

Maintenance Rating Program Monroe Expressway

Quarter 2 MRP Assessment



August 2023

CONSULTANT CERTIFICATION OF COMPLETION

July 31, 2023

Dennis Jernigan, P.E.

Director of Highway Operations, NCTA

1 South Wilmington Street

Raleigh, NC 27601

NCTA Monroe By-Pass Roadway Maintenance Performance Rating Program; Q2, FY 2023 Rating

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

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

Sincerely,

Mott MacDonald I&E, LLC

A handwritten signature in blue ink that reads "Ken M. McEntire". The signature is written in a cursive style with a clear, legible font.

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 all roadway features and toll facilities on the Monroe Expressway. This report presents results from the 2023 Second Quarter Assessment of the Monroe Expressway.

The overall 2023 second quarter rating of the Monroe Expressway was 96.4. This score is above the target rating score of 90 for the overall system. As shown in **Table 1**, all five elements assessed achieved a rating greater than the target rating of 85.

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

Element	MRP Rating	Target Rating
Road Surface	95.7	85.0
Unpaved Shoulders and Ditches	98.7	85.0
Drainage	96.5	85.0
Roadside	95.3	85.0
Traffic Control Devices	96.7	85.0
Overall MRP Performance Rating	96.4	90.0

This report also provides a rolling rating of the latest four quarterly inspections of the Monroe Expressway. As presented in **Table 2**, the rolling maintenance rating of the Monroe Expressway was 97.1.

Table 2: MRP Rolling Element Results

Element	Q3 2022 Rating	Q4 2022 Rating	Q1 2023 Rating	Q2 2023 Rating	Rolling Rating
Road Surface	100.0	98.8	100.0	95.7	98.6
Unpaved Shoulders and Ditches	100.0	100.0	95.4	98.7	98.8
Drainage	98.5	97.6	97.4	96.5	97.5
Roadside	90.1	94.2	92.3	95.3	93.0
Traffic Control Devices	96.5	97.0	99.4	96.7	97.4
Overall MRP Performance Rating	97.0	97.5	97.5	96.4	97.1

All the element ratings were above the desired rating of 85. It is important to note that these results are only representative of the first quarter sample, one of four quarterly surveys annually that provide an intermediate snapshot of seasonal conditions. Therefore, these results are not yet a statistically valid representation of the assets; only the total of all four quarterly inspections reported as a rolling rating, provides a 95% confidence level in statistical sampling.

2.0 Introduction

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. It is a comprehensive planning, measuring, and managing process that provides a means for communicating to managers, stakeholders, and key 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 survey results are rated against established threshold criteria. The program analysis is accomplished by implementing 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 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.

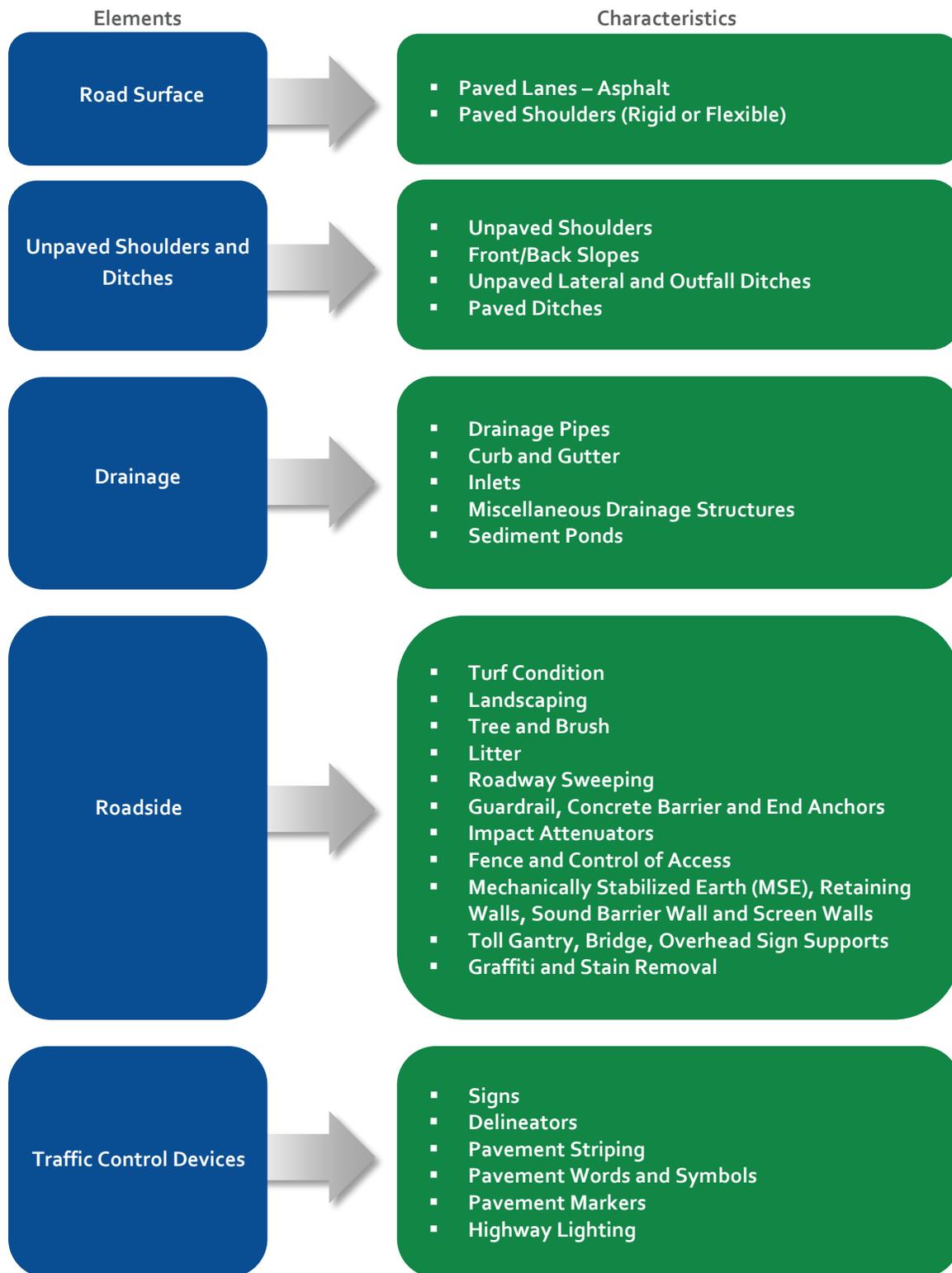
The NCTA performance standards, threshold criteria, and maintenance rating program were developed through a collaborative effort by NCTA managers, NCDOT maintenance staff, and consultants.

Using this field survey information, a maintenance matrix can be developed to show 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 are categorized into 5 elements. These elements and their characteristics can be seen in *Figure 1* below:

Figure 1: Maintenance Elements and Characteristics



Because some roadway characteristics are 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 shows which maintenance elements are deficient.

The program analysis is accomplished using 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, such as vegetation growth. Each maintenance characteristic is evaluated and recorded according to the criteria developed by the NCTA performance standards. This inventory was completed with electronic data collection tablets and programs for accurate GPS coordinates of each transportation asset.

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," it is coded as YES to meeting the criteria. If it does not meet the criteria, it is coded as a NO. When the survey is complete, the number of YES's and NO'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 NCTA's overall target rating score is 90, with each element level scoring at or above 85 and every characteristic at or above 80.

4.0 Monroe Expressway Description

The Monroe Expressway extends for approximately 18.5 miles between the U.S. 74 interchange to the west and U.S. 74 near Marshville to the east. The Monroe Expressway consists of eight interchanges and seven all-electronic toll collection zones. A map of the Monroe Expressway can be seen in **Figure 2** below:

Figure 2: Monroe Expressway Map



5.0 Survey Results

The overall Q2 2023 MRP rating for the Monroe Expressway is 96.4. This score is above the target rating score of 90 for the overall system. All the element ratings were above the desired rating of 85, and two characteristics scored below the minimum 80 rating. Individual characteristic ratings will be discussed in detail in the analysis section of this report.

Appendix A shows each of the individual assets that failed the MRP criteria. **Appendix B** includes maps of each of the individual asset locations that failed to meet the criteria displayed in the tables below. 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. After developing an inventory by recording the total number of instances of a particular feature, each feature is analyzed based on threshold criteria and a pass/fail result is designated and recorded for each to determine the percentage of the sample passed. The passing samples and sample totals are then multiplied by their weighted value, which are designated to each element based on importance to determine 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 overall MRP Performance rating results of the survey are presented in **Tables 3 and 4**.

Table 3: Element Results for Q2 2023

Element	MRP Rating
Road Surface	95.7
Unpaved Shoulders	98.7
Drainage	96.5
Roadside	95.3
Traffic Control Devices	96.7
Overall MRP Performance Rating	96.4

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%).

Table 4: Characteristic Results for Q2 2023

Road Surface	Sample Passed	Sample Total	Weighted Values	Actual PTS	Available PTS	Quarter Rating
Paved Lanes Asphalt	28	30	9	252	270	93
Paved Shoulder	30	30	5	150	150	100
Element Total				402	420	95.7
Unpaved Shoulders & Ditches	Sample Passed	Sample Total	Weighted Values	Actual PTS	Available PTS	Quarter Rating
Unpaved Shoulder	29	30	9	261	270	97
Front/Back Slopes	30	30	6	180	180	100
Lateral and Outfall Ditches, Unpaved	30	30	6	180	180	100
Ditches, Paved	11	11	5	55	55	100
Element Total				676	685	98.7
Drainage	Sample Passed	Sample Total	Weighted Values	Actual PTS	Available PTS	Quarter Rating
Drainage Pipes	31	31	7	217	217	100
Curb and Gutter	30	30	6	180	180	100
Inlets	29	32	7	203	224	91
Misc. Drainage Structure	17	18	4	68	72	94
Sediment Pond	2	2	7	14	14	100
Element Total				682	707	96.5
Roadside	Sample Passed	Sample Total	Weighted Values	Actual PTS	Available PTS	Quarter Rating
Turf Condition	54	55	7	378	385	98
Landscaping	15	15	4	60	60	100
Trees and Brush	15	15	4	60	60	100
Litter	30	30	4	120	120	100
Roadway Sweeping	30	30	5	150	150	100

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Guardrail, Concrete Barrier and End Anchors	31	31	9	279	279	100
Impact Attenuators	6	6	9	54	54	100
Fence, Control Access	24	29	7	168	203	83
Retaining Walls and Sound Barrier Walls	10	14	5	50	70	71
Toll Gantry Supports	6	8	5	30	40	75
Graffiti and Stain Removal	30	30	4	120	120	100
Element Total				1469	1541	95.3

Traffic Control Devices	Sample Passed	Sample Total	Weighted Values	Actual PTS	Available PTS	Quarter Rating
Signs	29	32	7	203	224	91
Object Markers and Delineators	30	30	3	90	90	100
Pavement Striping/Marking	30	30	8	240	240	100
Words and Symbols	30	32	7	210	224	94
Pavement Markers	30	30	9	270	270	100
Highway Lighting	3	3	6	18	18	100
Element Total				1031	1066	96.7

6.0 Analysis & Recommendations

MRP Elements

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

MRP Characteristics

All characteristics exceeded the NCTA minimum threshold criteria of 80, except for two.

Decorative Supports

Decorative Supports scored a 75 in the survey. Deficiencies in the decorative supports were directly related to paint scaling. The MRP Maintenance and Evaluation Standards V7 are below.

Maintenance and Evaluation Standards: Decorative supports do not meet the maintenance standards when any of the following criteria is observed:

- 1) More than 10% of exposed surface is covered with unwanted vegetation.
- 2) Any single spall 1 inch deep or greater or cumulative spalls covering a cumulative area over 5 SF on any single facing.
- 3) Unsealed cracks or joints greater than 0.25 inches in width.
- 4) Stained areas exhibit cumulative scaling in excess of 1 SF, if applicable.

Retaining Walls

Retaining Walls scored a 71 in the survey. Deficiencies in the retaining walls were directly related to spalling. The MRP Maintenance and Evaluation Standards V7 are below.

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

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

Efforts are underway to identify and provide solutions for both the Decorative Supports and Retaining Walls.

7.0 Current Rolling MRP Rating

The rolling maintenance rating of the Monroe Expressway was 97.1, exceeding NCTA’s overall target rating of 90. All elements exceeded NCTA’s rolling rating threshold criteria of 85. All characteristic rolling ratings met or exceeded the target rating of 80.

The 2022/2023 results are presented in *Exhibit 1* and *Table 5*. These results are a collection of the latest four quarterly inspections.

