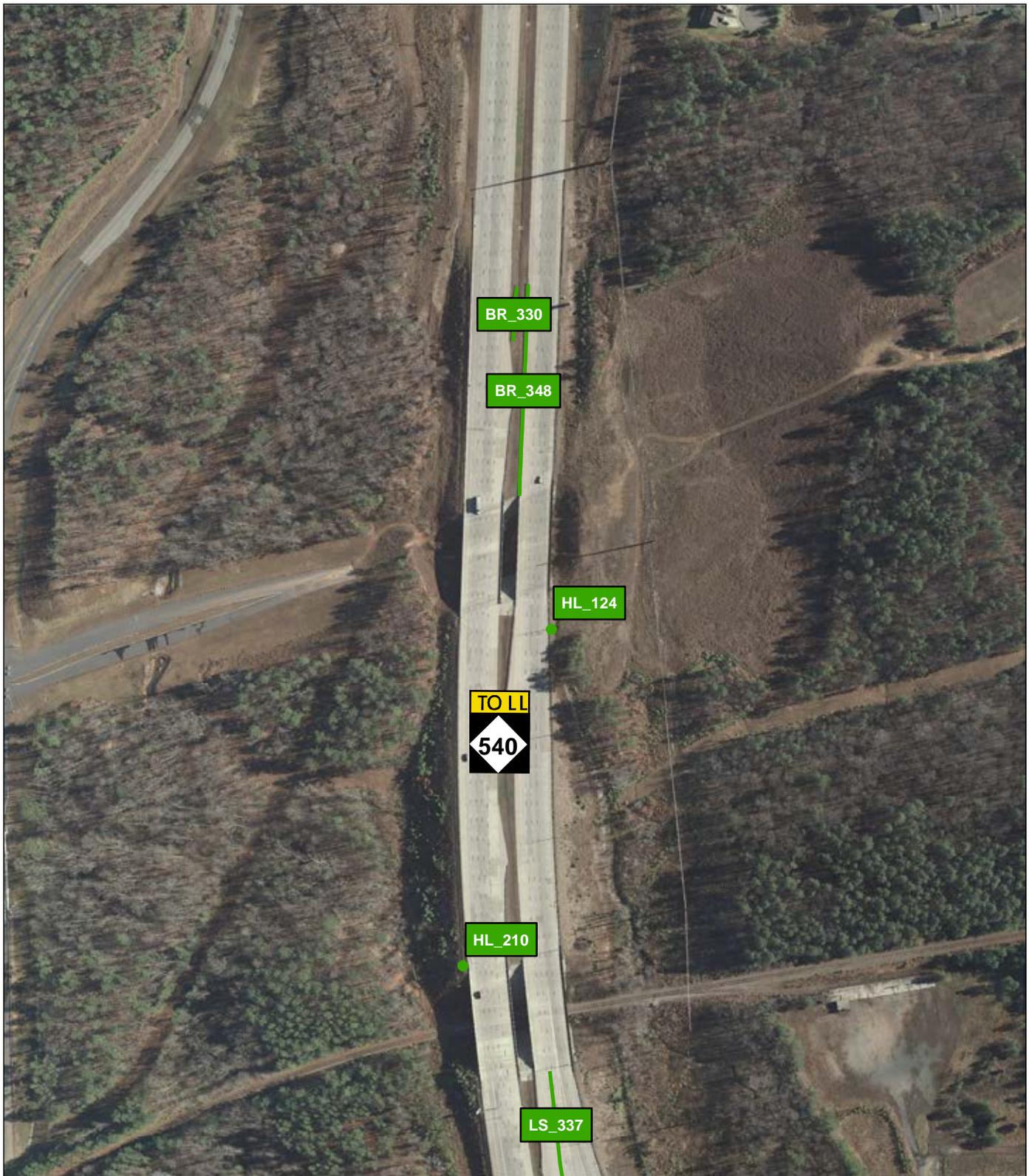


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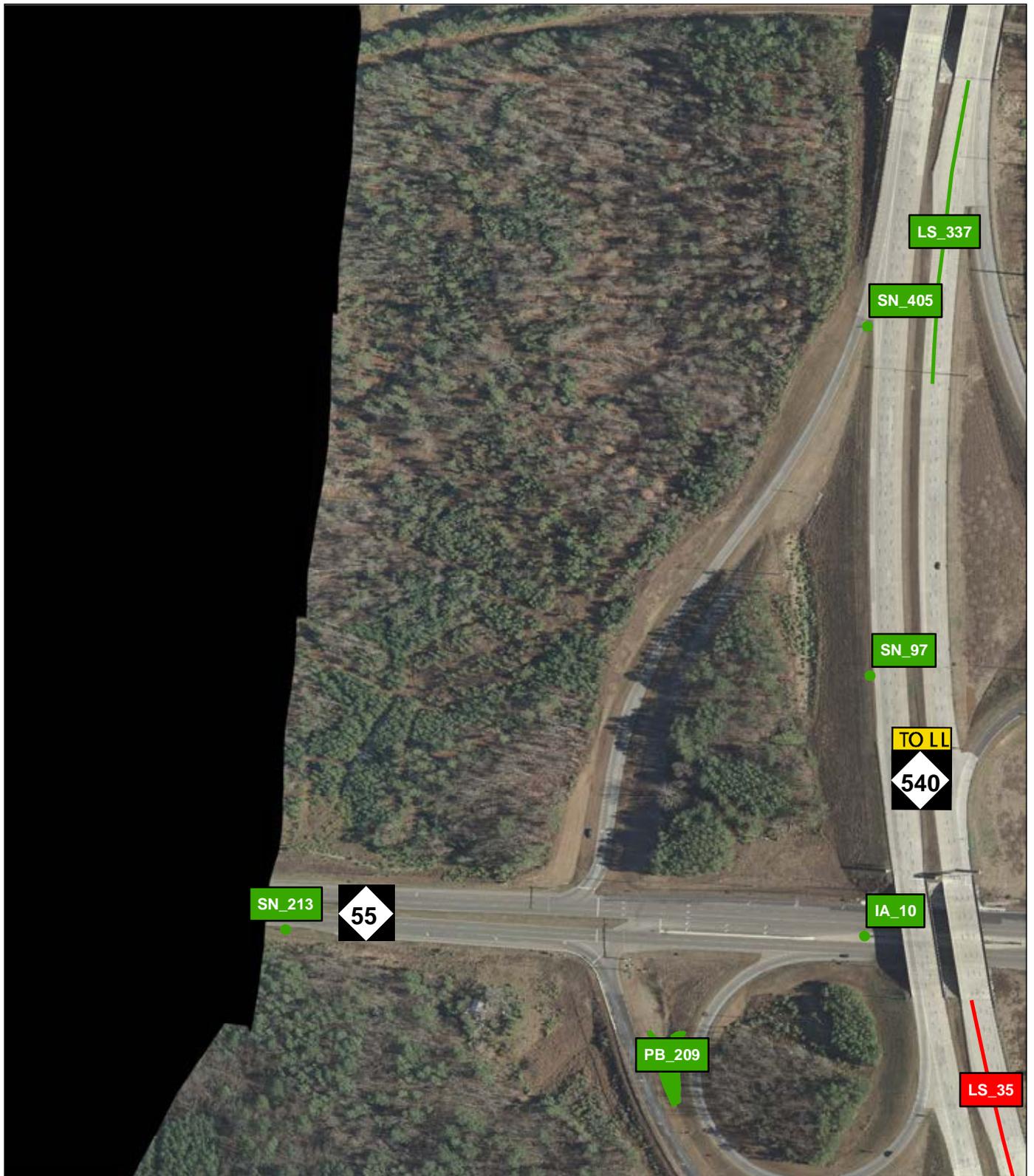


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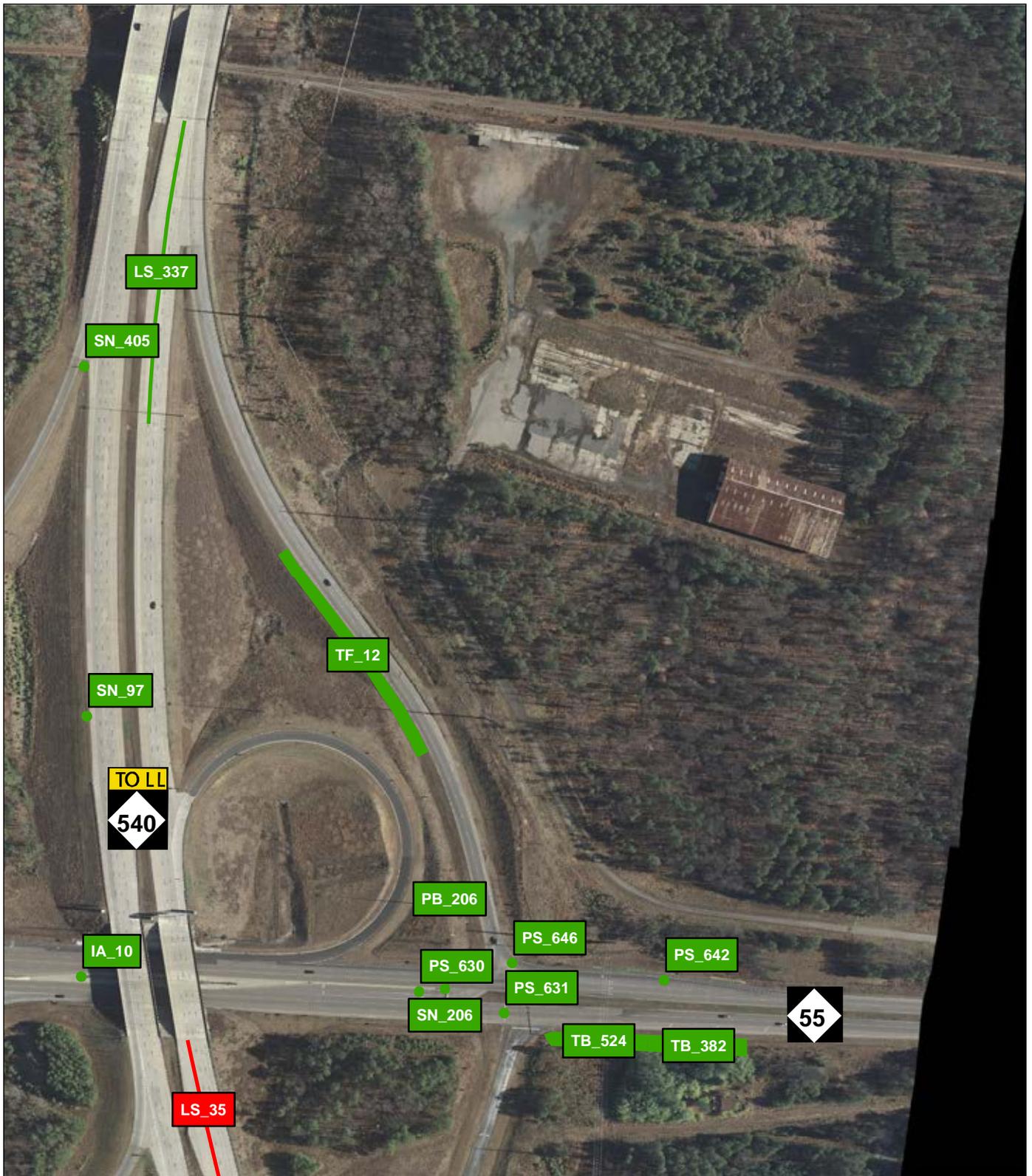


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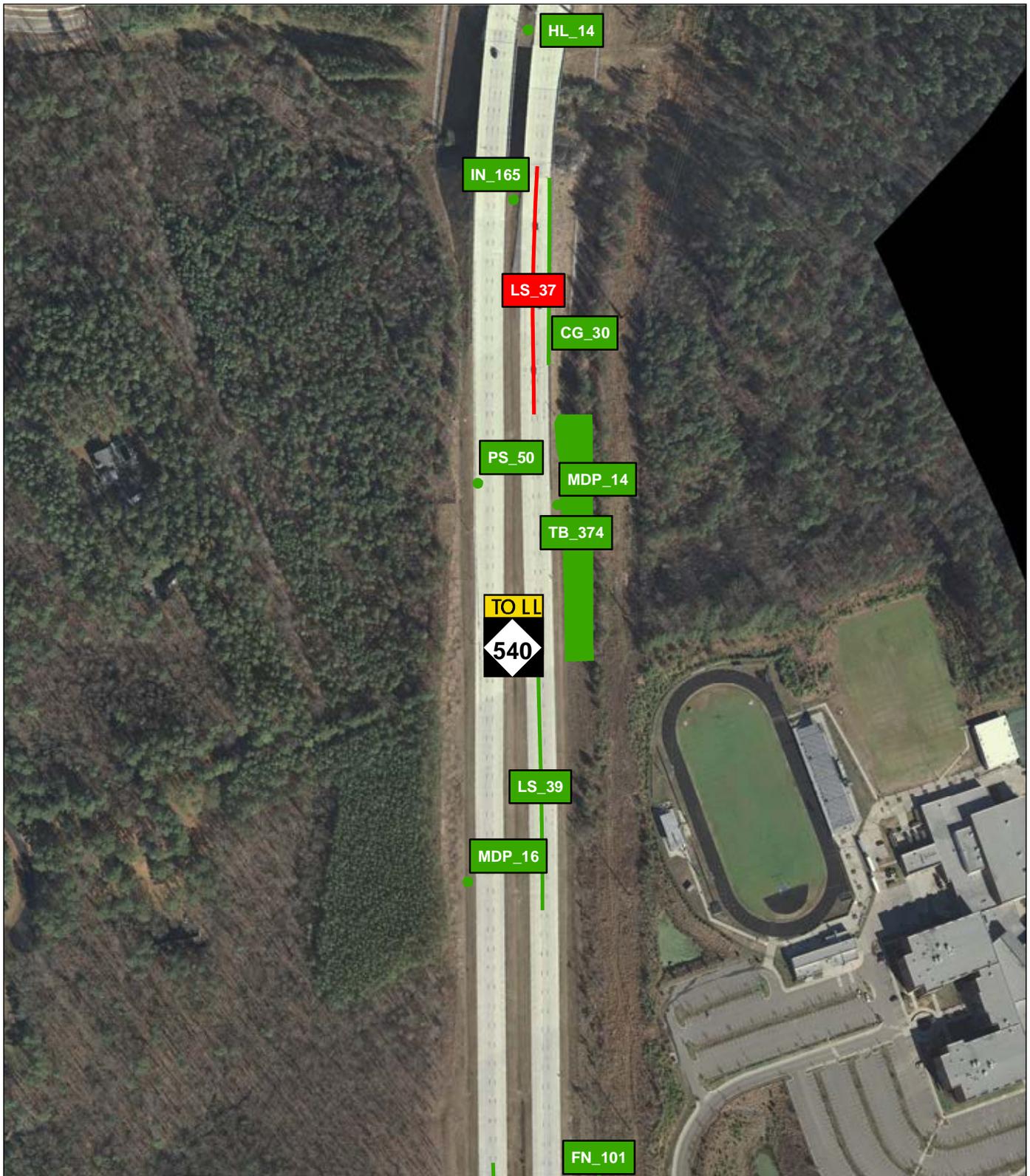


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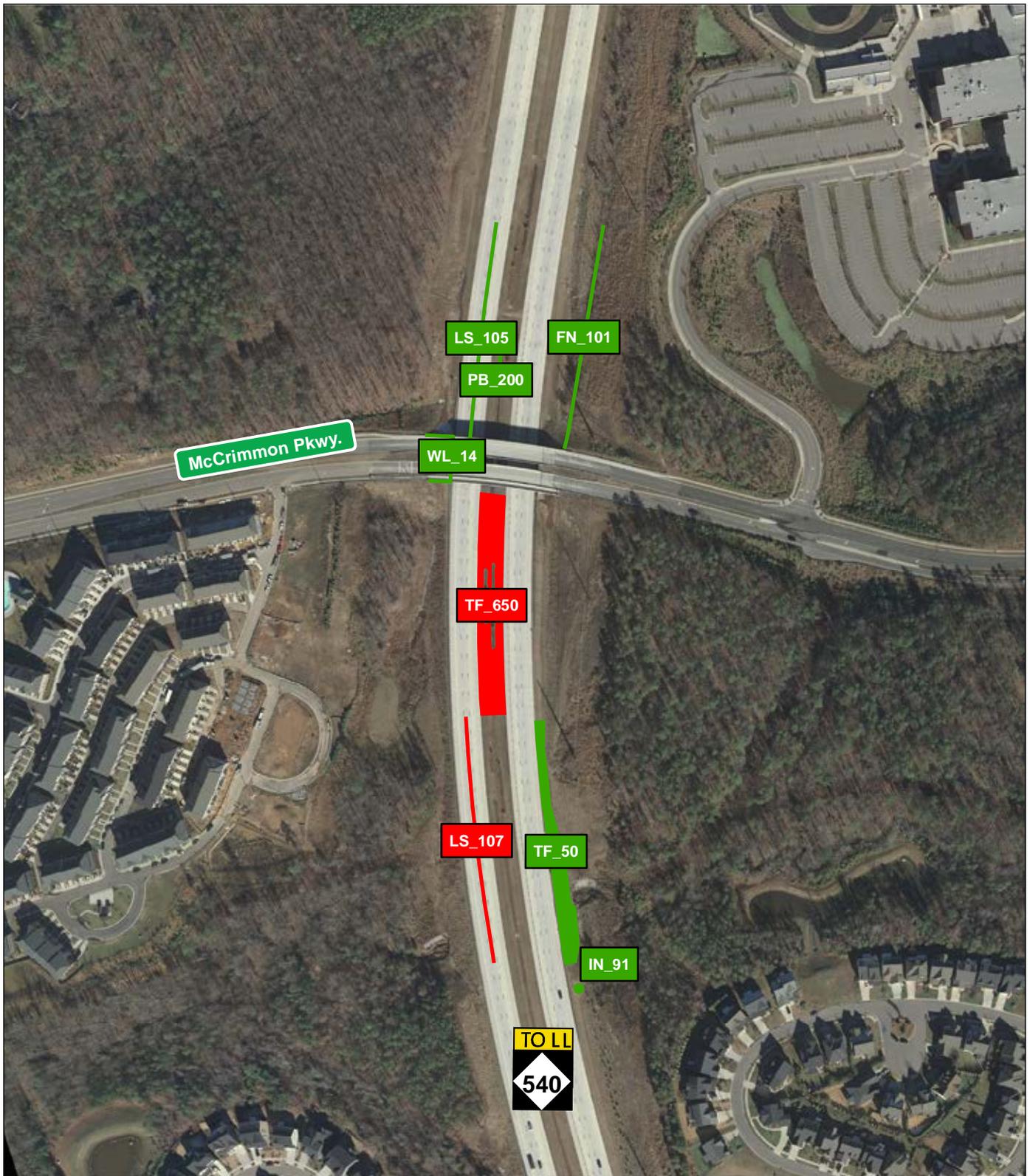