Exhibit 1: MRP Element Results for 2022/2023

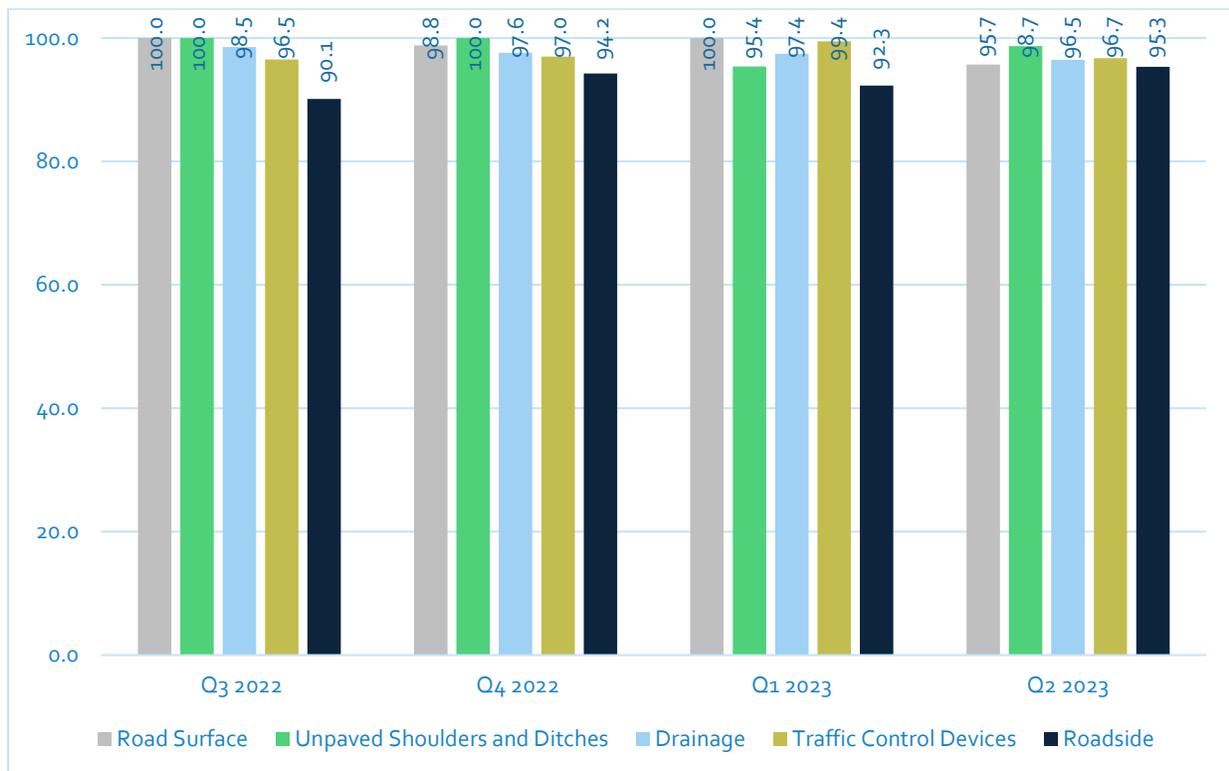


Table 5: MRP Rolling Element Results

Road Surface	Q3 2022 Rating	Q4 2022 Rating	Q1 2023 Rating	Q2 2023 Rating	Rolling Rating
Paved Lanes Asphalt	100	100	100	93	98.3
Paved Shoulder	100	97	100	100	99.1
Element Total					98.6
Unpaved Shoulders and Ditches	Q3 2022 Rating	Q4 2022 Rating	Q1 2023 Rating	Q2 2023 Rating	Rolling Rating
Unpaved Shoulder	100	100	90	97	97.4
Front/Back Slopes	100	100	100	100	100
Lateral and Outfall Ditches, Unpaved	100	100	100	100	100
Ditches, Paved	100	100	92	100	97.6
Element Total					98.8
Drainage	Q3 2022 Rating	Q4 2022 Rating	Q1 2023 Rating	Q2 2023 Rating	Rolling Rating
Drainage Pipes	100	100	100	100	100
Curb and Gutter	100	97	95	100	98.2
Inlets	97	97	97	91	95.3
Sediment Basins	100	100	100	100	100
Misc. Drainage Structure	95	95	95	94	94.7
Element Total					97.5
Roadside	Q3 2022 Rating	Q4 2022 Rating	Q1 2023 Rating	Q2 2023 Rating	Rolling Rating
Turf Condition	65	81	80	98	81.5
Landscaping	87	100	93	100	94.9
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	94	100	94	100	96.9
Impact Attenuators	100	100	100	100	100
Fence, Control Access	95	86	91	83	88.9
Retaining Walls and Sound Barrier Walls	100	100	100	71	92.9
Decorative Supports	100	100	100	75	94.1
Graffiti and Stain Removal	100	100	100	100	100
Element Total					93.0
Traffic Control Devices	Q3 2022 Rating	Q4 2022 Rating	Q1 2023 Rating	Q2 2023 Rating	Rolling Rating
Signs	91	95	100	91	94.8
Delineators	100	100	100	100	100.0
Pavement Striping/Marking	100	100	100	100	100.0
Words and Symbols	97	100	98	94	97.2
Pavement Markers	100	93	100	100	98.3
Highway Lighting	100	100	100	100	100
Element Total					97.4

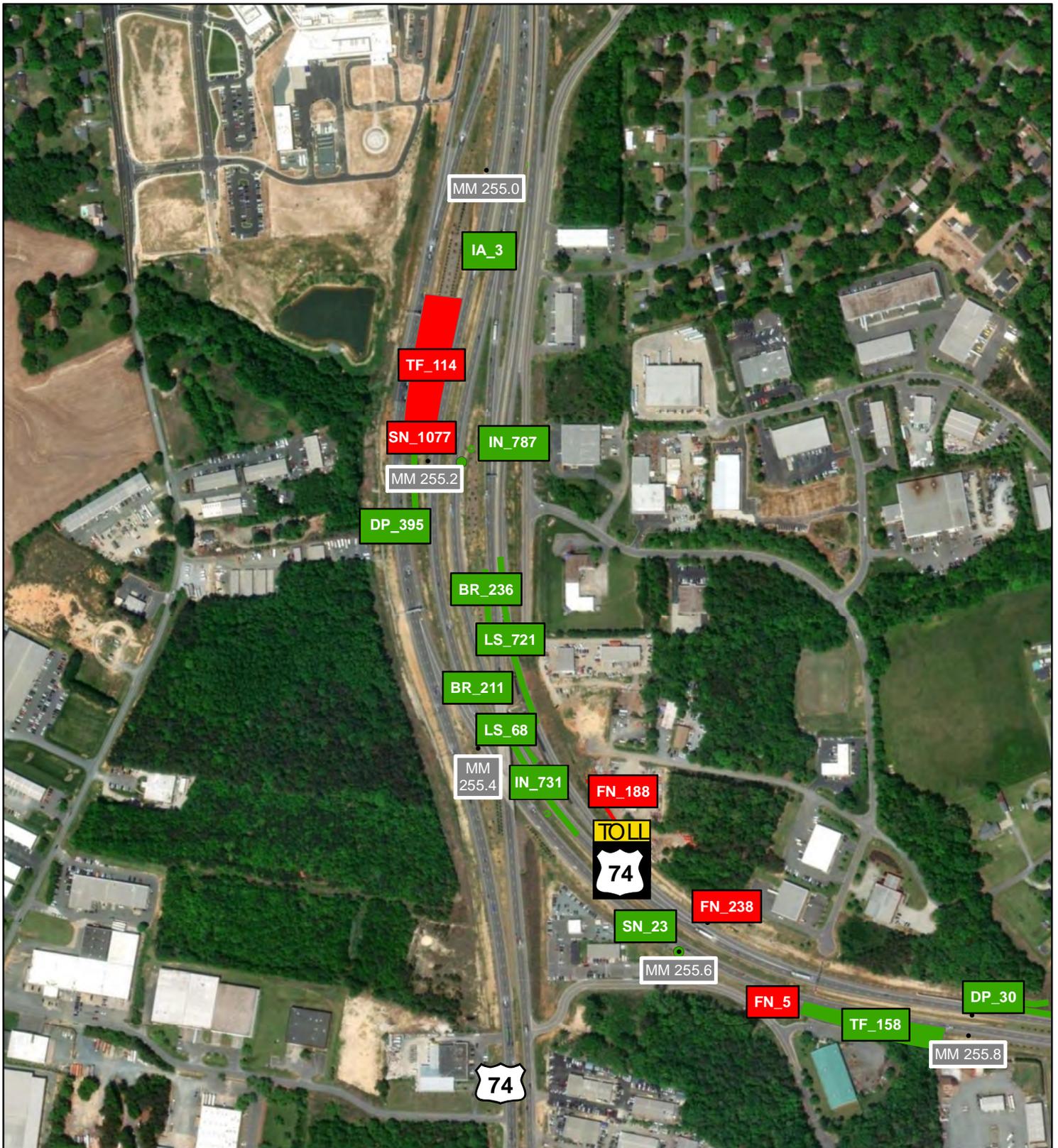
8.0 Conclusion

This report presents the 2023 second quarter assessment of the Monroe Expressway. The NCTA's target ratings are 90 for the rolling rating, 90 for the overall quarter rating, 85 for elements, and 80 for characteristics. The second quarter rating was 96.4 and the rolling rating was 97.1, both ratings met the target rating of 90.

All element ratings were above the target ratings for the quarter. During the second quarter assessment, all characteristics met or exceeded the target rating of 80.

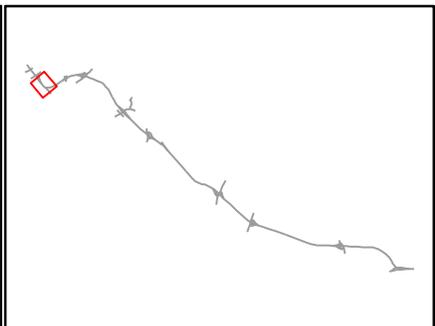
The maintenance provider is encouraged to continue using asset management principles and a performance management approach to work planning.

Appendix B: Monroe Expressway MRP Q2 2023 Assessment Locations



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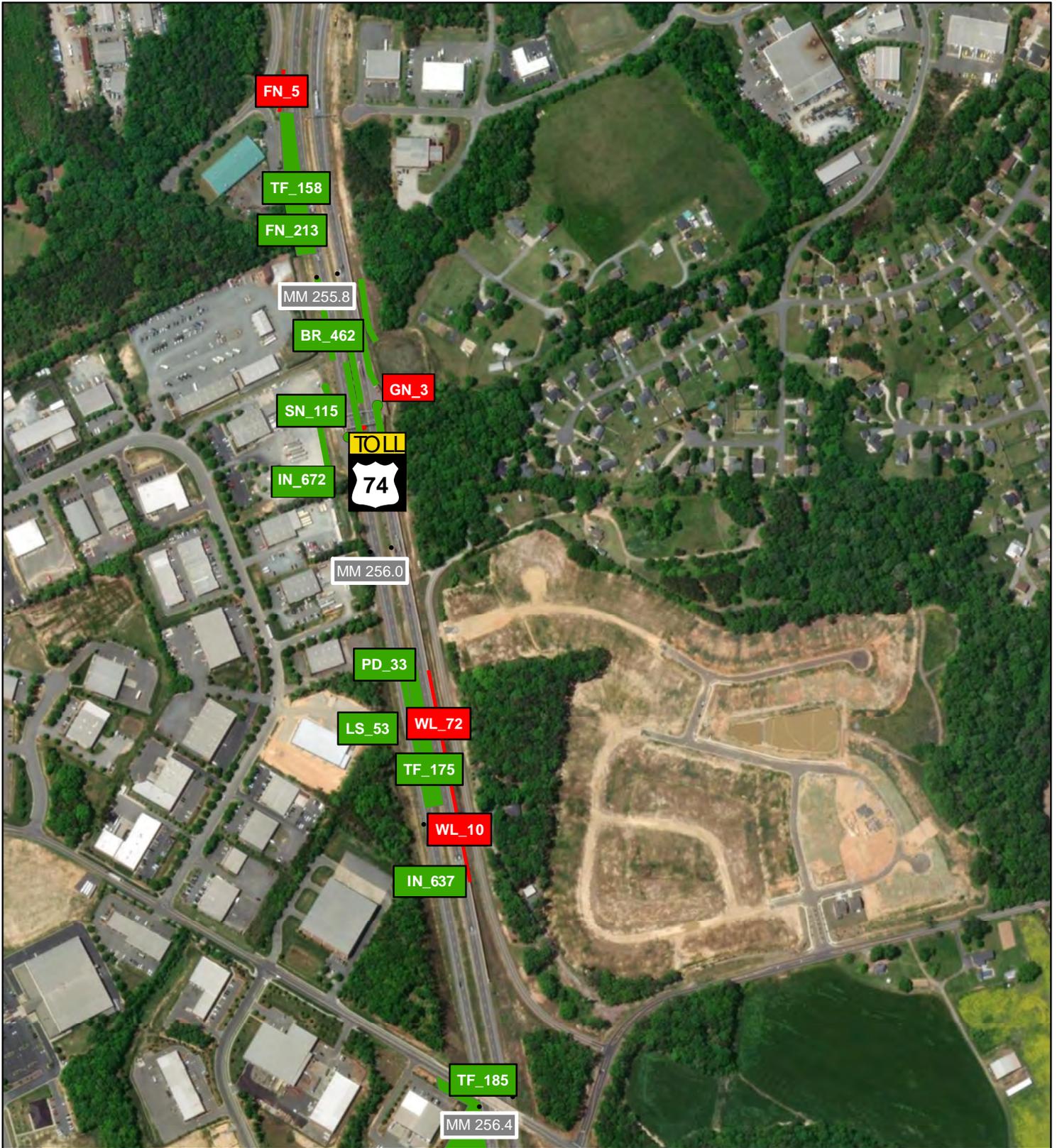
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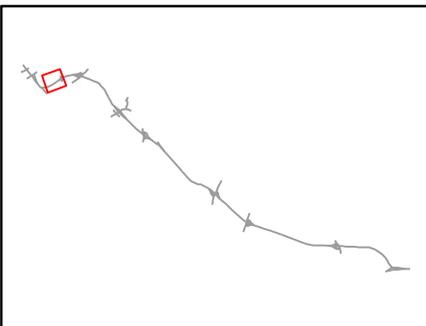
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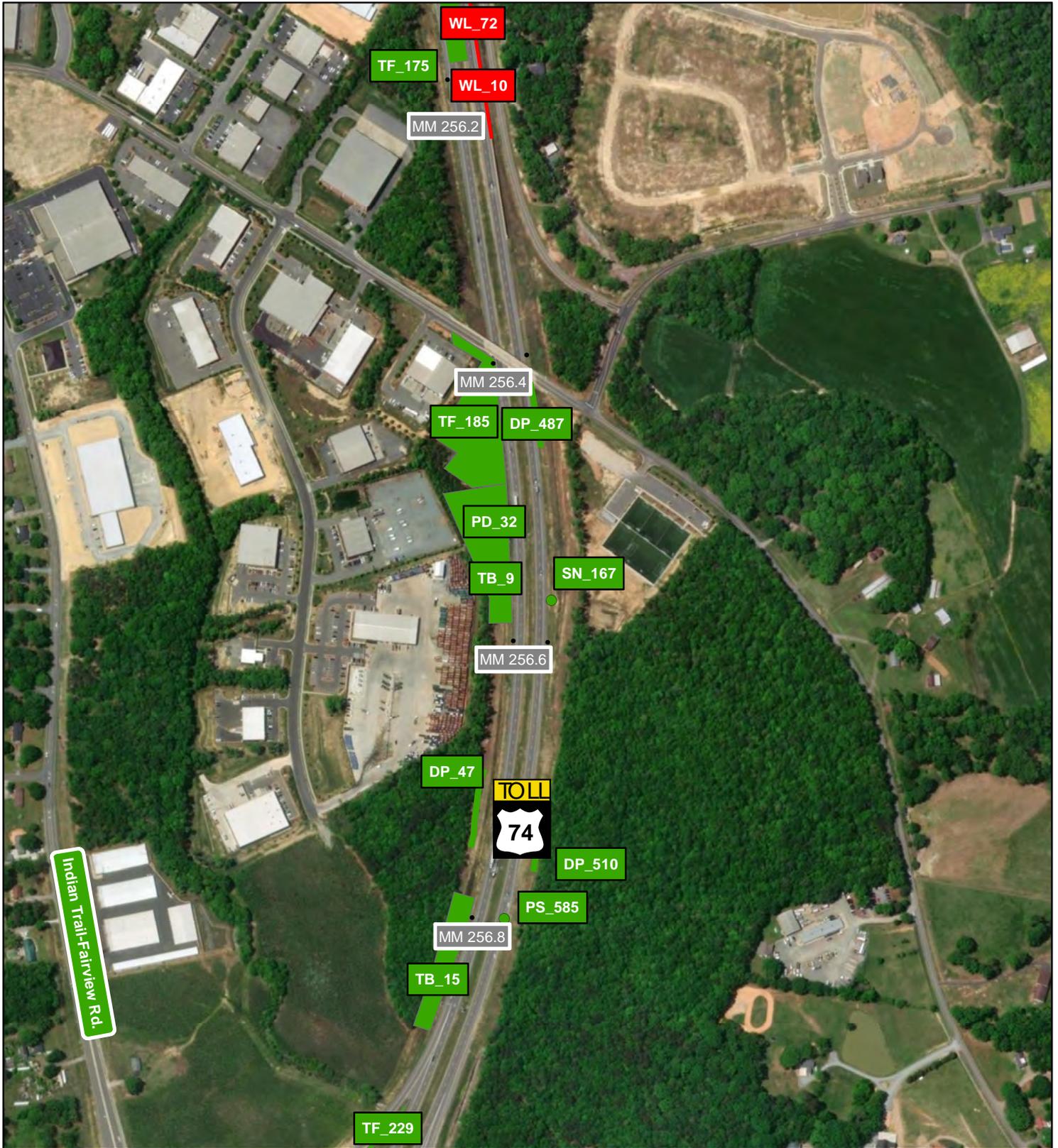




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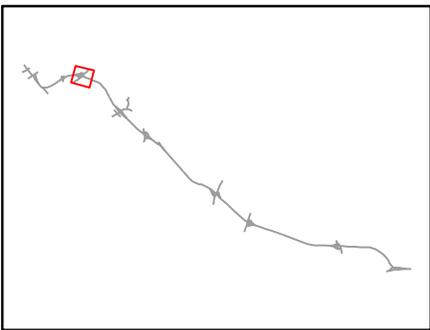


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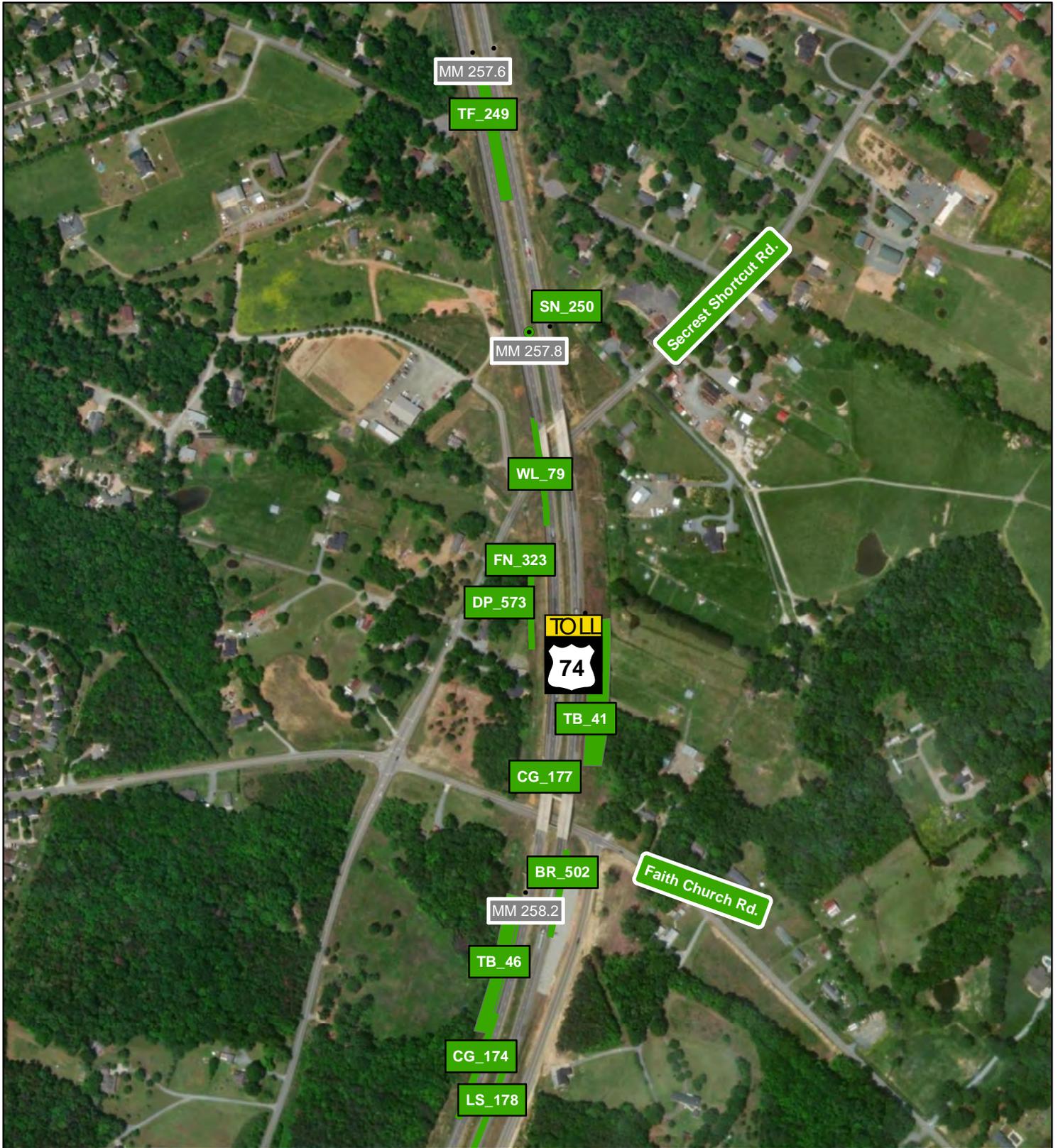
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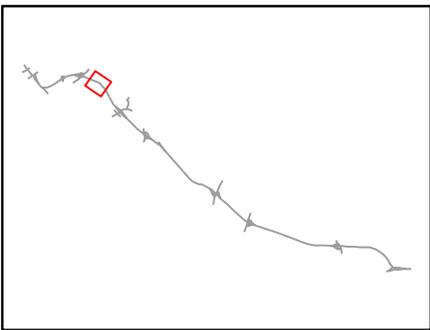
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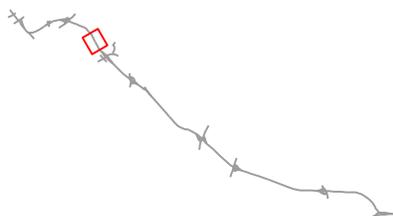
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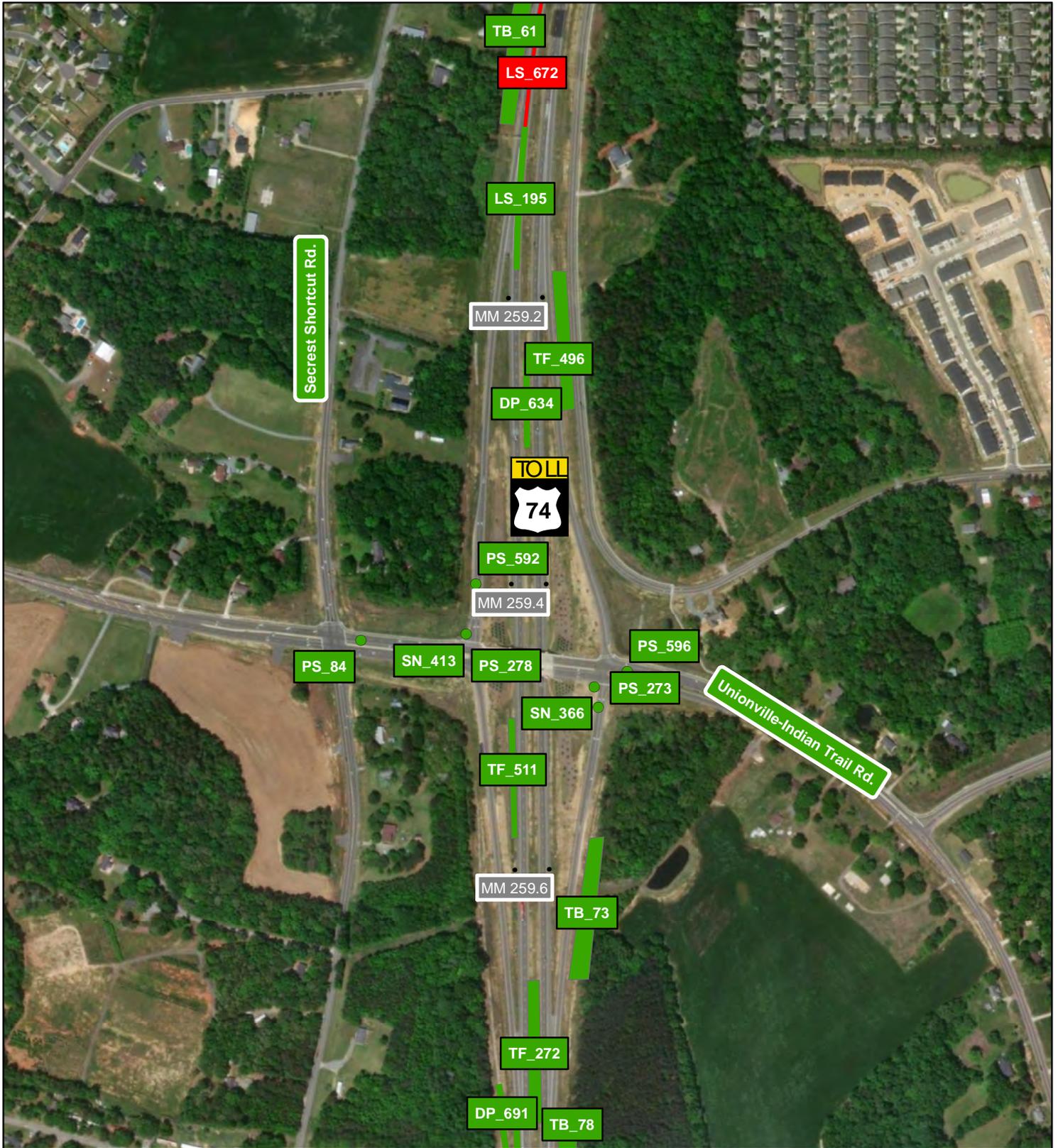