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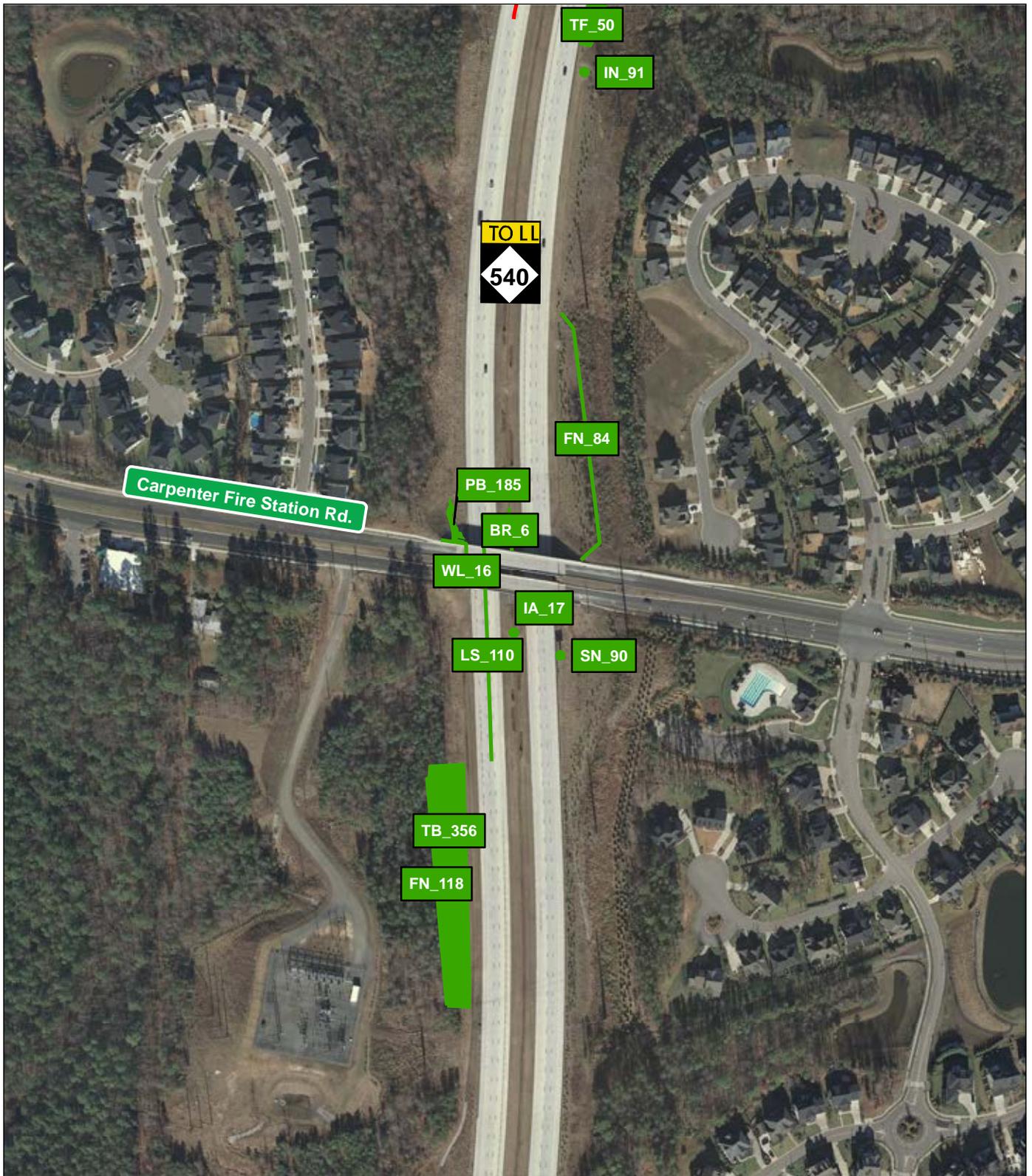


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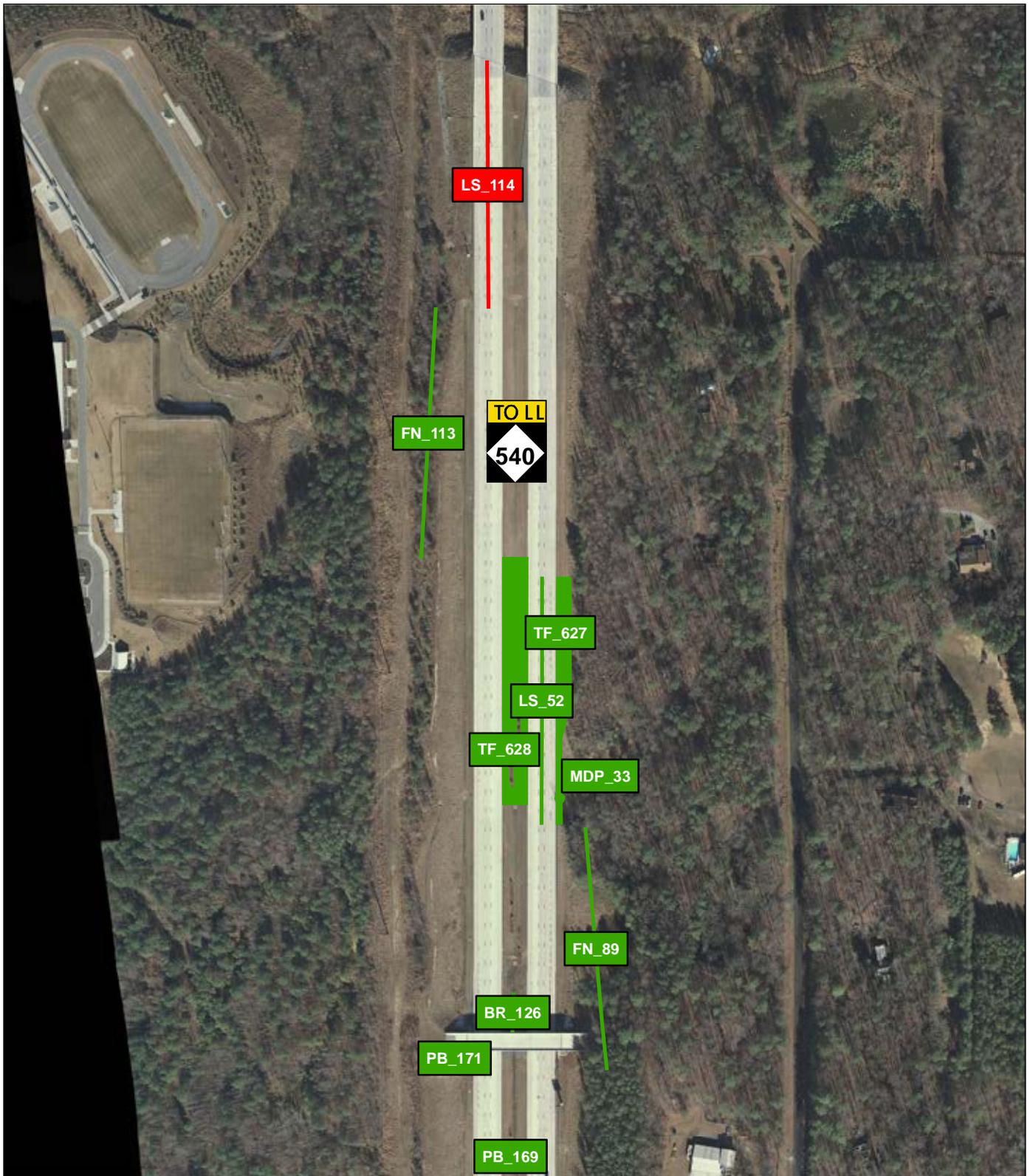


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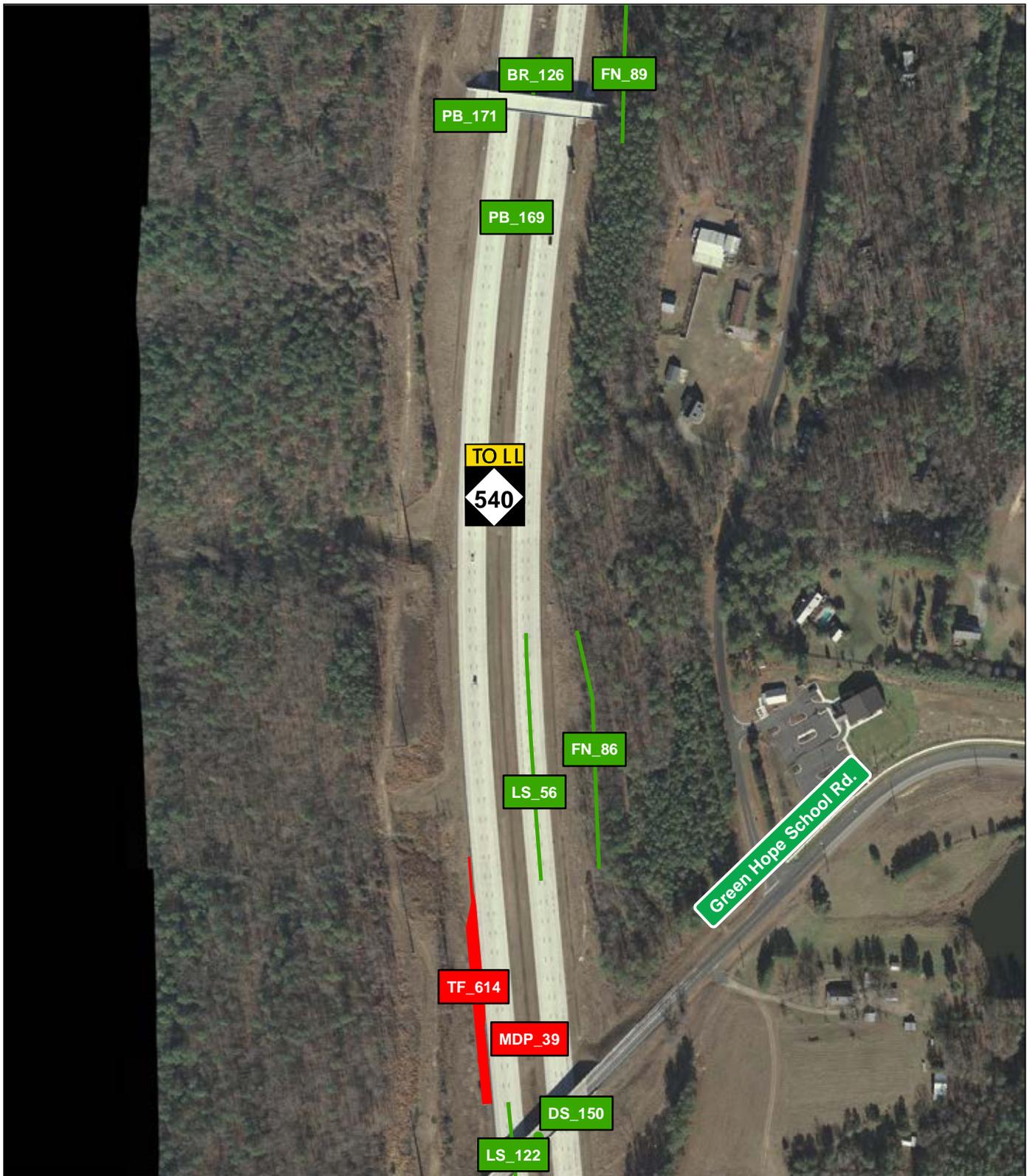


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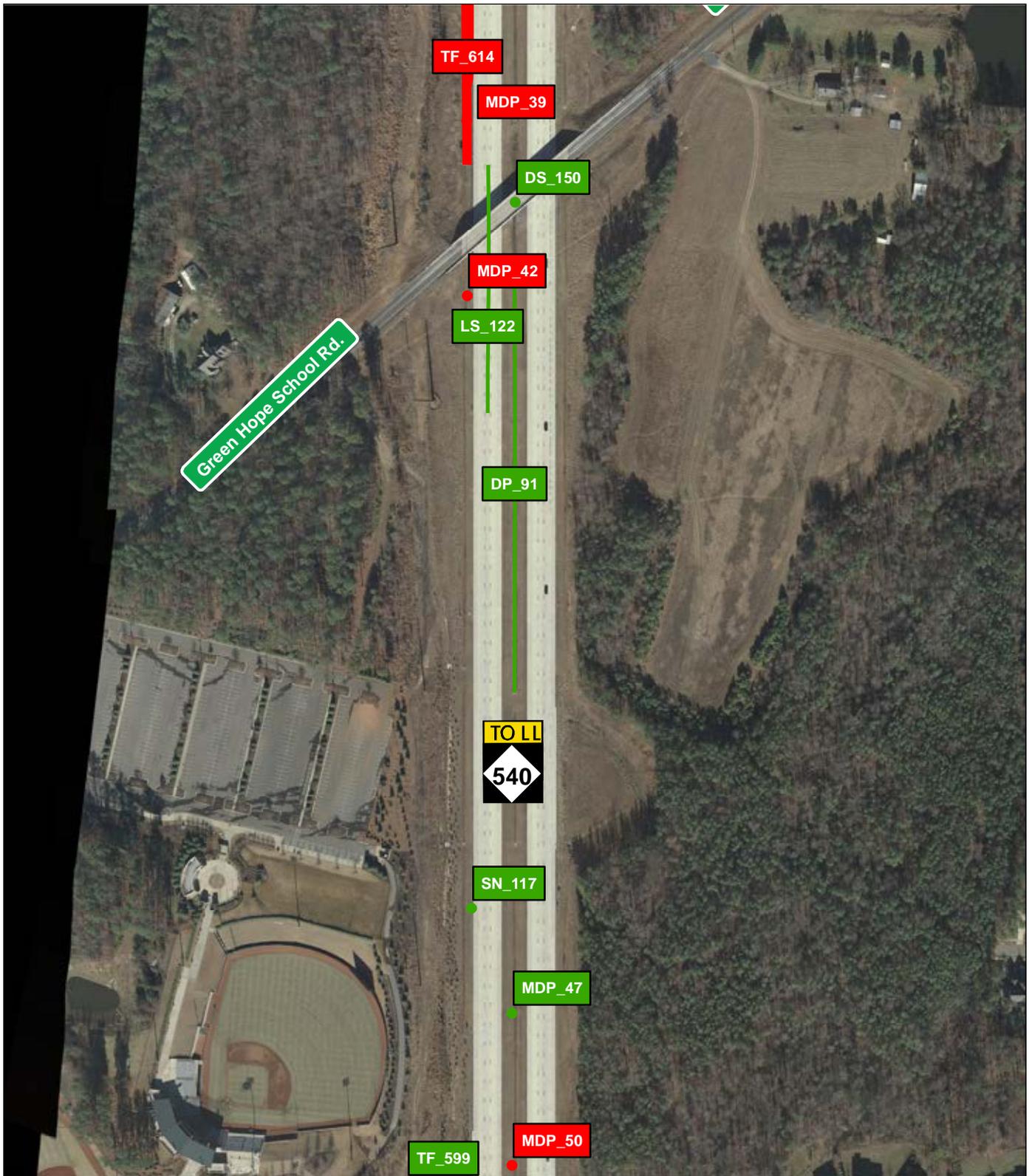


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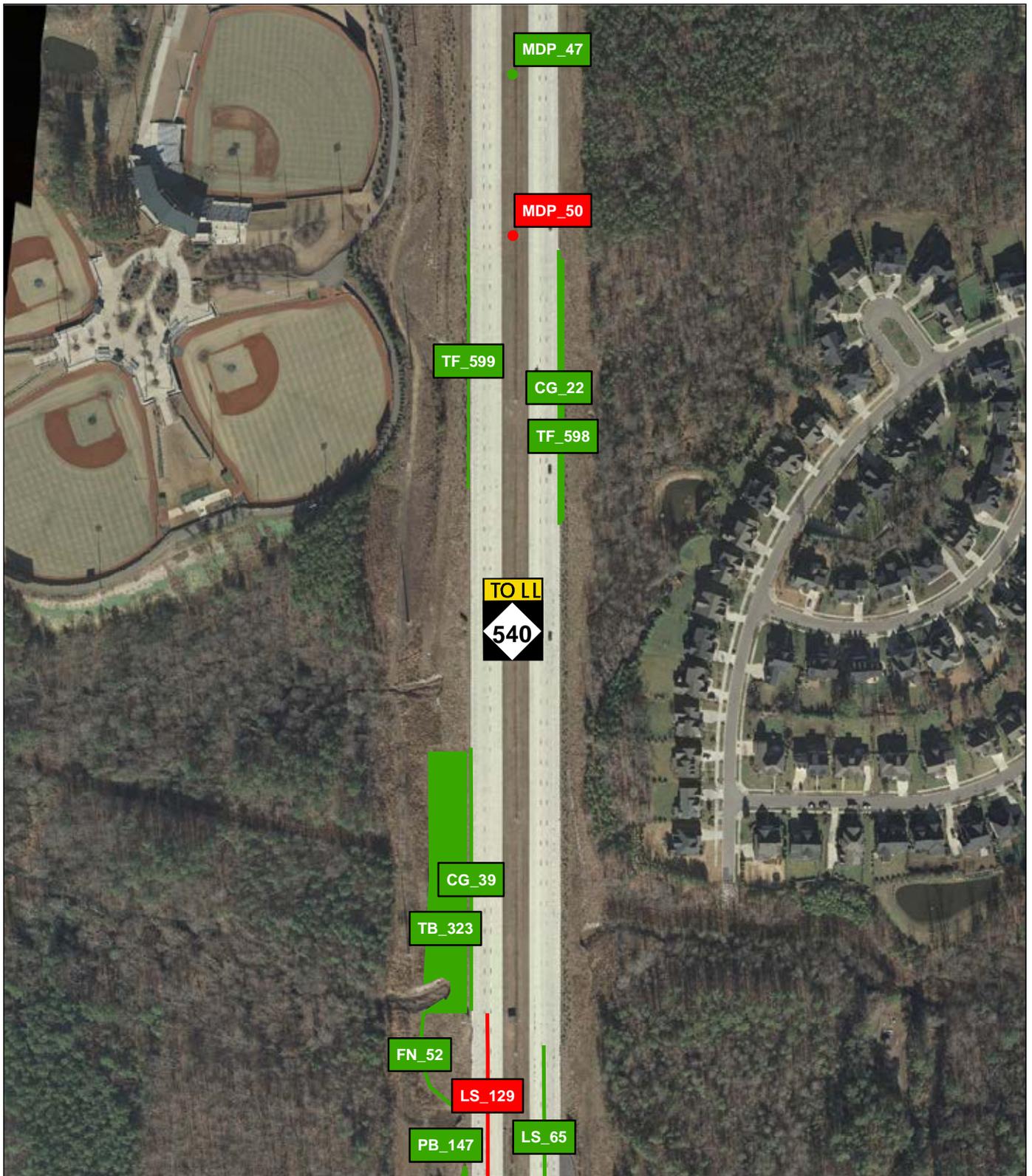


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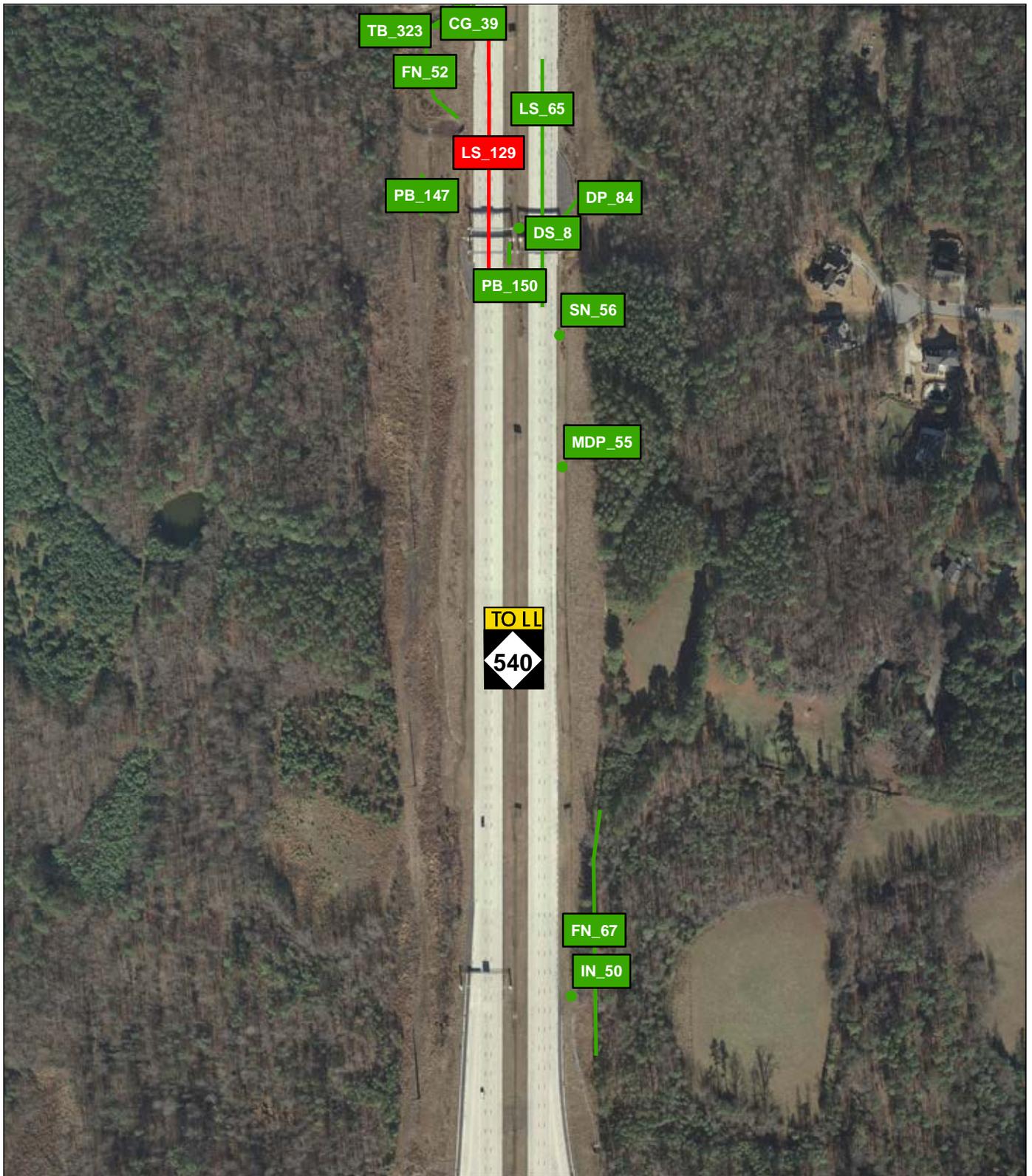