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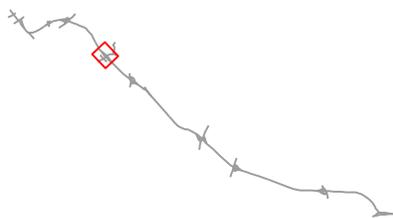


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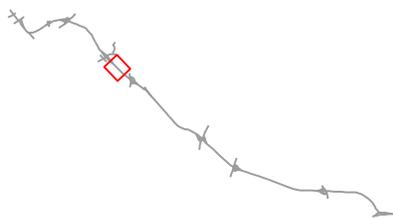


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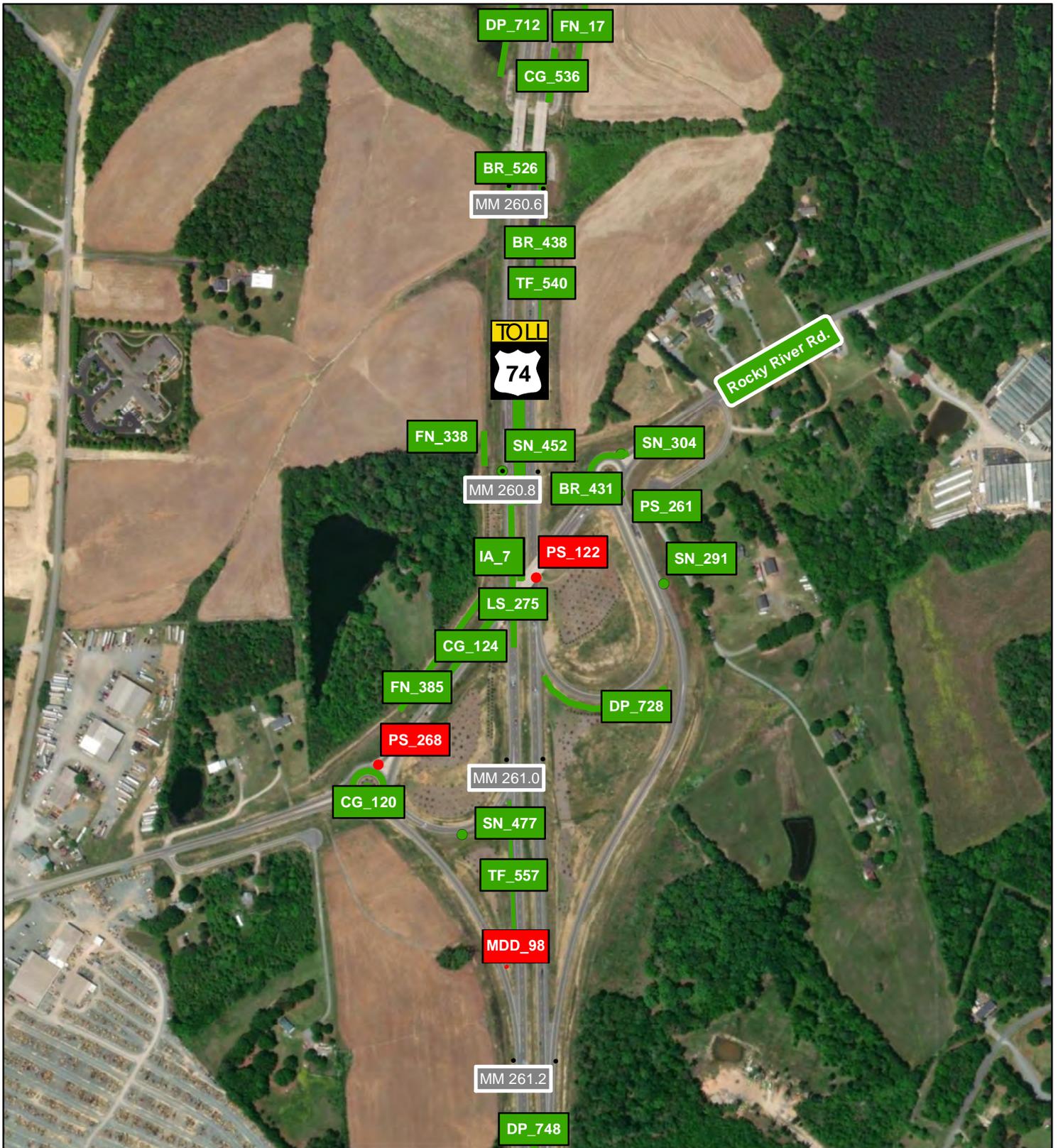


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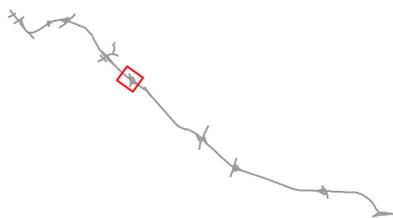


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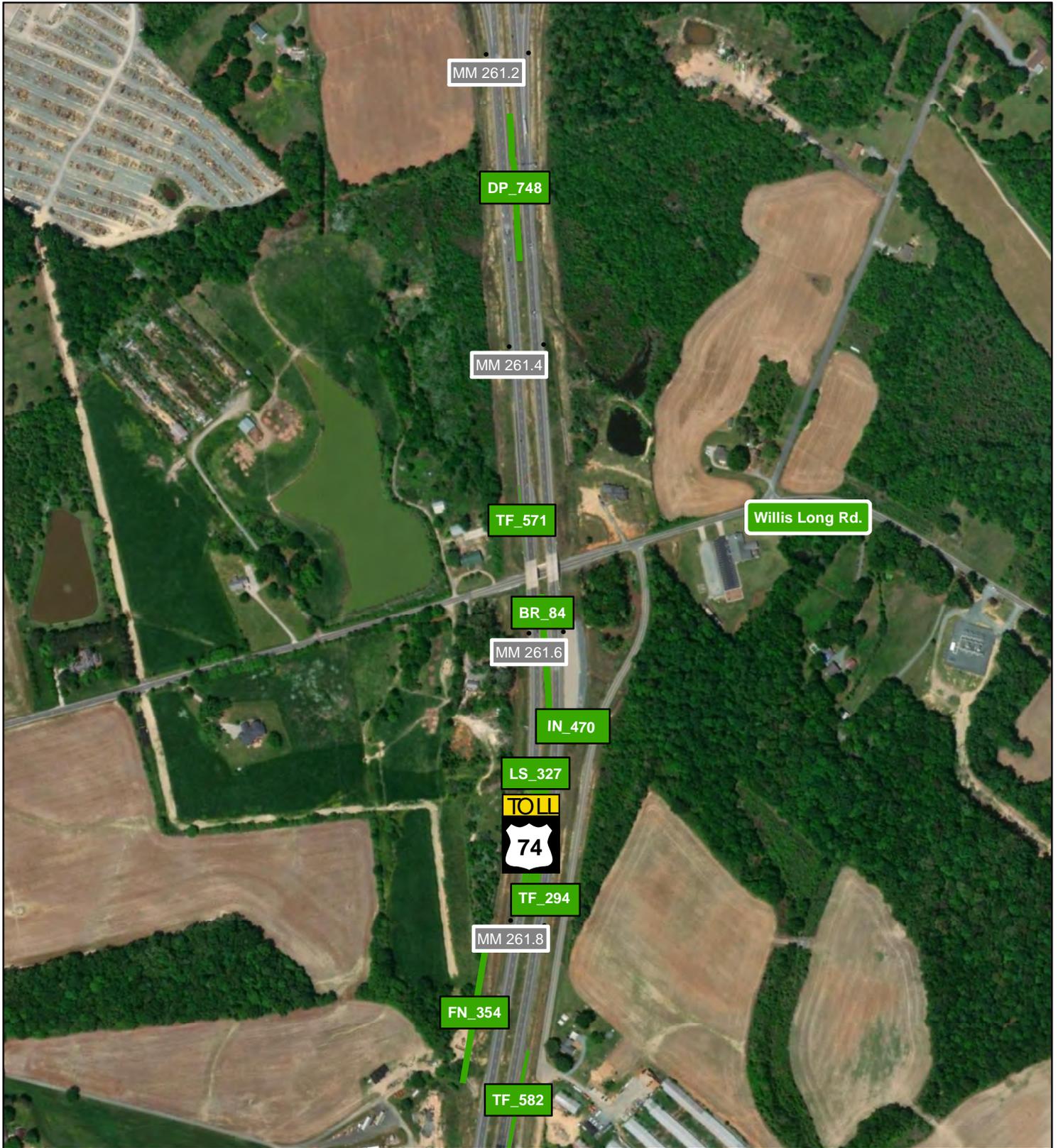


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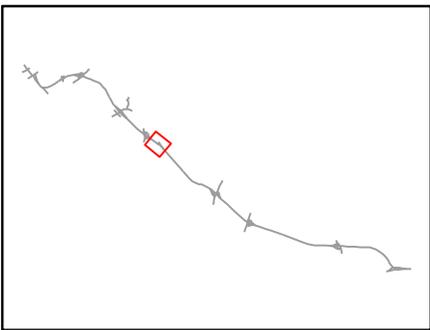