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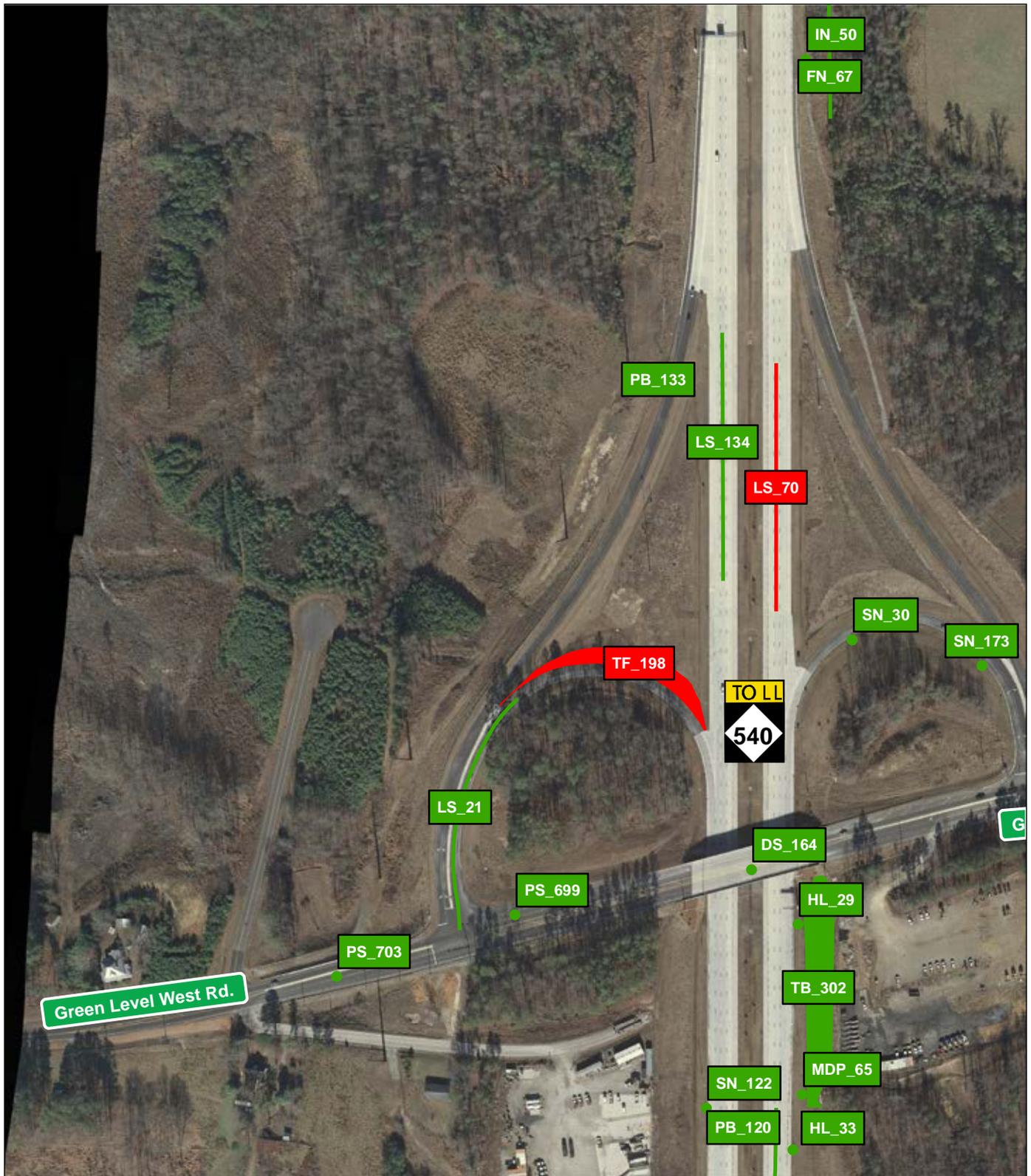


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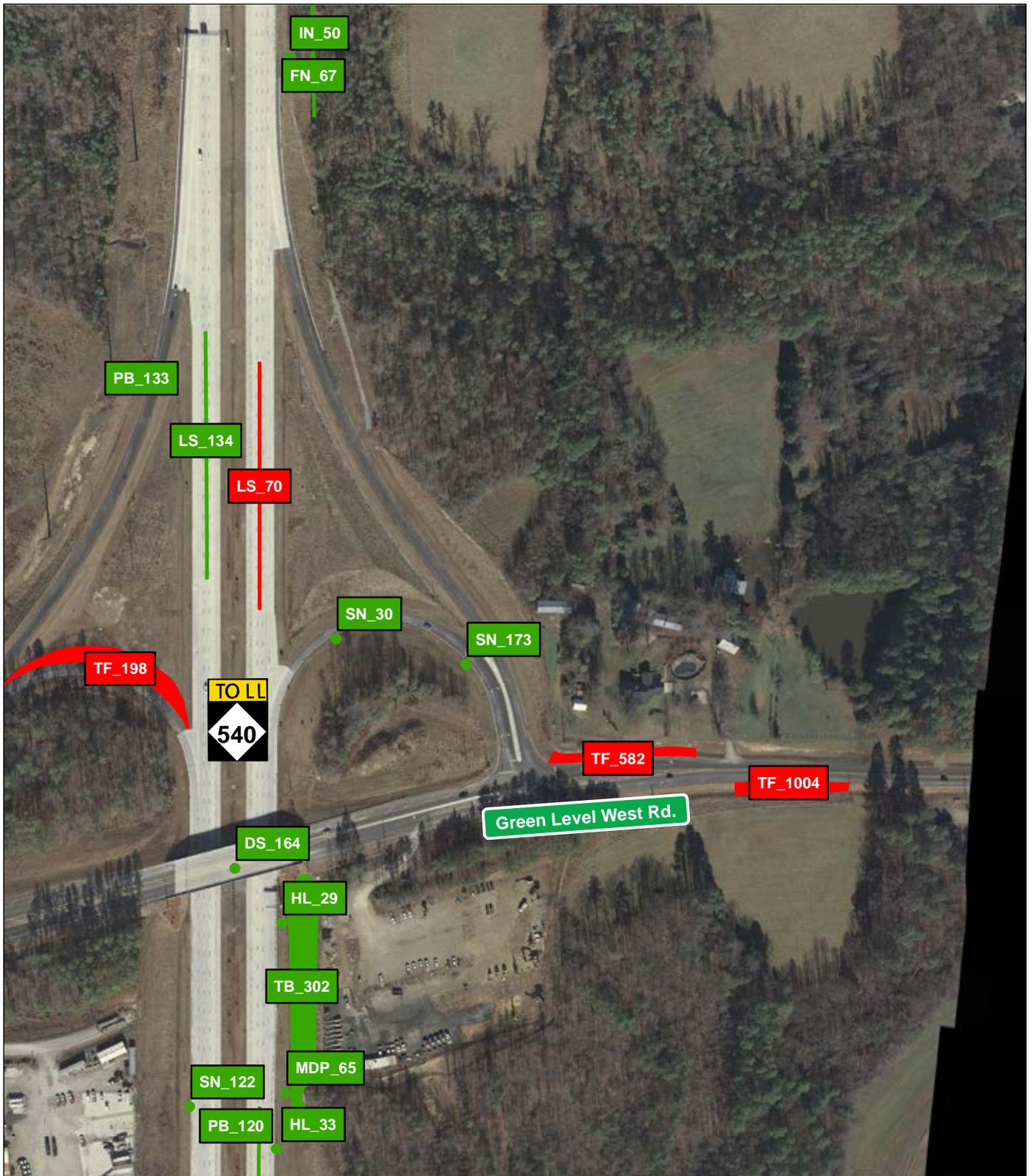


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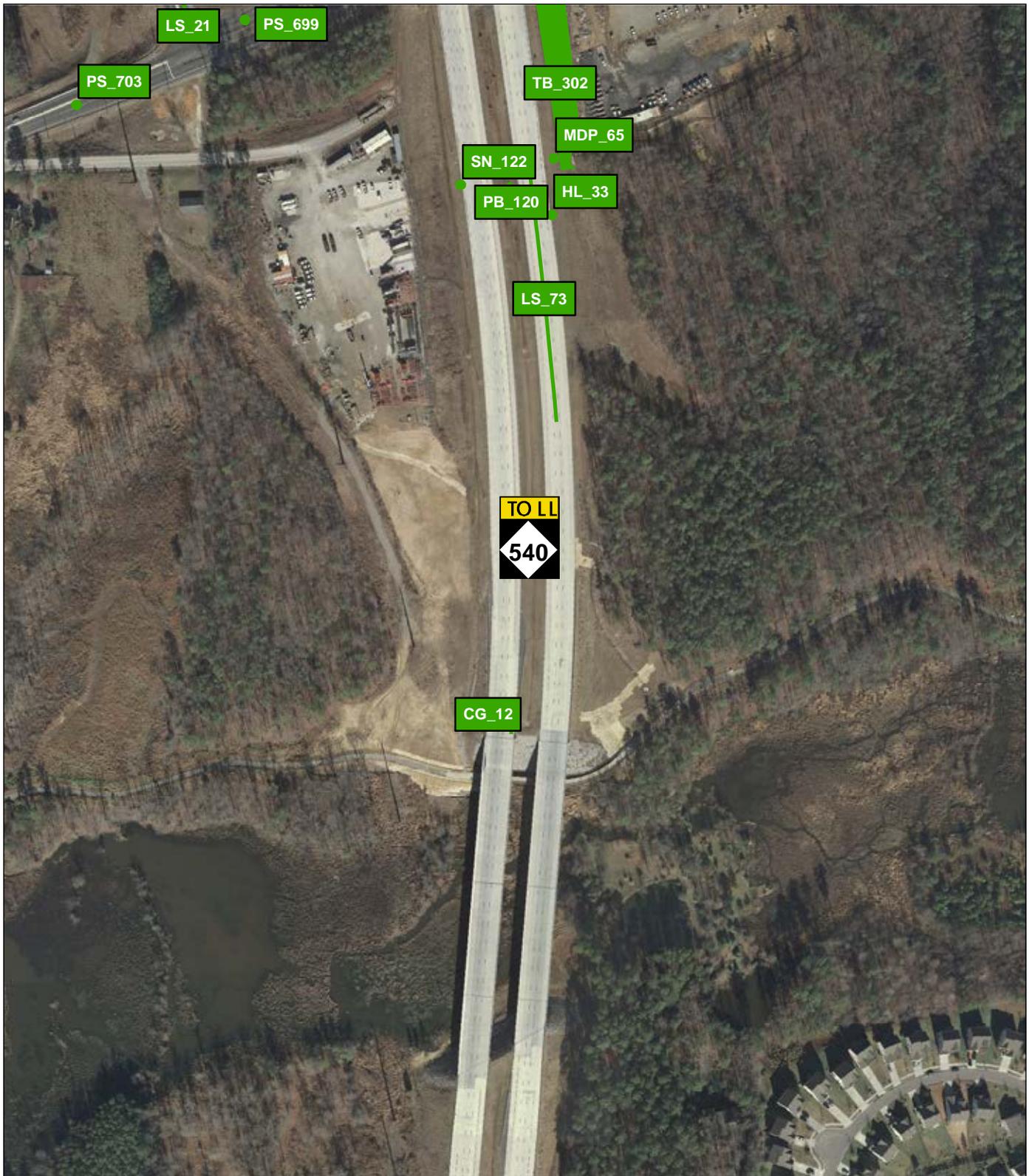


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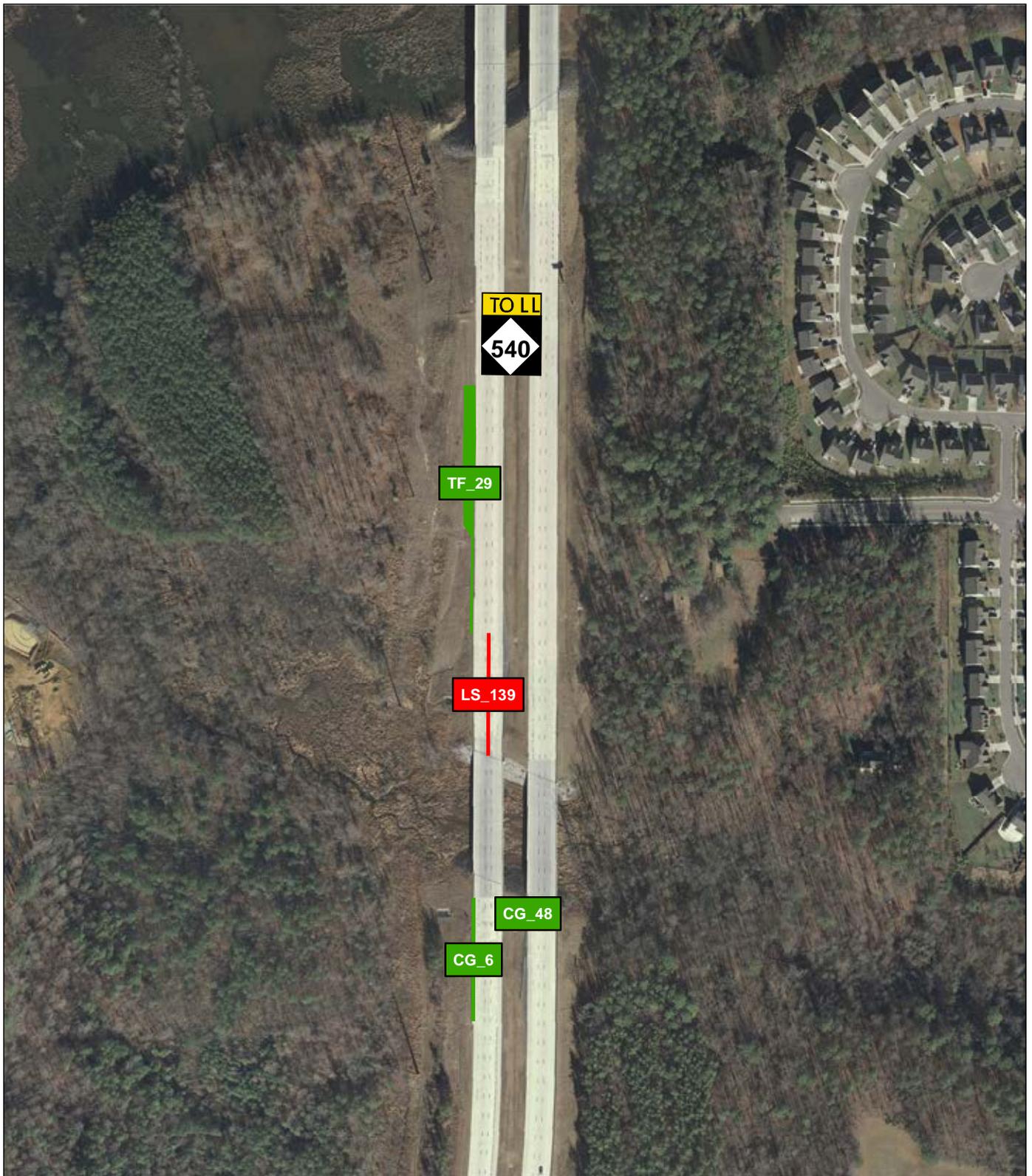


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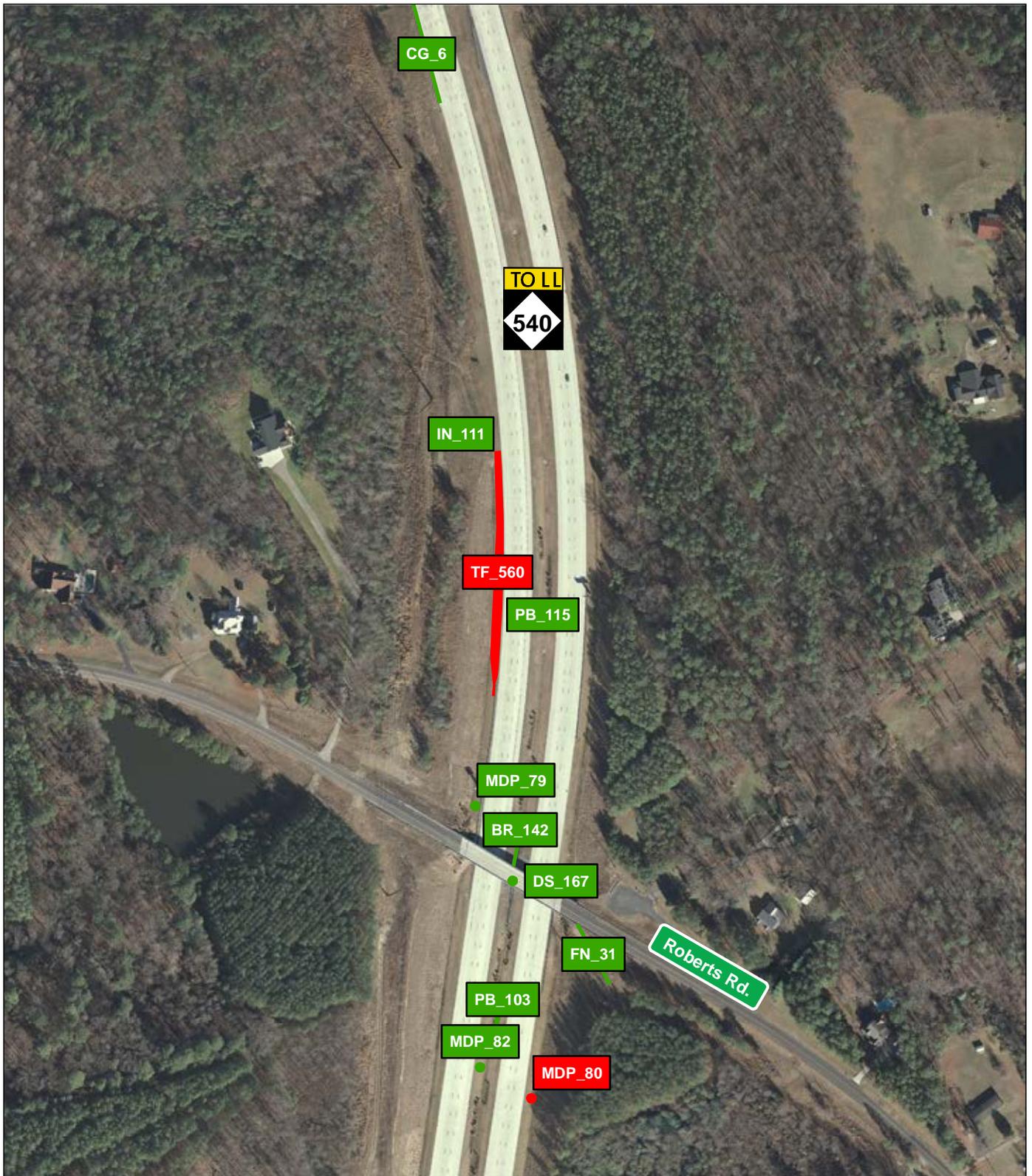


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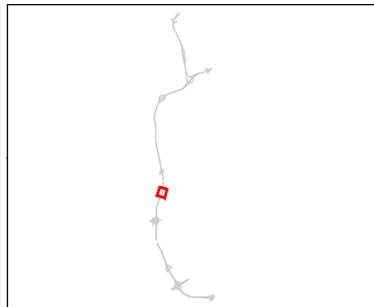


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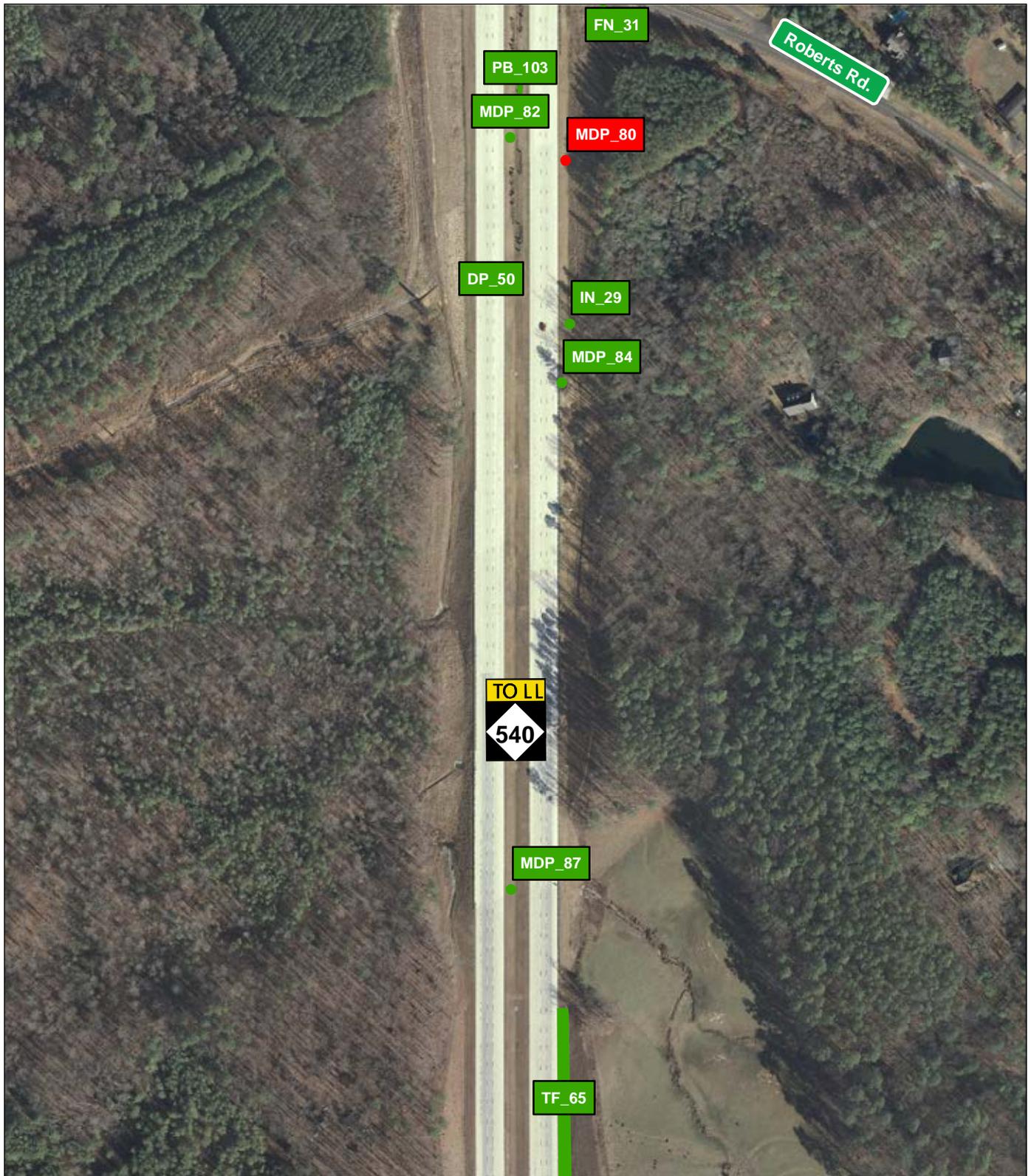


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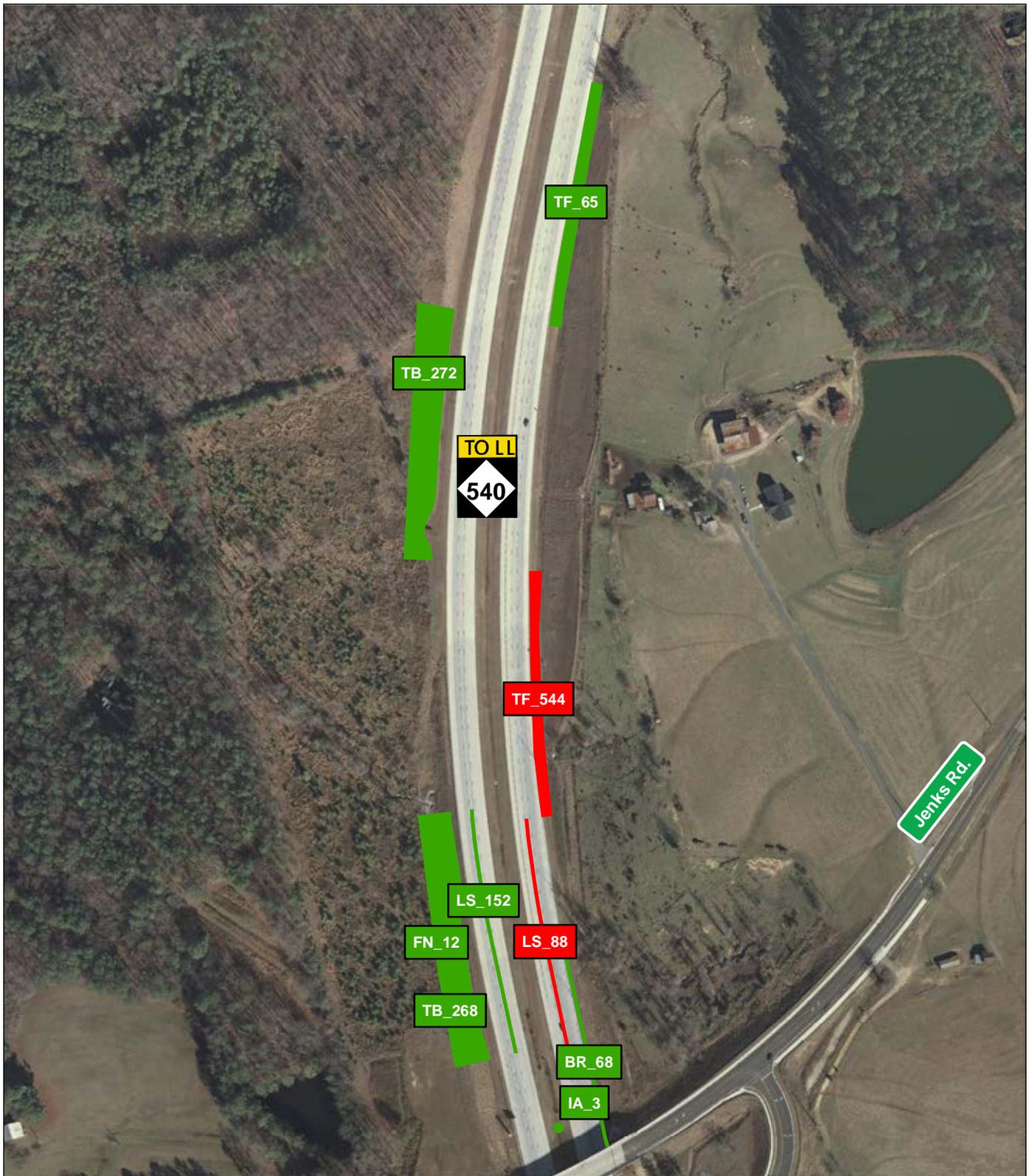


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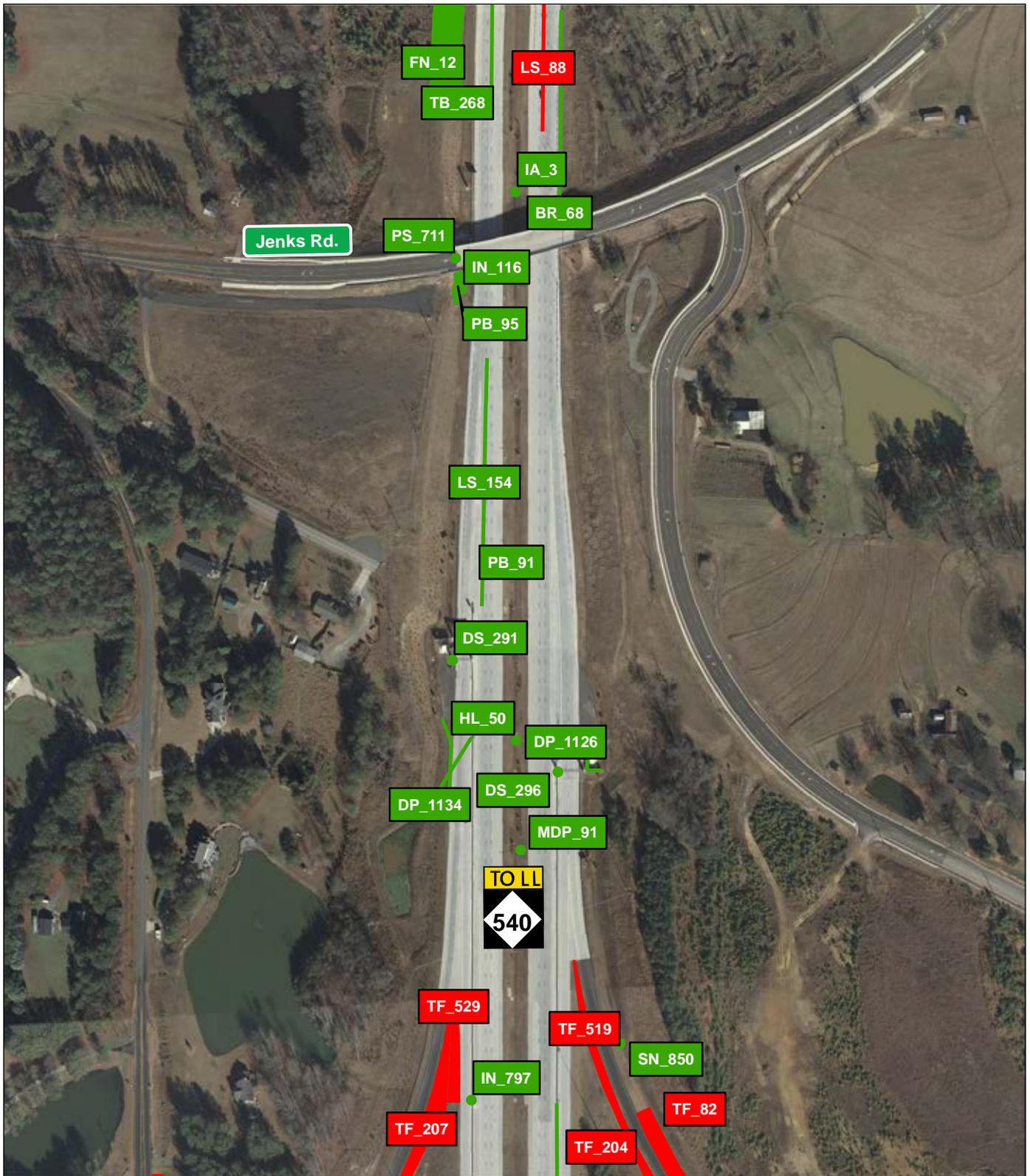


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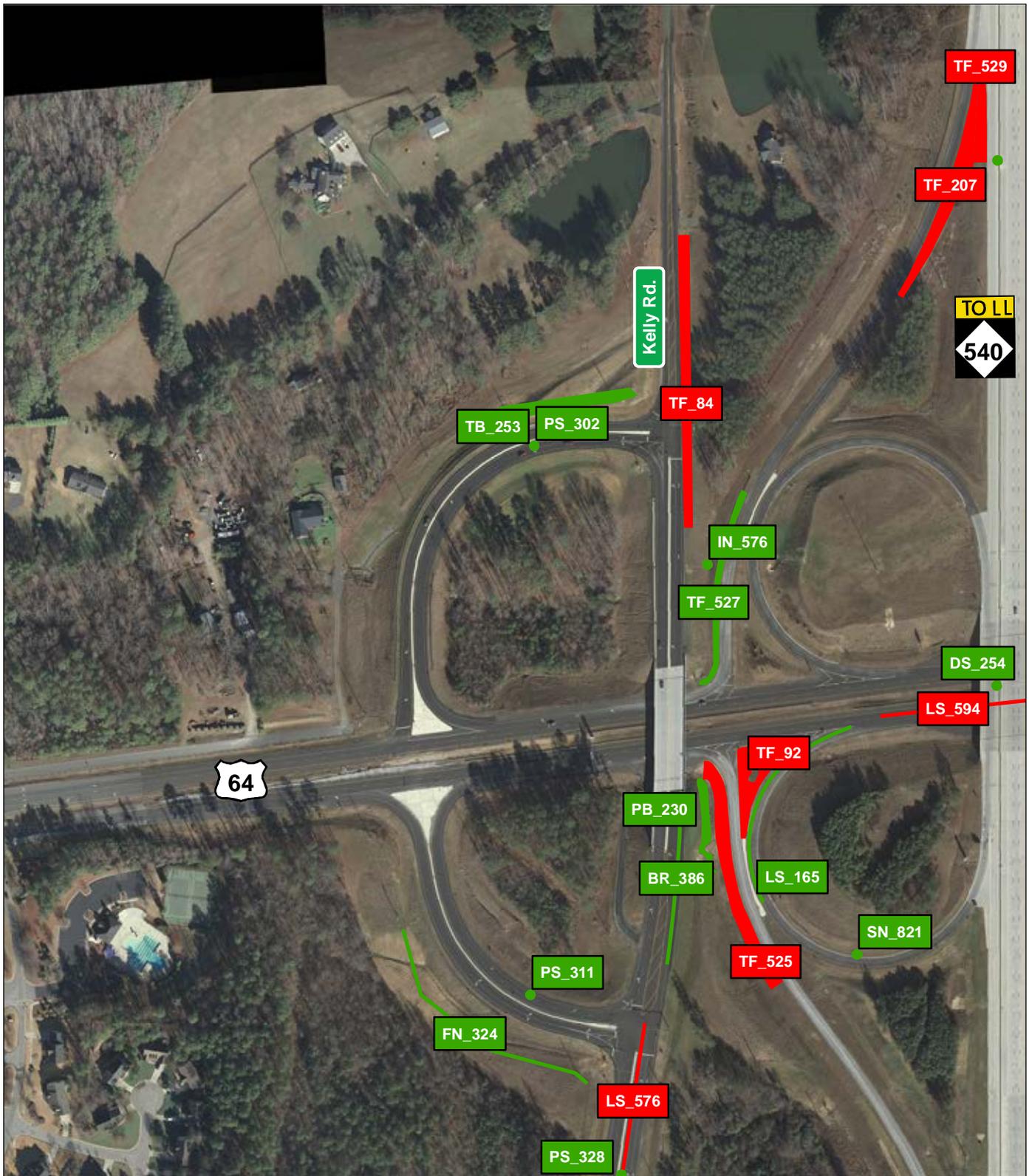


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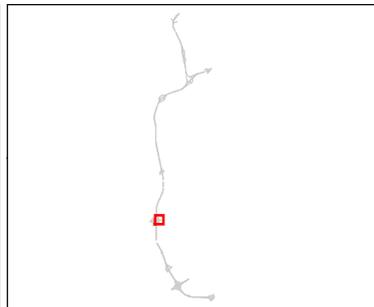


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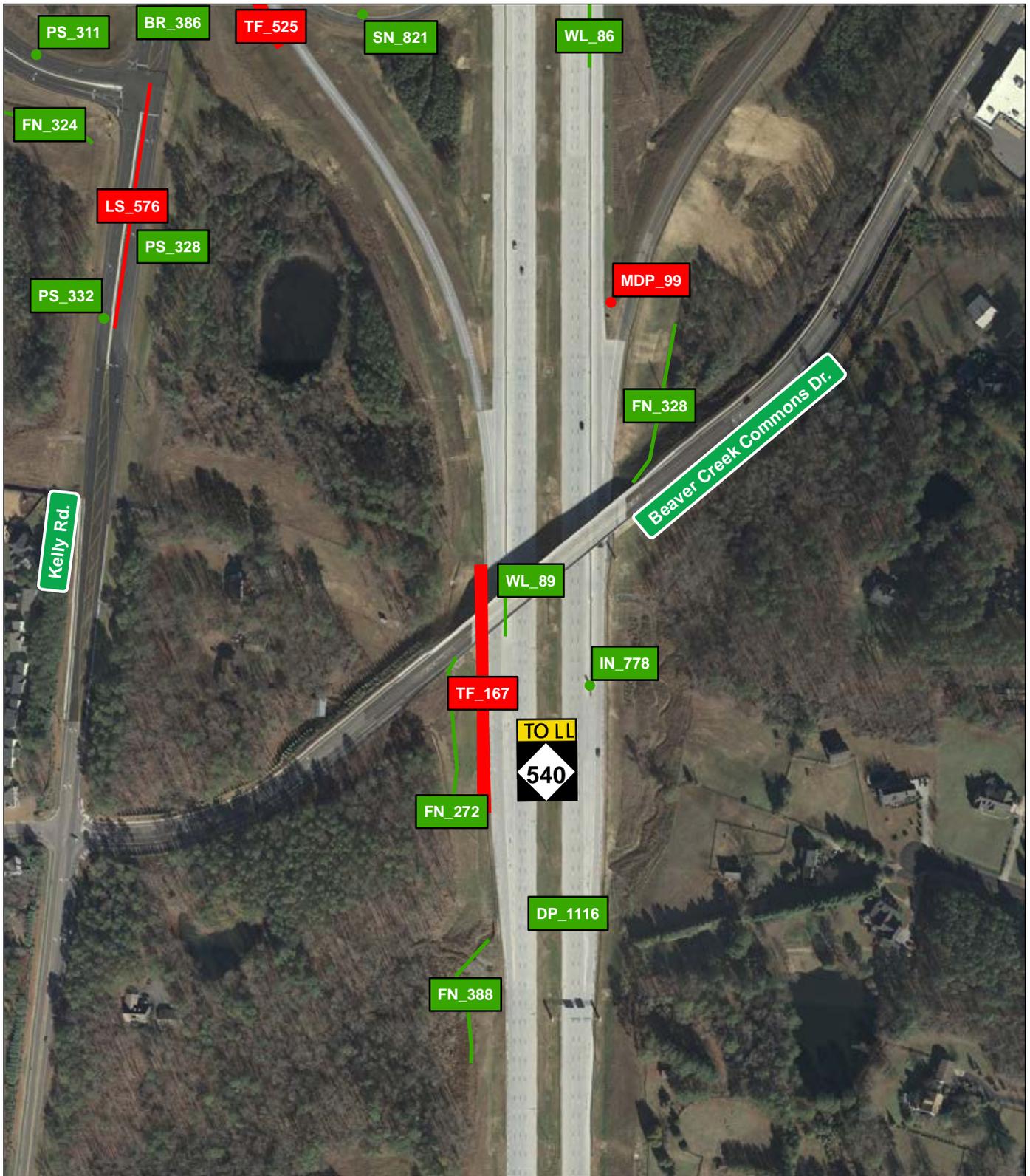


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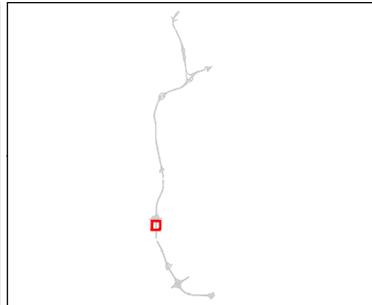