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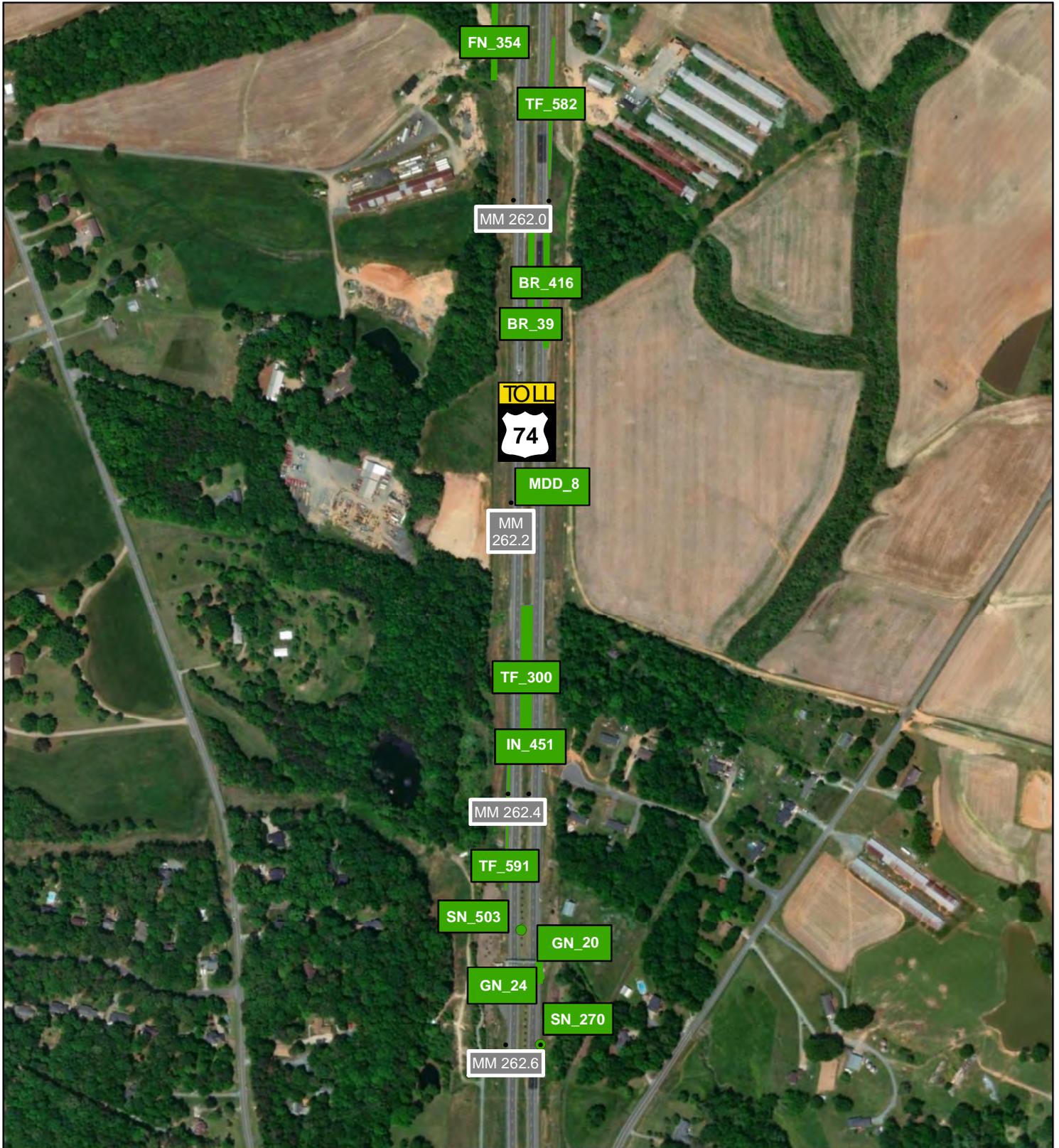
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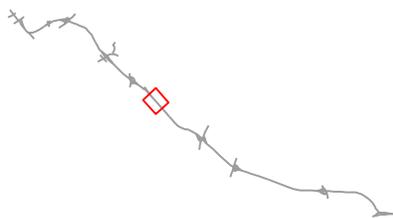
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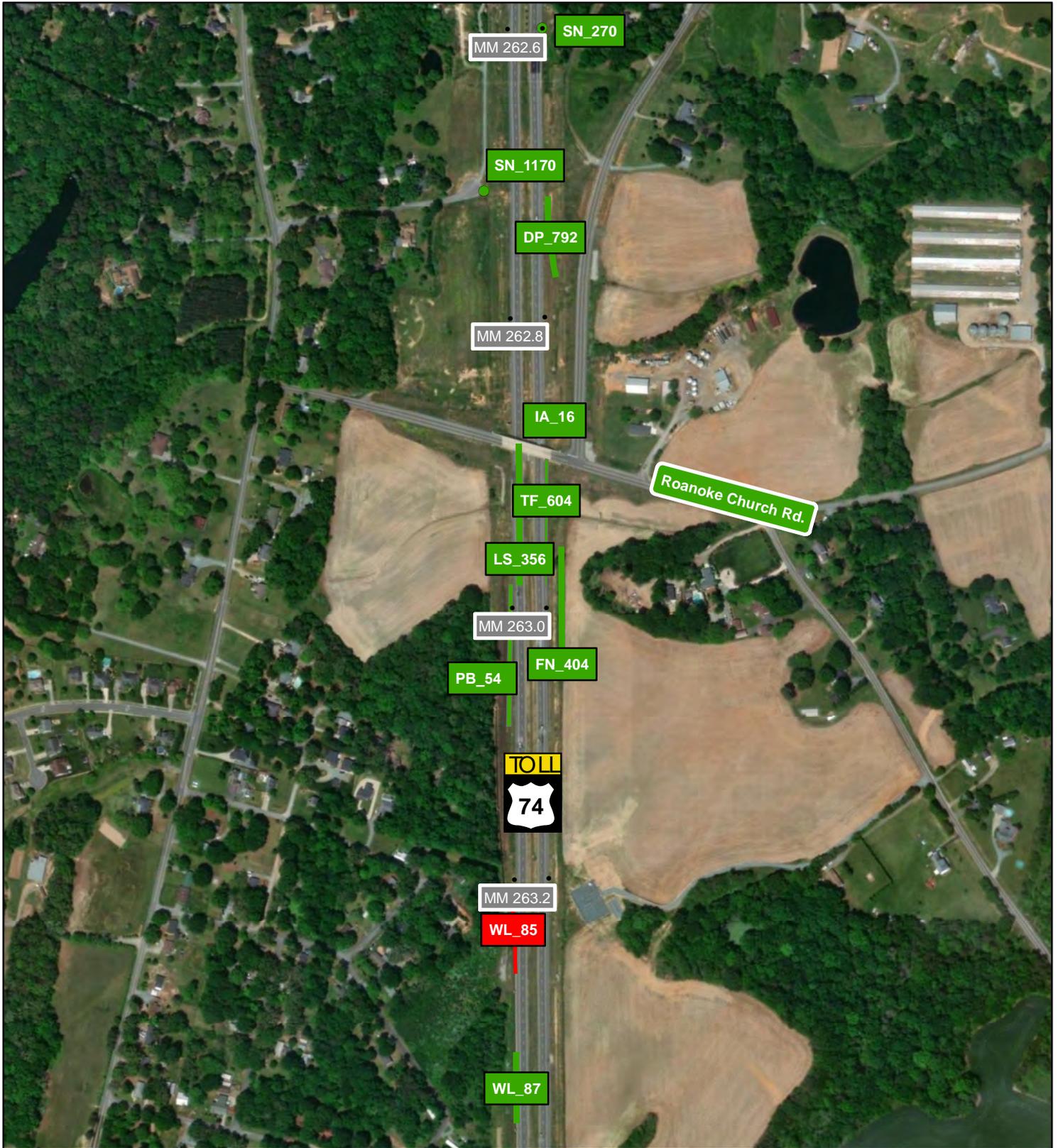


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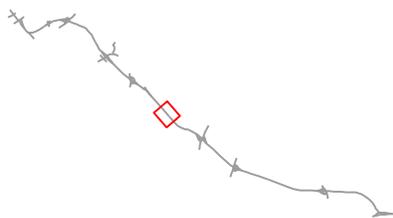


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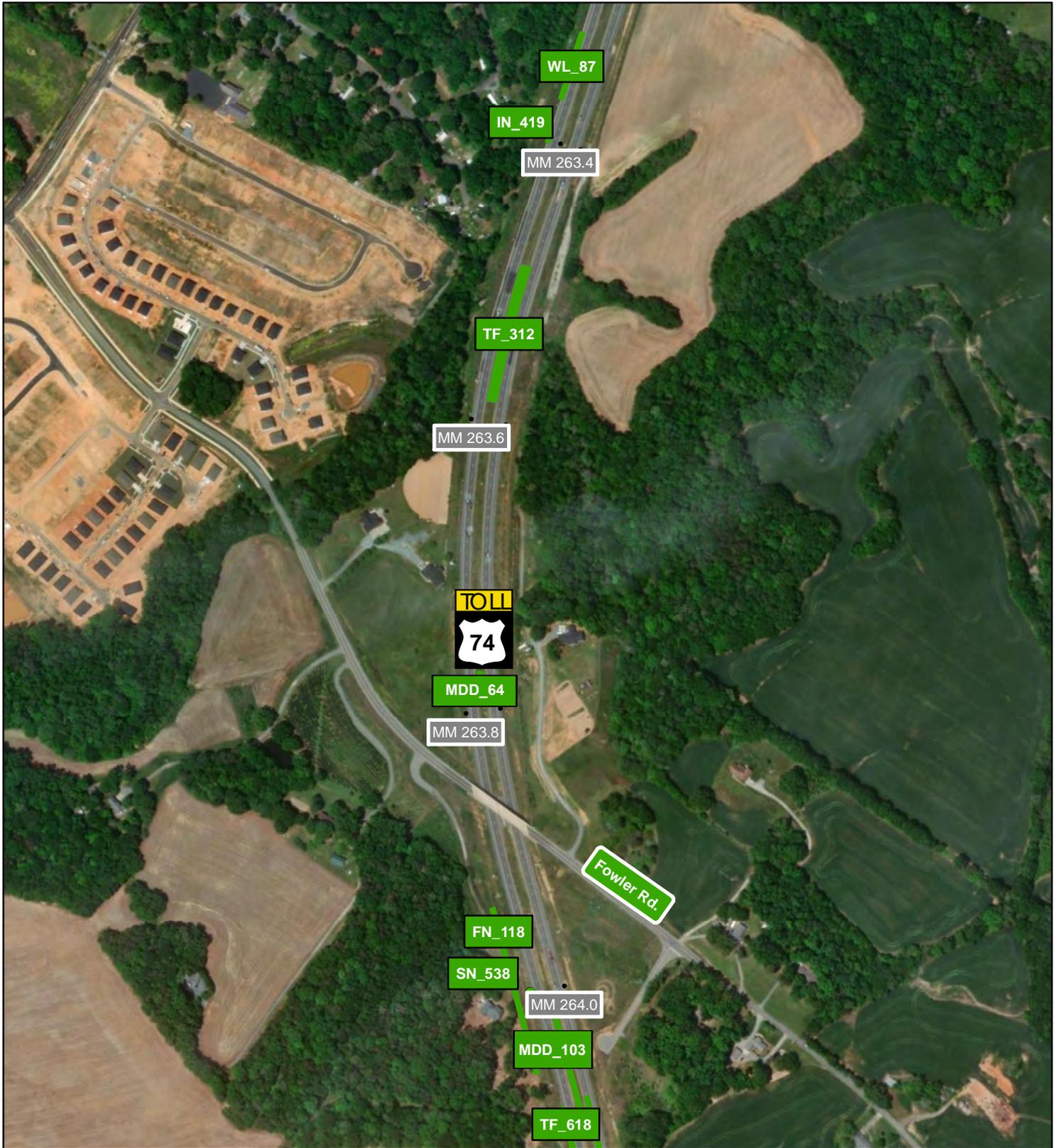


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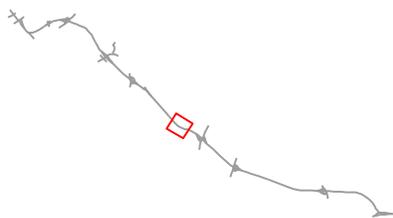


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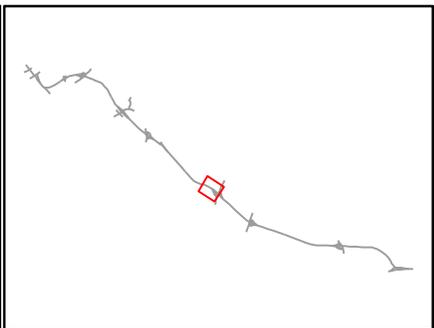