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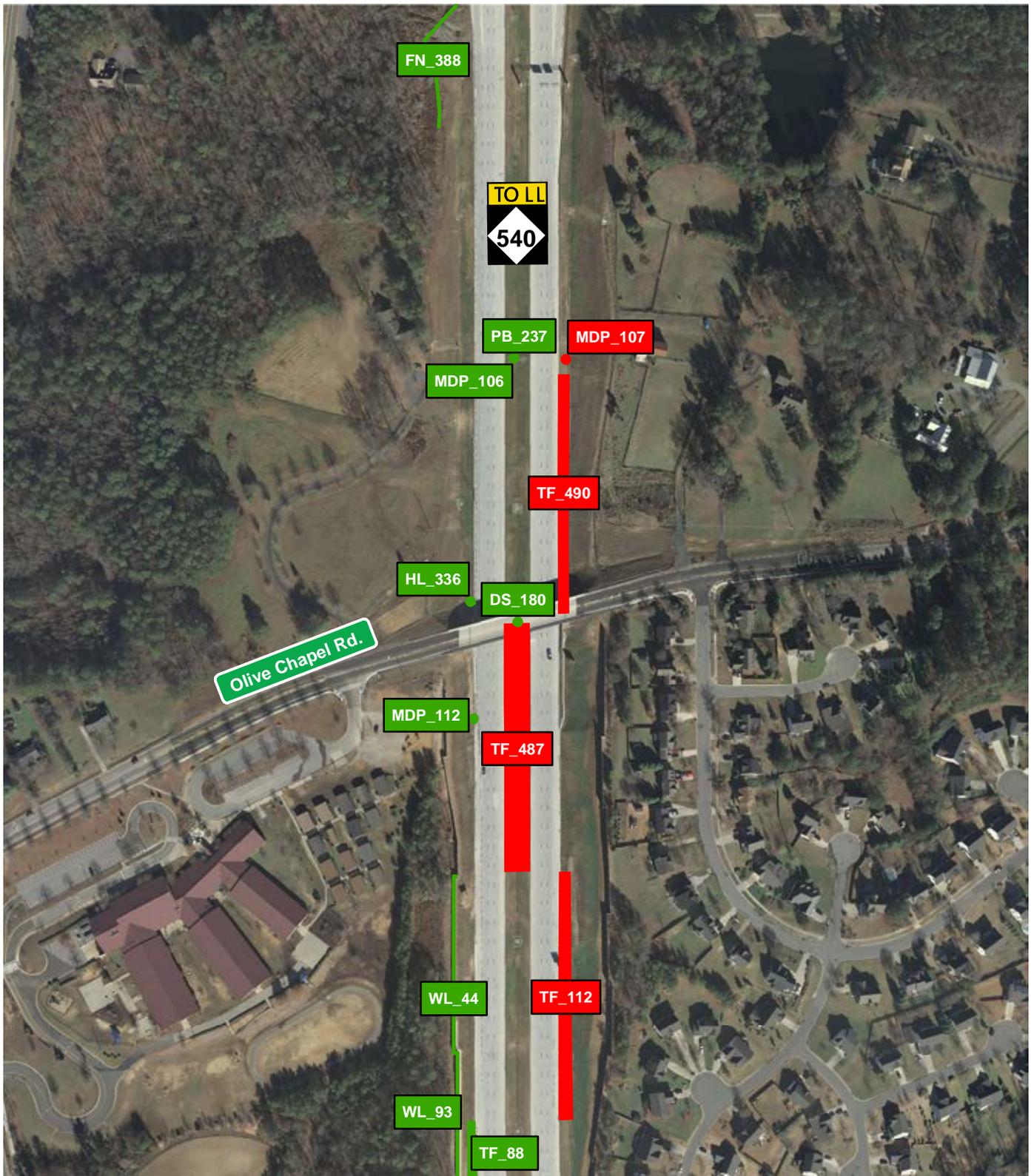


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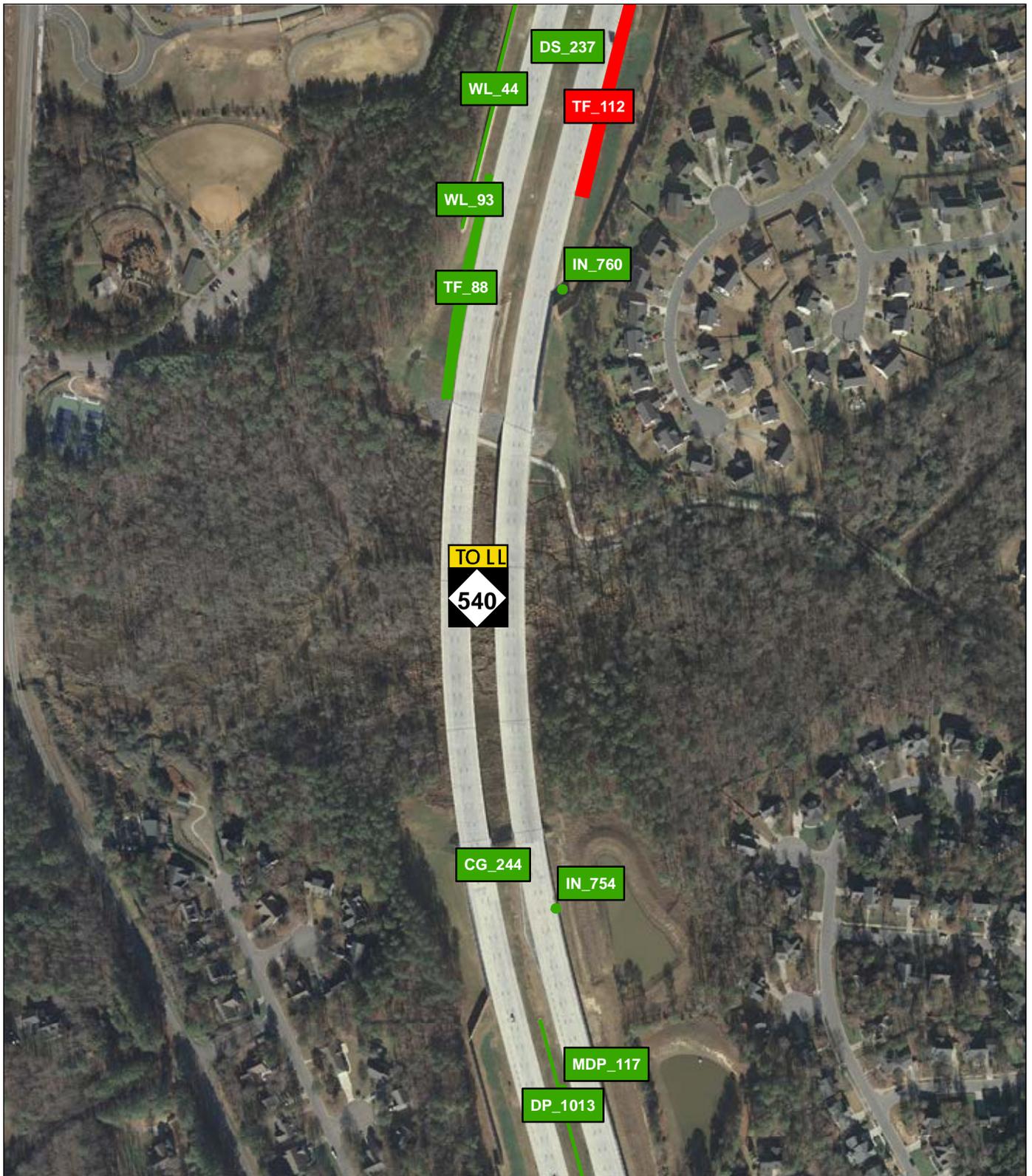


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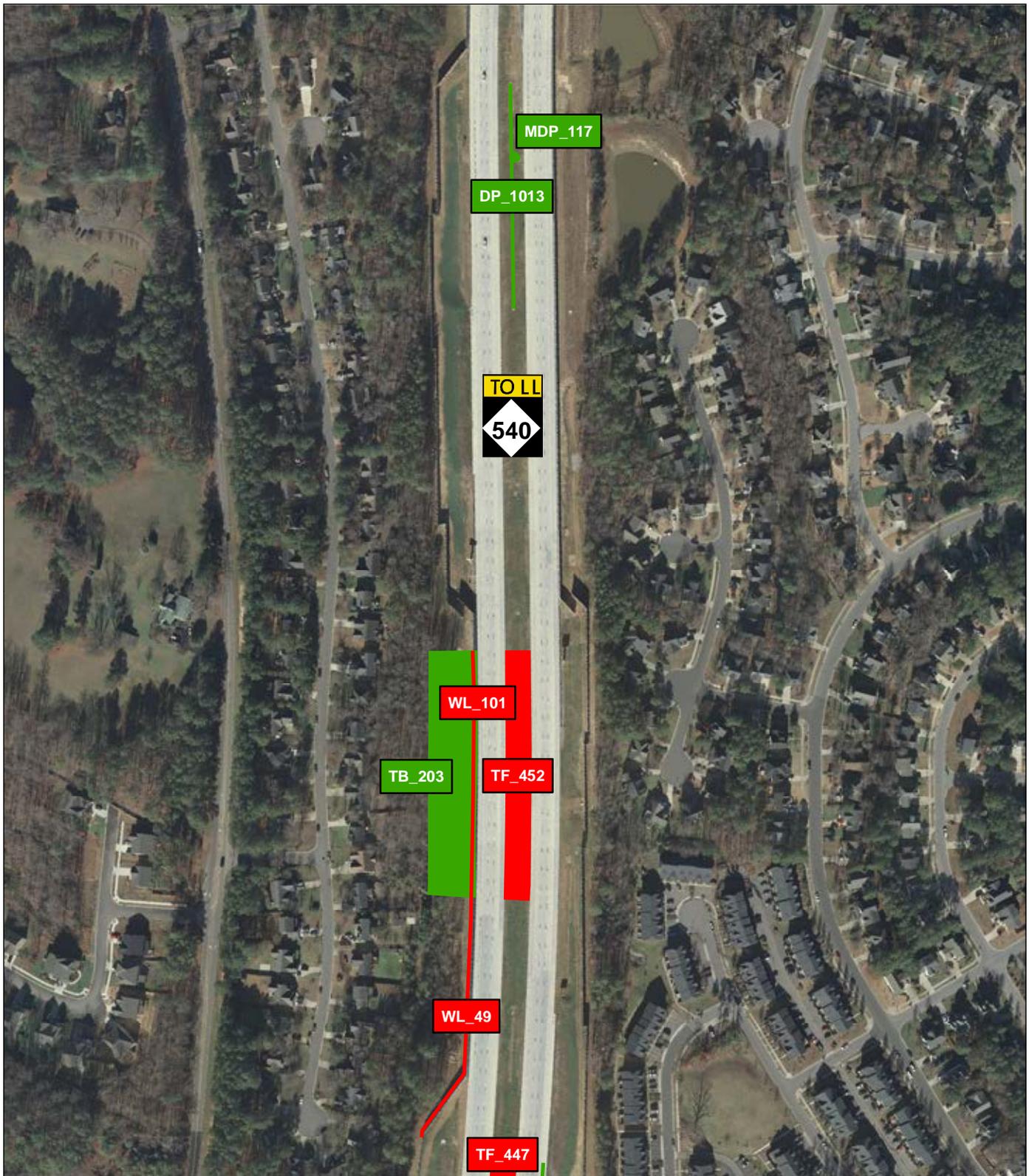


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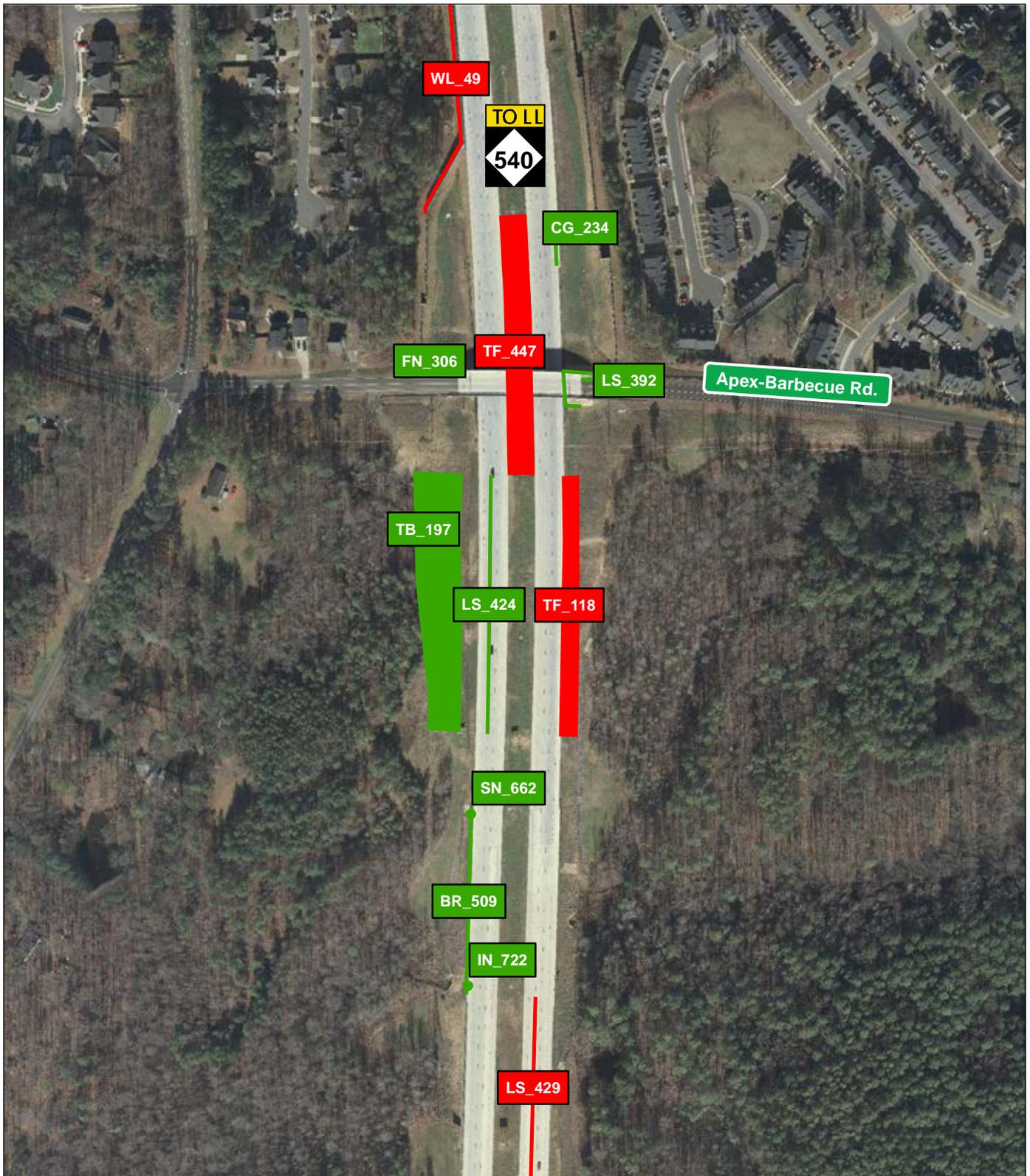


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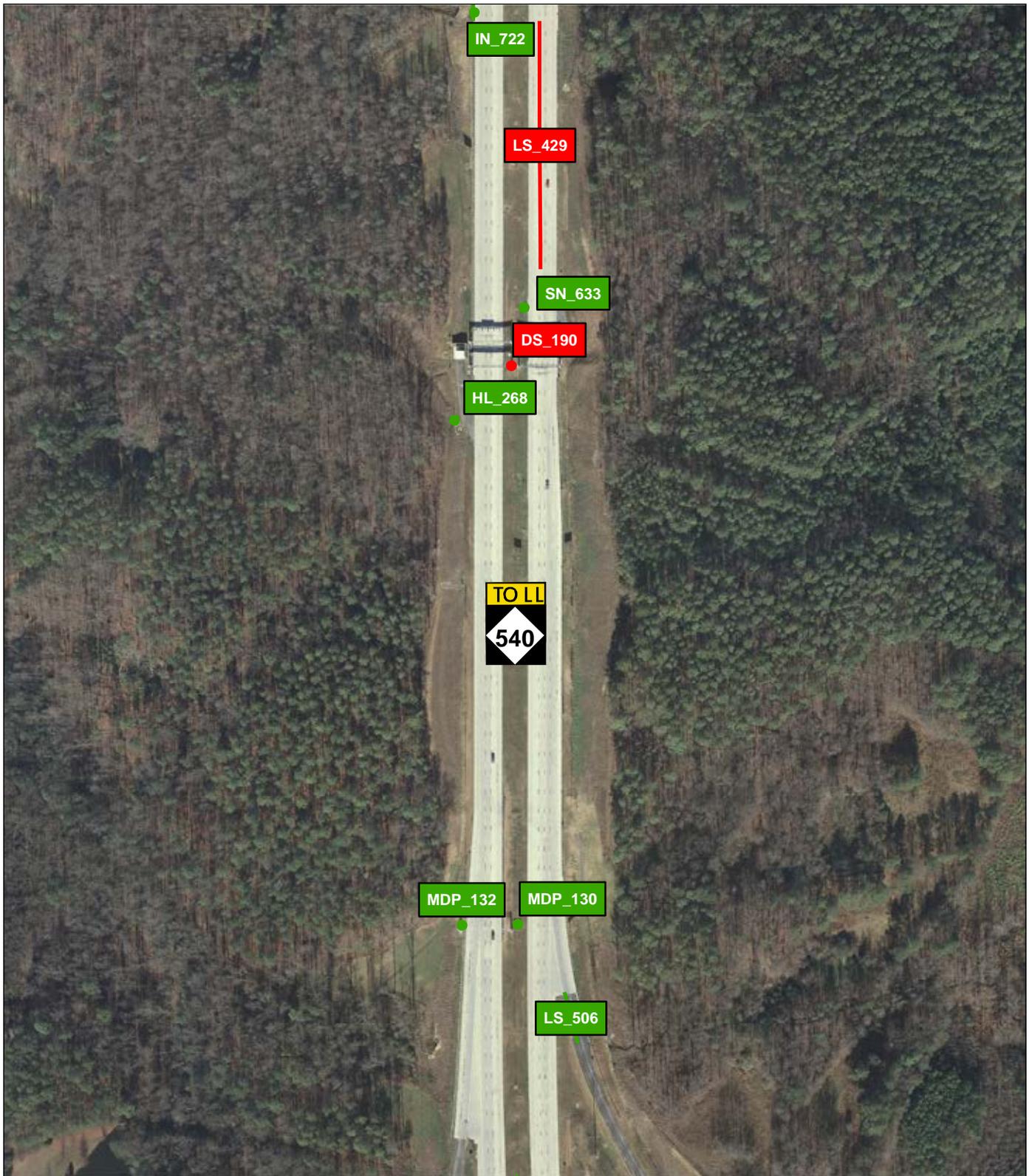


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-  Passing Asset
-  Failing Asset



Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations

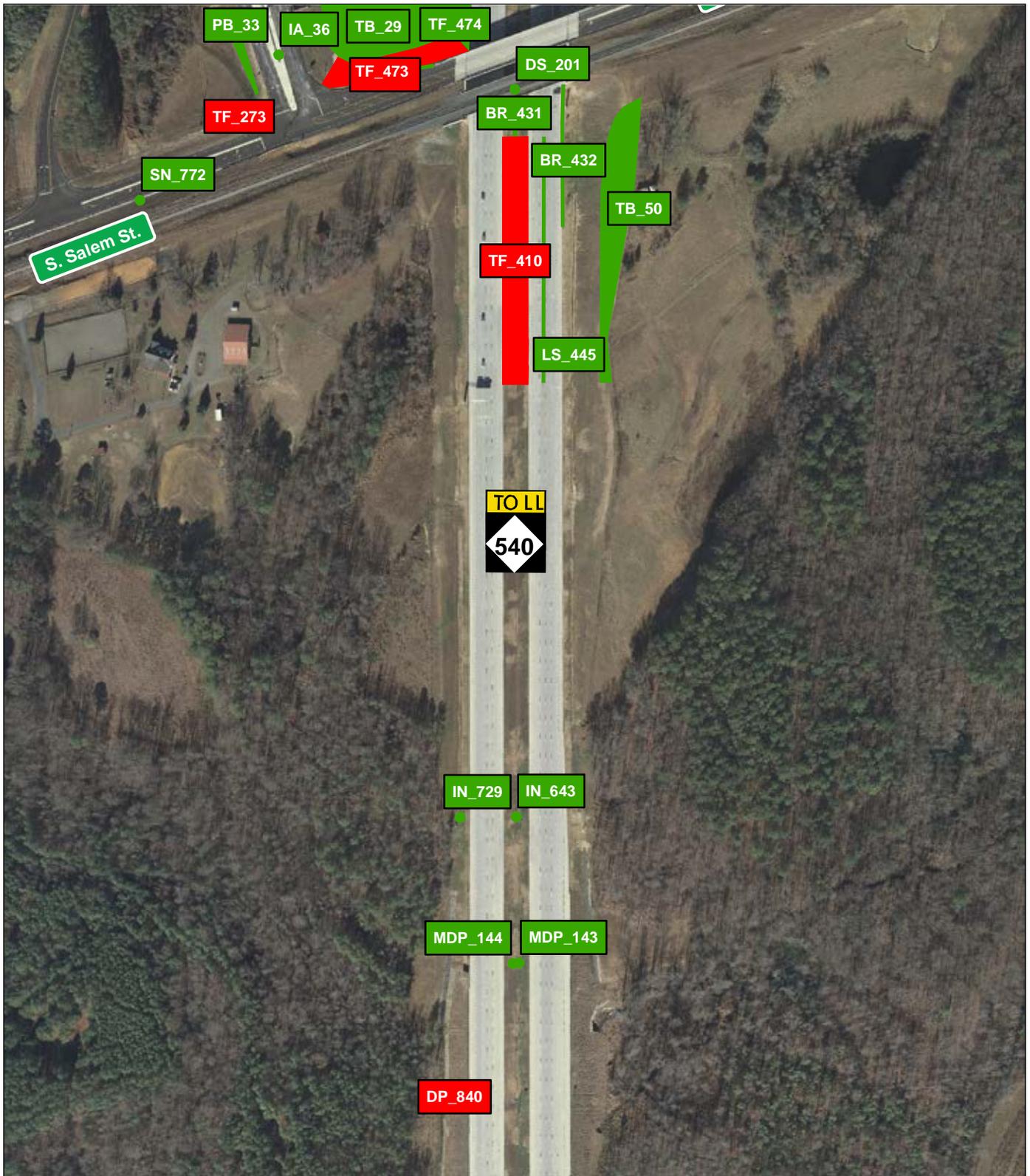


Legend

- Passing Asset
- Failing Asset



Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations

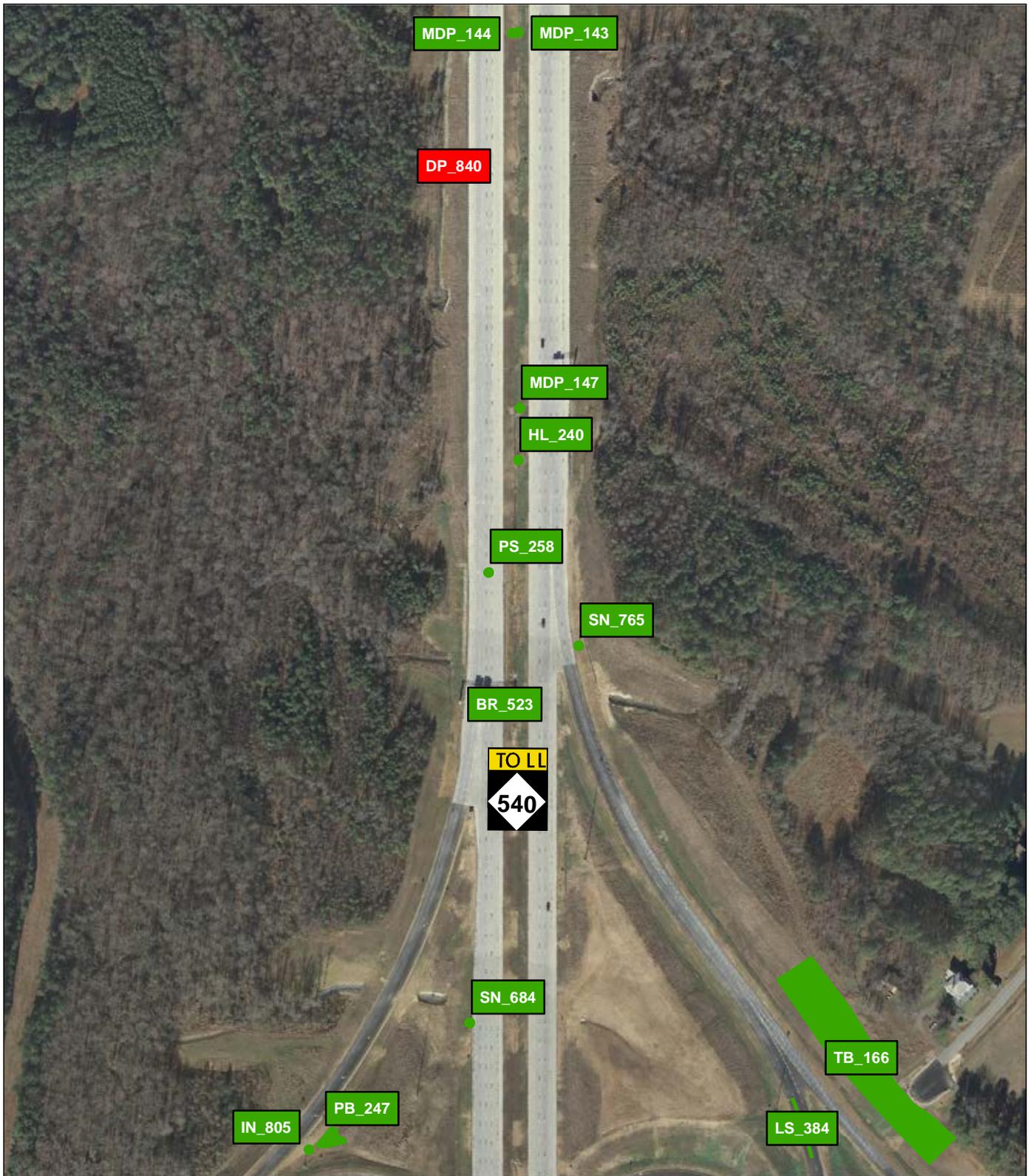


Legend

- Passing Asset
- Failing Asset



Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations

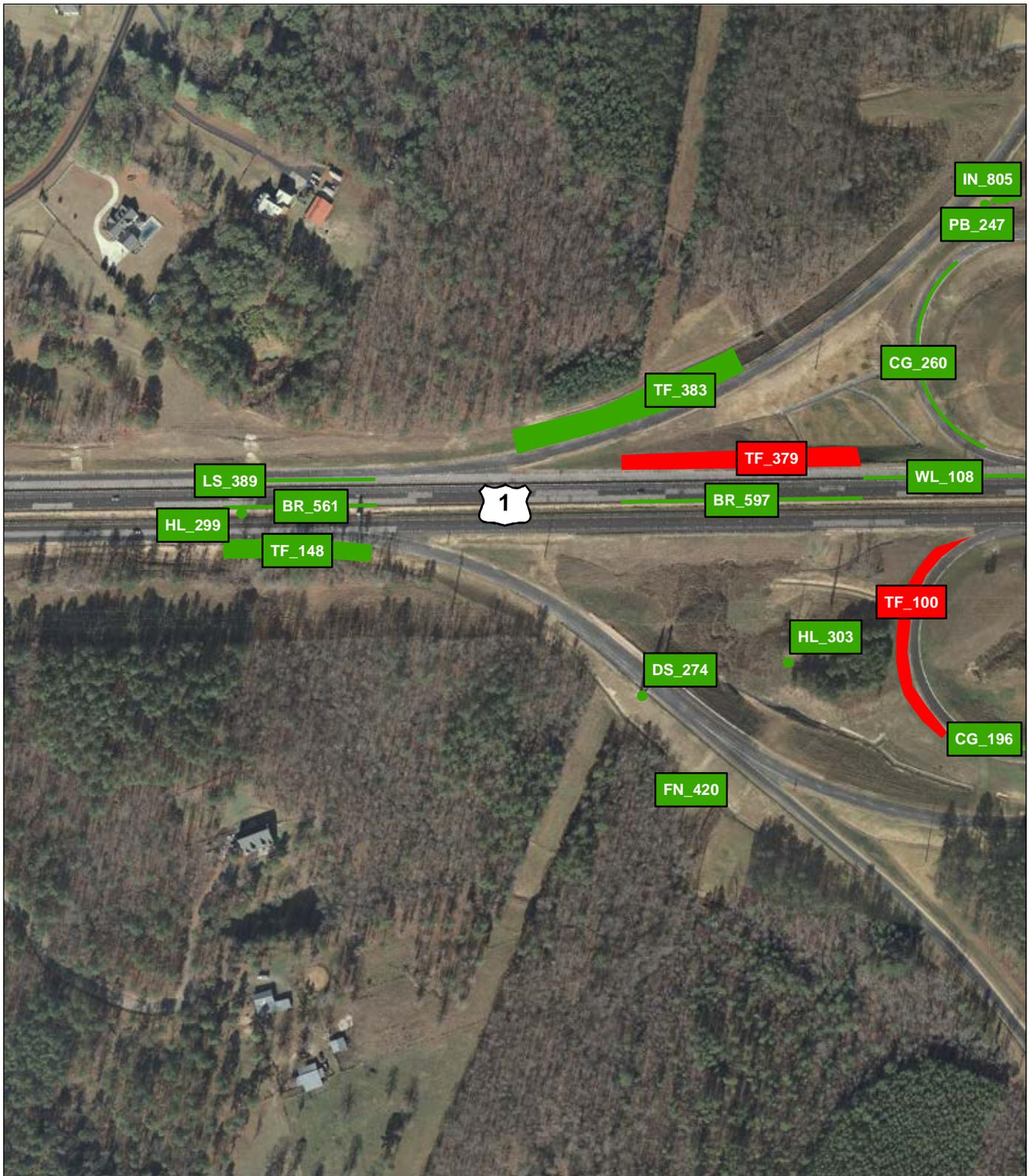


Legend

-  Passing Asset
-  Failing Asset



Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations



Legend

-  Passing Asset
-  Failing Asset



Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations



Legend

- Passing Asset
- Failing Asset



Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations

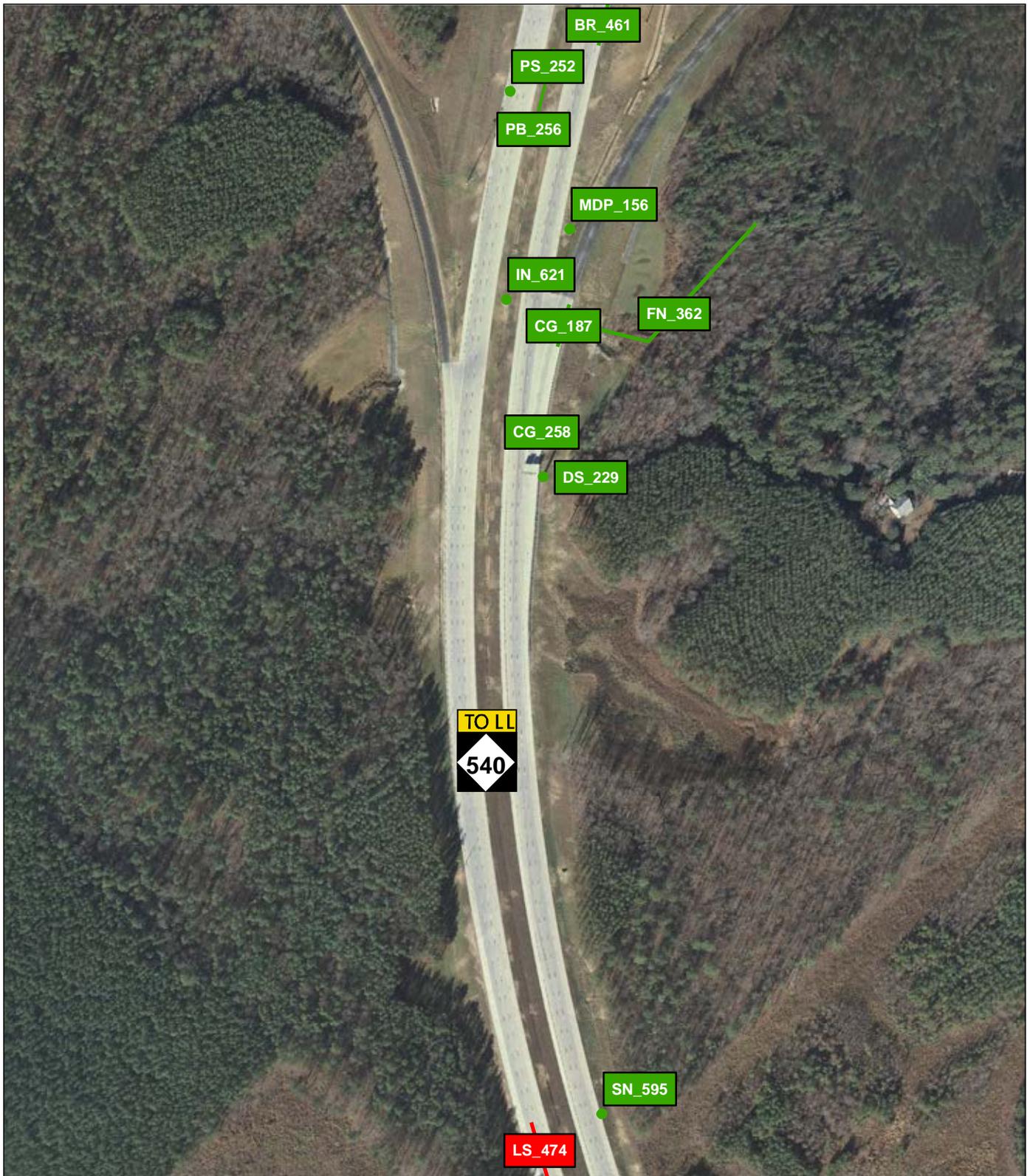


Legend

-  Passing Asset
-  Failing Asset

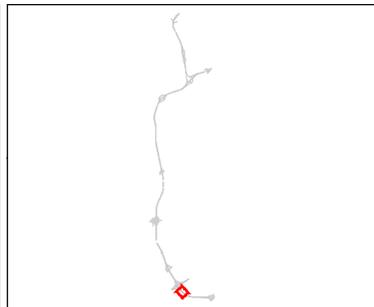


Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations

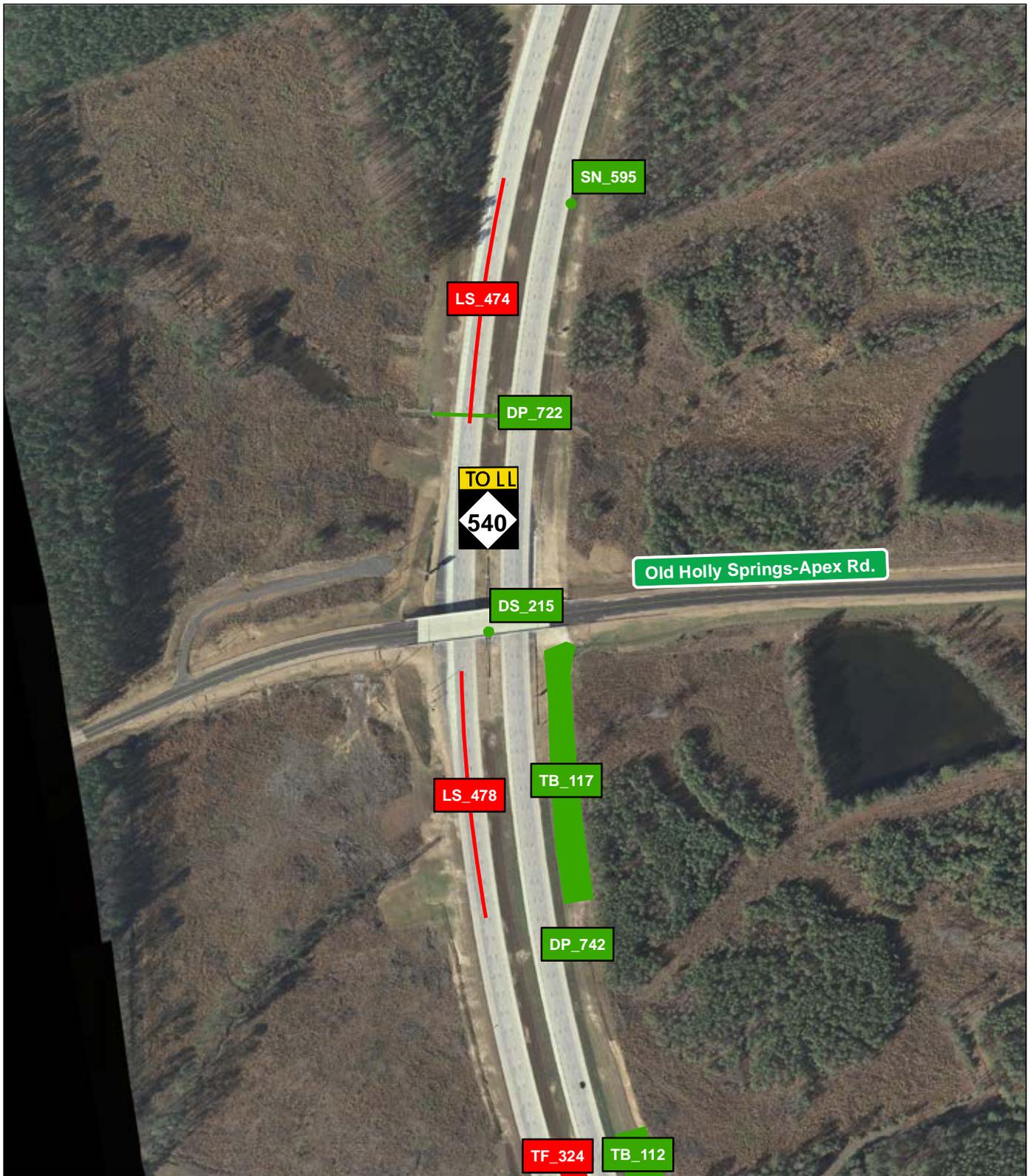


Legend

-  Passing Asset
-  Failing Asset



Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations

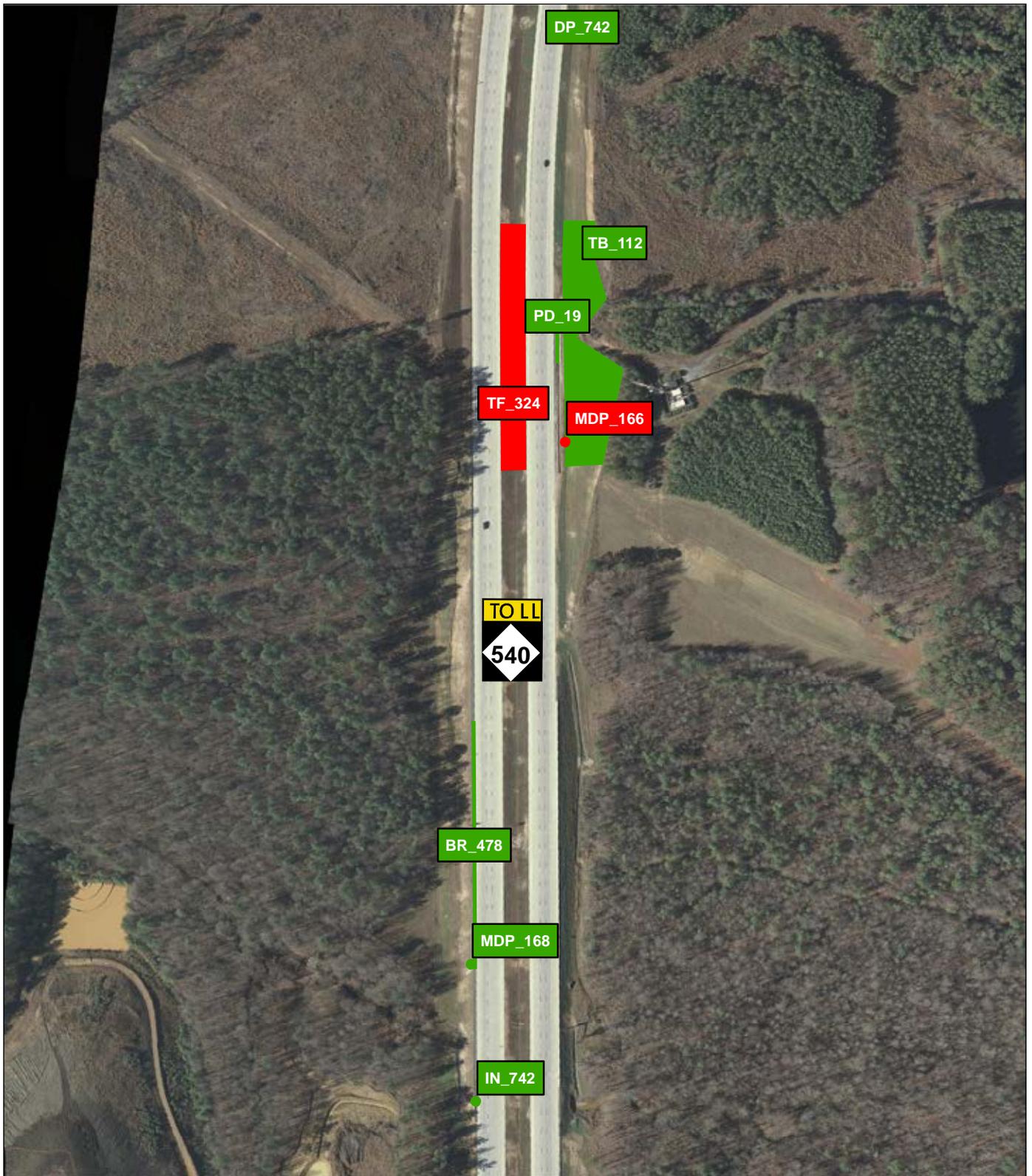


Legend

-  Passing Asset
-  Failing Asset



Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations



Legend

-  Passing Asset
-  Failing Asset

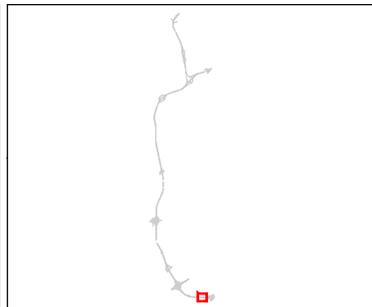


Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations

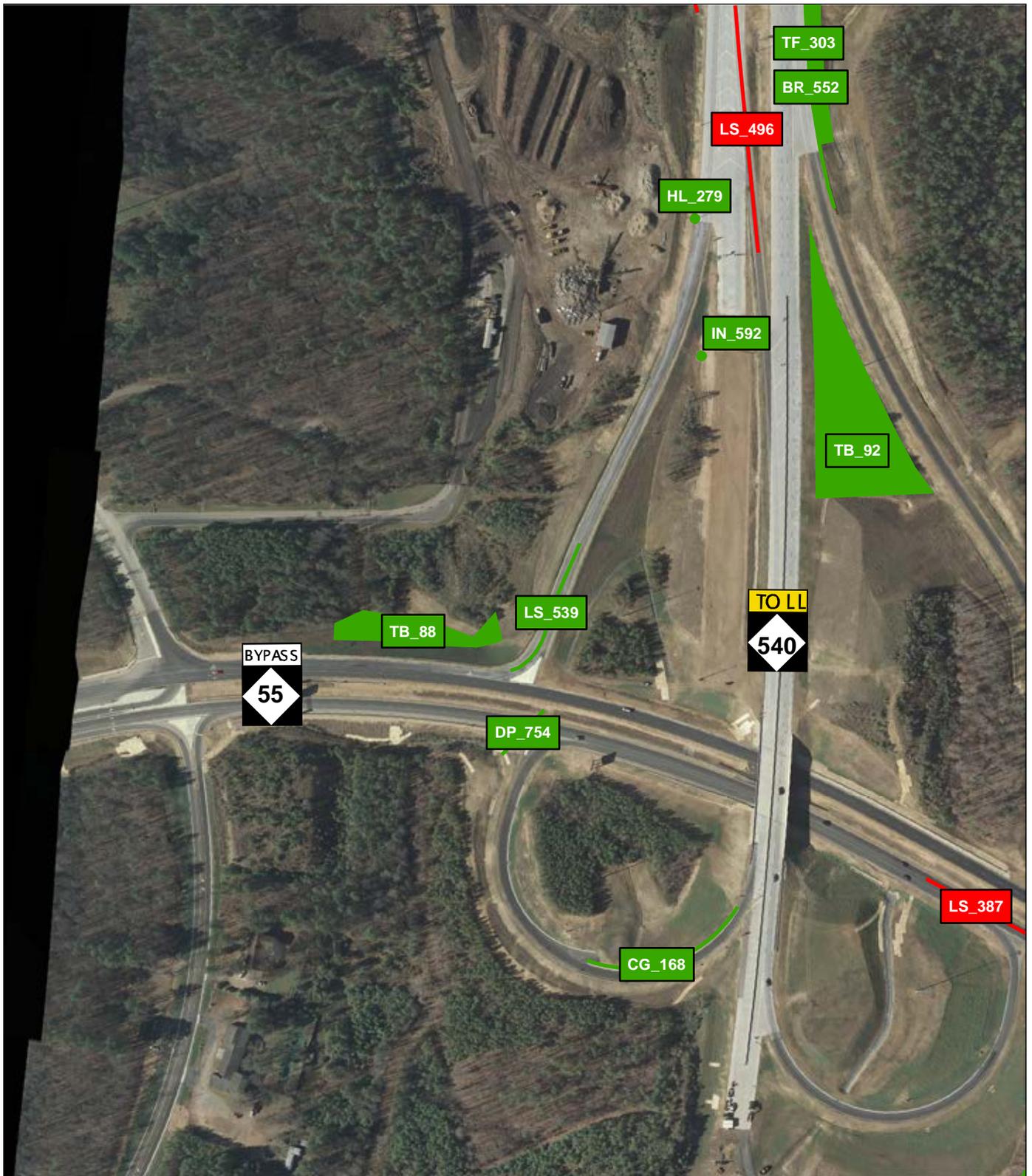


Legend

-  Passing Asset
-  Failing Asset



Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations



Legend

-  Passing Asset
-  Failing Asset



Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations



Legend

-  Passing Asset
-  Failing Asset



Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations

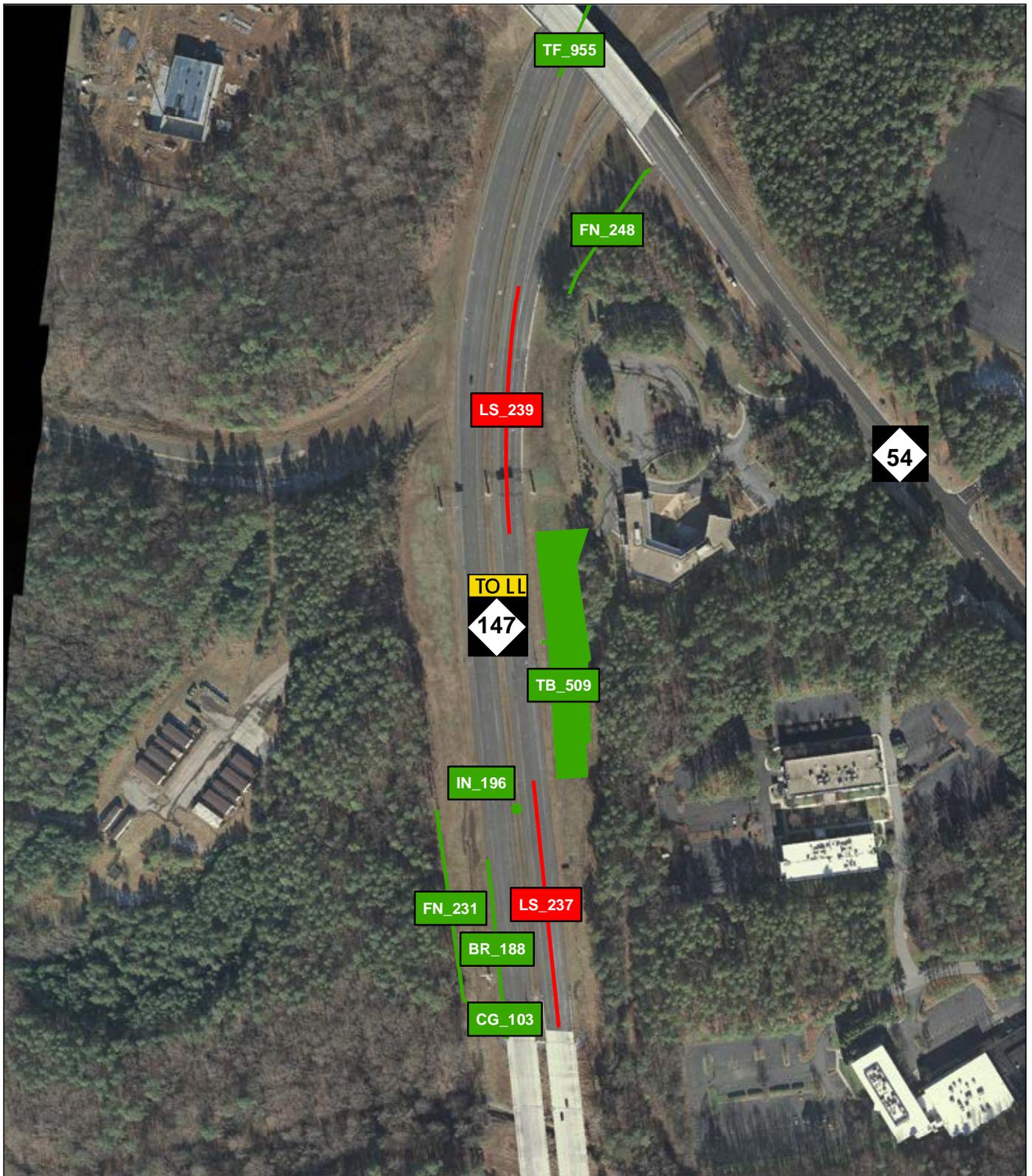


Legend

-  Passing Asset
-  Failing Asset



Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations

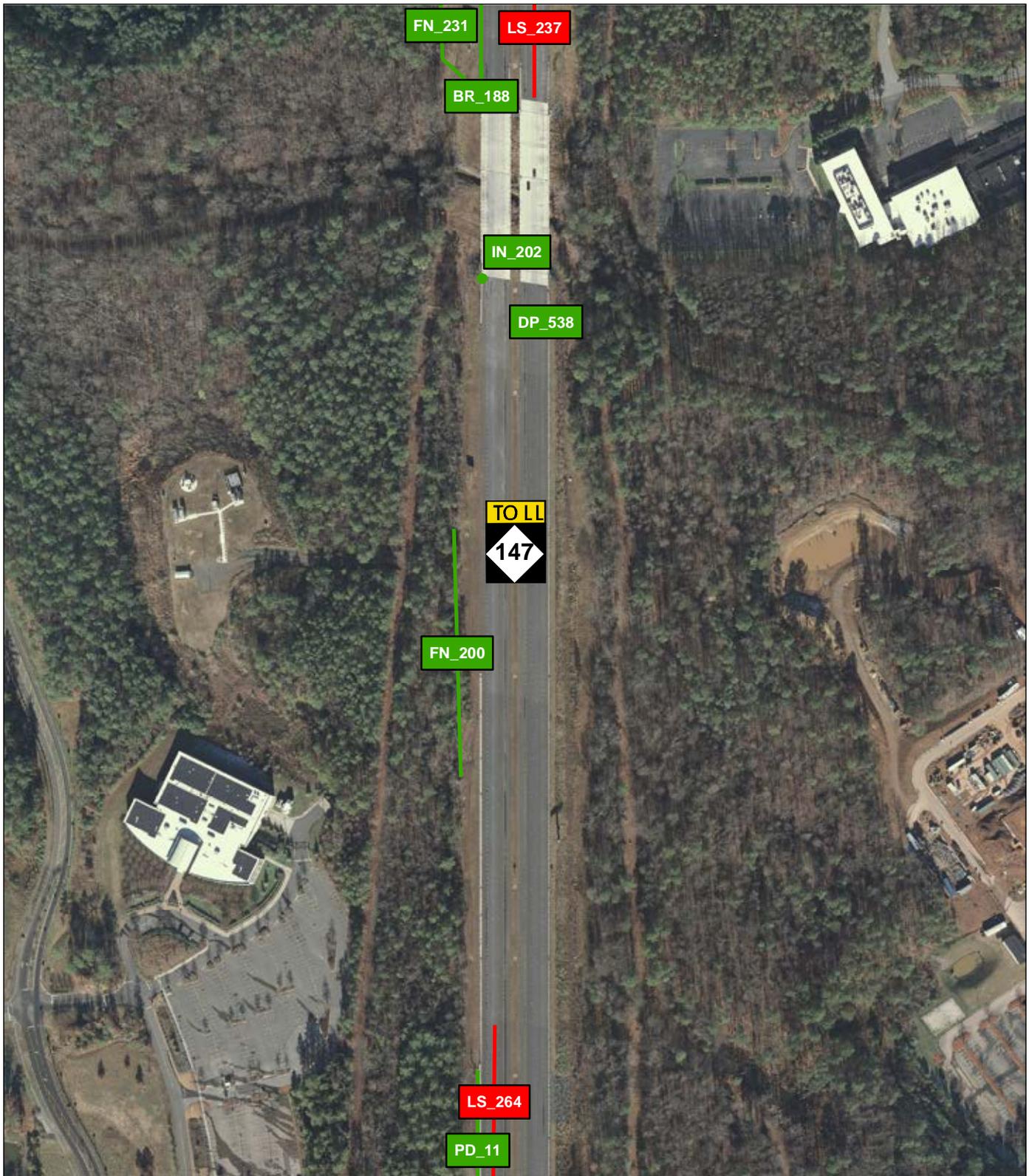


Legend

-  Passing Asset
-  Failing Asset



Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations

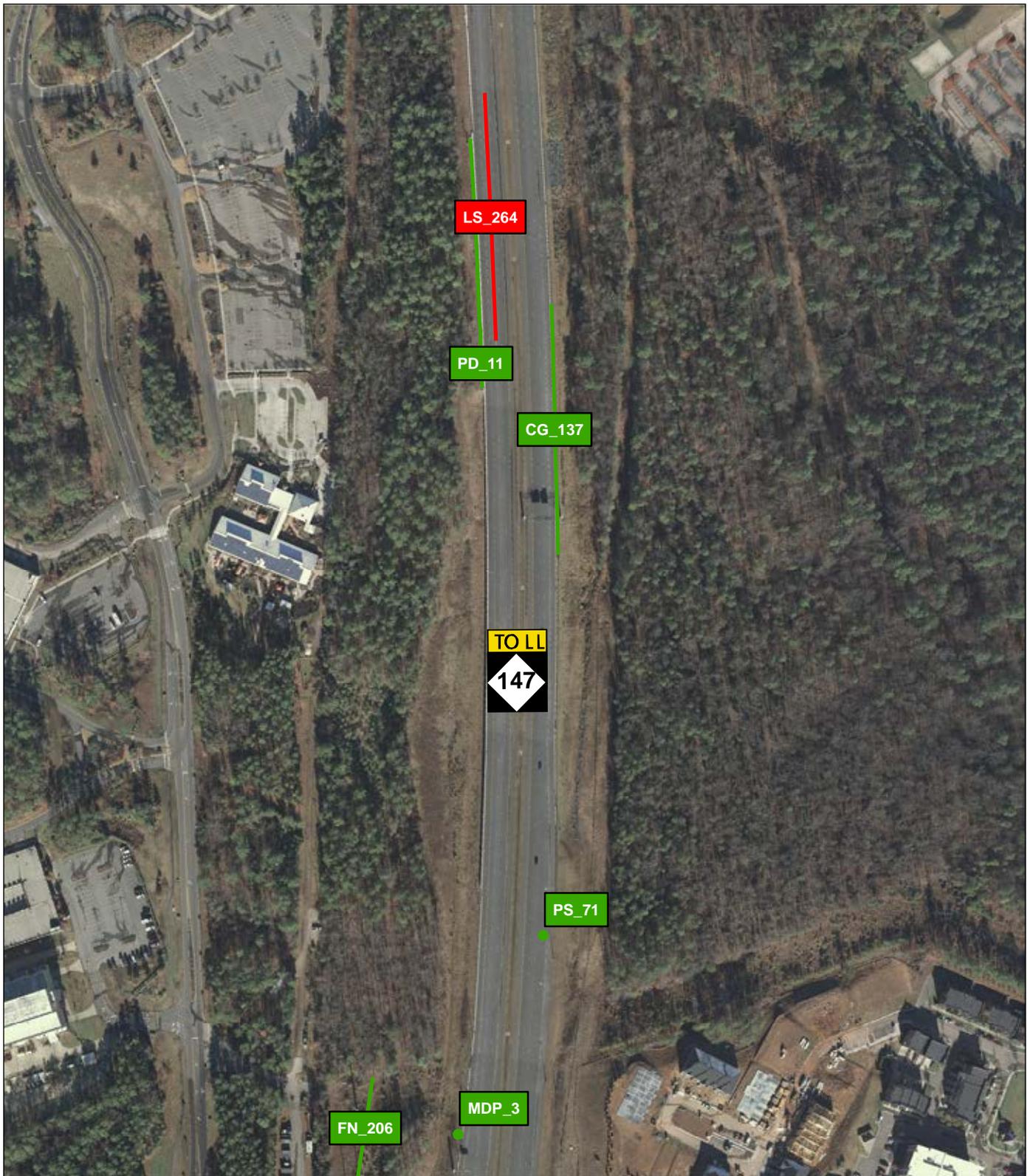


Legend

-  Passing Asset
-  Failing Asset



Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations

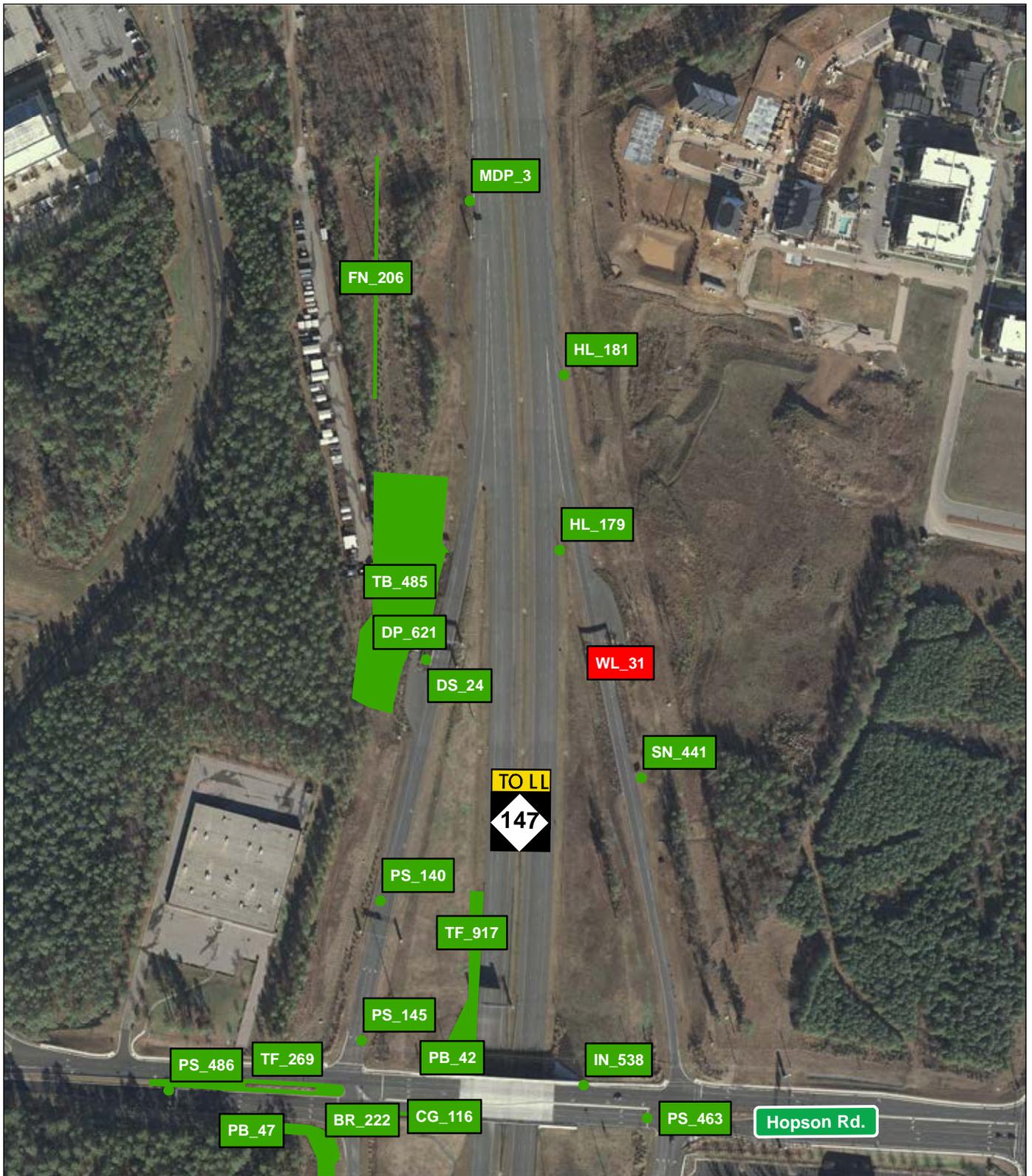


Legend

-  Passing Asset
-  Failing Asset

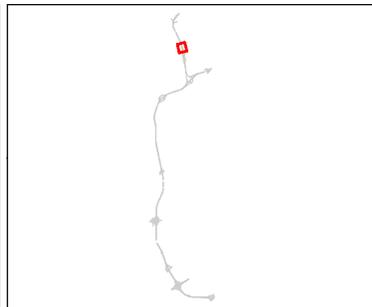


Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations

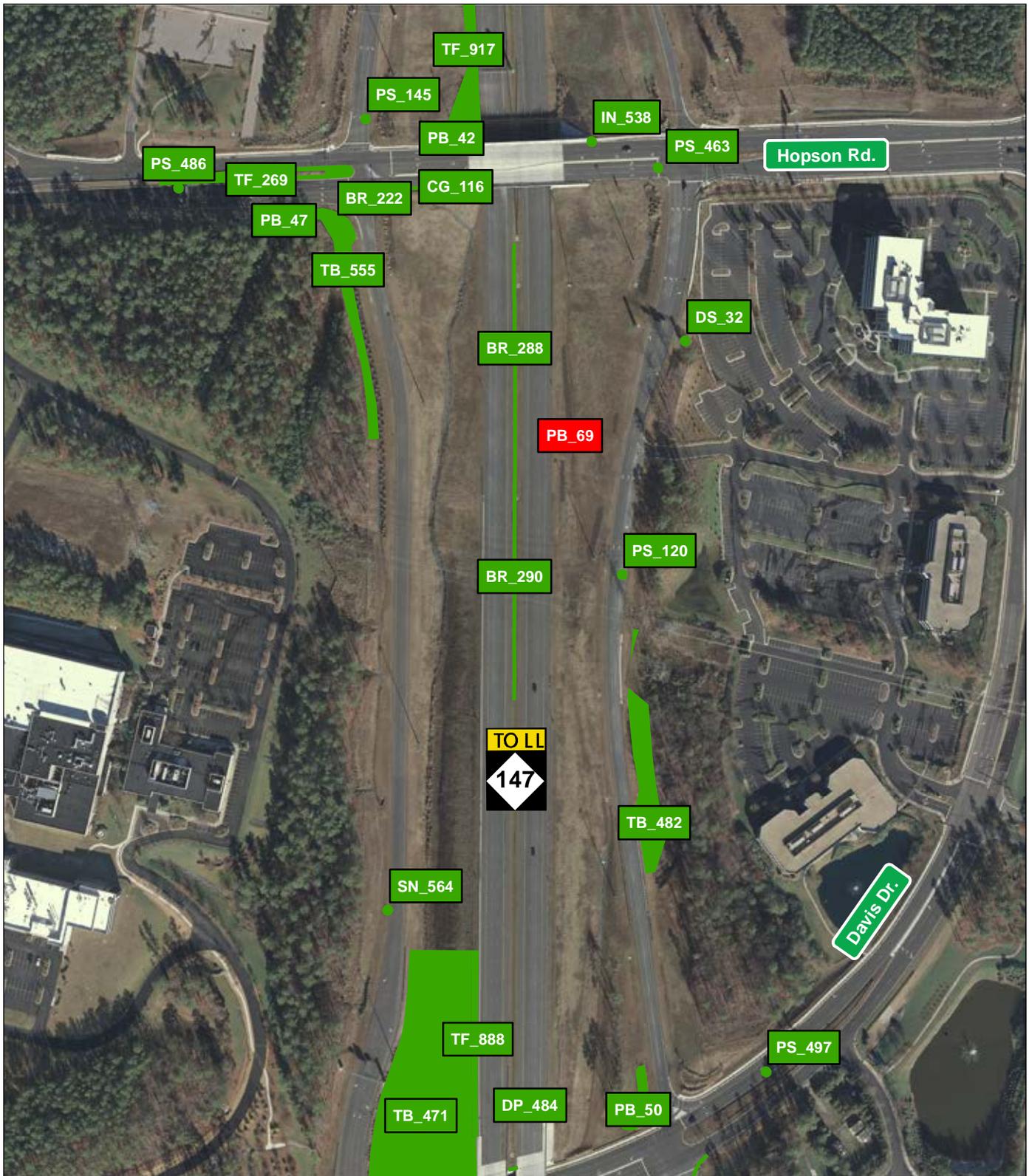


Legend

-  Passing Asset
-  Failing Asset

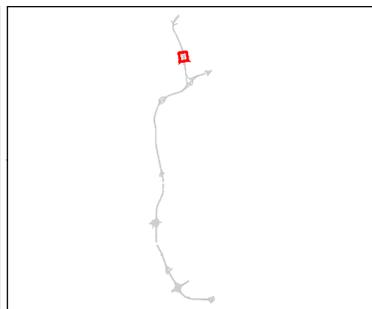


Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations

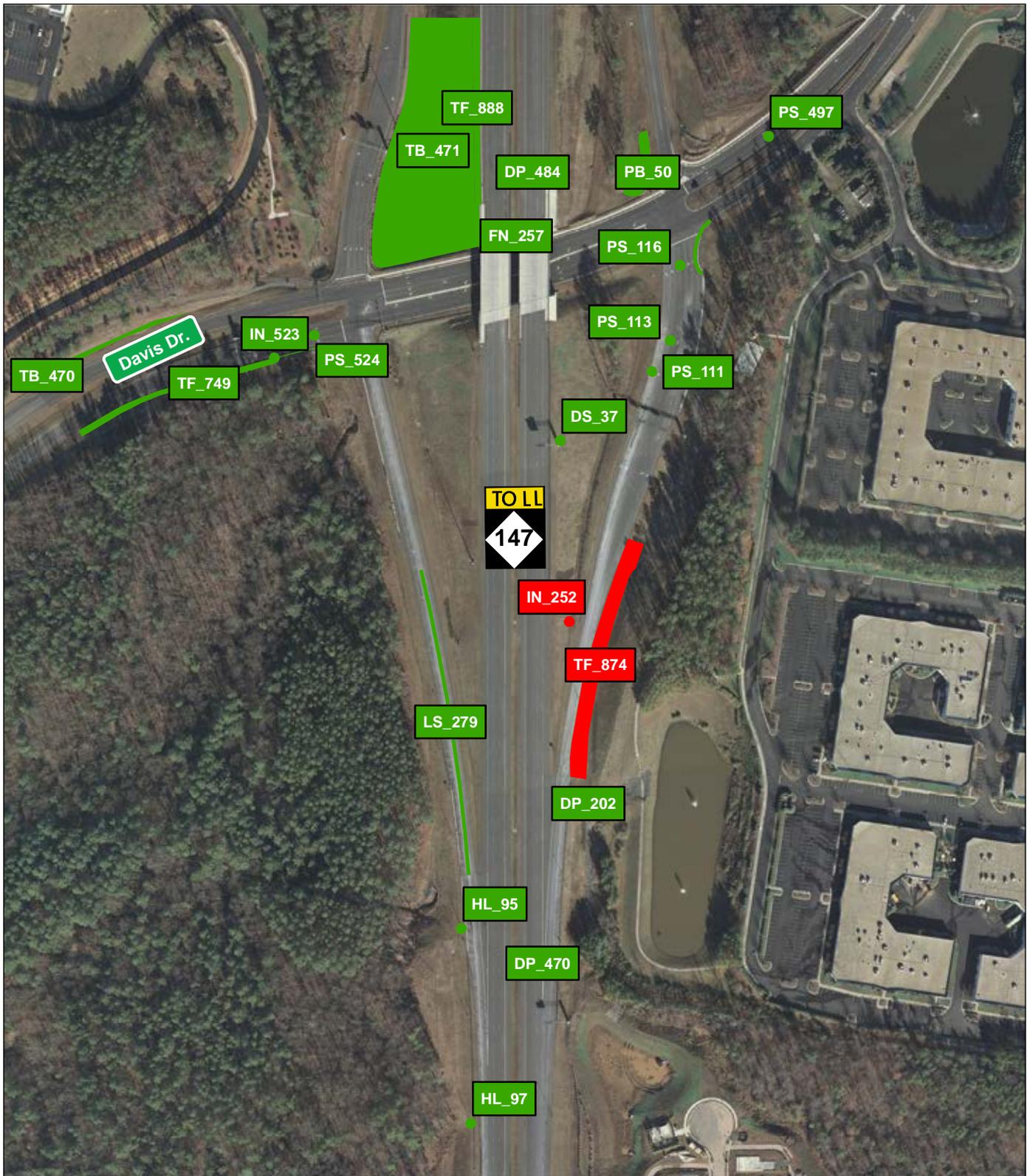


Legend

- Passing Asset
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Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations

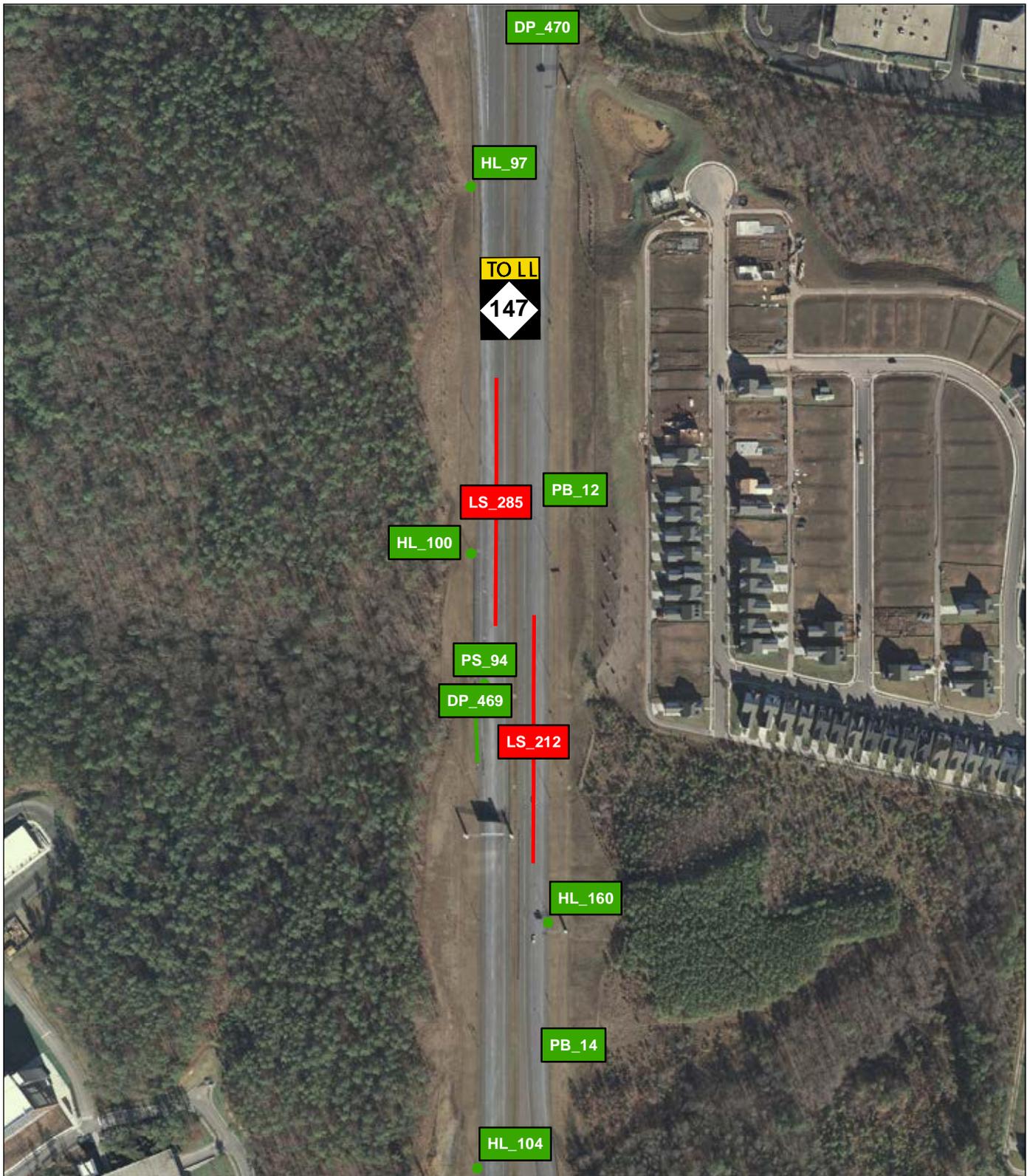


Legend

- Passing Asset
- Failing Asset



Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations



Legend

-  Passing Asset
-  Failing Asset



Appendix A: Triangle Expressway 2015 First Quarter Asset Assessment Locations



Legend

-  Passing Asset
-  Failing Asset



Appendix B

Triangle Expressway 2015 First Quarter Table Results of Assets Failing MRP

Appendix B: Triangle Expressway 2015 First 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
Misc. 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)	15
Paved Lanes – Concrete (LS)	16
Paved Shoulders (LS)	17
Unpaved Shoulders (LS)	18
Front/Back Slopes (LS)	19
Unpaved Lateral and Outfall Ditches (LS)	20
Litter (LS)	21
Roadway Sweeping (LS)	22
Pavement Striping (LS)	23
Pavement Markers (LS)	25
Delineators (LS)	29