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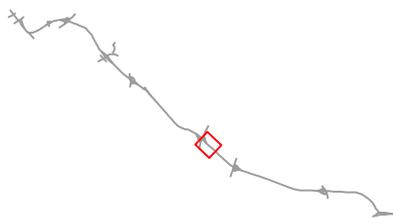
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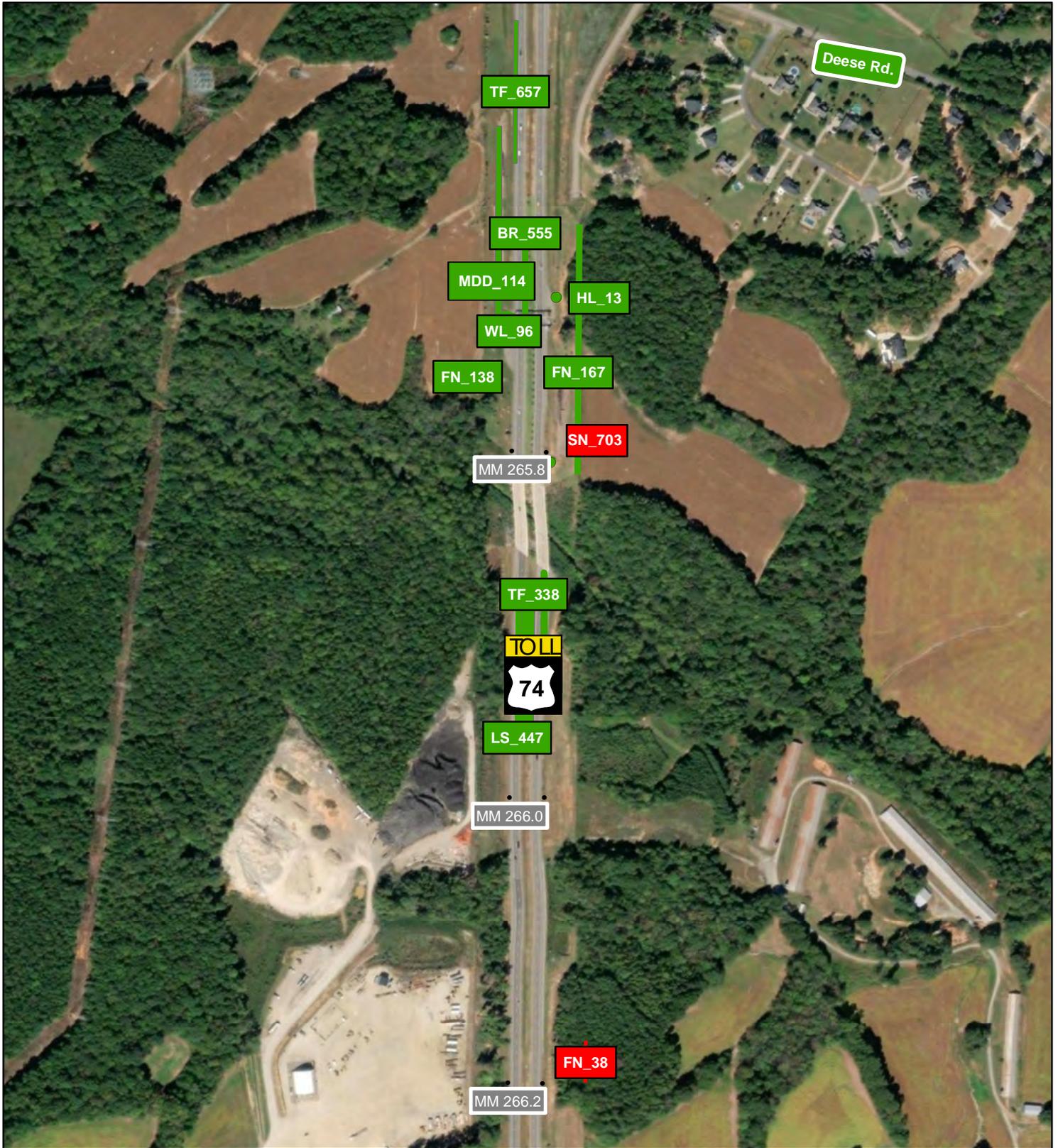


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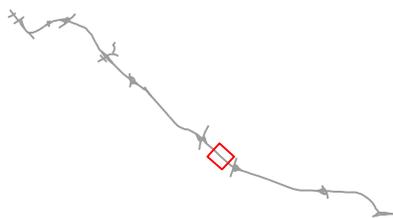


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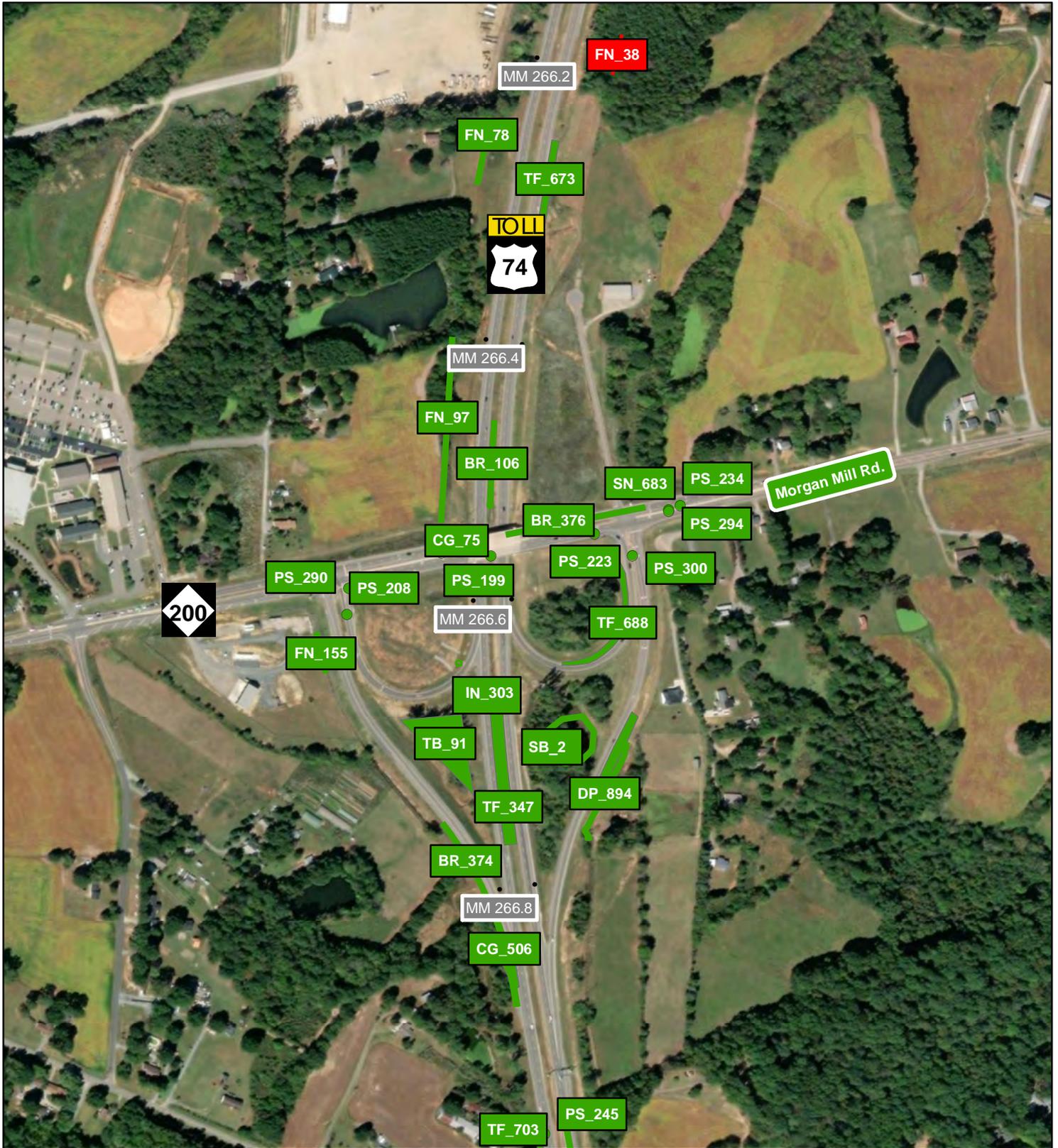


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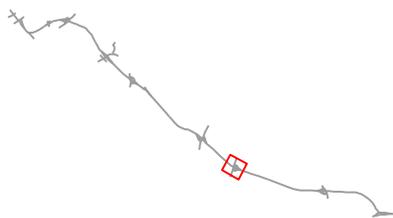


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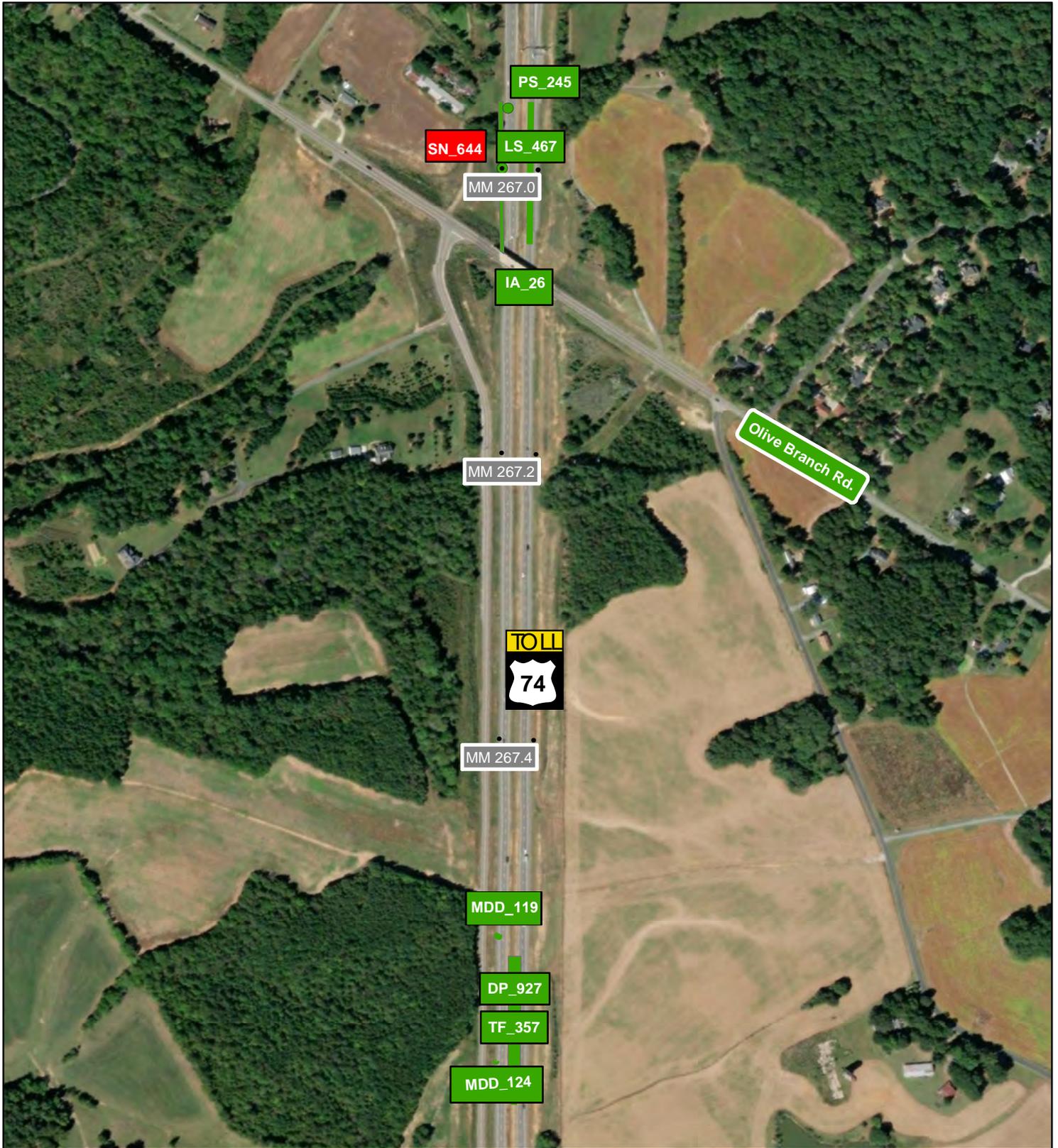


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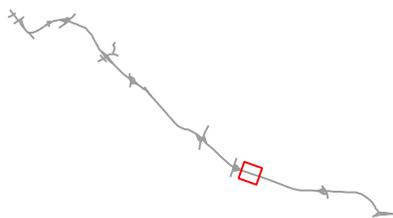