Paved Ditches (PD)	30
Pavement Words and Symbols (PS)	31
Signs (SN)	32
Tree and Brush (TB)	33
Turf Condition (TF)	34
MSE/Retaining Walls, Sound Barrier Walls and Screen Walls (WL)	43

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
This asset did not produce any failures.					

Curb and Gutter (CG)

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

Decorative Supports (DS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Gantry Support	DS_190	Spalls		A37

Drainage Pipes (DP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Lateral Pipe	DP_729	Obstruction		A47
2	Drain	DP_840	Obstruction		A39, A40

Misc. Drainage Structures (MDP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Shoulder Drain	MDP_12	Obstruction		A12
2	Shoulder Drain	MDP_39	Obstruction		A18, A19
3	Shoulder Drain	MDP_42	Obstruction		A19
4	Shoulder Drain	MDP_50	Obstruction		A19, A20

Misc. Drainage Structures (MDP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Shoulder Drain	MDP_80	Obstruction		A26, A27
6	Shoulder Drain	MDP_99	Obstruction		A32
7	Shoulder Drain	MDP_107	Obstruction		A33
8	Shoulder Drain	MDP_166	Obstruction		A46

Fence and Control of Access (FN)

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

Graffiti (GR)

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

Highway Lighting (HL)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Single Roadway	HL_142	Exposed Electrical Wire		A4

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	Inlets	IN_252	Obstruction		A56

Landscaping (PB)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Plant Bed	PB_69	Unhealthy		A55

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
This asset did not produce any failures.					

Paved Shoulders (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_292	Paved Shoulder Joint		A6
2	Concrete	LS_309	Paved Shoulder Joint		A2, A4

Unpaved Shoulders (LS)

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

Front/Back Slopes (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
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.					

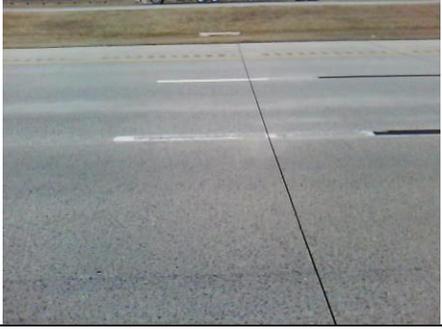
Litter (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_594	Litter		A30, A31

Roadway Sweeping (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_114	Roadway Sweeping		A16, A17

Pavement Striping (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_70	Nighttime Line Visibility	Not Available for Nighttime Failure.	A22, A23
2	Asphalt	LS_299	Line Width		A2
3	Concrete	LS_306	Nighttime Line Visibility	Not Available for Nighttime Failure.	A4, A5
4	Concrete	LS_309	Nighttime Line Visibility	Not Available for Nighttime Failure.	A2, A4
5	Concrete	LS_441	Missing Line		A38
6	Concrete	LS_474	Missing Line		A44, A45
7	Concrete	LS_478	Missing Line		A45

Pavement Striping (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
8	Concrete	LS_496	Missing Line		A47, A48, A49

Pavement Markers (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_35	Missing Markers & Marker Reflectivity		A10, A11, A12
2	Concrete	LS_37	Missing Markers & Marker Reflectivity		A12, A13
3	Concrete	LS_114	Missing Markers & Marker Reflectivity		A16, A17
4	Concrete	LS_139	Missing Markers & Marker Reflectivity		A25
5	Asphalt	LS_209	Marker Reflectivity	Not Available for Nighttime Failure.	A58
6	Asphalt	LS_212	Marker Reflectivity	Not Available for Nighttime Failure.	A57

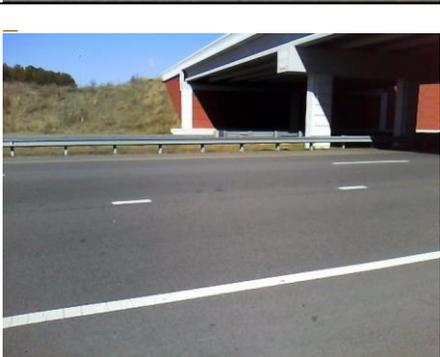
Pavement Markers (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
7	Asphalt	LS_237	Missing Markers & Marker Reflectivity		A51, A52
8	Asphalt	LS_239	Marker Reflectivity	Not Available for Nighttime Failure.	A51
9	Asphalt	LS_264	Marker Reflectivity	Not Available for Nighttime Failure.	A52, A53
10	Asphalt	LS_285	Marker Reflectivity	Not Available for Nighttime Failure.	A57
11	Asphalt	LS_292	Missing Markers & Marker Reflectivity		A6
12	Asphalt	LS_295	Marker Reflectivity	Not Available for Nighttime Failure.	A7
13	Asphalt	LS_299	Missing Markers & Marker Reflectivity		A2

Pavement Markers (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
14	Concrete	LS_309	Missing Markers & Marker Reflectivity		A2, A4
15	Concrete	LS_326	Missing Markers & Marker Reflectivity		A6, A7
16	Concrete	LS_330	Missing Markers & Marker Reflectivity		A7, A8
17	Concrete	LS_347	Missing Markers & Marker Reflectivity		A6, A7

Pavement Markers (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
18	Concrete	LS_356	Missing Markers & Marker Reflectivity		A2
19	Asphalt	LS_387	Missing Markers & Marker Reflectivity		A48, A49
20	Asphalt	LS_576	Missing Markers & Marker Reflectivity		A30, A32
21	Asphalt	LS_594	Missing Markers & Marker Reflectivity		A30, A31

Delineators (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_88	Missing Markers & Nighttime Reflectivity		A28, A29
2	Concrete	LS_107	Missing Markers & Nighttime Reflectivity		A14
3	Concrete	LS_129	Missing Markers & Nighttime Reflectivity		A20, A21
4	Concrete	LS_429	Missing Markers & Nighttime Reflectivity		A36, A37

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
This asset did not produce any failures.					

Signs (SN)

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

Tree and Brush (TB)

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

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Turf	TF_82	Bareground		A29, A31
2	Turf	TF_84	Bareground		A30
3	Turf	TF_92	Bareground		A30
4	Turf	TF_100	Bareground		A41, A42

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Turf	TF_112	Bareground		A33, A34
6	Turf	TF_118	Bareground		A36
7	Turf	TF_167	Bareground		A32
8	Turf	TF_198	Bareground		A22, A23

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
9	Turf	TF_204	Bareground		A29, A31
10	Turf	TF_207	Bareground		A29, A30, A31
11	Turf	TF_273	Bareground		A38, A39
12	Turf	TF_324	Bareground		A45, A46

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
13	Turf	TF_375	Bareground		A43
14	Turf	TF_379	Bareground		A41, A42
15	Turf	TF_410	Bareground		A38, A39
16	Turf	TF_447	Bareground		A35, A36

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
17	Turf	TF_452	Bareground		A35
18	Turf	TF_473	Bareground		A38, A39
19	Turf	TF_487	Bareground		A33
20	Turf	TF_490	Bareground		A33

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
21	Turf	TF_514	Bareground		A31
22	Turf	TF_519	Bareground		A29, A31
23	Turf	TF_525	Bareground		A30, A32
24	Turf	TF_529	Bareground		A29, A30, A31

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
25	Turf	TF_544	Bareground		A28
26	Turf	TF_560	Bareground		A26
27	Turf	TF_582	Bareground		A23
28	Turf	TF_614	Bareground		A18, A19

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
29	Turf	TF_650	Bareground		A14
30	Turf	TF_727	Bareground		A7, A8
31	Turf	TF_736	Bareground		A6, A7
32	Turf	TF_785	Bareground		A5, A58

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
33	Turf	TF_874	Bareground		A56
34	Turf	TF_1004	Bareground		A23

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

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Screen Wall	WL_3	Spalling		A7
2	Screen Wall	WL_31	Spalling		A54
3	Sound Wall	WL_49	Cracked Joint		A35, A36
4	Sound Wall	WL_101	Cracked Joint		A35