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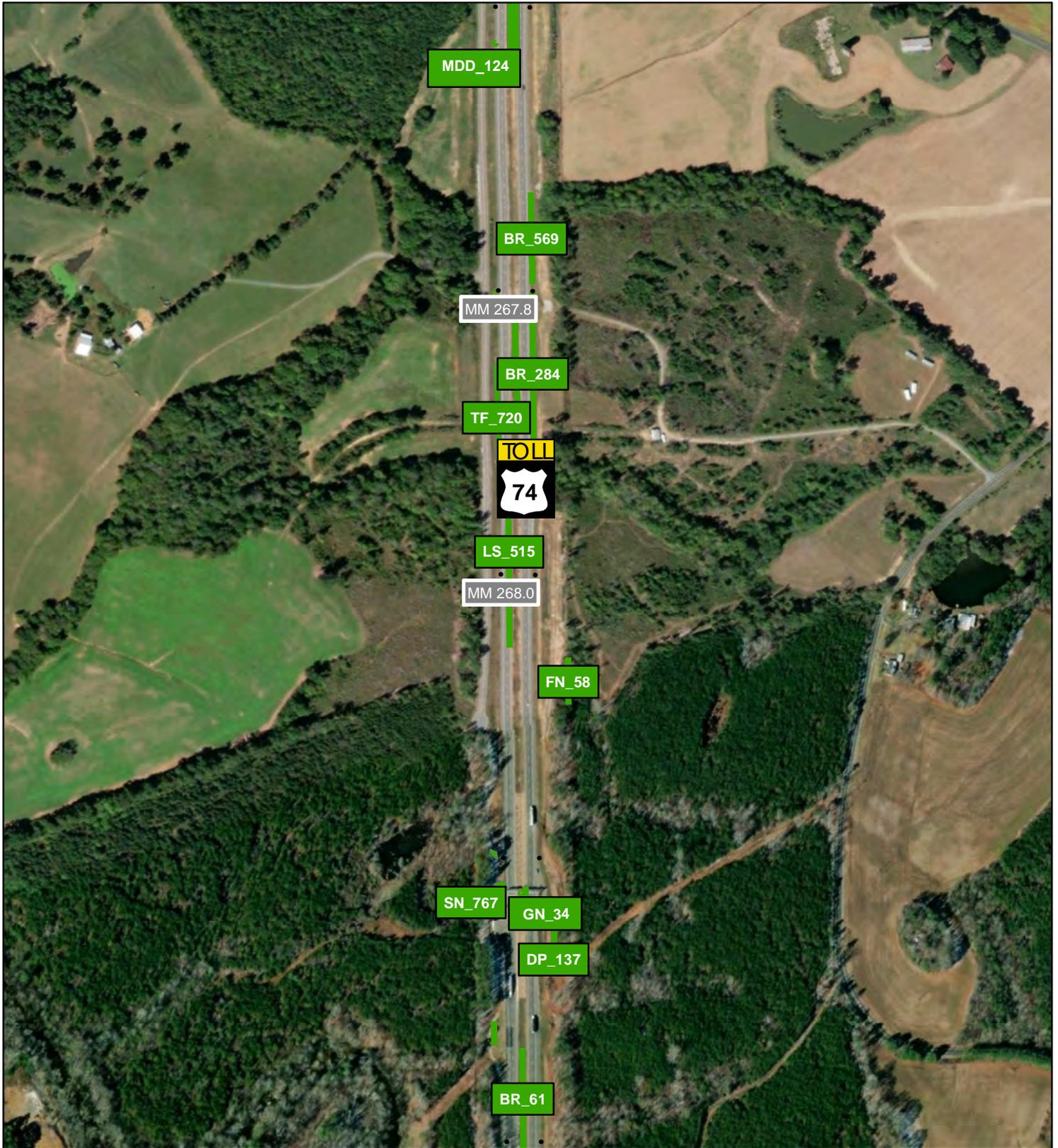


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-  Passing Asset

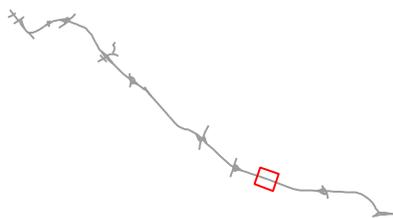


Appendix B: Monroe Expressway MRP Q2 2023 Assessment Locations

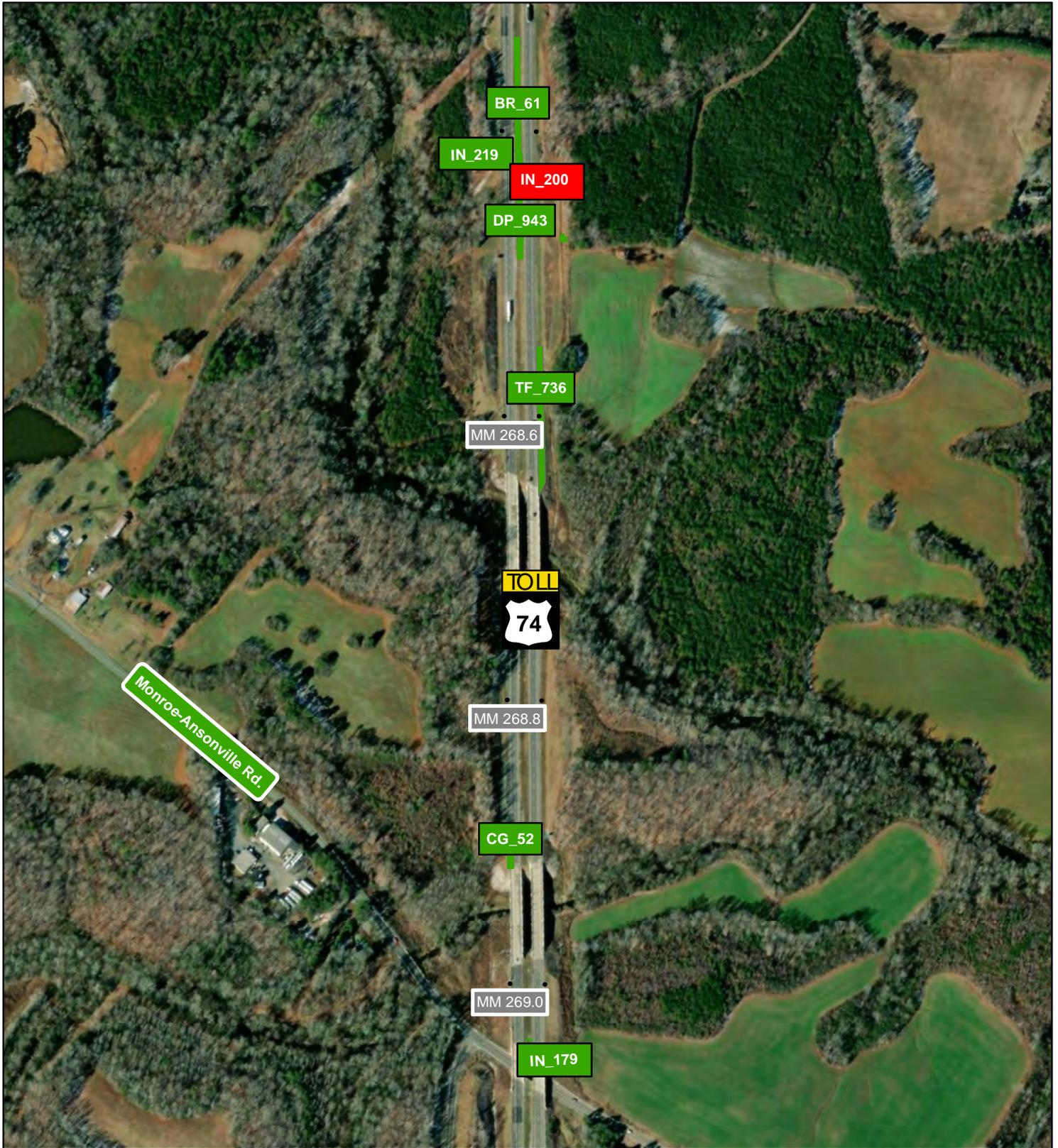


Legend

-  Failing Asset
-  Passing Asset

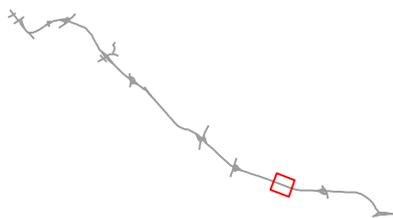


Appendix B: Monroe Expressway MRP Q2 2023 Assessment Locations



Legend

-  Failing Asset
-  Passing Asset

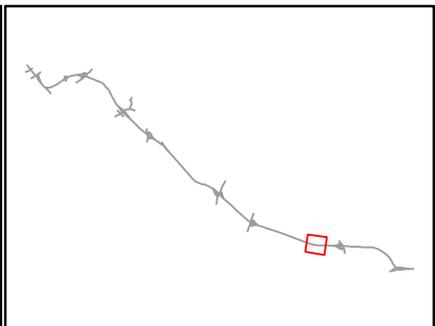


Appendix B: Monroe Expressway MRP Q2 2023 Assessment Locations



Legend

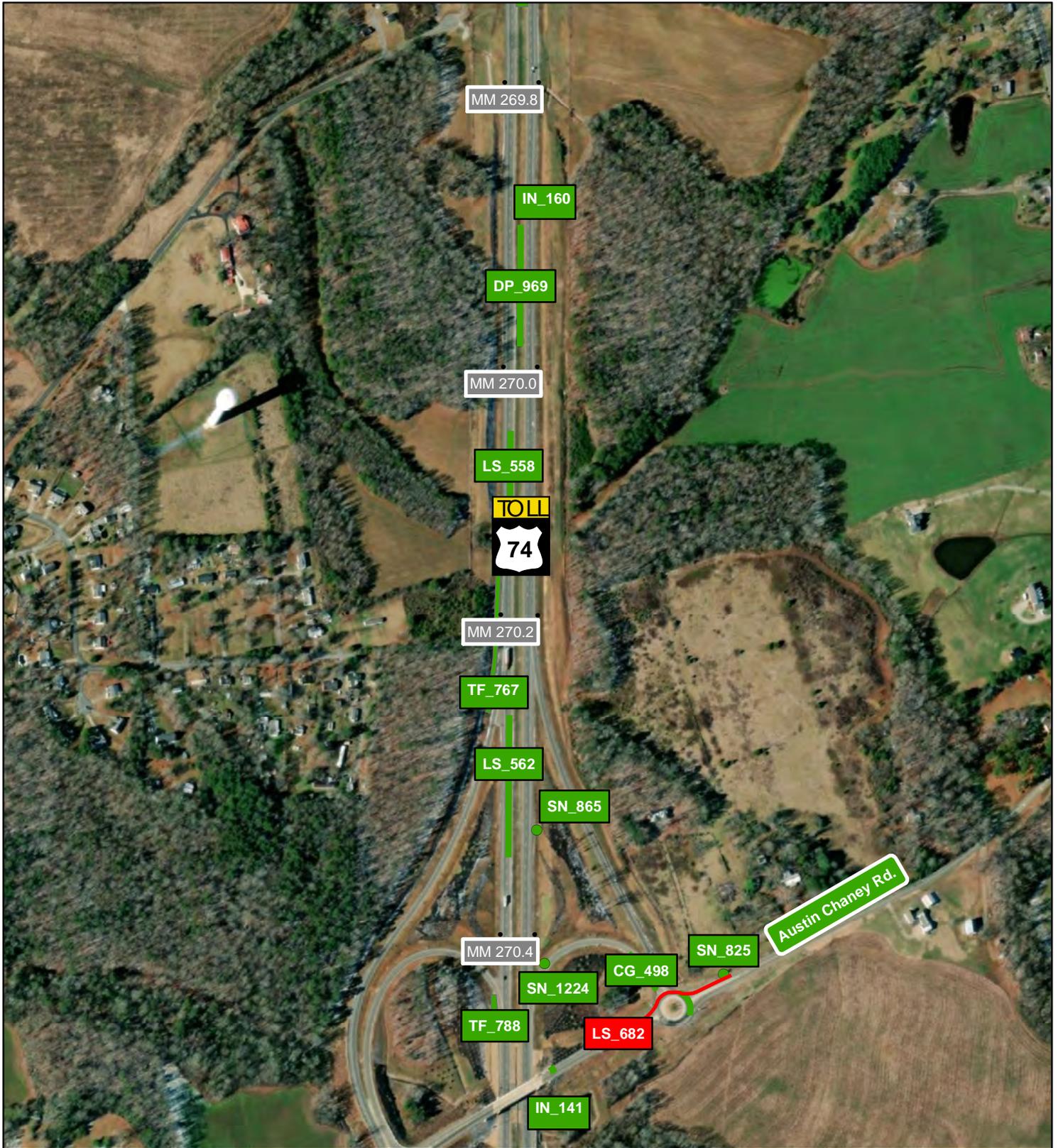
- Failing Asset
- Passing Asset



NORTH CAROLINA
Turnpike Authority

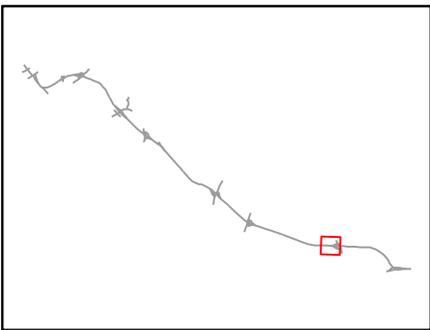
B21

Appendix B: Monroe Expressway MRP Q2 2023 Assessment Locations



Legend

- Failing Asset
- Passing Asset





NORTH CAROLINA
Turnpike Authority

B22

Appendix B: Monroe Expressway MRP Q2 2023 Assessment Locations

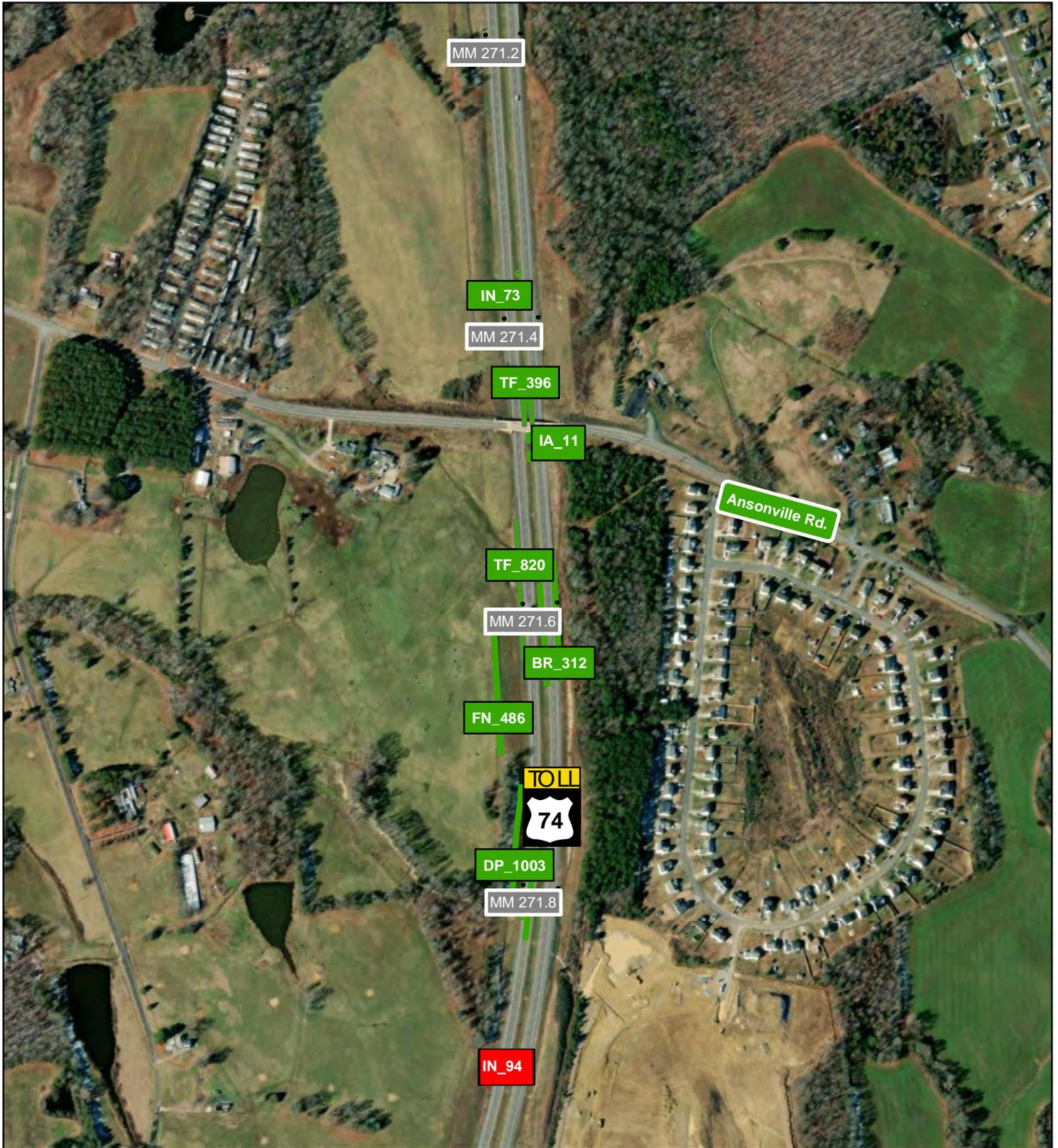


Legend

- Failing Asset
- Passing Asset

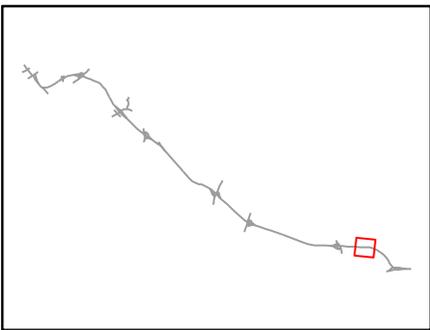


Appendix B: Monroe Expressway MRP Q2 2023 Assessment Locations



Legend

-  Failing Asset
-  Passing Asset



NORTH CAROLINA
Turnpike Authority

B24

Appendix B: Monroe Expressway MRP Q2 2023 Assessment Locations

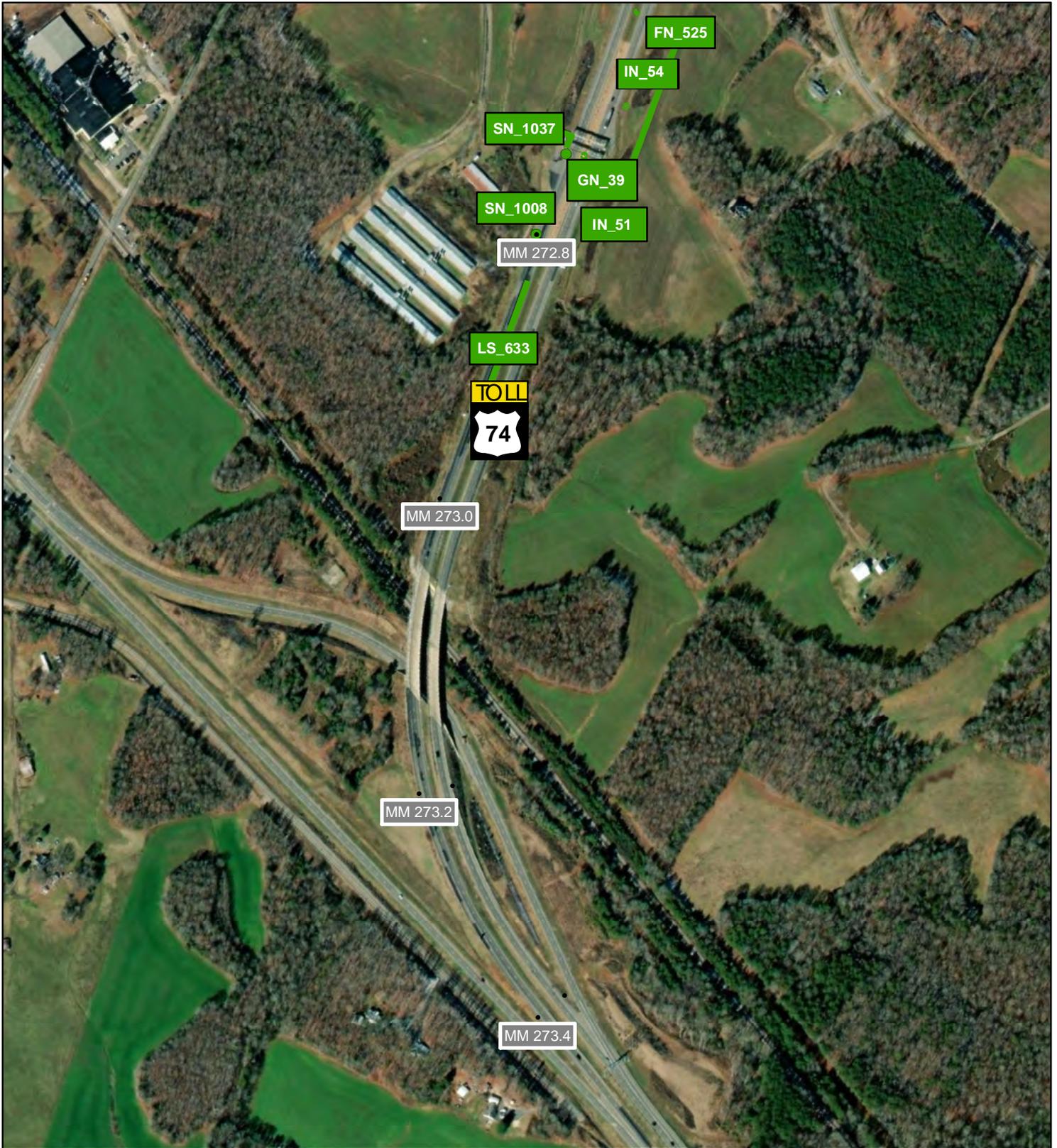


Legend

-  Failing Asset
-  Passing Asset

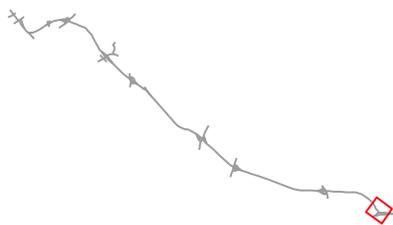


Appendix B: Monroe Expressway MRP Q2 2023 Assessment Locations



Legend

-  Failing Asset
-  Passing Asset



Appendix A

**Monroe Expressway 2023 Second Quarter Table Results of Assets Failing
MRP**

Appendix A: Monroe Expressway 2023 Second Quarter Table Results of Assets Failing MRP

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

All assets and their respective prefixes are listed below:

Guardrail, Concrete Barrier and End Anchors (BR).....	1
Curb and Gutter (CG).....	2
Toll Gantry Supports (GN).....	3
Drainage Pipes (DP).....	4
Misc. Drainage Structure (MDD).....	5
Fence and Control of Access (FN)	6
Graffiti (GR).....	8
Highway Lighting (HL)	9
Impact Attenuators (IA).....	10
Inlets (IN).....	11
Landscaping (PB).....	12
Paved Lanes – Asphalt (LS)	13
Paved Shoulders (LS)	14
Unpaved Shoulders (LS).....	15
Front/Back Slopes (LS)	16
Unpaved Lateral and Outfall Ditches (LS)	17
Litter (LS).....	18
Roadway Sweeping (LS).....	19
Pavement Striping (LS)	20
Pavement Markers (LS).....	21
Delineators (LS).....	22
Paved Ditches (PD).....	23
Pavement Words and Symbols (PS)	24
Signs (SN)	25
Tree and Brush (TB).....	26
Turf Condition (TF)	27
MSE/Retaining Walls, Sound Barrier Walls and Screen Walls (WL)	28
Sediment Basins(SB).....	329

Guardrail, Concrete Barrier and End Anchors (BR)

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

Curb and Gutter (CG)

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

Toll Gantry Supports (GN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	GN_3	Scaling	No Photo Provided	B2
2	Concrete	GN_13	Scaling		B8

Drainage Pipes (DP)

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

Misc. Drainage Structure (MDD)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	MDD_98	Obstruction		B9

Fence and Control of Access (FN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Woven	FN_5	Hole		B1 & B2
2	Woven	FN_38	Height		B16 & B17
3	Woven	FN_188	Hole		B1
4	Woven	FN_238	Hole		B1

5	Woven	FN_287	Height		B6
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Graffiti (GR)

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

Highway Lighting (HL)

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

Impact Attenuators (IA)

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

Inlets (IN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	IN_94	Erosion		B24 & B25
2	Concrete	IN_200	Erosion		B20
3	Concrete	IN_564	Surface Damage		B8

Landscaping (PB)

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

Paved Lanes – Asphalt (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_146	Cracking		B4
2	Asphalt	LS_682	Cracking		B22 & B23

Paved Shoulders (LS)

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

Unpaved Shoulders (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_672	Drop-off		B6 & B7

Front/Back Slopes (LS)

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

Unpaved Lateral and Outfall Ditches (LS)

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

Litter (LS)

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

Roadway Sweeping (LS)

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

Pavement Striping (LS)

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

Pavement Markers (LS)

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

Delineators (LS)

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

Paved Ditches (PD)

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

Pavement Words and Symbols (PS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	PS_122	Nighttime Reflectivity	No Photo Provided	B9
2	Asphalt	PS_268	Nighttime Reflectivity/Daytime Assessment		B9

Signs (SN)

#	Sign Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Mile Marker	SN_644	Sign Support		B18
2	Toll Sign	SN_703	Nighttime Reflectivity	No Photo Provided	B16
3	Mile Marker	SN_1077	Leaning		B1

Tree and Brush (TB)

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

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Turf	TF_114	Bare Ground		B1

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

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	WL_10	Cracking		B2 & B3
2	Concrete	WL_72	Cracking		B2 & B3
3	Concrete	WL_74	Cracking		B4
4	Concrete	WL_85	Spalling		B12

Sediment Basins(SB)

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